12-2013

Competing Risks Models of Farm Service Agency Guaranteed Operating and Farm Ownership Loans

Deng Long
University of Arkansas, Fayetteville

Competing Risks Models of Farm Service Agency Guaranteed Operating and Farm Ownership Loans

Competing Risks Models of Farm Service Agency Guaranteed Operating and Farm Ownership Loans

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Agriculture Economics

By

Deng Long
University of Jinan
Bachelor of Science in Economics, 2011

December 2013
University of Arkansas

This thesis is approved for recommendation to the Graduate Council.

Dr. Bruce L. Ahrendsen
Thesis Director

Dr. Bruce L. Dixon
Committee Member

Dr. Charles B. Dodson
Committee Member

ABSTRACT

This thesis examines the possible outcomes (expired with no loss, settled for loss, still performing) of loans and the time to hazard events of over 19,000 guaranteed operating and farm ownership loans which were provided by the Farm Service Agency (FSA). Loans guaranteed by FSA are made by commercial banks, Farm Credit System (FCS), or other lenders to farmers who have limited ability to obtain loans from normal sources without the Federal guarantee. The guarantee allows for payment up to 95 percent when borrowers default. Cox proportional hazards models for operating loans and farm ownership loans are estimated to identify borrower characteristics, loan characteristics, lender types, and farm and macro-economic environment factors that influence loan outcomes. The estimation results indicate that beginning farmer loans are more likely to expire and more likely to have loss claims and loans with interest assistance are less likely to expire and less likely to have loss claims than are regular loans. Loan outcomes also differ by loan amount, loan term, lender type, and region. In addition, preferred or certified lenders are less likely to have operating loan loss claims. Finally, contemporaneous variables, in particular delinquency status, have a significant impact on loan outcomes.

ACKNOWLEDGEMENTS

First, I would like to thank my advisor Dr. Bruce Ahrendsen for his valuable advice and guidance through my thesis writing process. It would be impossible for me to finish this thesis without him.

Also, special thanks to Dr. Bruce Dixon who patiently provided sound advice and vision for me to complete me thesis.

I would also like to thank Dr. Charles Dodson for giving me generous access to the the USDA data and reports. I also deeply appreciate the support from Diana Danforth for the computer programming in my thesis.

I am grateful to be part of the Department of Agricultural Economics and Agribusiness at the University of Arkansas, Fayetteville. All the faculty, staff and students in the department made my two year study a wonderful journey.

DEDICATION

I dedicate this thesis to my parents who have fully supported me in all that I have done.

Also, this thesis is dedicated to my partner, Patrick Kells, who gives me precious inspiration and motivation.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

Federal credit programs represent one of the major assistance programs for farmers in agricultural production. Direct loan programs were the main loan assistance programs until the mid-1980s. The combination of relatively high default and loss rates with fewer Federal budget resources led to a policy shift from direct loans to guaranteed loans (Ahrendsen et al., 2005). The lending authority increase in the 1996 Federal Agriculture Improvement and Reform (FAIR) Act had Farm Service Agency (FSA) guaranteed loans take a more important role than before. The Farm Security and Rural Investment Act of 2002 kept the lending authority increase from the 1996 farm bill. The 2002 farm bill also made interest assistance (IA) authority permanent for guaranteed operating loans (Ahrendsen et al., 2011). The Food, Conservation, and Energy Act of 2008 increased the limitation amount of direct operating (OL) loans and farm ownership (FO) loans from $200,000 to $300,000, whereas the loan limit for guaranteed OL or FO loans has been adjusted annually since fiscal year 1999 when the limit was $700,000 (Settlage, 2005) to $1,302,000 for fiscal year 2013 (USDA/FSA, 2013a).

Overall, these changes allowed more borrowers to have access to farm credit assistance from the government. The demand for guaranteed loans is also quickly increasing (Dodson and Koenig, 2006). Therefore, more comprehensive studies about guaranteed loan programs are necessary.

1.1 Purpose of Study and Hypotheses

The identification of factors affecting the probability of default and loss for loans has been a topic of interest for researchers who want to better identify and manage risk. Identifying such factors and their potential impact provides useful information to the Federal government and the private sector so they may evaluate the effectiveness of loan programs, generate strategies to lower program risk, and perform due diligence on rating loan applicants.

Recently, Dixon et al. (2011) modeled the likelihood and duration of various loan outcomes using a sample of FSA direct farm loans. They applied a competing risks, Cox proportional hazards model to a sample of FSA direct loans to identify factors that affect loan outcome and loan duration. However, no similar study of guaranteed loans has been done.

This study models possible loan outcomes and the time to hazard events, i.e., time to loan outcomes. The models include variables that are associated with demographic and farm financial characteristics as well as loan and lender characteristics. Cox competing risks regression models will be estimated using quarterly data to analyze the guaranteed loan outcome, i.e., guarantee expiration or loss claim, and time to these outcomes.

The objectives of this study are: (1) Identify demographic, economic and farm financial and characteristics together with loan characteristics and lender types associated with the relative likelihood of guaranteed loan outcomes, e.g., guarantee expiration or loss claim; and (2) Identify factors associated with the time to hazard event, i.e., the duration until FSA guarantee expiration or loss claim using FSA data. The null hypothesis is that the demographic, financial, loan and lender characteristics have no impact on type of loan outcome and length of time to loan outcome. The alternative hypothesis is that these characteristics impact loan outcomes.

These analyses provide policy relevant information. Knowing borrower, loan and lender characteristics related to guaranteed loan outcomes and durations and will help FSA better predict these outcomes and durations in the future. The findings will also be useful to indicate the influence of economic changes on guaranteed loan outcomes. FSA can use the results to forecast the payment performances of guaranteed loans and reduce the risks relative to loan guarantees as well.

1.2 Organization

This thesis is organized as follows. Chapter 2 summarizes the research background of this study. Previous studies about FSA loans and loan duration are reviewed in Chapter 3. Chapter 4 summarizes the data sources. Chapter 5 presents a statistical summary of the data and discusses the methodology and theoretical model estimated in this study. Chapter 6 presents and interprets the results of the econometric analysis. Chapter 7 includes the summary, conclusions, policy implications, as well as directions for further research.

CHAPTER 2: RESEARCH BACKGROUND

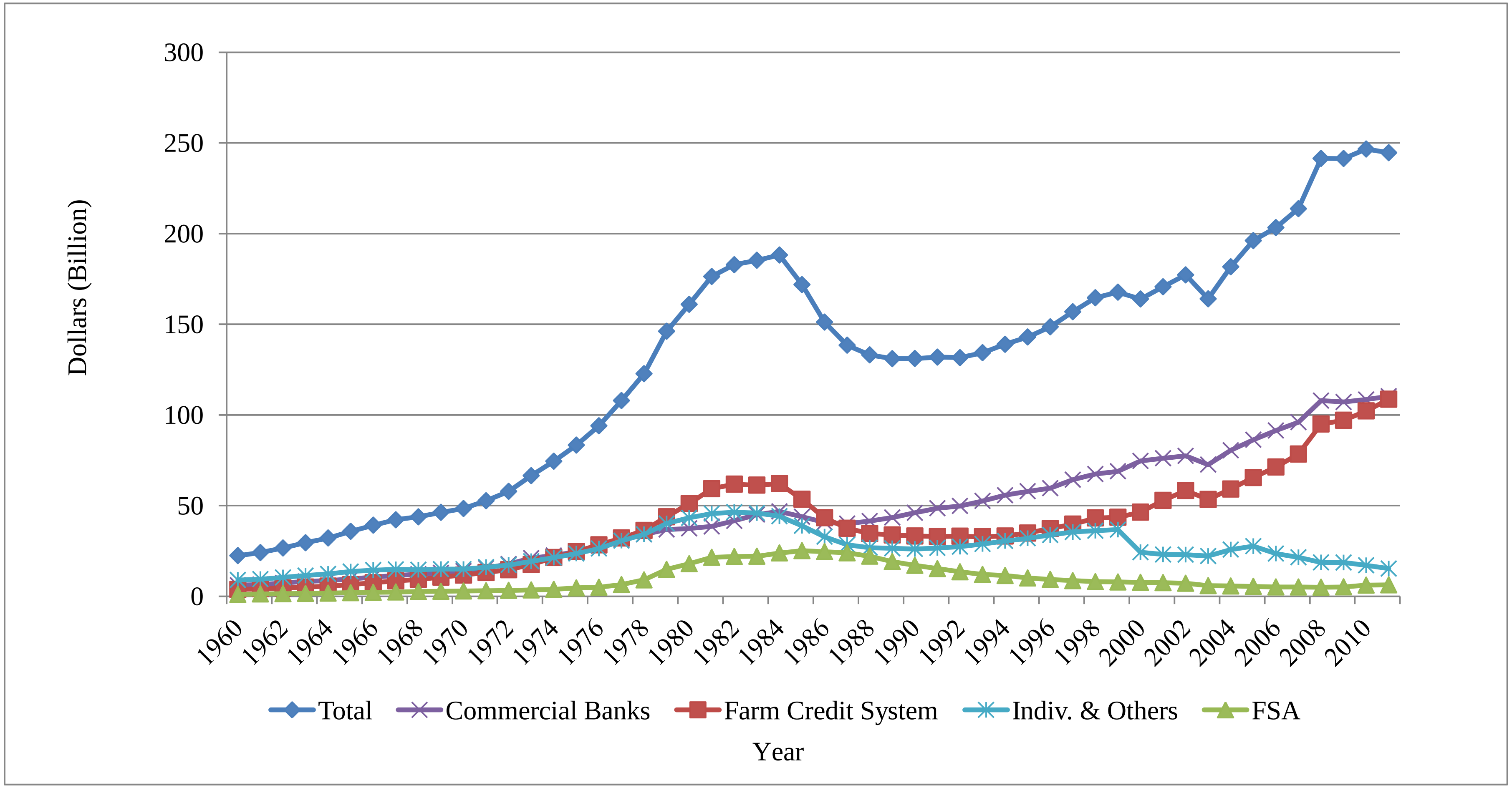
2.1 FSA Farm Loan Programs

As an agency of the United States Department of Agriculture (USDA), the Farm Service Agency (FSA) provides both direct and guaranteed loans to farmers who are financially constrained and cannot obtain credit from commercial sources at reasonable rates and terms. Two main credit assistance programs are the direct loan program and the guaranteed loan program. 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. Three major loan types are provided in the assistance programs. Farm ownership (FO) loans are long term loans which can be used to purchase farmland, make farmland improvements and repairs, and improve soil and water conservation. Farm operating loans (OL) are short term loans which can be used to pay for operation expenses, livestock, equipment, feed, seed, fertilizer, and other operating expenses. Emergency loans (EM) provide financial assistance to farmers experiencing physical or production losses from a natural disaster or quarantine. These funds can be used to restore or replace essential property, pay all or part of production costs associated with the disaster year, pay essential family living expenses, reorganize the farming operation, and refinance certain debts, excluding real estate (USDA/FSA, 2013b). Emergency loans do not qualify for FSA guarantees so our attention is directed to OL and FO loans.

2.2 FSA Direct Loan Program

As shown in figure 2.1, the shares of the U.S. farm debt market by commercial banks and Farm Credit System (FCS) have increased since the late 1980s and the portion of lending by FSA has decreased. Commercial banks hold the largest share of the U.S. farm business debt market. For example, Commercial banks had a combined 45 percent share of the total farm debt market in 2011 (USDA/ERS, 2012).

Figure 2.1 U.S total farm business debt by lender from 1960 to 2011



Source: U.S. Farm Income and Wealth Statistics (USDA/ERS, 2012).

The USDA's involvement in the farm credit market was mainly through direct loan programs until the 1980s. The direct loan program primarily has FO, OL, and EM loans and is where FSA provides a loan of government funds directly to a farmer, i.e., no intermediary is involved. Temporary credit in the form of direct loans is provided to farmers by FSA until farmers can refinance their loans with a commercial, private lender. However, several policy changes shifted the emphasis from the direct loan program to the guaranteed loan program over time with the first shift to guaranteed loans occurring in 1984 (Ahrendsen et al., 2005).

FSA administers loan programs to provide social equity by resolving imperfections in farm credit markets for farmers (Dodson and Koenig, 2006). Imperfections usually include insufficient lending resources, imperfect competition, and asymmetric information. Insufficient resources are problematic when a small lending agency may have liquidity issues to support loan requests from qualified borrowers. For example, a lender may reach their regulatory lending limit and not be able to provide credit to all creditworthy applicants. Also, when a limited number of farms are located in the same neighborhood, it is highly possible that there are not enough lending agencies to serve the market. This will cause insufficient lending resources. Imperfect competition shows when only a limited number of lenders serve the market. Moreover, information asymmetries arise because lenders may not have sufficient information about borrowers or their farm business to evaluate their loan requests properly. FSA loan programs can address these problems by helping a large group of farmers obtain credit or loans when they fail to do so because of different reasons.

FSA loan programs address issues of social equity by also providing disadvantaged borrowers access to resources (Dodson and Koenig, 2006). Both direct and guaranteed loan programs are implemented to serve as credit sources for both economically and socially-disadvantaged borrowers. Economically-disadvantaged borrowers include beginning farmers, farmers who are constrained by financial limitations, and socially disadvantaged (SDA) farmers. Beginning farmers are defined as those who have not operated a farm for more than 10 years (USDA/FSA, 2011a). The definition of SDA is borrowers belonging to groups including women, Blacks or African Americans, American Indians, Alaskan Natives, Hispanics, Asian Americans and Pacific Islanders groups (USDA/FSA, 2011b).

2.3 FSA Guaranteed Loan Program

The Farm Service Agency (FSA) guaranteed loan program was initiated under the Consolidated Farm and Rural Development Act of 1972 (Dodson and Koenig, 2006). Like the direct loan program, the guaranteed loan program is intended to assist farmers in obtaining credit at reasonable rates and terms. However, unlike the direct loan program, the guaranteed loans are made and serviced by private lenders and guaranteed by the government against loan losses. Guaranteed loans are expected to bear lower risks and fewer costs than direct loans. Direct loans are available to farmers who cannot obtain credit at competitive rates even with a guarantee, whereas guaranteed loans are aimed at farmers who can acquire credit at reasonable rates and terms with a guarantee. Due to this difference in their missions, direct loans more likely serve farmers who have more severe financial problems. Both loan programs are intended to serve as temporary credit sources instead of permanent sources. Guaranteed loans are usually used as an interim step for farmers transitioning from the direct loan program to regular commercial lending (Dodson and Koenig, 2006).

OL loans and FO loans are two major guaranteed loan types offered by FSA. FSA provides lending institutions payment guarantees up to 90 percent of the current principal if the borrower of the loan defaults (95 percent for certain refinanced direct loans and beginning farmers). The OL and FO guaranteed loans have similar loan purposes as their OL and FO direct loan counterparts. After the mid-1980s, guaranteed loans started to hold a larger portion of FSA loan obligations and authorities than direct loans. As shown in table 2.1, the dollar amounts of guaranteed OL and FO loans have been greater than their direct loan counterparts since fiscal year 2002, except for OL loans in fiscal year 2012.

The difference in direct loan program and guaranteed loan program funding continued in fiscal year 2013. The available funds in fiscal year 2013 for direct OL and FO loans are 1.04 billion dollars. The available funds authorize guaranteed OL and FO loans up to 2.89 billion dollars (USDA/FSA, 2013c).

It can be seen in tables 2.2 and 2.3 that the total loan principal outstanding of guaranteed loans is more than the total loan principal outstanding of direct loans in most years by large amounts. Moreover, guaranteed loans are less likely to have repayment problems. For example in fiscal year 2012, the rates of loan volume that are delinquent for guaranteed OL and FO loans are on 2.2% and 0.9%, whereas direct OL and FO loans have delinquency rates by loan volume of 6.2% and 1.9%.

The major providers of guaranteed loans are commercial banks. Other users include FCS, credit unions, mortgage loan companies, small business investment companies, state lending agencies and insurance companies. Although commercial banks hold the largest share of the U.S. farm debt market with 45 percent of the market in 2011, they originate a disproportionately large share of FSA guaranteed loans with over half of those loans originated. For example, during 2004 and 2005, 67 percent of obligated guaranteed loans were originated by commercial banks, as showed in the FSA obligation loan data discussed and analyzed later in this thesis. During fiscal years 1995-2003, commercial banks made 81.2 percent of all guaranteed OL loans originated (Ahrendsen et al., 2011).

Table 2.1 Direct and guaranteed loan numbers and obligations for fiscal years[a] 2002-2012

	Direct Loan Program						Guaranteed Loan Program			
Fiscal Year	Operating Loan		Farm Ownership		Emergency		Operating Loan		Farm Ownership	
	Loan number	Loan amount[b]	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount
2002	14,623	$668	1,521	$178	949	$58	6,733	$1,053	3,905	$1,101
2003	14,756	$690	1,453	$169	1,479	$96	6,576	$1,013	4,198	$1,231
2004	13,760	$610	1,228	$142	656	$30	5,980	$951	3,753	$1,099
2005	13,416	$556	2,222	$272	381	$24	5,397	$885	3,461	$1,027
2006	15,041	$641	2,144	$275	724	$52	5,297	$938	3,171	$949
2007	14,185	$600	2,305	$303	1,074	$75	5,132	$918	2,980	$965
2008	14,133	$629	2,679	$382	607	$45	4,820	$947	3,325	$1,171
2009	20,467	$1,226	3,337	$560	313	$30	5,650	$1,235	3,687	$1,273
2010	19,689	$1,242	4,316	$703	340	$36	6,755	$1,510	4,447	$1,606
2011	17,806	$1,049	3,472	$581	298	$33	5,287	$1,173	4,886	$1,906
2012	20,413	$1,169	3,231	$530	309	$31	4,250	$934	3,850	$1,499

[a] Fiscal year is October 1 through September 30.

[b] All dollar amounts are in millions.

Source: FSA – Farm Loan Programs Monthly Management Summary for September, years 2002-2012 (USDA/FSA, 2012).

Table 2.2 Direct loan unpaid principal and interest outstanding and delinquency at end of fiscal years[a] 2002-2012

	Operating Loan				Farm Ownership Loan				Emergency Loan			
Fiscal Year	Principal and Interest		Delinquency		Principal and Interest		Delinquency		Principal and Interest		Delinquency	
	Loan number	Loan amount[b]	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount
2002	79,525	$2,970	NA	$367	56,331	$3,586	NA	$139	38,470	$1,807	NA	$332
2003	77,617	$2,928	NA	$367	50,463	$3,293	NA	$142	34,188	$1,654	NA	$364
2004	72,516	$2,736	NA	$311	45,612	$3,063	NA	$122	28,303	$1,388	NA	$298
2005	68,985	$2,524	12,130	$256	41,987	$2,928	3,551	$105	23,979	$1,161	6,038	$242
2006	68,364	$2,467	10,249	$214	39,745	$2,902	3,081	$89	20,916	$1,022	5,064	$205
2007	67,638	$2,403	10,020	$194	37,938	$2,912	2,726	$79	18,659	$920	4,224	$160
2008	66,412	$2,354	9,263	$177	37,009	$3,049	2,484	$72	16,578	$821	3,783	$140
2009	70,866	$2,803	10,608	$192	36,638	$3,307	2,775	$74	14,666	$758	3,744	$150
2010	74,569	$3,225	11,269	$217	37,807	$3,763	2,848	$75	13,022	$683	3,352	$134
2011	75,603	$3,374	10,970	$216	37,477	$4,003	2,748	$78	11,375	$609	2,979	$131
2012	77,012	$3,443	10,568	$215	36,686	$4,153	2,740	$77	9,963	$538	2,716	$117

[a] Fiscal year is October 1 through September 30.

[b] All dollar amounts are in millions.

Source: FSA – Farm Loan Programs Monthly Management Summary for September, years 2002-2012 (USDA/FSA 2012).

Table 2.3 Guaranteed loan principal outstanding and delinquency of fiscal years[a] 2002-2012

	Operating Loan				Farm Ownership Loan			
Fiscal Year	Principal		Delinquency		Principal		Delinquency	
	Loan number	Loan amount[b]	Loan number	Loan amount	Loan number	Loan amount	Loan number	Loan amount
2002	42,717	$3,924	2,056	$132	24,474	$4,222	829	$51
2003	42,289	$4,005	2,230	$153	25,290	$4,718	899	$59
2004	39,391	$3,846	1,451	$113	25,676	$5,058	697	$54
2005	36,542	$3,567	1,241	$98	26,133	$5,330	607	$50
2006	33,370	$3,367	1,112	$84	26,156	$5,451	504	$44
2007	30,558	$3,329	909	$74	25,995	$5,607	467	$44
2008	27,768	$3,088	650	$57	25,860	$5,838	440	$48
2009	26,802	$3,144	844	$81	26,511	$6,242	654	$79
2010	27,223	$3,437	939	$97	28,043	$6,916	648	$78
2011	26,044	$3,427	789	$88	29,660	$7,681	621	$71
2012	24,221	$3,152	674	$70	30,640	$8,346	548	$73

[a] Fiscal year is October 1 through September 30.

[b] All dollar amounts are in millions.

Source: FSA – Farm Loan Programs Monthly Management Summary for September, years 2002-2012 (USDA/FSA 2012)

The FCS is the next largest institutional lender to U.S. farmers with 44 percent of the total farm debt market (USDA/ERS, 2012) and is the second largest originator of FSA guaranteed loans. For example according to the data provided by FSA for this thesis, FCS originated 27 percent of FSA guaranteed loans in calendar years 2004 and 2005. Besides the obvious risk reducing feature of using the FSA guaranteed loan program, lending institutions may benefit from this program since they can increase their profit by reselling the guaranteed loans in the secondary market through the Federal Agricultural Mortgage Corporation (Farmer Mac). The Farmer Mac II program provides financial institutions with an efficient and competitive secondary market for the guaranteed portions of loans and enhances participants' ability to offer innovative products to their customers.

Guaranteed loan volume has increased relative to direct loan volume, reflecting a more efficient use of financial resources by leveraging the limited government dollars that are available. Guarantees also lower a lender's risk, enabling them to increase the amount of funds they lend to creditworthy farmers. Considering all the factors above, more research about the duration of guaranteed loans needs to be done since several prior studies have only identified important characteristics for direct loans and I am not aware of any studies that have done this for guaranteed loans.

CHAPTER 3: LITERATURE AND METHODOLOGY REVIEW

In recent years, an increasing number of empirical studies have been done on FSA loans. Before policies switched the emphasis from direct loans to guaranteed loans, there was little analysis of FSA guaranteed loan programs. The review of previous studies on FSA guaranteed loan programs contributes to the first part of this chapter. Secondly, previous loan duration studies are reviewed. Finally, the review of methodology is presented.

Literature Review

3.1 Studies of FSA Guaranteed Loan Program

Many studies of FSA guaranteed loan programs have focused on default rates and loss claims levels of guaranteed loans. Some of them identified characteristics of banks that influence the obligation volume and loss claims volume of guaranteed loans (Dixon et al., 1999; Settlage et al., 2000; Settlage et al., 2001a; Settlage et al., 2001b; Settlage, 2005).

Dixon et al. (1999) identified the factors which influenced the volume of loan guarantees and loss claims on FSA guaranteed operating loans over time among banks in Arkansas. They used a six-equation model which contains three "double hurdle" sub-models. The three sub-models represent the decision and activity level of OL loans, FO loans and OL loss claims separately. Each sub-model contains two equations including "selection" and "regression" equations.

In the OL and FO guaranteed loan obligated volume sub-models, the "selection" equation is where the dependent variable is a binary variable which indicates whether the bank made guaranteed loans or not in certain years. In the "regression" equation, the level of loans obligated was estimated as a function of appropriate independent variables containing the financial characteristics of banks, banks' locations, and the level of competitiveness between banks. In the loss claim sub-model, the binary dependent variable in the “selection” equation indicates whether a bank had a loss claim or not. Loan characteristics and financial characteristics of banks were independent variables in the loss claim “regression” equation. Default is one of the most important outcomes of loans. Therefore, the results reported in their study gives this thesis some indication of variables influencing loan loss claims.

A positive sign for a coefficient implies that a variable has a positive influence on loss claim. The results of the regression model for OL loss claims in Dixon et al. (1999) showed that an increase in farm income decreases the probability of loss claims. The more a bank was exposed to guaranteed loans, the higher the volume of loss claims. Several variables reflecting general agricultural sector economic conditions had significant impacts on loss claims. For example, the costs of paying back loans are higher when the interest rates increase, suggesting that the likelihood for default rises.

In the study conducted by Settlage et al. (2000, 2001a), two regression models for both FO and OL loans using state-level data from forty states for 1990-1997 and 1991-1998 are estimated to examine FSA guaranteed loan loss claim activity in the U.S for these two time period. Some results from the estimation were similar with the loss claim study of guaranteed loans among the banks in Arkansas (Dixon et al., 1999).

In the FO model in Settlage et al. (2000, 2001a), state-level debt-to-asset ratio and national-level interest rate have significant positive relationships with FO loss claims rates, whereas the sign of state-level rate of return on assets is significant and negative. In the OL model, some factors such as annual debt service amount, share of guaranteed loans made by commercial banks, and farm size have a significant impact on the loss claim rate of OL loans. So, when the portion of debt service payments in annual gross farm income increases, OL loss claims rates increase. The commercial bank result indicates that when commercial banks make a larger share of the guaranteed loans in a state, the loss claim rate decreases. The negative, significant relationship between farm size and loss claims rates indicates that states with larger farms may have less risk because of higher efficiency. The results also indicate that it is highly possible that factors outside the agricultural sector impact loss claims. In addition, interest rate assistance does not alter the overall state-level loss claims rates. However, this subsidy might offset long term interest rate increases in an effort to limit loss claims rates.

Settlage et al. (2001b) estimated two principal outstanding models for guaranteed FO loans and OL loans respectively by using a feasible generalized least squares estimator with fixed effects for annual, state-level data. Their research is highly related to this study because loan principal outstanding can be used to predict the level of loss claims by multiplying principal outstanding with loss claim rate.

The dependent variables are state-level first difference of FO and OL principal outstanding per farm. For explanatory variables, they included variables describing farm financial status such as debt-to-asset ratio, net farm income per farm, and debt coverage ratio. They also included variables such as percentage of state agricultural revenue coming from crops, average farm size, and proportion of farm operators working more than 200 days off-farm. Results showed financial characteristics variables and farm economy indicators had major impacts on the volume of principal outstanding for both FO and OL guaranteed loans.

In the FO model in Settlage et al. (2001b), a positive significant relationship between debt-to-asset ratio and FO principal outstanding shows that the greater the debt relative to assets, the higher the FO principal outstanding. The sign for the coefficient on crop revenue percentage is also positive. This implies that FO principal outstanding increases when the portion of revenues from the sales of crops is higher. The proportion of farm operators working off-farm more than 200 days per year has a negative relationship. This indicates that farmers who are employed outside the farm have better ability to pay back the existing loans.

In the OL model, debt-to-asset ratio has a significant positive relationship to principal outstanding, as in the FO model. The net farm income coefficient has a significant negative relationship to the principal outstanding. This indicates the higher the net farm income, the lower the principal outstanding will be. Similar to the FO model, the proportion of farm operators working more than 200 days off-farm has a negative and significant relationship to principal outstanding. However, contrary to the FO model, crop revenue percentage has a negative relationship with the OL principal outstanding. This result indicates that farms in states more dependent on crops have less of a need for guaranteed OL loans. The negative sign on the ratio of total loans made by commercial banks to total assets of commercial banks shows that when banks expose themselves to higher risk, they tend to search for more protection in the form of loan guarantees.

Settlage (2005) applies a modified portfolio selection model to identify factors which affect the likelihood of a commercial bank will use guaranteed loans as well as factors influencing the usage level of the program for the fiscal years of 1995 to 2003. The results from both FO and OL lender models indicated that lenders with certain characteristics have a higher probability of guaranteed loan origination. Larger asset size, higher loan-to-asset and agricultural loan-to-total loan ratios, and multi-bank holding company affiliation are distinct characteristics of those who use the FSA guaranteed loan program more frequently.

Ahrendsen et al. (2011) analyzed the use of guaranteed operating loans and interest assistance (IA) by U.S. commercial banks by using a triple hurdle, three-equation model. The results showed a selection bias tended to exist. Most banks do not make guaranteed OL loans and a large portion of banks do not use IA even when they make OL loans. However, the banks that make IA loans tend to do it intensively. Some variables such as farm debt servicing ratio, bank loan-to-asset ratio, bank returns on non-agricultural loans, banks habitually using guaranteed loans, and bank size have a major impact on the utilization of guaranteed OL loans and IA. In addition, increases in lending risk and financial stress relate with rises in guaranteed OL loan and IA usage.

3.2 Studies of Loan Duration

Duration models have been applied in various mortgage loan studies (Jackson and Kaserman, 1980; Hakim and Haddad, 1999; Ambrose and Capone, 1998; Ambrose and Capone, 2000; Ciochetti et al., 2003). In these previous studies, researchers measured the effects of borrower and lender characteristics, loan characteristics and economic environment factors on the probability of default and prepayment.

Dressler and Stokes (2010) modeled the factors that influence prepayment and default of agricultural loans by using a sample of FCS loans. Previous research paid more attention to FCS mortgage default but ignored the hazard of prepayment of FCS loans. In their study, prepayment was considered to be a risky termination from the bank’s perspective. Besides Dixon et al. (2011), this is the only application of survival analysis technique within a competing risks framework on agricultural loans that I could identify.

Dressler and Stokes’ (2010) research incorporates both static covariates and dynamic covariates. Static covariates are variables whose values are set at time of loan origination and dynamic covariates are variables whose values change over time after loan origination, annually in Dressler and Stokes’ (2010) study. The dynamic independent variables are FICO score after loan origination, current ratio after origination, debt to asset ratio after origination, and 12 months rolling average of corn to milk price ratio. Four models are estimated. They are regression models for prepayment with static covariates, for default using static covariates, for payment with both static and time-varying variables, and for default with both static and time-varying variables. The unit of observation in their study is individual loans. The results of the Cox proportional hazards model with only static covariates indicate that interest rate, branch location, current ratio, a refinanced loan, and the interaction of refinance and debt-to-asset ratio at origination are important factors which influence the risk of prepayment. However when time-varying covariates are added, the results change such that current ratio is no longer significant and the time-varying covariates are insignificant. For the risk of default model with static covariates, monthly payment and interest rate at loan origination are significant. When time-varying covariates are added, interest rate is no longer significant, but the FICO credit score and debt-to-asset ratio during the survival time are significant predictors of the risk of default. As noted by the authors, there were only 21 and 12 default observations in their two risk of default models, i.e., the static and static and time-varying models, respectively.

Heitfield and Sabarwal (2004) estimated a competing risks model of subprime automobile loans to identify the sources of default and prepayment risks on subprime automobile loans. They used vectors of quarterly fixed effects to examine the effect of macroeconomic factors on the loan instead of including variables in the regression model directly. The results showed that the default rate increases intensively in the first year and increases or remains stable thereafter. In addition, prepayment rates increase much faster and stay higher than default hazard rates. They found that interest rates did not influence prepayment rates. Shocks to household liquidity such as unemployment have a comparatively large effect on the default rates of subprime automobile loans.

Glennon and Nigro (2005) used a sample of loans in the Small Business Administration (SBA) loan guarantee program to analyze the likelihood and timing of default for small firms who receive loans. They used the discrete-time hazard model which is similar to Cox proportional hazard model. Both firm characteristics and lender characteristics are included as independent variables. One important finding of their research is that loan default levels of SBA loans are time dependent, which suggests that using a time-varying sample design—including the timing of default into the model—is necessary. Additionally, the results suggested that the relationship between default behavior and independent variables is maturity specific, which means loans with different maturity periods (i.e. three years, seven years, or fifteen years to maturity) present varying default behavior. They also pointed out a result which is similar to previous loan studies that the default probability of small loans is highly correlated with both the regional and industrial economic conditions. Overall, the research showed the importance of including time-varying variables in the model when estimating duration models for loans.

Review of Methodology

In my thesis, the Cox proportional hazards regression model with competing risks is employed as the main methodology to estimate the possible loan outcomes. This methodology will be briefly reviewed in the section below.

3.3 Survival Analysis

Survival analysis is usually used to model the time until a certain event happens. This method was applied first to medical studies to observe the time to death of patients (Allison, 2010). This use also explains the origination of the name of the method – Survival Analysis.

Researchers in other fields have used survival analysis to study a large variety of topics in economics, sociology, engineering, etc.

There are several reasons to select survival analysis models over classical regression methods in this study. Classical regression models assume the dependent variable to be normally distributed about the conditional mean but this need not be true of many duration times. Also, some observations are censored, which means they have not experienced any event of interest by the time the data collection ends—the so-called censoring problem. Moreover, the classical regression model does not deal well with time-varying covariates. Survival models solve these three main problems. In survival models, the dependent variable or response is the waiting time until the occurrence of a well-defined event which may not be normally distributed about some conditional mean function. Survival models handle censoring and time-varying covariates well.

Logit and probit models can also be used to estimate the risk of certain event. I did not choose these two models because they do not allow inclusion of time-varying covariates and do not estimate the likelihood of an outcome given the duration of the loan. A further weakness of these methods is that they do not explicitly utilize the time to the event.

Some basic notations and concepts of survival analysis are presented below.

The Survival Function

We assume T is a continuous positive random variable representing the length of time until the occurrence of an event with probability density function f(t) and cumulative density function $F(t) = \Pr\{T \leq t\}$, giving the probability the event has occurred by duration t.

The survival function is $S(t) = \Pr\{T > t\} = 1 - F(t) = \int_t^{\infty} f(t)\,dt$, which is the probability of surviving (no event) at least until time t.

The Hazard Function

The hazard function (hazard rate) is the probability of an event of interest at time t given survival up to time t.

$h(t) = \lim_{dt \to 0} \frac{\Pr\{t<T<t+dt|T>t\}}{dt} = \frac{f(t)}{S(t)}$

Censoring

Censoring occurs when the outcome of a particular loan is not observed as of the end of data collection. For example, in my thesis, the FSA data are available until the second quarter in calendar year 2012 (June 30, 2012), but some loans are still performing at that time. So, these observations are censored. 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).

3.4 Cox Proportional Hazards Model

The Cox model is based on a modeling approach to the analysis of survival times. The purpose of the model is to explore the effects of multiple covariates on survival distribution.

A parametric model with exponential form may be written as

$$\log(h_i(t))=\alpha+\beta_1 x_{i1}+\beta_2 x_{i2}+\cdots+\beta_k x_{ik}$$

or

$$h_i(t)=\exp(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik})$$

In this model, a positive β indicates that an increase in x increases the hazard and decreases survival time.

Different from the parametric model, by using Cox proportional hazards model, there is no need to make any assumptions about the shape of the hazard function or the distribution of the time of occurrence for some event, T. This means the baseline hazard function $\alpha(t)=\log h_0(t)$ is unspecified, where

$$\log h_i(t)=\alpha(t)+\beta_1 x_{i1}+\beta_2 x_{i2}+\cdots+\beta_k x_{ik}$$

It can also be written as

$$h_i(t)=h_0(t)\exp(\beta_1 x_{i1}+\beta_2 x_{i2}+\cdots+\beta_k x_{ik})$$

If there are two different observations, their hazard ratio will be

$$\frac{h_i(t)}{h_j(t)}=\frac{h_0(t)\exp(\beta_1 x_{i1}+\beta_2 x_{i2}+\cdots+\beta_k x_{ik})}{h_0(t)\exp(\beta_1 x_{j1}+\beta_2 x_{j2}+\cdots+\beta_k x_{jk})}$$

$$=\frac{\exp(\beta_1 x_{i1}+\beta_2 x_{i2}+\cdots+\beta_k x_{ik})}{\exp(\beta_1 x_{j1}+\beta_2 x_{j2}+\cdots+\beta_k x_{jk})}$$

Consequently, the Cox model is a proportional-hazards model. A positive β suggests an increase in x will increase the hazard and decrease the survival time.

3.5 Cox Regression Modeling

The Cox model is a semi-parametric model. Therefore, Cox regression can be estimated by partial maximum likelihood method (Kalbfleisch and Prentice, 2002). The Cox regression model has a constant term in my study as was done in Dixon et al. (2011). I use partial maximum likelihood to estimate the model. For further information, see Kalbfleisch and Prentice (2002).

CHAPTER 4: DATA SOURCES

In my thesis, some data come from FSA. Other data, such as data for contemporaneous variables, are from different 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. This chapter will summarize the sources of data.

FSA provides loan-level data on loan and borrower characteristics and lender type. The loan data are from three FSA sources: loan obligation, loan payment, and loan losses. The first source is a loan obligation record system that contains information on all guaranteed OL and FO farm loans as of the time the loans were obligated. The second FSA data source is quarterly data on loan payments and the loan's status (loan status reports). These loan status reports include information on whether a loan is current or not, length of delinquency, balance outstanding, and if the loan is in stage of liquidation. Quarterly loan status data were collected from the end of each quarter beginning with the first quarter of calendar year 2004 (March 31, 2004) through the second quarter of 2012 (June 30, 2012). The third FSA data source is a report containing information on loans that had a debt settlement claim, i.e., loss claim, filed by a lender. A total of 532 loans obligated in calendar years 2004 and 2005 were in all three FSA data sources, i.e., the loss claim report, loan status reports, and obligation report.

The population selected is all loans obligated in calendar years 2004 and 2005. These two years were selected because they coincide with the beginning of the available quarterly loan status report data. These two years were also selected because the time period, the first quarter of 2004 to the second quarter of 2012, provides a sufficiently long time period to fully analyze OL loans since most OL loans are not expected to perform beyond seven years.

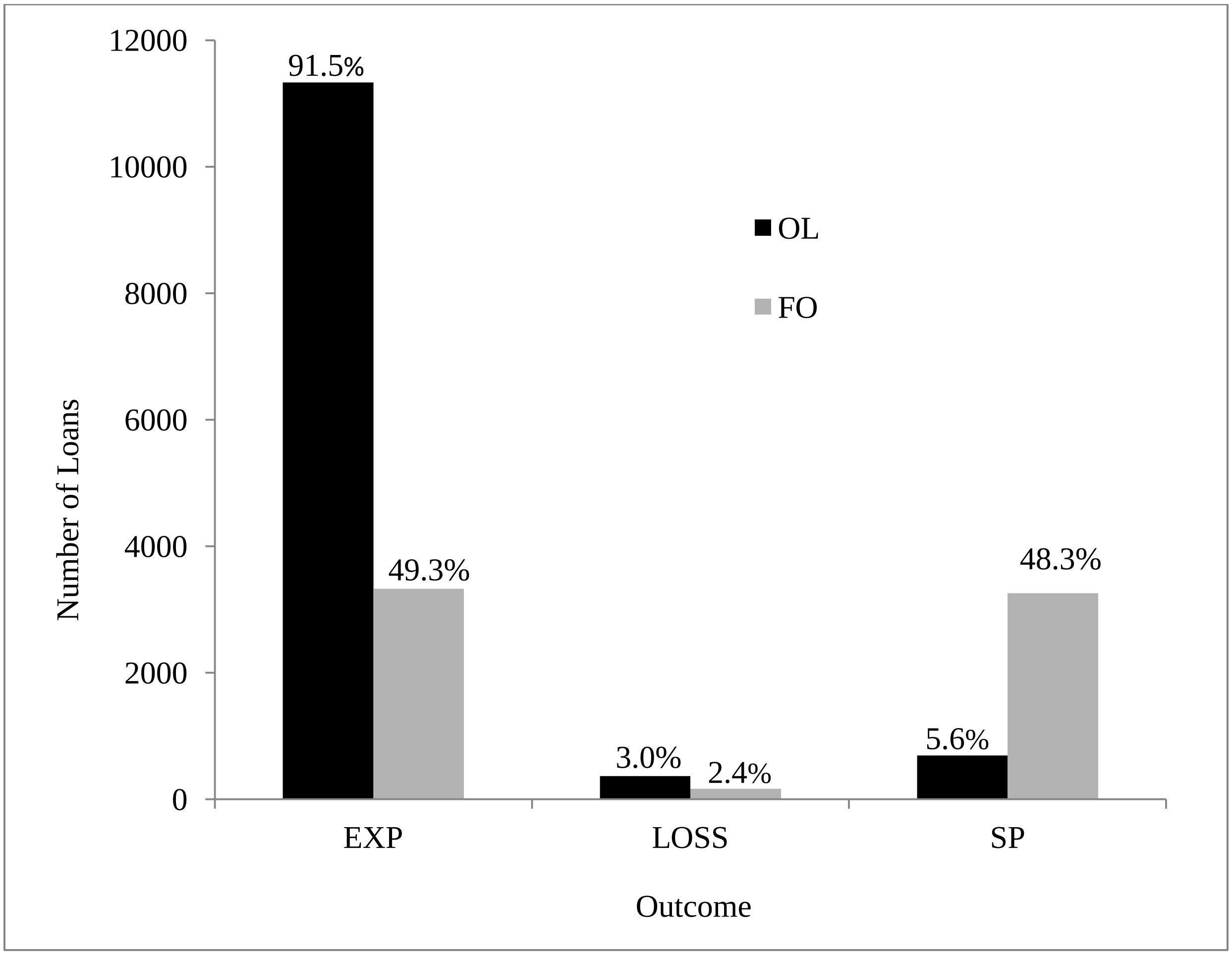
A total of 26,927 loans were obligated during calendar years 2004 and 2005, although only 20,791 of these loans appeared in the quarterly loan status reports. The inconsistency of 6,136 loans in the obligation data and loan status data is because only loans with a code “ACTIVE” were included in the loan status reports provided by FSA. Many of the 6,136 loans were likely paid off or refinanced before a status report was filed, such as self-liquidating production loans. Moreover, there may be lags in the status reports since preferred lenders may not be required to make status report within 6 months of loan origination and by the time a status report is supposed to be filed, the loan has been paid off or refinanced. Also, lenders may fail to file a status report for some loans for other reasons. Therefore, these 6,136 loans were excluded from the analysis since their status over time cannot be identified. In other words, 20,791 observations were in both datasets.

A sample with 19,126 loans is chosen from the loans that were in both obligation dataset and quarterly loan status dataset for several reasons. First, 12,327 observations were missing in at least one quarterly status report from the quarter of obligation to the quarter when the loan is first observed in a loan status report. A loan missing in one or more quarterly status reports is probably because lenders do not need to file a report with FSA until six to twelve months after a loan is obligated. Also, it may be that lenders fail to file a status report for some loans. After consulting with FSA personnel, it was deemed reasonable to only include those loans that have a status report recorded within eight or fewer quarters from the quarter of obligation since there is a lag from loan obligation date to when a lender is required to file a status report. This results in the exclusion of 107 observations from the dataset in this step. Second, 1123 observations are excluded because they have at least one missing quarter between when they are first observed in the status reports and when they are last observed. Third, 17 loans are excluded because of likely data-entry errors for their recorded interest rate. Sixteen loans had a 0 percent interest rate without interest assistance and one loan had an interest rate of 28.25 percent, which is way too high to be a correct interest rate for guaranteed loans. Finally, 25 loans were made in Alaska, Hawaii or Puerto Rico and are omitted because the contemporaneous economic data in the model are not available for these three areas. An observation may be excluded from the final dataset for one or more of these four reasons.

Out of the 19,126 loans, 6,754 (35 percent) are FO loans, whereas 12,372 (65 percent) are OL loans. Three different loan outcomes are defined. Expired with no loss claim (EXP) is defined as a loan guarantee that expires before maturity, at maturity or after maturity without a loss claim, such that the loan no longer appears in the quarterly status reports (see appendix table A.1 for the frequency of loan outcome by quarter of loan maturity date). It is possible that a loan with an expired guarantee corresponds to a loan that has been paid-in-full. Or it may be the lender no longer expects the loan to be of sufficient risk to continue the loan guarantee. Loans that expired before maturity, at maturity or after maturity are combined into one group since there is no risk related to a loan as long as it did not have a loss claim. Loss claim (LOSS) is defined as a loan that had a debt settlement date, which means the lender received a loss claim payment. All loans with loss claims are grouped into one category to get a greater number of observations for modeling since few loans had a loss claim after maturity. A still performing (SP) loan is defined as a loan that neither expired nor has a loss claim as of the final quarterly status report, i.e., June 30, 2012.

There are differences between OL and FO loan outcome percentages (figure 4.1). FO loans are long term loans whereas OL loans have much shorter maturities. Almost half (3,259) of FO loans were still performing (SP) 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 loans expired while only 49.3 percent of FO loans expired. The loss claim percentages for both loan types are almost the same with 3.0 percent (367) for OL loans having a slightly higher percentage than the 2.4 percent (165) for FO loans.

Figure 4.1 Outcomes for 12,372 OL and 6,754 FO loans



Source: FSA loan status record data

Due to these structural differences in OL and FO loan outcomes, it is reasonable to conclude that the two types of loans perform differently. The differences in loan outcomes by loan delinquency experience, i.e., has a loan ever been delinquent or not, are displayed in table 4.1. 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) did not have a loss claim and 24 percent (472) did have a loss claim. Of the 17,142 loans that had not experienced a delinquency, nearly 100 percent (17,082) did not have a loss claim, whereas 60 had a loss claim. This shows very convincingly that, simply on a bivariate basis, delinquency is a strong but not perfect predictor of a loss claim. A delinquency indicates a 24% chance of a loss claim. The probability of a loss claim without a delinquency is only about 3%. Also 89% of loans with a loss claim had been delinquent in at least one quarter. So, it is a rare loan loss claim that did not have a delinquency. A reason why a higher percentage of loans with a loss claim are not delinquent is because losses are borrower based instead of loan based. Once a loss claim is filed, the borrower is effectively closed out and his relationship with FSA is terminated. Therefore, the loans where a loss claim paid with no delinquency likely means that the borrower was in default on other guaranteed loans.

Table 4.1 Loan loss claim outcome and delinquency experience cross frequencies

		Delinquency		
		Never Delinquent	Delinquent	Total
Loss	No loss	17,082	1,512	18,594
	Loss	60	472	532
	Total	17,142	1,984	19,126

The loan obligation data collected by FSA includes borrower demographics (e.g., gender, birth date, marital status) and other information related to loan characteristics and lender type. Quarterly status reports for calendar year 2004 through the second quarter of 2012 are used to determine the loan outcomes of expired and loss claim. A loan is considered as still performing if the loan appears in the loan status report for the second quarter (June 30) of 2012 and it had never had a loss claim.

Data on variables that vary over time were collected. These variables are intended to indicate the changing economic environment. The variables include net farm income per farm, operating profit margin, farm real estate value, agricultural non-real estate interest rate, and unemployment rate. They were collected from different Federal Government sources. These data and their sources are discussed in greater detail in the next chapter.

CHAPTER 5: MODEL SPECIFICATION AND DESCRIPTIVE STATISTICS

5.1 Dependent Variables

The dependent variable in this study is loan duration until a loan outcome. Duration is measured in number of quarters from loan obligation to loan outcome of either expired with no loss claim (EXP) or loss claim (LOSS). Models are estimated separately for OL loans and FO loans.

5.2 Cox Proportional Hazards Model Specifications

Two individual hazard functions for each loan model are estimated: expired with no loss hazard and loss claim hazard. If a loan exists and has not had a loss claim 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 (Escalante et al., 2006; Dixon et al., 2007; McFadden, 2009; Dixon et al., 2011). Table 5.1 gives the descriptions of variables that are used in the model specification. The expected signs of coefficients for the OL and FO proportional hazards models can be found in table 5.2.

In the models, borrower characteristics are age (AGE), marital status (MARRIED), borrower gender (GNDR), borrower race (RACE), borrower region, which include 10 region variables and prior involvement with FSA loans (BHIST).

The borrower region was defined as the 10 USDA Farm Production regions (USDA/ERS, 2010), which are: Northeast (NE), Lake States (LKS), Corn Belt (CRN), Northern Plains (NPL), Appalachian (APP), Southeast (SE), Delta (DLT), Southern Plains (SPL), Mountain (MTN), and Pacific (PAC).[1] The regional variables are included since previous studies have shown that regional differences are important factors in the demand for loan programs (Dodson and Koenig, 2003; Ahrendsen et al., 2011).

Loan characteristic variables include loan obligation request amount (LAMT), if the loan was delinquent or not in a certain 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 assistant 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) loan. However, IA and LOC are only included in the OL loan model since they only apply to OL loans. Guaranteed loans are targeted at least in part to beginning, socially and economically disadvantaged farmers, adding the BF, BFS and IA dummy variables will help better understand the risks, costs, and benefits of these programs and to the demographic groups indicated. It is highly possible that these disadvantaged farmers will behave differently regarding payback ability because they face more severe financial and social problems. The inclusion of IA and LOC will allow FSA to better understand if loan types have different loan outcomes within the OL loan program.

[1] 1 (NE): CT, ME, MA, VT, RI, NH, NY, NJ; 2 (LKS): MI, WI, MN; 3 (CRN): IL, IN, IA, MO, OH; 4 (NPL): KS, NE, ND, SD; 5: (APP) KY, NC, TN, VA, WV; 6 (SE): AL, FL, GA, SC; 7 (DLT): AR, LA, MS; 8 (SPL): OK, TX; 9 (MTN): AZ, CO, ID, MT, NV, NM, UT, WY; 10 (PAC): CA, OR, WA.

[2] Socially disadvantaged farmer (SDA) is not included to avoid potential collinearity problems since both RACE and GNDR variables are included in the model.

Loan term (LTERM) is computed by subtracting the quarter number of closing date from the quarter number of maturity date.[3] By including the LTERM variable in the model, it can be seen if the length of loans influences outcomes of loans. I hypothesize that a substantial proportion of loans are paid back when the loans are close to maturity as was found by Dixon et al. (2011).

Interest rate directly influences the cost for borrowers to pay back the loan. A dummy variable indicating the loan has fixed or variable interest rate (INTYPE) is included. A loan with low fixed interest rate probably will be held longer since the borrower will pay off higher interest rate loans sooner and as long as the variable interest rate is higher over that period. On the other hand, since the interest rate generally declined during the last seven years of the study period, it is possible that loans with variable interest rates have a shorter pay off period than loans with fixed interest rate. The interest rate (INTRATE) reported at loan origination is included in the model as well. I did not use a quarterly time-varying interest rate that is unique for each loan because I do not have a reliable record for quarterly interest rates in the loan status reports.

Characteristics of lenders include lender type, whether a lender is a commercial bank (CB), Farm Credit System (FCS) or others such as credit union, mortgage bank, saving bank, insurance company, etc. (OTHER). In the category of commercial bank, the banks are divided into two categories; top ten largest banks (LCB) and small commercial banks (SCB), which are those commercial banks that are not the top ten banks (SCB).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). The top ten banks are those banks with the

[3] Another way to model LTERM is to estimate it as a time-varying variable by calculating duration between the loan's current quarter and its quarter of maturity date.

highest total deposits at the end of the second quarter of 2004 that are also in the FSA dataset.[4] The FSA data includes bank name and bank tax ID as identifiers, but the bank name listed for each loan may not be identical to the FFIEC bank name and the FFIEC does not use a bank tax ID. Therefore, I matched the top ten bank names with the same or similar bank names and the corresponding tax IDs in the FSA data. The LCB and SCB binary variables are included because it was found in earlier agricultural loan studies that large banks behave differently from small banks (Dixon et al., 1997).

Another lender characteristic is if the lender is a preferred or certified (PC) lender by FSA. For example, it is expected that a PC lender should be less likely to have a loss claim. This is expected since criteria to become a PC lender includes that the lender have agricultural and guaranteed lending experiences and has relatively little loss experience with FSA guarantees. For example, loss rates cannot exceed 7 percent to be a certified lender and 3 percent to be a preferred lender (USDA/FSA, 2010).

The time-varying, economic environment variables are measured quarterly or annually at the smallest regional level given availability of the data. All the contemporaneous variables, with the exception of DEL, are lagged one quarter considering the reaction time for borrowers to change their behavior in response to changes in economic conditions.

State-level net farm income per farm (NFIF) was calculated by using ERS state net farm income and state farm numbers (USDA/ERS, 2012). These are annual data. Therefore, the data for a year are repeated for each quarter within that particular calendar year. NFIF measures the profitability of farms by state and year. Operating profit margin (OPM) was gathered from

[4]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, 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.

annual, state-level ERS data. OPM is computed by dividing net farm income by the value of farm production. It is a measurement of farm efficiency by state and year. Both profitability and efficiency are important factors that determine the ability to pay back loan principal and interest. Farm real estate value (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) and is repeated quarterly within a year.

The interest rate is an important factor that influences the lending decision and loan repayment capacity and is included in the models. The time-varying interest rate (INTR) used in the study is the average effective interest rate on all non-real estate bank loans and is collected quarterly by the Federal Reserve Bank of Kansas City (2013).

Monthly state-level unemployment rates (UNEMP) are obtained from the Bureau of Labor Statistics (2013) and averaged to quarterly unemployment rate. UNEMP provides an indication of the general economic wellbeing by quarter and by state. Labor force demand also implies the demand of the state economy.

Table 5.1 Variable definitions	
Dependent variable	
DUR	Quarters from obligation to observed status (expired with no loss (EXP), settled for loss (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
GNDR	Equals 1 if borrower gender is female or organization owned by female, 0 otherwise
RACE	Equals 1 if borrower is racial or ethnic minority, 0 otherwise
BHIST	Equals 1 if borrower had involvement with FSA before, 0 otherwise
LAMT	Loan obligation amount in thousand dollars
LTERM	Loan term measured as subtracting quarter of obligation from quarter of maturity
INTYPE	Equals 1 if interest type is fixed, 0 otherwise
INTRATE	Lender guarantee interest rate
BF	Equals 1 if loan has beginning farmer 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
LCB	Equals 1 if lender is a top ten commercial bank, 0 otherwise
SCB	Equals 1 if lender is not a top ten commercial bank, 0 otherwise
PC	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 5.1 Variable definitions

Time varying	
DEL	Equals 1 if loan was delinquent in certain quarter, 0 otherwise
NFIF	State-level quarterly net farm income per farm measured as net farm income divided by farm number in thousands of dollar
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 unemployment rate (%), seasonally adjusted unemployment rate (%)

Table 5.2 Expected signs of coefficients for OL and FO loan Cox proportional hazard models					
		OL		FO	
Origination Variables		EXPIRE	LOSS	EXPIRE	LOSS
	AGE	-	+	-	+
	MARRIED	+	-	+	-
	GNDR	+/-	+/-	+/-	+/-
	RACE	+/-	+/-	+/-	+/-
	BHIST	+	-	+	-
	LAMT	-	+	-	+
	LTERM	-	+	-	+
	INTYPE	-	+	-	+
	INTRATE	-	+	-	+
	BF	-	+	-	+
	BFS	-	+	-	+
	IA	+/-	+/-	NA	NA
	LOC	+/-	+/-	NA	NA
	FCS	+	-	+	-
	LCB	+	-	+	-
	OTHER	+/-	+/-	+/-	+/-
	PC	+	-	+	-
	NE	+/-	+/-	+/-	+/-
	CRN	+/-	+/-	+/-	+/-
	LKS	+/-	+/-	+/-	+/-
	NPL	+/-	+/-	+/-	+/-
	APP	+/-	+/-	+/-	+/-
	SE	+/-	+/-	+/-	+/-
	DLT	+/-	+/-	+/-	+/-
	SPL	+/-	+/-	+/-	+/-
	MTN	+/-	+/-	+/-	+/-
	PAC	+/-	+/-	+/-	+/-
Contemporaneous Variables					
	DEL	-	+	-	+
	NFIF	+	-	+	-
	OPM	+	-	+	-
	REV	+	-	+	-
	INTR	-	+	-	+
	UNEMP	-	+	-	+

NA: Not applicable

5.3 Descriptive Statistics

Some empirical analyses of the data before model estimation are necessary to understand certain facts of the dataset. It will help in removing outliers that could possibly induce biased estimation results and fix missing data problems to enhance data completeness.

Fund code and program code are FSA variables in the original dataset that both provide information on whether a loan is an OL or FO loan. However, after checking the completeness of both variables, fund code is more complete than program code with four more observations. Therefore, fund code is used as an indication of loan type. The quarterly loan status and loss claim data are in different datasets than the loan obligation dataset. A unique identifier for each loan is used to match quarterly loan and loss claim data with the loan obligation data.

Descriptive statistics for all loans are presented in table 5.3. About 67.8 percent of borrowers are male and organizations owned by male, only 3.4 percent are female and organizations owned by female, and 28.8 percent are family unit and organizations owned by public body. For marital status, 18.6 percent are not married and 0.6 percent are separated, whereas 80.8 percent are married. The average borrower age (AGE) in the sample is 43. Among borrowers, 93.2 percent are white, 0.5 percent are African Americans, 2.0 percent are American Indian/Alaskan native, 1.3 percent are Hispanic, and 3.0 percent are Asian or Pacific Islander.

Twenty-four percent of borrowers chose fixed interest rates and 76 percent chose variable interest rates. Farmer loans are used for different purposes. Thirty-three percent of loans are made for annual living or operating expense, 11 percent are for equipment for livestock and property purchases, 6 percent are used for capital improvement or construction cost, 13 percent are for real estate purchases, 23 percent are for refinance debt with the same lender, 10 percent are for debt refinancing with different creditors, and 3 percent are used to refinance direct farm loan debt. Among the borrowers of loans, 34.9 percent never had a guaranteed or direct loan before whereas 65.1 percent have current or previous involvement with FSA guaranteed and/or direct loan programs. For loans to borrowers with current or former FSA involvement, 10.1 percent are direct loans, 32.5 percent are guaranteed loans only, and 22.5 percent are guaranteed and direct loans.

Out of the 19,126 loans that were obligated in calendar years 2004 and 2005 and are in the dataset, 12,372 were OL loans and 6,754 were FO loans. There are almost twice as many OL loans as FO loans. A total of $2.13 billion went to OL loans with an average of $172 thousand per loan and $1.98 billion went to FO loans with an average of $294 thousand per loan. Out of all loans, 3,844 (20.1 percent) loans were made to beginning farmers (BF) and 690 (3.6 percent) loans were made to socially disadvantaged (SDA) farmers. Moreover, 836 (4.4 percent) loans are made to both BF and SDA (BFS) farmers. For all loans, 14.7 percent received interest assistance and 33.1 percent are in line-of-credit loans, although among OL loans only, the percentages are 22.7 and 51.2.

The average duration of loans is 17 quarters. The standard deviation of loan duration is 9. Among all loans, 96 percent have a 90 percent of guarantee, whereas the lowest guarantee percentage is 60 and the highest guarantee percentage is 95. A total of 1,984 (10.4 percent) loans were reported as delinquent at end of at least one quarter. Of these loans, 185 (9.3 percent) were delinquent in the quarter of maturity. Moreover, 1,876 loans (94.6 percent) were delinquent in at least one quarter before the quarter of their maturity date.

Lender characteristics variables showed that 67.2 percent of loans were made by commercial banks, or if lenders are defined as top-ten (LCB) and non-top ten agricultural commercial banks (SCB), they originated 2.2 percent and 65.0 percent of all loans respectively.

The Farm Credit System (FCS) originated 26.8 percent. The remaining 6.1 percent of loans are made by other lenders, such as credit unions, mortgage loan companies, savings banks,

Table 5.3 All loan summary statistics

	All loans (EXP, LOSS, SP)				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	12749	42.78	12.00	18.00	83.00
MARRIED	16067	0.81	0.39	0	1
GNDR	19126	0.32	0.47	0	1
RACE	19126	0.07	0.25	0	1
BHIST	19126	0.65	0.48	0	1
LAMT ($1000)	19126	215.547	186.647	1.898	852.000
LTERM	19126	39.65	30.55	1.00	160.00
INTYPE	19126	0.24	0.43	0	1
INTRATE (%)	19126	7.18	1.20	0.05	12.25
BF	19126	0.20	0.40	0	1
SDA	19126	0.04	0.19	0	1
BFS	19126	0.04	0.20	0	1
IA	19126	0.15	0.35	0	1
LOC	19126	0.33	0.47	0	1
FCS	19126	0.27	0.44	0	1
LCB	19126	0.02	0.16	0	1
SCB	19126	0.65	0.48	0	1
Other	19126	0.06	0.24	0	1
PC	19126	0.52	0.50	0	1
NE	19126	0.06	0.19	0	1
CRN	19126	0.21	0.41	0	1
LKS	19126	0.15	0.35	0	1
NPL	19126	0.16	0.37	0	1
APP	19126	0.07	0.26	0	1
SE	19126	0.06	0.23	0	1
DLT	19126	0.09	0.28	0	1
SPL	19126	0.08	0.27	0	1
MTN	19126	0.07	0.25	0	1
PAC	19126	0.06	0.23	0	1
Contemporaneous Variables					
DEL	352320	0.02	0.14	0	1
NFIF ($1000)	352320	37.360	22.877	-5.245	200.061
OPM	352320	0.24	0.07	-0.06	0.44
REV ($1000)	352320	2.383	1.549	0.260	16.800
INTR (%)	352320	6.52	1.50	4.25	8.60
UNEMP (%)	352320	5.58	2.03	2.40	14.13

Table 5.3 All loan summary statistics (continued)

	Only EXP Loans				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	9666	42.80	12.00	18.00	83.00
MARRIED	12194	0.81	0.39	0	1
GNDR	14643	0.33	0.47	0	1
RACE	14643	0.06	0.24	0	1
BHIST	14643	0.69	0.46	0	1
LAMT ($1000)	14643	194.719	176.445	1.898	852.000
LTERM	14643	32.15	25.52	1.00	160.00
INTYPE	14643	0.21	0.41	0	1
INTRATE (%)	14643	7.21	1.21	0.05	12.10
BF	14643	0.20	0.40	0	1
SDA	14643	0.04	0.19	0	1
BFS	14643	0.03	0.18	0	1
IA	14643	0.17	0.38	0	1
LOC	14643	0.41	0.49	0	1
FCS	14643	0.24	0.43	0	1
LCB	14643	0.02	0.16	0	1
SCB	14643	0.68	0.47	0	1
Other	14643	0.06	0.24	0	1
PC	14643	0.52	0.50	0	1
NE	14643	0.05	0.19	0	1
CRN	14643	0.21	0.41	0	1
LKS	14643	0.15	0.36	0	1
NPL	14643	0.18	0.38	0	1
APP	14643	0.07	0.25	0	1
SE	14643	0.05	0.22	0	1
DLT	14643	0.09	0.29	0	1
SPL	14643	0.07	0.26	0	1
MTN	14643	0.07	0.25	0	1
PAC	14643	0.06	0.24	0	1
Contemporaneous Variables					
DEL	225736	0.01	0.12	0	1
NFIF ($1000)	225736	37.022	21.608	-5.245	200.061
OPM	225736	0.24	0.07	-0.06	0.44
REV ($1000)	225736	2.195	1.440	0.260	16.800
INTR (%)	225736	6.76	1.41	4.25	8.60
UNEMP (%)	225736	5.16	1.70	2.40	14.13

Table 5.3 All loan summary statistics (continued)

	Only LOSS Loans				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	371	40.41	11.00	20.00	73.00
MARRIED	449	0.77	0.42	0	1
GNDR	532	0.27	0.45	0	1
RACE	532	0.17	0.38	0	1
BHIST	532	0.61	0.49	0	1
LAMT ($1000)	532	285.376	194.780	6.088	852.000
LTERM	532	33.91	23.84	3.00	160.00
INTYPE	532	0.21	0.41	0	1
INTRATE (%)	532	7.65	1.17	2.50	12.25
BF	532	0.26	0.44	0	1
SDA	532	0.04	0.20	0	1
BFS	532	0.15	0.36	0	1
IA	532	0.08	0.28	0	1
LOC	532	0.40	0.49	0	1
FCS	532	0.16	0.37	0	1
LCB	532	0.02	0.22	0	1
SCB	532	0.78	0.43	0	1
Other	532	0.04	0.19	0	1
PC	532	0.39	0.49	0	1
NE	532	0.02	0.12	0	1
CRN	532	0.10	0.29	0	1
LKS	532	0.10	0.30	0	1
NPL	532	0.07	0.25	0	1
APP	532	0.08	0.26	0	1
SE	532	0.07	0.25	0	1
DLT	532	0.16	0.37	0	1
SPL	532	0.33	0.47	0	1
MTN	532	0.02	0.15	0	1
PAC	532	0.06	0.24	0	1
Contemporaneous Variables					
DEL	8188	0.25	0.43	0	1
NFIF ($1000)	8188	35.770	21.829	-1.033	147.524
OPM	8188	0.26	0.08	-0.04	0.44
REV ($1000)	8188	2.147	1.201	0.260	8.500
INTR (%)	8188	6.74	1.42	4.25	8.60
UNEMP (%)	8188	5.58	1.72	2.63	14.13

etc. Lenders preferred or certified by FSA made 51.6 percent of loans.

For the 532 loans with loss claims, the average total claim amount is $170,310 with a standard deviation of $101,250. The maximum claim amount is $603,124. These loans have an average loan obligation of $285,376, which is much higher than $215,547 for all loans and $194,719 for the expired loans.

Descriptive summary statistics for OL loan variables are reported in table 5.4. Table 5.5 presents the descriptive statistics for FO loan variables.

Table 5.4 OL Summary Statistics

	All loans (EXP, LOSS, SP)				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	8036	42.89	12.00	18.00	82.00
MARRIED	10156	0.81	0.40	0	1
GNDR	12372	0.33	0.47	0	1
RACE	12372	0.05	0.22	0	1
BHIST	12372	0.73	0.44	0	1
LAMT ($1000)	12372	172.549	157.491	1.898	852.000
LTERM	12372	21.11	6.36	1.00	65.00
INTYPE	12372	0.17	0.38	0	1
INTRATE (%)	12372	7.32	1.25	1.85	12.25
BF	12372	0.20	0.40	0	1
SDA	12372	0.04	0.20	0	1
BFS	12372	0.02	0.15	0	1
IA	12372	0.23	0.42	0	1
LOC	12372	0.51	0.50	0	1
FCS	12372	0.23	0.42	0	1
LCB	12372	0.02	0.14	0	1
SCB	12372	0.70	0.46	0	1
Other	12372	0.05	0.23	0	1
PC	12372	0.51	0.50	0	1
NE	12372	0.05	0.18	0	1
CRN	12372	0.20	0.40	0	1
LKS	12372	0.15	0.36	0	1
NPL	12372	0.19	0.39	0	1
APP	12372	0.06	0.24	0	1
SE	12372	0.04	0.20	0	1
DLT	12372	0.09	0.29	0	1
SPL	12372	0.08	0.27	0	1
MTN	12372	0.06	0.24	0	1
PAC	12372	0.06	0.25	0	1
Contemporaneous Variables					
DEL	195304	0.02	0.15	0	1
NFIF ($1000)	195304	37.841	21.905	-5.245	200.061
OPM	195304	0.25	0.07	-0.06	0.44
REV ($1000)	195304	2.186	1.454	0.260	15.700
INTR (%)	195304	6.69	1.43	4.25	8.60
UNEMP (%)	195304	5.19	1.76	2.40	14.13

Table 5.4 OL Summary Statistics (continued)					
	Only EXP Loans				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	7338	42.93	12.00	18.00	82.00
MARRIED	9294	0.81	0.40	0	1
GNDR	11313	0.33	0.47	0	1
RACE	11313	0.05	0.21	0	1
BHIST	11313	0.74	0.44	0	1
LAMT ($1000)	11313	168.794	156.277	1.898	852.000
LTERM	11313	20.83	6.32	1.00	65.00
INTYPE	11313	0.17	0.37	0	1
INTRATE (%)	11313	7.29	1.25	1.85	12.10
BF	11313	0.20	0.40	0	1
SDA	11313	0.04	0.20	0	1
BFS	11313	0.02	0.14	0	1
IA	11313	0.22	0.41	0	1
LOC	11313	0.53	0.50	0	1
FCS	11313	0.23	0.42	0	1
LCB	11313	0.02	0.14	0	1
SCB	11313	0.70	0.46	0	1
Other	11313	0.05	0.23	0	1
PC	11313	0.52	0.50	0	1
NE	11313	0.05	0.18	0	1
CRN	11313	0.20	0.40	0	1
LKS	11313	0.15	0.36	0	1
NPL	11313	0.19	0.40	0	1
APP	11313	0.06	0.23	0	1
SE	11313	0.04	0.20	0	1
DLT	11313	0.10	0.29	0	1
SPL	11313	0.07	0.26	0	1
MTN	11313	0.07	0.25	0	1
PAC	11313	0.07	0.25	0	1
Contemporaneous Variables					
DEL	169859	0.01	0.12	0	1
NFIF ($1000)	169859	37.608	21.652	-5.245	169.502
OPM	169859	0.24	0.07	-0.06	0.44
REV ($1000)	169859	2.122	1.434	0.260	15.700
INTR (%)	169859	6.77	1.40	4.25	8.60
UNEMP (%)	169859	5.06	1.64	2.40	14.13

Table 5.5 FO Summary Statistics

	All loans (EXP, LOSS, SP)				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	4713	42.60	11.00	18.00	83.00
MARRIED	5911	0.81	0.39	0	1
GNDR	6754	0.32	0.47	0	1
RACE	6754	0.10	0.30	0	1
BHIST	6754	0.50	0.50	0	1
LAMT ($1000)	6754	294.309	208.880	3.000	852.000
LTERM	6754	73.60	28.04	1.00	160.00
INTYPE	6754	0.37	0.48	0	1
INTRATE (%)	6754	6.94	1.07	0.05	10.75
BF	6754	0.21	0.41	0	1
SDA	6754	0.03	0.16	0	1
BFS	6754	0.08	0.27	0	1
FCS	6754	0.34	0.47	0	1
LCB	6754	0.03	0.20	0	1
SCB	6754	0.56	0.50	0	1
Other	6754	0.07	0.26	0	1
PC	6754	0.53	0.50	0	1
NE	6754	0.06	0.24	0	1
CRN	6754	0.24	0.43	0	1
LKS	6754	0.14	0.35	0	1
NPL	6754	0.12	0.33	0	1
APP	6754	0.09	0.29	0	1
SE	6754	0.08	0.27	0	1
DLT	6754	0.07	0.26	0	1
SPL	6754	0.08	0.27	0	1
MTN	6754	0.07	0.26	0	1
PAC	6754	0.04	0.20	0	1
Contemporaneous Variables					
DEL	157016	0.02	0.13	0	1
NFIF ($1000)	157016	36.767	23.971	-5.245	200.061
OPM	157016	0.24	0.07	-0.06	0.44
REV ($1000)	157016	2.627	1.627	0.260	16.800
INTR (%)	157016	6.30	1.55	4.25	8.60
UNEMP (%)	157016	6.06	2.23	2.40	14.13

Table 5.5 FO Summary Statistics					
	All loans (EXP, LOSS, SP)				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	4713	42.60	11.00	18.00	83.00
MARRIED	5911	0.81	0.39	0	1
GNDR	6754	0.32	0.47	0	1
RACE	6754	0.10	0.30	0	1
BHIST	6754	0.50	0.50	0	1
LAMT ($1000)	6754	294.309	208.880	3.000	852.000
LTERM	6754	73.60	28.04	1.00	160.00
INTYPE	6754	0.37	0.48	0	1
INTRATE (%)	6754	6.94	1.07	0.05	10.75
BF	6754	0.21	0.41	0	1
SDA	6754	0.03	0.16	0	1
BFS	6754	0.08	0.27	0	1
FCS	6754	0.34	0.47	0	1
LCB	6754	0.03	0.20	0	1
SCB	6754	0.56	0.50	0	1
Other	6754	0.07	0.26	0	1
PC	6754	0.53	0.50	0	1
NE	6754	0.06	0.24	0	1
CRN	6754	0.24	0.43	0	1
LKS	6754	0.14	0.35	0	1
NPL	6754	0.12	0.33	0	1
APP	6754	0.09	0.29	0	1
SE	6754	0.08	0.27	0	1
DLT	6754	0.07	0.26	0	1
SPL	6754	0.08	0.27	0	1
MTN	6754	0.07	0.26	0	1
PAC	6754	0.04	0.20	0	1
Contemporaneous Variables					
DEL	157016	0.02	0.13	0	1
NFIF ($1000)	157016	36.767	23.971	-5.245	200.061
OPM	157016	0.24	0.07	-0.06	0.44
REV ($1000)	157016	2.627	1.627	0.260	16.800
INTR (%)	157016	6.30	1.55	4.25	8.60
UNEMP (%)	157016	6.06	2.23	2.40	14.13

Table 5.5 FO Summary Statistics (continued)					
	Only EXP Loans				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	2328	42.41	12.00	18.00	83.00
MARRIED	2900	0.82	0.38	0	1
GNDR	3330	0.34	0.47	0	1
RACE	3330	0.10	0.30	0	1
BHIST	3330	0.53	0.50	0	1
LAMT ($1000)	3330	282.796	209.521	3.000	852.000
LTERM	3330	70.64	28.48	2.00	160.00
INTYPE	3330	0.36	0.48	0	1
INTRATE (%)	3330	6.94	1.05	0.05	10.75
BF	3330	0.21	0.41	0	1
SDA	3330	0.03	0.16	0	1
BFS	3330	0.08	0.27	0	1
FCS	3330	0.27	0.45	0	1
LCB	3330	0.03	0.21	0	1
SCB	3330	0.62	0.49	0	1
Other	3330	0.08	0.26	0	1
PC	3330	0.51	0.50	0	1
NE	3330	0.06	0.23	0	1
CRN	3330	0.24	0.42	0	1
LKS	3330	0.15	0.35	0	1
NPL	3330	0.12	0.32	0	1
APP	3330	0.10	0.29	0	1
SE	3330	0.08	0.27	0	1
DLT	3330	0.08	0.27	0	1
SPL	3330	0.08	0.27	0	1
MTN	3330	0.06	0.25	0	1
PAC	3330	0.05	0.21	0	1
Contemporaneous Variables					
DEL	55877	0.02	0.12	0	1
NFIF ($1000)	55877	35.240	21.375	-5.245	200.061
OPM	55877	0.24	0.07	-0.06	0.44
REV ($1000)	55877	2.416	1.433	0.260	16.800
INTR (%)	55877	6.72	1.44	4.25	8.60
UNEMP (%)	55877	5.46	1.85	2.40	14.13

Table 5.5 FO Summary Statistics (continued)					
	Only LOSS Loans				
Origination Variables	N	Mean	Std. Dev.	Min	Max
AGE	133	40.14	10.00	21.00	67.00
MARRIED	152	0.81	0.39	0	1
GNDR	165	0.35	0.48	0	1
RACE	165	0.36	0.48	0	1
BHIST	165	0.39	0.49	0	1
LAMT ($1000)	165	408.532	199.99	40.000	852.000
LTERM	165	62.78	22.90	8.00	160.00
INTYPE	165	0.32	0.47	0	1
INTRATE (%)	165	7.20	0.89	4.50	9.25
BF	165	0.24	0.43	0	1
SDA	165	0.01	0.11	0	1
BFS	165	0.35	0.48	0	1
FCS	165	0.19	0.40	0	1
LCB	165	0.03	0.31	0	1
SCB	165	0.73	0.48	0	1
Other	165	0.04	0.20	0	1
PC	165	0.46	0.50	0	1
NE	165	0.02	0.15	0	1
CRN	165	0.09	0.29	0	1
LKS	165	0.09	0.29	0	1
NPL	165	0.02	0.15	0	1
APP	165	0.12	0.33	0	1
SE	165	0.05	0.23	0	1
DLT	165	0.19	0.40	0	1
SPL	165	0.32	0.47	0	1
MTN	165	0.03	0.17	0	1
PAC	165	0.05	0.23	0	1
Contemporaneous Variables					
DEL	3195	0.27	0.44	0	1
NFIF ($1000)	3195	32.744	20.267	-1.033	147.524
OPM	3195	0.25	0.09	-0.04	0.44
REV ($1000)	3195	2.164	1.123	0.260	6.600
INTR (%)	3195	6.67	1.48	4.25	8.60
UNEMP (%)	3195	5.68	1.74	2.80	14.13

5.5 Model Selection Strategy

Two Cox, competing risks, proportional hazards models are estimated: one for OL loans and one for FO loans. The samples for the models are OL loans and FO loans originated in 2004 and 2005. Four hazard functions are estimated: two for expired with no loss, two for settled for loss. Some independent variables are excluded in preliminary estimation to simplify the model. The process is stated in detail below.

All origination and contemporaneous variables were included in initial model estimation. The results of initial models are presented in the tables A.2 and A.3 in the Appendix. Both AGE and MARRIED have missing value problems. Nearly one third (6,377) of observations have missing values for the birth date variable used to compute age. Also, 16.0 percent (3,059) observations have no record of marital status. In order to get as many observations as possible, I decided to consider excluding them from the final model first. The results of initial models show that MARRIED is not significant in any of the hazard functions in both models. Thus, MARRIED is excluded.

In the two models without MARRIED, AGE is significant in the loss claim function of the OL loan model and also in both expiration and loss claim functions of the FO model. However, I suspect there is collinearity between BF and AGE. After checking the correlation, the result shows that the correlation between them is -0.52, which as expected shows that beginning farmers tend to be younger. Therefore, AGE is excluded from the final model thereby letting BF be a proxy for AGE and allowing 4,353 and 1,995 more observations to be used in the final OL and FO models. The estimation results for OL and FO loan models without AGE and MARRIED are presented in Appendix tables A.4 and A.5.

In order to simplify the model more, 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 and reported in Appendix tables A.6 and A.7. For the OL model, INTYPE, LOC, NE and REV were excluded from the final model. For the FO model, GNDR, RACE, INTYPE, OTHER, NE, LKS, MTN, and REV were excluded from the final model.

CHAPTER 6: MODEL ESTIMATION RESULTS

For the estimation of the coefficients listed in table 5.1, a positive coefficient indicates that an increase in the variable increases the likelihood the event happens at a given point in time and decreases the expected time to the outcome. Elasticities are computed at the sample means and indicate the percent change in the hazard rate given a one percent increase in the corresponding independent variable. Comparing elasticities removes the problem caused by the different units of measurement for the independent variables.

6.1 Cox Proportional Hazards Model Estimation

6.1.1 OL Loan Model Estimation Results

Cox proportional hazards model estimated coefficients for the OL model are presented in table 6.1. Out of the 53 coefficients in the two hazard functions, 41 are significant at the 0.10 level or better. GNDR is significant and negatively signed in loss claim model, indicating females and organizations owned by females are less likely to have a loss claim and the time to loss claim is longer compared to males or organizations owned by males. RACE is negative and highly significant in the expired with no loss model, which indicates that loans made by non-white borrowers are less likely to expire with no loss and the payback period is longer. BHIST is highly significant and positive in the expired with no loss hazard function, indicating loans made to borrowers who have previous involvement with FSA pay back faster and have a higher possibility of expiration with no loss.

The negative sign on LAMT shows increasing LAMT decreases the likelihood of expiration and increases the time to expiration with no loss hazard. LAMT is significant and positive in the loss claim hazard function indicating larger loan amounts are more likely to have a loss claim.

It is in my expectation that increasing loan term decreases the likelihood of expiration with no loss and this result is confirmed. Thus, the highly significant, negative sign of LTERM coefficient in the expiration hazard function is intuitive. INTRATE is positive and significant in both hazard functions. This indicates a higher interest rate at loan origination increases the likelihood for both expiration and loss claim. The higher interest rate raises the cost for the loan and leads to a greater incentive to refinance and payback the loan. The interest rate generally fell over the sample period, which made refinancing and repaying the loans even more advantageous. Also, the higher costs associated with higher interest rates at loan origination make loans harder to payback and induce loss claims. The impact on loss claim is much higher than on expire as indicated by the magnitudes of the coefficients and the elasticities.

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 and result in a loss claim. Relatively though, the likelihood increase in the loss hazard function is much higher than in the expired with no loss hazard function. The sign of BFS is positive in the loss hazard function, which indicates that farmers who are both BF and SDA are more likely to have a loss claim and take a shorter time to file the claim. These results are somewhat different than those in Dixon et al. (2011). They found BF to be insignificant while direct loans that were both BF and SDA were less likely to be paid in full and, after loan restructuring, were more likely go into default. To the extent that expired guaranteed loans are paid in full, then the BF program appears to be more successful for guaranteed loans than direct loans. However in terms of loan default, it appears the BF program is less successful for guaranteed loans than direct loans.

The negative signs of IA in expired with no loss hazard and loss claim hazard indicates loans with interest assistance are less likely to expire and have a loss. For expired with no loss hazard, it could be that borrowers want to keep the loan longer since they have the subsidy benefit of interest assistance. For the loss hazard, 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 enough to make loss claims less likely. Thus the loss claim possibilities for IA loans are lower. This finding is consistent with the finding in Ahrendsen et al. (2004). They found lower percentages of IA loans had loss claims than did non-IA loans, indicating IA users are more advantaged in repaying loans.

The positive sign on FCS in the expiration hazard function and the negative sign in loss claim function indicates that, compared with loans made by SCB, loans made by FCS are more likely to expire and less likely to have losses. Like FCS, the positive and significant signs of LCB and 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. The negative sign on PC in the loss claim hazard function is intuitive. Loans made by FSA preferred or certified lenders have a lower likelihood to have a loss claim. These results show that in order to reduce lending risks, FSA should try to attract more FCS, large commercial bank, and preferred or certified lenders to make guaranteed loans.

All regional impacts are relative to the Corn Belt region since CRN is omitted from the estimation. The results indicate there are significant differences between the regions and the Corn Belt region. The significant positive signs of LKS, DLT and PAC in both hazard functions indicate that loans made in the Lake States, Delta and Pacific regions have higher likelihoods of both expiration and loss than does the Corn Belt region. The magnitudes of the coefficients indicate the likelihood of loss claim is relatively much higher than the likelihood of expiration. The positive sign of MTN indicates that loans obligated in the Mountain region have a higher

Table 6.1 Competing risk model estimates of hazard function coefficients and elasticities for OL loans

Variables	EXP			LOSS		
Time invariant	Coefficient Estimate		Elasticity[b]	Coefficient Estimate		Elasticity
CON[a]	9.9523	***		NA		
GNDR	-0.0246			-0.2153	**	
RACE	-0.2120	***		-0.0322		
BHIST	0.1700	***		0.0563		
LAMT	-0.0005	***	-0.0859	0.0009	***	0.2168
LTERM	-0.0718	***	-1.4955	-0.0083		-0.1739
INTRATE	0.0121	**	0.0883	0.1800	***	1.4140
BF	0.0784	***		0.3445	***	
BFS	0.1149			0.9868	***	
IA	-0.2464	***		-0.5545	***	
FCS	0.0563	*		-0.3451	*	
LCB	0.2660	***		-0.1505		
OTHER	0.1294	***		-0.5828		
PC	0.0148			-0.4649	***	
LKS	0.0599	**		0.3748	**	
NPL	-0.1413	*		0.0883		
APP	-0.1189	***		0.4562	**	
SE	-0.3945	***		0.5502	**	
DLT	0.2519	***		0.7961	***	
SPL	-0.0125			1.4072	***	
MTN	0.1091	***		-0.2289		
PAC	0.4338	***		0.7361	**	
Time variant						
DEL	0.0441			3.0818	***	
NFIF	0.0024	***	0.0903	-0.0017	**	-0.0652
OPM	0.4303	*	0.1053	4.1842	***	1.1492
INTR	-0.0043	***	-0.0293	0.2962	***	2.0109
UNEMP	-0.0460	***	-0.2328	-0.0058	***	-0.0319

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

possibility to expire with no loss. On the contrary, NPL is marginally significant and negatively signed, indicating loans made in the Northern Plains region are less likely to expire with no loss.APP and SE have the same negative signs in the expiration function, although they both have positive signs in the loss claim function. These results indicate loans in the Appalachian and Southeast regions have a lower possibility to expire and are more likely to have a loss claim. SPL is highly significant and positive in the loss claim function, indicating that loans originated in the Southern Plains region have a higher possibility to have a loss claim.

For the contemporaneous variables, DEL is highly significant and has a positive sign in the loss claim hazard function, which is intuitive. Delinquency indicates the loan has repayment problems. The loss rate would be expected to be higher for loans which are delinquent so that a delinquency is a strong signal that a loan could be headed to a loss claim.

The coefficient sign of NFIF is positive in expired with no loss hazard function and negative in loss claim hazard function. This suggests that increasing NFIF increases the likelihood of expiration and shortens the expiration time and decreases the likelihood of loss claim.

The positive sign on OPM in the expired with no loss hazard function reflects that higher OPM leads to higher possibility of expiration with no loss. However, the positive sign on OPM in the loss hazard function is surprising and indicates that increasing OPM increases the likelihood of loss. This contrary result could be because the measure of OPM is for all farms within a state and may not be a good indicator for individual farms. It could also be that OPM reflects differences in the structure of agriculture between states. The denominator of OPM 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 famers may receive little of this total income. 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, OPM may be reflecting the structure of agriculture in the state.

INTR is negative and significant in the expired with no loss function and positive and significant in the loss hazard function. This result matches my expectation since increasing variable interest rates over time increases the cost for loans and a large portion of loans (83 percent) had a variable interest rate at the time of loan origination. The increasing cost increases the difficulties of repayment for farmers and also both lengthens the time to expiration and shortens the time to loss claim. UNEMP is significant in both expired with no loss and loss claim hazard functions. The negative signs on UNEMP indicate that increasing unemployment rate decreases the likelihood of expiration with no loss and the likelihood of loss claim. To the extent that unemployment makes it more difficult to repay a loan, the latter result is surprising. However, the unemployment variable measures unemployment at the state level and it would be much better if the employment status of the individual borrower was known.

6.1.2 FO loan Model Estimation Results

The model estimation results for FO loans are presented in table 6.2. The coefficient signs are generally consistent with expectations.

For the FO model, BHIST is highly significant and positive, but only for expired with no loss claim hazard, indicating borrowers who have had previous involvement with FSA are more likely to have their loans expire with no loss. The time to expire is shorter as well.

The LAMT coefficient is highly significant for both expired and loss claim hazards, but the signs are different. The negative sign for LAMT in the expiration hazard function indicates that increasing loan amount decreases the probability of expiration. In other words, loans with lower loan amounts are more likely to expire with no loss. The positive sign of LAMT for the loss claim hazard function shows that a higher loan amount increases the likelihood of a loss claim and shortens the expected time to file a loss claim. Relatively, a percent change in LAMT has a larger impact for the hazard rate of loss claim than for the hazard rate of expired with no loss. These results are similar to those in the OL loan model.

Increasing LTERM decreases the expired with no loss hazard rate and increases the time to expiration. It is in my expectation since loans with longer loan terms should take relatively longer to pay back. The sign of LTERM is also negative in the loss claim hazard function, indicating the longer the loan term, the lower the likelihood of loss claim is. This is expected since a loan of a given amount and interest rate will have a lower payment per period the longer the loan term is.

INTRATE is positive and significant in expire with no loss hazard function, which is the same result as the OL loan model. A higher interest rate at loan origination raises the cost for the loan and leads to a greater incentive to refinance and payback the loan.

Farmers who are BFs have a positive and significant relationship with both expired with no loss and loss claim hazards, although it is only marginally significant for the expired hazard. The positive relationship indicates that BF loans are more likely to expire and have loss claims. BF farmers are those who have relatively little experience and have constrained financial resources. They 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 BF loans. Also, with limited experience and financial resources, it is not surprising to see farmers with BF loans have an increased loss claim hazard since these farmers probably have more difficulties paying back loans. The influence of BF on the hazard rate is much higher for loss claim than expire. BFS has a positive and highly significant coefficient in the loss hazard function, indicating loans made to farmers that are both BF and SDA are more likely to have a loss claim and have shorter time to the loss claim. These results are the same as those found for the OL loan model.

Loans made by FCS have a lower likelihood to expire compared to SCB. This is expected since FCS loans tend to have longer maturities than SCB loans. The negative sign of PC indicates that loans made by FSA preferred or certified lenders are less likely to expire and is a little surprising. Perhaps these loans are in good financial condition and thereby continue to exist.

The Corn Belt region again serves as the base for comparing the impacts of other regions. The negative sign of NPL coefficient implies that loans originated in the Northern Plains region are less likely to expire with no loss and have a longer time to expiration. The opposite result is found for the Southeast region, where loans in that region are more likely to expire with no loss relative to the Corn Belt region. For the Delta and Pacific regions, loans have higher possibilities to expire and to have loss claim. APP and SPL are positive in the loss claim hazard function, indicating loans obligated in the Appalachian and Southern Plains regions have higher likelihoods of loss claim.

Five contemporaneous variables have significant coefficients at the 0.10 or better level in the expired with no loss hazard function while only two variables are significant in the loss claim function. The delinquency status (DEL) of a loan at a given point in time is highly significant and positive for both expiration and loss hazards. For the expired with no loss hazard function, it could be that delinquent loans are more likely to be refinanced and expire sooner due to repayment difficulties. For the loss hazard function, delinquency leads to a shorter time to the loss claim outcome and to a higher likelihood of a loss claim. The occurrence of delinquency

Table 6.2 Competing risk model estimates of hazard function coefficients and elasticities for FO loans

Variables	EXP			LOSS		
Time invariant	Coefficient Estimate		Elasticity[b]	Coefficient Estimate		Elasticity
CON[a]	5.2962	***		NA		
BHIST	0.1568	***		0.0110		
LAMT	-0.0004	***	-0.1241	0.0010	***	0.4167
LTERM	-0.0066	***	-0.4634	-0.0103	***	-0.6447
INTRATE	0.0197	**	0.1365	0.1057		0.7611
BF	0.0877	*		0.4766	**	
BFS	-0.0552			1.1216	***	
FCS	-0.4212	***		-0.3845		
LCB	0.1686			-0.1868		
PC	-0.0894	**		-0.1090		
NPL	-0.1811	*		-0.1002		
APP	0.0889			0.6208	**	
SE	0.1426	**		-0.1578		
DLT	0.1390	*		0.7428	**	
SPL	0.0096			1.0518	***	
PAC	0.3048	***		0.7256	*	
Time variant						
DEL	0.7082	***		3.6133	***	
NFIF	-0.0021	*	-0.0751	-0.0106		-0.3454
OPM	1.0414	**	0.2546	0.5260		0.1309
INTR	0.0298	***	0.2004	-0.0123	*	-0.0820
UNEMP	-0.0591	***	-0.3228	0.0577		0.3281

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

indicates a loan has some problems. As we would expect, delinquency is likely to increase the probability of loss. DEL has a much larger impact on loss claim given its coefficient magnitude of 3.61 relative to 0.71 for the expired with no loss hazard.

NFIF has a negative and marginally significant sign in the expired with no loss function, indicating loans with higher net farm income per farm are less likely to expire with no loss. This result is not expected. It is probably because the variable is not accurate enough to give information at the individual borrower level since it is measured at the state level.

OPM has a significantly positive coefficient and indicates that increases in OPM increases the likelihood of expiration. OPM measures net farm income relative to value of farm production. Thus higher OPM indicates greater farm efficiency at generating net farm income, which may lead to increased farmer repayment ability.

The coefficient of INTR is positive in the expired with no loss hazard function and negative in the loss claim hazard function, indicating that the likelihood of expired with no loss increases with an increasing interest rate and the likelihood of having a loss decreases with an increasing interest rate. These results are opposite from those for the OL loan model. It may be that the non-real estate interest rate used in the model is not a good proxy for FO loans which are real estate loans. UNEMP has a negative sign, indicating that expiration is later with increasing unemployment rate.

6.2 Hazard Function Ratios

In competing risks models, independent variables common to the two hazard functions (expire and loss claim) have an impact on both hazard events. Computing a hazard function ratio (loss claim divided by expired) and examining the change in the ratio as a function of an independent variable can measure 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 6.1 plots the ratio of the loss claim hazard function to the expired with no loss hazard function with LAMT, for both the OL and FO models.

LAMT is the obligation loan request amount when loans were originated. It can be seen in the graph that the time to loss claim decreases sharply relative to time to expiration with no loss. It is not surprising since the larger the loan amount is, the harder to pay it back. Larger loans are more likely to have a loss claim and less likely to expire with no loss. There is not much difference between the ratios for OL and FO loans.

Figure 6.2 shows the OL and FO loan hazard function ratios as a function of LTERM. Loan term is measured by subtracting quarter of obligation from quarter of maturity. As shown in the figure, 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 quite a long term for operating loans and is nearly double the average term of 21 quarters for OL loans in the sample. Therefore, most of the loan term range that is likely relevant still has an increasing ratio, but not nearly as much as is found 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.

The OL and FO hazard function ratios as a function of INTRATE are plotted in figure 6.3. It can be seen from the figure that the time to loss claim decreases relative to time to expiration with no loss as interest rate increases for OL loans, i.e., the likelihood of loss claim increases relative to the likelihood of expiration as interest rate increases. FO loans follow the similar trend, 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 the sample range.

Figure 6.1 Ratio of loss claim hazard rate to expired with no loss hazard rate as a function of loan amount

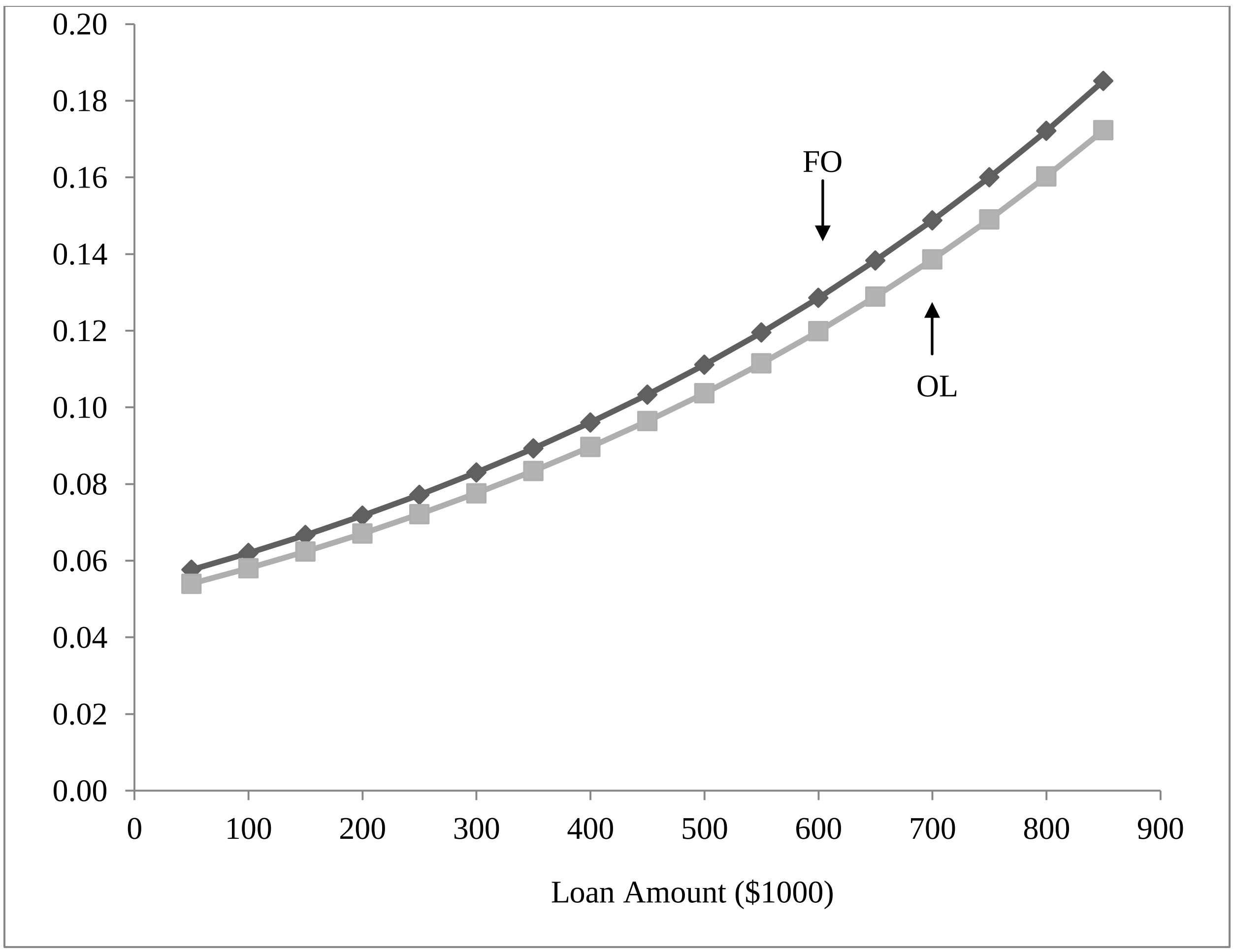


Figure 6.2 Ratio of loss claim hazard rate to expired with no loss hazard rate as a function of loan term

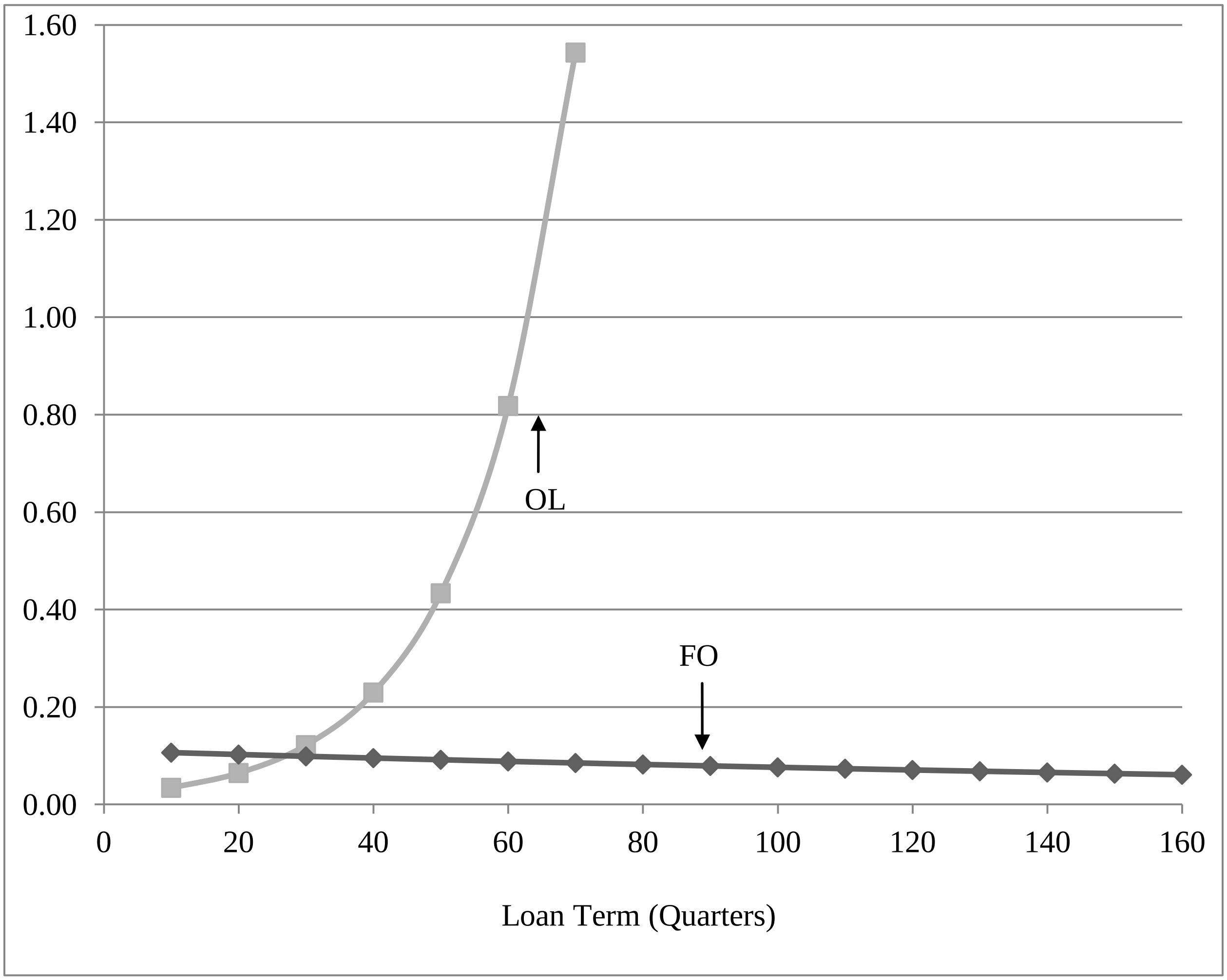
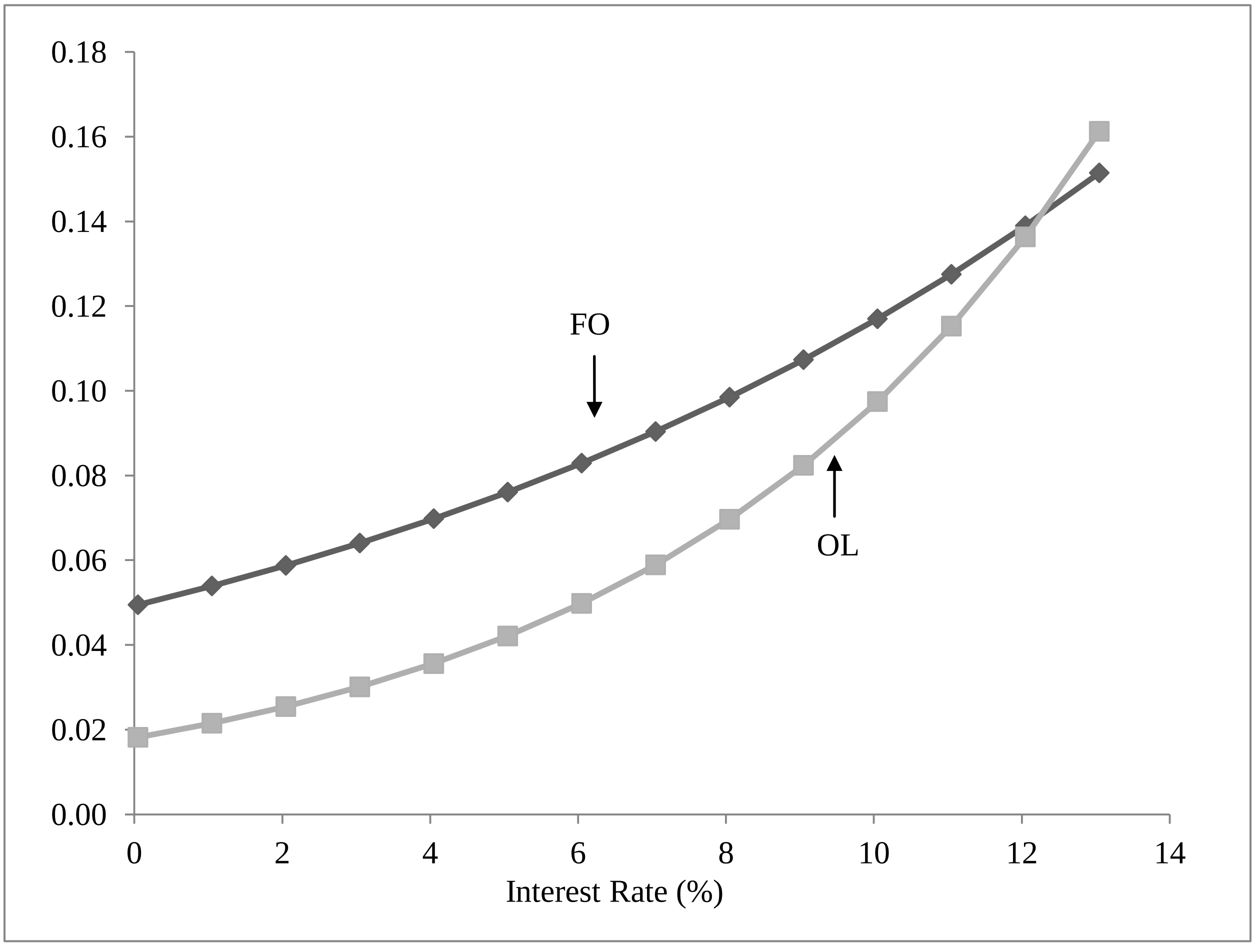


Figure 6.3 Ratio of loss claim hazard rate to expired with no loss hazard rate as a function of interest rate



CHAPTER 7: CONCLUSIONS

This chapter summarizes the conclusions of my study. Moreover, possible directions for future research are suggested.

7.1 Conclusion

From a policy making perspective, the statistically significant relationships of beginning farmer and interest assistance (IA) loans with loan outcomes provide important policy implications. Loans targeted to beginning farmers are more likely to have a loss claim. This result is not surprising since farmers receiving these loans have less experience and typically less resources than non-beginning farmer loan recipients. 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. FSA may consider increasing its 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 IA program appears to be successful, such that IA loans are less likely to have a loss claim or expire, i.e., IA loans are held longer. However, more evidence of IA program success may have been if IA was not found to be significant. If IA was not significant, an argument could be made that farmers with IA loans are placed on the same level-playing field as farmers with non-IA loans such that both loans have the same likelihoods of expiring or loss claim.

The results showed that lender type is important. The Farm Credit System, top ten largest commercial banks and other lenders were more likely to have OL loans expire than did small commercial banks. This also was found for FO loans originated by the Farm Credit System. Moreover, the Farm Credit System had a lower loss hazard rate than did small commercial banks. These results may indicate that different lenders have different loan risk profiles and that FSA should take this into consideration when considering its own risk profile for guaranteed loans. Continuing on the importance of lender type, preferred or certified lenders have a lower loss hazard rate for OL loans, indicating FSA’s Preferred and Certified Lender programs work effectively. Guaranteed lenders who have had previous involvement with FSA and those who have had greater success with limiting loss claims have lower costs for making guaranteed loans and, therefore, are given more freedom in the loan making process.

The strong significance for contemporaneous variables sheds light on the impacts environmental variables have on loan performance. The changes in farm and general economies largely influence the performance of loans, such as a good year for agriculture is likely to make it easier to repay loans. This is consistent with the results in Dixon et al. (2011) for FSA direct OL loans and Dressler and Stokes (2010) for FCS farm mortgage loans. In addition, the results of this thesis show the importance of loan delinquency status. Although loan delinquency status is usually taken into consideration when evaluating the probability of loss claim, it is also important when estimating the probability of OL loan expiration.

7.2 Implications for Future Studies

Due to the missing value problem, age and marital status are lost as borrower demographic characteristics. It would be better if I could have more precise borrower demographic characteristics such as any changes in marital status. Besides delinquency status, the only contemporaneous variables used are those that indicate the state of agricultural and general economy conditions. National and state level economic variables are imposed on individual loans. Thus, it would enhance the accuracy of the model if the financial characteristics for each loan or borrower were available over time. These variables would give information on what borrower financial factors may have an impact on the likelihood of loan expiration and loss claim.

Given the significance of lender type and preferred or certified lenders, it would be interesting to see if other lender characteristics influence loan loss claim or expiration with no loss.

Appendices

Table A.1 Frequency of loan outcome by quarter of loan maturity date				
Loan Outcome	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Still performing, post maturity	108	0.56	108	0.56
Still performing	3,843	20.09	3,951	20.66
Expired at maturity, no loss	1,490	7.79	5,441	28.45
Expired before maturity, no loss	12,222	63.91	17,663	92.35
Expired post maturity, no loss	931	4.87	18,594	97.22
Settled for loss by maturity	492	2.57	19,086	99.79
Settled for loss post maturity	40	0.21	19,126	100

Table A.2 Competing risk model estimates of hazard function coefficients and elasticities for OL loans with all independent variables

	EXP			LOSS		
Variables	Coefficient			Coefficient		
Time invariant	Estimate		Elasticity[b]	Estimate		Elasticity
CON	9.6456	***				
AGE	-0.0050	***	-0.2164	-0.0054		-0.1996
MARRIED	-0.0402			-0.2389		
GNDR	0.0187			0.0002		
RACE	-0.2251	***		-0.0128		
BHIST	0.1588	***		0.0843		
LAMT	-0.0008	***	-0.1383	0.0015	***	0.3289
LTERM	-0.0687	***	-1.4305	0.0008		-0.0699
INTYPE	-0.0285			-0.0546		
INTRATE	0.0018		0.0747	0.1715	***	1.5316
BF	0.0093			0.3852	**	
BFS	0.1626	*		1.1883	***	
IA	-0.2285	***		-0.3778	**	
LOC	0.0883	***		0.1119		
FCS	0.0826	**		-0.2439		
LCB	0.3552	***		0.1638		
OTHER	0.2050	***		-0.6725		
PC	0.0024			-0.5177	***	
NE	0.0154			-0.2318		
LKS	0.1362	***		0.1549		
NPL	-0.0052			-0.2991		
APP	-0.1465	**		0.4030		
SE	-0.3912	***		0.0699		
DLT	0.3214	***		0.1637		
SPL	-0.0042			1.2384	***	
MTN	0.2256	***		-0.5768		
PAC	0.5196	***		0.1291		
Time variant						
DEL	0.1646	***		3.2361	***	
NFIF	0.0008		0.0474	0.0014		-0.2376
OPM	0.4931	**	0.0925	2.5538	**	1.0106
REV	0.0378	***	0.0771	-0.0124		0.1112
INTR	-0.0392	**	2.7820	0.2754	***	8.0570
UNEMP	-0.0610	***	-0.2493	-0.0207		-0.9218

Notes: N= 8,019; 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 A.3 Competing risk model estimates of hazard function coefficients and elasticities for OL loans without MARRIED variables

	EXP			LOSS		
Variables	Coefficient			Coefficient		
Time invariant	Estimate		Elasticity[b]	Estimate		Elasticity
CON	9.5325	***		NA		
AGE	-0.0053	***	-0.2296	-0.007		-0.2546
GNDR	0.0103			-0.0776		
RACE	-0.2205	***		0.1451		
BHIST	0.1576	***		0.0816		
LAMT	-0.0008	***	-0.1411	0.0014	***	0.3174
LTERM	-0.0688	***	-1.4313	0.0002		-0.0894
INTYPE	-0.0280			-0.0458		
INTRATE	0.0026		0.0813	0.1647	***	1.5040
BF	0.0134			0.4005	**	
BFS	0.1476			0.9880	***	
IA	-0.2270	***		-0.3812	**	
LOC	0.0890	***		0.1025		
FCS	0.0856	**		-0.2543		
LCB	0.3505	***		0.0881		
OTHER	0.2050	***		-0.6963		
PC	0.0017			-0.5163	***	
NE	0.0099			-0.2300		
LKS	0.1297	***		0.1212		
NPL	-0.0067			-0.3314		
APP	-0.1459	**		0.4218		
SE	-0.3955	***		0.0666		
DLT	0.3187	***		0.1188		
SPL	-0.0049			1.2130	***	
MTN	0.2229	***		-0.6184		
PAC	0.5202	***		0.2699		
Time variant						
DEL	0.1655	***		3.2273	***	
NFIF	0.0008		0.0478	0.0010		-0.2417
OPM	0.4856	*	0.0915	2.7403	*	1.0268
REV	0.0374	***	0.0762	-0.0243		0.0873
INTR	-0.0395	**	2.7683	0.2685	***	8.4846
UNEMP	-0.0612	***	-0.2503	-0.0291		-0.9405

Notes: N= 8,036; 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 A.4 Competing risk model estimates of hazard function coefficients and elasticities for FO loans without MARRIED and AGE variables

Variables	EXP			LOSS		
	Coefficient Estimate		Elasticity [b]	Coefficient Estimate		Elasticity
Time invariant						
CON	10.0874	***		NA		
GNDR	-0.0261			-0.2241	*	
RACE	-0.2085	***		-0.0102		
BHIST	0.1687	***		0.0514		
LAMT	-0.0005	***	-0.0897	0.0008	***	0.1858
LTERM	-0.0707	***	-1.4730	-0.0023		-0.1174
INTYPE	-0.0377			-0.0048		
INTRATE	0.0129		0.1468	0.1755	***	1.6744
BF	0.0795	***		0.3442	***	
BFS	0.1169			0.9982	***	
IA	-0.2459	***		-0.5629	***	
LOC	0.0237			0.1627		
FCS	0.0559	**		-0.3067	*	
LCB	0.2730	***		-0.1607		
OTHER	0.1330	***		-0.5532	*	
PC	0.0137			-0.4643	***	
NE	0.0021			-0.6140		
LKS	0.0688	**		0.3272		
NPL	-0.0961	**		0.1932		
APP	-0.1084	**		0.3629		
SE	-0.3820	***		0.4348	*	
DLT	0.2805	***		0.8272	***	
SPL	0.0082			1.3845	***	
MTN	0.1513	***		-0.1569		
PAC	0.4648	***		0.7912	**	
Time variant						
DEL	0.0427			3.0955	***	
NFIF	0.0020	***	0.0805	-0.0038		-0.3952
OPM	0.5255	**	0.1043	4.5514	***	1.4127
REV	0.0157		0.0352	0.0669		0.3010
INTR	-0.0051		2.6469	0.2898	***	11.3357
UNEMP	-0.0471	***	-0.2155	-0.0157		-0.8124

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 A.5 Competing risk model estimates of hazard function coefficients and elasticities for FO loans with all independent variables

Variables	EXP			LOSS		
Time invariant	Coefficient Estimate		Elasticity[b]	Coefficient Estimate		Elasticity
CON	4.5148	**		NA		
AGE	-0.0057	***	-0.2413	-0.0166	*	-0.6642
MARRIED	0.0285			-0.0041		
GNDR	0.0636			0.1489		
RACE	-0.0718			0.2991		
BHIST	0.1419	***		-0.0092		
LAMT	-0.0005	***	-0.1547	0.0009	**	0.3857
LTERM	-0.0060	***	-0.4224	-0.0112	**	-0.7012
INTYPE	-0.0464			-0.1485		
INTRATE	0.0274	*	0.1904	0.1226		0.8825
BF	0.0130			0.4121		
BFS	-0.0310			0.7387	**	
FCS	-0.3878	***		-0.4646	*	
LCB	0.1376			-0.1976		
OTHER	-0.1024			-0.2157		
PC	-0.0777	*		0.0567		
NE	0.1228			-1.2278		
LKS	0.0227			-0.1180		
NPL	-0.1246			-0.0797		
APP	0.0644			0.6256		
SE	0.1736	*		-0.3156		
DLT	0.1841	*		0.6103		
SPL	0.0109			1.0008	**	
MTN	-0.0527			-0.5236		
PAC	0.3833	***		0.6863		
Time variant						
DEL	0.6764	***		3.5912	***	
NFIF	-0.0032	*	-0.1121	-0.0105		-0.3441
OPM	1.3912	***	0.3401	0.2524		0.0628
REV	0.0190		0.0459	0.0244		0.0527
INTR	0.0133		0.0891	-0.0418		-0.2789
UNEMP	-0.0666	***	-0.3635	0.0491		0.2790

Notes: N= 4,709; 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 A.6 Competing risk model estimates of hazard function coefficients and elasticities for FO loans without MARRIED variables

Variables	EXP			LOSS		
Time invariant	Coefficient Estimate		Elasticity[b]	Coefficient Estimate		Elasticity
CON	4.5334	***		NA		
AGE	-0.0056	***	-0.2486	-0.0166	*	-0.688
GNDR	0.0706			0.1503		
RACE	-0.0717			0.3003		
BHIST	0.1413	***		-0.0093		
LAMT	-0.0005	***	-0.1511	0.0009	**	0.3884
LTERM	-0.0060	***	-0.4210	-0.0112	**	-0.6987
INTYPE	-0.0468			-0.1507		
INTRATE	0.0285	*	0.2870	0.1231		0.9935
BF	0.0090			0.4098		
BFS	-0.0357			0.7379	**	
FCS	-0.3857	***		-0.4638	*	
LCB	0.1427			-0.1971		
OTHER	-0.1005			-0.2151		
PC	-0.0787	**		0.0578	**	
NE	0.1261			-1.2252		
LKS	0.0205			-0.1191		
NPL	-0.1285			-0.0824		
APP	0.0658			0.6266		
SE	0.1716	*		-0.3173		
DLT	0.1847	*		0.6076		
SPL	0.0099			0.9982	**	
MTN	-0.0538			-0.5253		
PAC	0.3823	***		0.6858		
Time variant						
DEL	0.6771	***		3.5931	***	
NFIF	-0.0031	*	-0.0870	-0.0105		-0.3304
OPM	1.3852	***	0.2163	0.2512		0.0703
REV	0.0177		0.0349	0.0231		-0.0637
INTR	0.0131	***	6.2391	-0.0419		6.4622
UNEMP	-0.0669	***	-0.3830	0.0491		0.4150

Notes: N= 4,712; 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 A.7 Competing risk model estimates of hazard function coefficients and elasticities for FO loans without AGE and MARRIED variables

	EXP			LOSS		
Variables	Coefficient			Coefficient		
Time invariant	Estimate		Elasticity[b]	Estimate		Elasticity
CON	5.4186	***		NA		
GNDR	0.0561			0.1340		
RACE	-0.0694			0.3029		
BHIST	0.1358	***		-0.0238		
LAMT	-0.0004	***	-0.1198	0.0011	***	0.4249
LTERM	-0.0067	***	-0.4705	-0.0109	***	-0.6874
INTYPE	-0.0593			-0.0558		
INTRATE	0.0339	*	0.3135	0.1206		0.9717
BF	0.0812	*		0.5067	**	
BFS	-0.0263			0.8917	***	
FCS	-0.4312	***		-0.3426		
LCB	0.1784	*		-0.1590		
OTHER	-0.1074			-0.3573		
PC	-0.0753	**		-0.1213		
NE	0.0571			-0.0927		
LKS	0.0751			0.6420		
NPL	-0.1690	*		0.0466		
APP	0.0879			0.7860	**	
SE	0.1582	**		-0.0331		
DLT	0.1509	*		0.8059	*	
SPL	0.0150			1.1214	***	
MTN	-0.1303			0.0174		
PAC	0.3408	***		0.9441	*	
Time variant						
DEL	0.7048	***		3.6207	***	
NFIF	-0.0023	*	-0.0814	-0.0109		-0.3330
OPM	0.9959	**	0.2145	0.6515		0.0796
REV	0.0073		0.0261	-0.0257		-0.0533
INTR	0.0315		6.2533	-0.0106	*	6.4767
UNEMP	-0.0628	***	-0.3711	0.0570		0.4178

Notes: N= 6,704; 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. 310-28.

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.165-81.

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, published at: purl.umn.edu/15778.

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

Ambrose, B.W. and Capone C.A. (1998), "Modeling the conditional probability of foreclosure in the context of single-family mortgage default resolutions", *Real Estate Economics*, Vol. 26 No. 3, pp: 391-429.

Ambrose, B.W. and Capone, C.A. (2000), "The hazard rates of first and second defaults", *Journal of Real Estate Finance and Economics*, Vol. 20 No. 3, pp. 275-93.

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 August 1, 2013.

Ciochetti B.A., Deng Y., Gao B. and Yao R. (2003), "The termination of commercial mortgage contracts through prepayment and default: A proportional hazard approach with competing risks", *Real Estate Economics*, Vol. 30 No. 4, pp: 595-633.

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 August 8, 2013.

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 (December), pp. 471-87.

Dixon, B.L., Neff, D.L., Ahrendsen, B.L. and McCollum, S.M. (1997), "Factors affecting commercial bank use of FSA loan guarantees in Arkansas", *Agricultural Finance Review*, Vol. 57, pp. 67-79.

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, August, available at: www.fsa.usda.gov/Internet/FSA_File/farm_loan_study_august_06.pdf

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.

Escalante, C.L., Brooks, R.L., Epperson, J.E. and Stegelin, F.E. (2006), "Credit risk assessment and racial minority lending at the Farm Service Agency", *Journal of Agricultural and Applied Economics*, Vol. 38 No. 1, pp. 61-75.

Federal Financial Institutions Examination Council (2004), "Consolidated reports of condition and income", June 30, 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 August 1, 2013.

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: http://www.kansascityfed.org/research/indicatorsdata/agfinance/index.cfm, accessed August 2, 2013.

Glennon, D. and Nigro, P. (2005), "Measuring the default risk of small business loans: a survival analysis approach", *Journal of Money, Credit, and Banking*, Vol. 37 No. 5, pp. 923-47.

Hakim, S.R. and Haddad M. (1999), "Borrower attributes and the risk of default of conventional mortgages", *Atlantic Economic Journal*, Vol. 27 No. 2, pp: 210-20.

Heitfield, E. and Sabarwal, T. (2004), "What drives default and prepayment on subprime auto loans?",*The Journal of Real Estate Finance and Economics*, Vol. 29 No. 4, pp:457-77.

Jackson, J.R. and Kaserman, D.L. (1980), "Default risk on home mortgage loans: a test of competing hypotheses", *Journal of Risk and Insurance*, Vol. 47, No. 4, pp: 678-90.

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", unpublished Master thesis, University of Arkansas, Fayetteville, AR, December.

Settlage L.A. (2005)," Examining the use of Farm Service Agency guaranteed loans by commercial banks", unpublished PhD thesis, Purdue University, West Lafayette, IN, December.

Settlage, L.A., Dixon, B.L. and Ahrendsen, B.L. (2000), "Factors determining FSA guaranteed loan loss claim activity in the U.S. for 1990-1997", *Staff paper 05 2000*, Department of Agricultural Economics and Agribusiness, University of Arkansas, Fayetteville, published at: purl.umn.edu/15782.

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 August 8, 2013.

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*, published at: purl.umn.edu/20738. Selected paper presented at the American Agricultural Economics Association annual meetings, Chicago, Illinois, August 5-8.

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 http://webarchives.cdlib.org/wayback.public/UERS_ag_1/20111128195215/http:/www.ers.usda.gov/Briefing/ARMS/resourceregions/resourceregions.htm, accessed November 27, 2013.

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

U.S. Department of Agriculture, Farm Service Agency (2010), "Lender's guide to elevated lender eligibility status for FSA guaranteed loan programs", Michigan, November, available at: http://www.fsa.usda.gov/Internet/FSA_File/clp_plp_criteria.pdf, accessed August 1, 2013.

U.S. Department of Agriculture, Farm Service Agency (2011a), "Fact sheet: loans for beginning farmers and ranchers", February, available at: http://www.fsa.usda.gov/Internet/FSA_File/beginningloans10.pdf., accessed August 1, 2013.

U.S. Department of Agriculture, Farm Service Agency (2011b), "Fact sheet: socially disadvantaged farmers and ranchers loan", February, available at: http://www.fsa.usda.gov/Internet/FSA_File/sdaloans1108.pdf, accessed August 1, 2013.

U.S. Department of Agriculture, Farm Service Agency (2012), "FSA – farm loan programs monthly management summary for September", years 2002-2012, National Office Farm Loan Programs, Washington, D.C.

U.S. Department of Agriculture, Farm Service Agency (2013a), "Farm loan programs – guaranteed farm loans", April 26, available at: http://www.fsa.usda.gov/Internet/FSA_File/guaranteed_farm_loans.pdf, accessed August 1, 2013.

U.S. Department of Agriculture, Farm Service Agency (2013b), “Farm loan programs”, http://www.fsa.usda.gov/FSA/webapp?area=home&subject=fmlp&topic=landing, accessed August 1, 2013

U.S. Department of Agriculture, Farm Service Agency (2013c), “Farm loan programs – funding”, http://www.fsa.usda.gov/FSA/webapp?area=home&subject=fmlp&topic=fun, accessed August 22, 2013

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