Journal of Agribusiness 28,2 (Fall 2010): 131–149

Determinants of FSA Direct Loan Borrowers' Financial Improvement and Loan Servicing Actions

Bruce L. Dixon, Bruce L. Ahrendsen, Aiko O. Landerito, Sandra J. Hamm, and Diana M. Danforth

Regression models of Farm Service Agency borrower net worth, debt-to-asset ratio, and loan servicing actions over an average seven-year period following loan origination are estimated to identify determinants of borrower financial progress over time. Results show significantly increasing net worth and debt-to-asset ratio. The change in net worth increases and the change in debt-to-asset ratio decreases as time in loan program increases. Increasing origination net worth tends to decrease loan servicing actions. Socially disadvantaged and beginning farmer loans perform similarly to nonprogram loans. Borrowers originating limited resource loans experience significant net worth impacts relative to borrowers originating regular FSA loans.

Key Words: direct loans, Farm Service Agency, negative binomial, servicing actions

The U.S. Department of Agriculture's Farm Service Agency (FSA) helps family farmers by providing credit to underserved borrowers, thereby filling credit gaps in credit markets. This financial assistance takes the form of granting direct loans or guaranteeing conventionally sourced loans so that credit is available to eligible, creditworthy farm borrowers. Direct loans are loans sourced by the U.S. Treasury and originated by FSA to farmers who do not meet the requirements for guaranteed loans. A guaranteed loan is made by commercial lenders and FSA guarantees the majority of any loan loss that may occur. Both direct and guaranteed loan programs provide operating loans (OLs), which can be both short- and intermediate-term loans, and long-term farm ownership (FO) loans.[1]

Bruce L. Dixon is professor, Bruce L. Ahrendsen is professor, Aiko O. Landerito is former graduate assistant, Sandra J. Hamm is program associate, and Diana M. Danforth is program associate, all in the Department of Agricultural Economics and Agribusiness, University of Arkansas at Fayetteville, Division of Agriculture. This research is based upon work partially supported by the USDA Cooperative State Research, Extension, and Education Service (CSREES), Farm Service Agency Direct Farm Loan Program Effectiveness Study, Award No. 2004-39528-14476 between the Farm Service Agency and the Department of Agricultural Economics and Agribusiness at the University of Arkansas at Fayetteville, Division of Agriculture. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the USDA or the University of Arkansas.

[1] OL loans can be used to purchase farm materials (e.g., seed, fertilizer, and feed) and equipment and livestock, as well as pay other farm operating expenses. FO loans can be used primarily to purchase farmland or construct buildings. Direct OL and FO loans have maximums of $300,000. Emergency (EM) loans are offered only as direct loans in counties that the President declares a disaster area or that the Secretary of Agriculture declares as a quarantine area, and have a maximum indebtedness per borrower of $500,000.

By providing access to loans for creditworthy borrowers, FSA seeks to improve these borrowers' financial well-being and, ultimately, have them graduate to commercial credit sources. Supporting productive farms, which implies improvement in borrowers' financial well-being, is the number one goal of the FSA's strategic plan for years 2005–2011 (USDA/FSA, 2009). Financial progress can be measured by favorable changes that occur in a borrower's financial characteristics in comparison to his/her financial status at loan origination. In addition, with improving changes in borrowers' financial characteristics, frequency of loan servicing actions should be minimal.

Congress mandates FSA to allocate various proportions of loans to socially disadvantaged (SDA) farmers and beginning farmers (BFs). This mandate emphasizes including those who have been previously underserved—SDA farmers—and a concern for the future generation of farm operators—beginning farmers. SDA farmers include women and racial minorities as defined by FSA. Beginning farmers generally have 10 or fewer years of farming experience, with specific eligibility requirements differing between OL and FO loans.

FSA screens direct loan applicants so that only those considered as creditworthy receive loans. FSA screenings involve examining many factors, such as past credit experiences, repayment capacity, and loan security (collateral), prior to loan approval. These factors are considered in projecting the likelihood that the borrower will be able to make the loan payments. Because FSA direct borrowers are on the financial margin (since they must have been denied credit by a commercial lender), they can experience more difficulty making payments than commercial borrowers. These difficulties are reflected by loan servicing actions (LSAs) such as loan restructurings, write downs, and delinquencies. Occurrences of these events may be indicators of the borrower's loan progress and ultimate ability to pay back the loan or to default. Other gauges of borrowers' loan progress are changes in their financial characteristics such as farm profitability and solvency.

In this study, positive changes in net worth and a decrease in debt-to-asset ratio are considered indicators of financial progress. Even if the occurrence of LSAs does not lead to default, these actions imply increased costs for FSA. Thus, minimizing their frequency is desirable. By being able to predict the frequency of such actions, FSA could refine its evaluation of the likelihood of borrower success and thereby assist borrowers through more effective borrower screening and setting of loan terms.

The objectives of this study are: (*a*) to estimate how loan and borrower characteristics at loan origination are related to changes in borrower financial characteristics (net worth and debt-to-asset ratio) over an average of seven years, and (*b*) to estimate how financial and loan characteristics at loan origination are related to the frequency and type of LSAs (loan restructurings and delinquencies).[2] A sample of FSA direct loan borrowers who originated loans between October 1, 1993

[2] The number of write downs was recorded for each borrower observed. However, write downs were so infrequent in the sample that no reliable statistical models could be estimated.

and September 30, 1996, and whose subsequent behavior was observed until November/December 2004, is used for estimation and hypothesis testing.

In the remainder of this paper, relevant literature is highlighted, and methods and models are presented followed by a brief discussion of the data and their sources. Results of the estimated models are then reported and impacts of the findings are summarized.

Related Studies

Our principal interest lies in predicting how characteristics at loan origination and successive economic events influence financial well-being and number of LSAs. Most of the agricultural, credit-related literature is concerned with predicting the likelihood of loan approval and whether the loan is successfully paid back. We look primarily to this literature for concepts and variables that predict borrower success during loan payback. In addition, we consider past studies modeling financial well-being.

Factors Determining Loan Approval and Performance

Escalante et al. (2006) identify significant financial, structural, and demographic factors that influence loan approval for FSA direct and guaranteed loans. Logistic regression results of the credit-scoring related variables show that repayment margin ratio and current ratio are significant for their model which pools all observations. Repayment margin ratio and current ratio are significant in direct loan models.

Using Agricultural Resource Management Survey (ARMS) farm-level data, Katchova (2005) analyzes farm and borrower characteristics that indicate the likelihood of a farm operator acquiring farm credit, the loan amount, and the number of loans for U.S. farms. Farmer personal information including age, education, off-farm income, and the farmer's risk attitude are used as personal attributes that influence credit use, loan volume, and loan numbers. Farm attributes include the farm's descriptive and financial characteristics. A probit model is estimated as a function of personal and farm characteristics that affect whether a farmer has debt. A farmer's risk attitude is found to significantly influence whether the farmer used credit. Farm attributes such as gross farm income, government payments, contract use, crop insurance, and farmer's age also have a significant impact on credit use.

Featherstone et al. (2007) survey agricultural lenders in Kansas and Indiana to identify important borrower and lender characteristics influencing loan approval and interest rate levels. As shown by their results, borrower financial and personal characteristics significantly affect loan approval and interest rate decisions. Fair Isaac credit score is a significant determinant in loan approval and is inversely related to interest rate charged.

Phillips and Katchova (2003) estimate borrower migration rates from one credit rating classification to another. Their analysis examines the relationship of farm business credit migration and the business cycle. Annual (1985–2002) farm-level data from the Illinois Farm Business Farm Management Association are used to estimate migration rates on the basis of the farmer's calculated credit scores.[3] The study concludes that credit ratings improve during upticks in the business cycle and decline during general economic downturns.

Dixon et al. (2007) analyze borrower graduation rates and identify factors that affect whether borrowers remain in or exit the FSA direct loan program. Data were obtained from a survey where FSA farm loan managers collected the actual data from borrower files at the county office level.[4] A borrower was considered as exited from the direct loan program if he or she had no outstanding direct loans as of November 30, 2004; otherwise, the borrower was considered to be an active FSA borrower. The multinomial logit model includes three exit categories: (*a*) continued to farm without an FSA direct loan, (*b*) voluntarily left farming or retired, and (*c*) involuntarily left farming.

Results from Dixon et al.'s logit regression model show that the numbers of active FO, OL, and EM loans at time of loan origination, debt-to-asset ratio, race, and borrower age are significant for borrowers still in the FSA direct loan program as of November 2004. In addition to borrower race and gender, the financial characteristics of net worth, debt-to-asset ratio, ratio of nonfarm income to gross cash farm income, and numbers of OL and EM loans at time of loan origination for the given loan are significant for continuing farmers. Age, race, the loan being an FO, being a beginning farmer, debt-to-asset ratio, and the number of EM loans held at loan origination are significant for borrowers who voluntarily left farming or retired and no longer had an active loan with FSA. Number of FO loans held at origination, age, net worth, and experience of financial distress are significant for borrowers who left farming involuntarily and no longer had active direct loans with FSA.

Modeling Financial Characteristics

Using Southwestern Minnesota Farm Business Management Association data, Zech and Pederson (2003) identify factors that best predict the overall performance and repayment capacity of borrowers. Regression models explaining variation in net worth growth ratio[5] and term debt coverage ratio are estimated. In the estimated models, asset turnover ratio has a positive, significant effect whereas family living expenses are found to be significantly negatively related to the net worth growth ratio for all three time periods considered in the model.

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[3] The credit scoring models use financial ratios as explanatory variables. The financial ratios are those suggested by the Farm Financial Standards Task Force.

[4] The present study employs the same survey used by Dixon et al. (2007).

[5] Net worth growth is used as a measure of overall borrower financial performance and is calculated as the change in net worth over a year divided by average total assets.

Katchova (2008) compares the economic well-being of farm and nonfarm households over their life-cycle stages in terms of income and net worth. Farm households are grouped into rural residence farms, intermediate farms, and commercial farms. Nonfarm households are grouped into non-entrepreneurial households (households that do not have a business) and entrepreneurial households (with businesses). In determining life-cycle stages, farm and nonfarm households are grouped based on the age of the household head.

Katchova's results show that commercial farms and entrepreneurial households have significantly higher income and wealth (net worth) as compared with the rural residence farms, intermediate farms, and non-entrepreneurial households. Regression analysis is used to compare the economic well-being of households based on their life-cycle stages. Older age groups of farm and nonfarm households tend to have higher income and wealth compared with their respective youngest age groups. The one exception is for income of commercial farms, where age groups are insignificant.

Methods and Models

Ordinary least squares (OLS) is used to estimate regression models to identify those factors that influence the changes in the two selected financial characteristics. Because the two measures of loan servicing actions are reported as count data, the negative binomial count variable model of Cameron and Trivedi (1986) is estimated.

Hypothesized Financial Measures Models

Mean annual changes in net worth and debt-to-asset ratio are modeled in this study. These variables are computed by dividing the difference between the most recently observed value of the particular financial characteristic and its value at loan origination by the number of years between the two observations. Table 1 gives the definitions of the dependent and independent variables used in the study. The independent variables fall into three categories: borrower demographic variables, financial characteristics, and loan characteristics.

For the demographic variables, we have no particular sign expectations for gender and race. It is expected that financial well-being improves with borrower age.

Increases in borrower financial independent variables at loan origination—net worth (*NETWORTH*), current ratio (*CR*), ratio of balances to service debt divided by annual debt payments (*REPAY*), net cash farm income plus nonfarm income (*NI*), gross cash farm income (*GCFI*), and asset turnover ratio (*ATR*)—should improve net worth and decrease the debt-to-asset ratio. Origination levels of debt-to-asset ratio (*DA*), past financial difficulty (*FINDIS*), and household living expenses (*LIVEXP*) should decrease net worth and increase the debt-to-asset ratio.

Table 1. Definitions of Variables

Variable	Definition
Dependent Variables:	
Δ*NETWORTH*	Average annual change in net worth ($)
Δ*DA*	Average annual change in debt-to-asset ratio
RESTRUC	Number of restucturings since October 1, 1996
DELINQ	Number of delinquencies since October 1, 1996
Independent Variables: [a]	
A. Demographic:	
AGE	Primary borrower age in years
FEMALE	Binary variable, = 1 if female; 0 otherwise
RACE	Binary variable, = 1 if nonwhite; 0 otherwise
B. Financial Characteristics:	
NETWORTH	Solvency measure—total assets less total liabilities ($1,000s)
DA	Leverage measure—total debt divided by total assets
CR	Liquidity measure—current assets divided by current liabilities
REPAY	Repayment capacity—available balances to service debt divided by debt payments due in the current year
NI	Net cash farm income plus nonfarm income ($1,000s)
FINDIS	Binary variable, = 1 if borrower experienced receivership, was discharged in bankruptcy, or petitioned for reorganization under bankruptcy; 0 otherwise
GCFI	Gross cash farm income from crop, livestock, and other farm income ($1,000s)
ATR	Asset turnover ratio measured as gross cash farm income and nonfarm income divided by total assets
LIVEXP	Household living expenses ($1,000s)
LEXPHH	Living expenses per household member ($1,000s)
CROPREVR	Crop revenue divided by crop plus livestock revenue
Δ*LVNW*	Change in state-level farm real estate land value per acre (of borrower's state) corresponding to the spell between initial and subsequent measurement of net worth ($)
Δ*LVDA*	Annual percentage change in state-level farm real estate land value per acre (of borrower's state) corresponding to the spell between initial and subsequent measurement of debt-to-asset ratio (%)
INCNW	State average annual net farm income per farm (of borrower's state) during the years between initial and subsequent measurement of net worth ($1,000s)
INCDA	Ratio of state average annual net farm income per farm (of borrower's state) during the years between initial and subsequent measurement of debt-to-asset to state average annual net farm income per farm (of borrower's state) for 1993–2004
NUMOL	Number of FSA direct operating loans at loan origination
NUMFO	Number of FSA direct farm ownership loans at loan origination
NUMEM	Number of FSA direct emergency loans at loan origination

(continued . . .)

Table 1. Continued

Variable	Definition
C. Loan Characteristics:	
LR	Binary variable, = 1 if limited resource loan; 0 otherwise
BF	Binary variable, = 1 if beginning farmer loan assistance code; 0 otherwise
SDA	Binary variable, = 1 if socially disadvantaged farmer loan assistance code; 0 otherwise
BFS	Binary variable, = 1 if BF and SDA farmer loan assistance codes; 0 otherwise
TIMENW	Time between initial and final observation of net worth (years)
TIMEDA	Time between initial and final observation of debt-to-asset ratio (years)
TIMETO	Time from loan origination to October 1, 1996 (years)

[a] Refers to independent variables at time of loan origination except for Δ*LVNW*, Δ*LVDA*, *INCNW*, *INCDA*, *TIMETO*, *TIMENW*, and *TIMEDA*.

Sources of farm revenue from different enterprises should be important. Revenue source is measured as the ratio of crop revenue to the sum of crop and livestock revenue (*CROPREVR*). Nationally, crop farming had greater annual revenue volatility from 1994–2004 than livestock revenue.[6] Changes in farm land values at the state level (Δ*LVNW* and Δ*LVDA*) and net farm income per farm at the state level (*INCNW* and *INCDA*) were computed and included in the models to reflect the impact of the economic environment post loan origination, as advocated by the Phillips and Katchova (2003) study.[7] Increases in the change in land value and annual net farm income per farm should increase the annual changes in net worth and decrease annual changes in debt-to-asset ratio. Further detail on the computation of the land value and income variables is given in Landerito (2009). All variables in dollar units are nominal. The consumer price index had an annual geometric mean of 2.5% over 1993–2004. Land prices rose at a much faster rate of 5.6%, as measured by the variable Δ*LVDA*. Hence, the changes in net worth due to changes in Δ*LVNW* reflect the impact of rapidly rising land values.

The signs of the numbers of loans (*NUMOL*, *NUMFO*, and *NUMEM*) could be positive or negative depending on the dependent variable of interest and whether the number of existing FSA direct loans at origination indicates: (*a*) FSA familiarity and superior knowledge about the borrower, or (*b*) the precarious borrower situation that implies FSA is the lender of last resort. Alternatively, as borrowers

[6] Using U.S. Department of Agriculture/Economic Research Service (2009) data on historical U.S. crop and livestock revenue from 1994–2004, we find that crop revenues have a significantly ($p = 0.039$) higher variance than livestock revenues.

[7] The variables Δ*LVNW* and Δ*LVDA* are used in the change in net worth and change in debt-to-asset ratio models, respectively. Δ*LVNW* measures land value change in levels and Δ*LVDA* measures land value change as a rate to be compatible with the dependent variables of the change in net worth being in levels and that debt-to-asset is a ratio. The variable *INCNW* is in levels and *INCDA* is a rate to be used to reflect income effects in the change in net worth and change in debt-to-asset ratio models, respectively.

hold more FO loans at origination (*NUMFO*), equity should improve during periods of increasing land values, which corresponds to increasing net worth and decreasing debt-to-asset-ratio. Holding EM loans (*NUMEM*) indicates a past disaster(s), so increasing numbers of EM loans should make financial progress less likely.

Limited resource (*LR*) loans, socially disadvantaged (*SDA*) loans, beginning farmer (*BF*) loans, and loans that are both SDA and BF (*BFS*) are included as indicator (binary) variables to estimate the impact of these programs. The major policy issue is whether these loan programs put program borrowers on an equal footing with nonprogram borrowers. If program participants do better than non-participants, then an advantage has been conferred. Conversely, if program participants do worse, then the programs are not fully compensating for the perceived disadvantages of these borrowers.

Variables measuring the elapsed time between observing one of the two financial well-being variables at origination and its subsequent measurement (*TIMENW* and *TIMEDA*) are included to account for temporal effects. For changes in net worth and debt-to-asset ratio, increased length of time between measurements accounts for the impacts of increased time in the direct loan program. The impact could be positive or negative. Because FSA direct loans have lower than market interest rates, time could benefit borrowers. Alternatively, lengthier times in the program could indicate lack of financial strength to graduate to commercial loans.

Hypothesized Models Explaining Variation in Loan Servicing Actions

The numbers of the loan servicing actions are specific to the borrower—i.e., the particular loan that selected the borrower into the sample is not necessarily the loan that received the servicing. On the questionnaire, the farm loan managers were asked to report the number of loan servicing actions for the borrower on all FSA direct loans between October 1, 1996 and November/December 2004.

Independent variables for explaining loan servicing actions are largely the same as with the change in net worth and debt-to-asset models. The *AGE* variable is expected to be negatively signed. Financial characteristics including net worth (*NETWORTH*), nonfarm and farm income (*NI*), current ratio (*CR*), repayment ability (*REPAY*), asset turnover ratio (*ATR*), and gross cash farm income (*GCFI*) should be inversely related to loan servicing actions. Conversely, debt-to-asset ratio (*DA*), living expenses per household member (*LEXPHH*), prior financial difficulties (*FINDIS*), and *CROPREVR* could have positive influences on number of loan servicing actions. The relative volatility of crop revenues could influence the ability to make payments as scheduled. For the reasons stated in discussing the change in net worth and change in debt-to-asset ratio models, the signs of number of existing FSA direct loans (*NUMOL*, *NUMFO*, and *NUMEM*) could be positive or negative.

The length of time borrowers are in the direct loan program is crucial for loan servicing actions since the longer they are FSA borrowers, the more likely they may be to experience a loan servicing action or, alternatively, to benefit from low interest rates and avoid LSAs. The variable *TIMETO* measures the time from loan origination to October 1, 1996. Ceteris paribus, a relatively early loan should indicate a quicker exit from the direct loan program and fewer loan servicing actions post October 1, 1996. *TIMETO* should be negatively signed in the LSA equations.

Data Sources

The observational unit is the borrower associated with a particular loan. A total of 34,026 OL, 3,083 FO, and 8,358 EM loans were originated over fiscal years (FY) 1994–1996 (Nwoha et al., 2005). Three fiscal years were selected to prevent the unique, macro factors of one year from disproportionately influencing loan originations. The sample began in FY 1994 to allow for representative numbers of BF loans which were legislated in 1992. The population of loans was ordered by loan type, gender, race, geographical location, and origination date, and then systematic sampling was used to ensure proportionate representation for these groups. White males made up the vast majority of FSA direct loan borrowers. Because they were the most numerous borrowers, loans to white males were sampled at a rate of 1 in 18 for both OL and EM loans, and loans to other borrowers were sampled at a rate of 1 in 9. Regardless of gender and race, FO loans were sampled at a rate of 1 in 9 since fewer FO loans were originated relative to OL and EM loans.[8] The FSA farm loan managers were surveyed through an online instrument that was posted on the secured FSA internet site.

FSA direct loans originated in FY 1994–1996 were sampled from the states and territories. Borrowers' personal and loan information was collected by the farm loan managers. Much of the data came from the loan application and the farm and home plans (forms FSA 410-1 and 431-2).

After data cleaning, 2,715 responses were considered usable, yielding a 90% response rate from the total 3,004 sampled loans. Further descriptions of the data collection and methods are provided in Nwoha et al. (2005), with the actual survey instrument included in their Appendix 2.B.

For a given loan sampled, variables observed both at loan origination and subsequent to loan origination were collected. Data on all the independent variables in table 1 were observed as of origination of the loan sampled in the survey except for the time-related variables.[9] The subsequent observation on a borrower's net worth and debt-to-asset ratio could have been before or after the loan that brought the borrower into the sample was terminated. Consequently, changes in

[8] Because of the differences in sampling intensity, loans sampled at a rate of 1 in 18 were given a weight of 2 and those sampled at a rate of 1 in 9 a weight of 1 in all estimations.

[9] See Landerito (2009) for sources for variables observed over time, i.e., farm real estate values and net farm income that came from U.S. Department of Agriculture/Economic Research Service (2009) sources.

these variables may be influenced by other FSA loans of the borrower in addition to the loan that resulted in the borrower being in the sample. The subsequent values of net worth and debt-to-asset ratio were observed at various points in time that varied by borrower. The numbers of loan servicing actions (restructurings and delinquencies) were from October 1, 1996 until November/December 2004, and counted such actions on all direct loans held by the borrower during that time span.

Results and Discussion

Descriptive statistics of the dependent and independent variables are reported in table 2. The mean annual change in net worth is $9,097, which is statistically significant ($p = 0.000$). The mean value for the annual change in debt-to-asset ratio is 0.065 ($p = 0.002$). This positive value is unexpected since it indicates an increase in debt-to-asset ratio and greater financial stress. However, because FSA direct loan borrowers are typically younger than the farmer population as a whole, an increasing debt-to-asset ratio might result from operators increasing the scale of operation through debt. The sampled borrowers have average restructurings equal to 2.3 and delinquencies equal to 1.8.

Regression results from the two sets of models indicate a number of significant variables but most of the regressors are not significant at customary significance levels, although all models are statistically significant.[10] The variability in loan servicing actions is generally better explained by the estimated models than variability in the financial indicators.

Financial Measures Models

Results of the net worth and debt-to-asset regression models are presented in tables 3 and 4. All eight models are significant at *p*-values of 0.05 or lower. Coefficients of determination range from 0.07 to 0.48 and are roughly comparable to the regression models estimated by Zech and Pederson (2003). Visual inspection of tables 3 and 4 indicates that for a given dependent variable, say change in net worth, the coefficients differ by loan type. Thus, estimation of separate models by loan type is clearly justified. Segmenting the sample by different loan types—OL, FO, and EM loans, with OL loans further segmented into one-year and seven-year loans—improves the explanatory power of the models.

Only a few variables are significant for change in net worth ($\Delta NETWORTH$). The demographic variables are insignificant in all four models with the exception of *FEMALE*, which is negative and significant for FO loans. Some financial characteristics are significant. Net worth at origination (*NETWORTH*) is significant for FO and EM loans but unexpectedly negative for EM loans. The negative coefficient on the EM loans could be due to unexpected expenses and damage

[10] The estimated regression models do not have harmful levels of multicollinearity, as indicated by all variance inflation factors less than 10.

Table 2. Descriptive Statistics of the Dependent and Independent Variables

Variables	Mean	Std. Dev.	Minimum	Maximum
Dependent Variables:				
Δ*NETWORTH* ($)	9,097	39,438	−279,633	248,248
Δ*DA*	0.065	0.802	−1.118	34.270
RESTRUC	2.266	4.780	0.000	72.000
DELINQ	1.801	3.112	0.000	53.000
Independent Variables:				
A. Demographic:				
AGE (years)	42	13	17	85
FEMALE	0.045	0.206	0.000	1.000
RACE	0.096	0.295	0.000	1.000
B. Financial Characteristics:				
NETWORTH ($1,000s)	116	212	−672	3,145
DA	0.685	0.496	0.000	8.520
CR	1.619	4.544	0.000	79.106
REPAY	1.155	1.209	0.116	65.850
NI ($1,000s)	51	41	−139	419
FINDIS	0.055	0.229	0.000	1.000
GCFI ($1,000s)	157	164	0.000	2,969
ATR	1.144	2.048	0.000	20
LIVEXP ($1,000s)	19.83	10.58	0.70	141.14
LEXPHH ($1,000s)	7.43	4.99	0.23	70.57
CROPREVR	0.607	0.421	0.000	1.000
Δ*LVNW* ($)	702	723	−10	5,602
Δ*LVDA* (%)	5.8	1.9	−0.8	40.7
INCNW ($1,000s)	21.08	12.67	−0.6	81.52
INCDA	0.962	0.374	−2.940	9.323
NUMOL	1.465	1.721	0.000	15.000
NUMFO	0.446	0.835	0.000	12.000
NUMEM	0.433	1.000	0.000	11.000
C. Loan Characteristics:				
LR	0.230	0.421	0.000	1.000
BF	0.174	0.379	0.000	1.000
SDA	0.072	0.259	0.000	1.000
BFS	0.031	0.172	0.000	1.000
TIMENW (years)	6.703	2.982	−0.422	11.250
TIMEDA (years)	6.722	2.989	−0.422	11.250
TIMETO (years)	1.601	0.884	0.003	2.965

incurred by the disaster precipitating the EM loan. Additionally, borrowers originating EM loans had nearly double the net worth of FO borrowers, and therefore had more net worth to lose due to the disaster. Net income (*NI*) is negative and significant for seven-year OL loans and positive and significant for FO loans. The negative sign for the seven-year OL is unexpected and might be linked to increased risk taking by higher income borrowers.

Table 3. OLS Regression Estimates of the Average Annual Change in Net Worth

	Δ Net Worth			
Independent Variable	OL 1yr	OL 7yr	FO	EM
Intercept	−11,326.2	4,259.0	155.0	−7,842.8
AGE	52.5	−102.5	−295.2	−183.7
FEMALE	421.3	−23,352.3	−18,083.8**	6,472.9
RACE	−451.2	−30,622.3	−1,118.8	13,902.8
NETWORTH	10.5	19.6	85.3***	−51.7*
NI	−25.3	−177.9*	340.8***	−91.3
FINDIS	1,175.3	−1,990.0	−10,873.8	10,494.1
ATR	755.3	−777.6	−568.8	−4,789.0**
LIVEXP	−11.4	184.6	−508.1*	537.2
GCFI	9.2	33.2	−48.6	57.9
CROPREVR	−4,531.7	−8,291.7**	−2,023.2	−8,865.4
Δ*LVNW*	7.8***	5.3***	−0.0	4.2
INCNW	−127.6	−77.0	33.0	−39.0
NUMOL	−471.0	−2,449.8**	105.3	554.8
NUMFO	1,928.5	−316.4	−1,248.2	−1,850.3
NUMEM	1,407.9	617.9	−65.3	−3,251.5
LR	−5,307.2**	−6,385.8*	13,120.6**	NA
BF	−6,038.0	−1,107.1	10,368.9**	NA
SDA	−13,825.1	21,780.0	5,627.2	NA
BFS	−10,809.2	22,280.1	7,776.0	NA
TIMENW	2,656.3***	2,414.6***	1,513.3*	3,744.3***
No. of Observations	626	540	215	260
χ^2 [a]	80.7***	65.3***	35.7**	35.5***
R^2	0.15	0.15	0.30	0.12
Adjusted R^2	0.12	0.12	0.22	0.06

Notes: Single, double, and triple asterisks (*,**,***) denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. Standard errors are computed by White's (1980) heteroskedastic covariance matrix.

[a] Wald test of hypothesis that all slope coefficients simultaneously equal zero.

Crop revenue ratio (*CROPREVR*), living expenditures (*LIVEXP*), and asset turnover ratio (*ATR*) are negative and significant for OL seven-year loans, FO loans, and EM loans, respectively. As expected, increased living expenditures decrease the change in net worth. The negative effect of the crop revenue ratio may be explained by the volatility of crop revenues. The negative sign in the asset turnover ratio is unexpected and contrary to the results of Zech and Pederson (2003). Yet, this significant negative sign only occurs for EM loans and may reflect the impact of the emergency. Change in land value (Δ*LVNW*) is positively significant for both OL loan types. It is surprising that the coefficient is not significant for FO loans since increasing land values imply increased net worth for the land purchased and, as noted earlier, land values increased substantially over the sample period. FSA familiarity with the borrower as measured by the three variables *NUMOL*, *NUMFO*, and *NUMEM* are insignificant for all but one coefficient.

Table 4. OLS Regression Estimates of the Average Annual Change in Debt-to-Asset Ratio

	Δ Debt-to-Asset Ratio			
Independent Variable	OL 1yr	OL 7yr	FO	EM
Intercept	4.370	1.360	−0.330	0.016
AGE	0.003	−0.001*	−0.002	−0.001
FEMALE	−0.079	0.003	0.073**	−0.039
RACE	−0.040	0.090	0.060	0.073
DA	−0.032	−0.144***	−0.112***	−0.131***
CR	−0.002	−0.001*	0.009***	−0.012
REPAY	−0.115	−0.008	−0.016	−0.008
FINDIS	−0.139	0.100	0.014	−0.068**
ATR	0.040***	0.049**	0.011	0.000
LEXPHH	−0.002	0.003	−0.003	0.003
CROPREVR	0.030	0.027	0.008	−0.049
Δ*LVDA*	−3.855	−1.091*	0.523	0.531
INCDA	−0.056	−0.025	0.022	−0.335***
NUMOL	0.004	0.015	−0.008	0.001
NUMFO	0.001	0.003	0.010	−0.009
NUMEM	0.024	−0.000	0.012*	0.001
LR	−0.042	0.031	0.004	NA
BF	0.021	−0.015	−0.008	NA
SDA	0.024	−0.069	−0.068	NA
BFS	0.013	0.072	−0.001	NA
TIMEDA	−0.030**	−0.014**	−0.014**	−0.008
No. of Observations	427	344	116	198
χ^{2} [a]	0.040***	56.100***	100.000***	88.800***
R^2	0.072	0.170	0.481	0.283
Adjusted R^2	0.026	0.122	0.372	0.220

Notes: Single, double, and triple asterisks (*,**,***) denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. Standard errors are computed by White's (1980) heteroskedastic covariance matrix.

[a] Wald test of hypothesis that all slope coefficients simultaneously equal zero.

The only loan type variable with any consistent significance is limited resource (*LR*). Its significance is surprising given LR loans have reduced interest rates whereby the borrowers may have adequate repayment capacity consistent with other FSA borrowers, and *LR* is therefore expected to have no impact. *LR* is negative for one-year and seven-year OL loans but positive for FO loans. The differential impact could be attributable to the FO loans having a longer maturity, thereby conferring more benefit to LR FO borrowers than to regular FO borrowers. The negative signs for the OL loans suggest the LR program might not be achieving its goals of putting LR borrowers on similar footing as FSA loan borrowers not qualifying for the lower LR interest rate.

Length of time between the measurements of net worth (*TIMENW*) is significant and positive for all loan types, supporting the hypothesis that the passage of

time in the FSA program increases overall financial well-being. As discussed earlier, this could be due to favorable FSA loan terms and a positive survivor effect. But, as noted by Dixon et al. (2007), successful farms leave the FSA direct program as well as unsuccessful farms.

In the change in debt-to-asset (ΔDA) model, demographic variables are insignificant except for *AGE* in seven-year OL loans and *FEMALE* for FO loans. Debt-to-asset ratio at origination (*DA*) is negative and significant for the change in debt-to-asset for most loan types. This finding suggests farmers with higher DA at loan origination generally experienced less of an increase in DA per year. In the regression models, the mean values of debt-to-asset at origination for one-year OL, seven-year OL, and EM loan borrowers are 0.76, 0.68, and 0.72, respectively. FO loans have a lower mean of 0.51. We would expect FSA and other creditors to be reluctant to add debt since it would make an already perilous situation worse; hence, the negative sign is credible.

The efficiency measure (*ATR*) is significantly positive for one-year and seven-year OL loans—perhaps because as borrowers increase the scale of operation (thereby increasing efficiency), they also increase the change in the debt-to-asset ratio. The time between observing the original and last observation on debt-to-asset ratio (*TIMEDA*) is significant and negative for OL one-year and seven-year loans and for FO loans. The negative sign supports the hypothesis that longer durations in the FSA direct loan program lead to better economic success, as with the change in net worth model. While some of the remaining independent variables are significant in one of the four models, no clear relationships emerge. In general, the loan program variables and the numbers of existing FSA loans at origination are not significant.

Across the two models, the patterns present in the insignificant variables reveal some surprising findings. For the most part, demographics and the programmatic variables—*BF*, *SDA*, and *BFS*—are not significant. This suggests that changes in financial characteristics are not influenced by the SDA and BF programs. An exception is the LR program for $\Delta NETWORTH$. With this exception, special program and nonprogram borrowers appear to be on an equal footing in improving their financial status. This result can be viewed as a form of success for the SDA and BF programs since these special program borrowers are being put in neither an advantageous nor disadvantageous situation with respect to financial improvement vis-à-vis nonprogram participants. The numbers of OL, FO, and EM loans held at origination in general did not significantly affect the changes in financial characteristics.[11] This differs from findings reported by Dixon et al. (2007) who found the number of existing direct loans affects the likelihood of borrowers remaining in or exiting from the direct loan program. However, the remain or exit decision is different from changes in financial characteristics.

[11] Only two of 24 coefficients were significant.

Variation in Loan Servicing Actions

The estimated marginal effect coefficients of the negative binomial model for loan servicing actions are displayed in table 5. The marginal effects give the expected change in the number of servicing actions for a one-unit change in the independent variable evaluated at the sample means of the independent variables (Greene, 2007). The overall model fits are generally better than those of the financial measures models. All models are highly significant as measured by the likelihood-ratio statistic (χ^2). The explanatory power, measured by the McFadden pseudo-R^2 for the loan servicing models, is generally higher than the R^2 values in the financial measures models, although these two R^2s are not fully comparable.

Demographic and programmatic variables (*LR*, *BF*, *SDA*, and *BFS*) are not significant for loan servicing actions, which is somewhat similar to the changes in the financial measures models except that limited resource loans (*LR*) were associated with shifts in the changes in net worth. The only variables significant in multiple models are net worth at origination (*NETWORTH*) and the number of EM loans held at origination (*NUMEM*). As expected, higher levels of net worth at origination lead to fewer loan servicing actions. The net worth effect is significantly negative for one-year OL, seven-year OL, and FO loans for delinquencies.

It is somewhat surprising that only three of the other financial variables are significant, and only in one of the eight models each. We expected at least some of the financial variables would be significant across the models since these variables have direct bearing on the repayment capability of borrowers. But what is likely happening here is that loans are made to borrowers who are creditworthy and then an unforeseen event occurs which suddenly diminishes payback ability. Loss of an outside income source or a dip in farm income could cause financial difficulty. Likewise, illness could lead to an inability to pay. Clearly, the models would be enhanced by data on individual borrowers' financial conditions over time to explain the observed loan servicing action, but such data would be very difficult to obtain.

Four of the eight *NUMEM* coefficients are significant and positive. Hence, the greater the number of EM loans a borrower has, the more frequently he or she is likely to have difficulty making payments than borrowers with fewer or no EM loans. As this finding strongly implies, past disasters or emergencies resulting in the need for an EM loan suggest the borrower might have difficulty making loan payments for another EM loan or other direct loans. *NUMOL* and *NUMFO* coefficients are not significant in any of the delinquency models, but each is significant and positive in one of the restructuring models. Dixon et al. (2007) found that increasing numbers of direct loans existing at the time of loan origination implied the borrower was less likely to graduate from the FSA direct loan program to commercial funding sources. Our results imply borrowers with more outstanding direct loans at origination are more likely to have loan servicing actions.

Table 5. Estimated Marginal Effects of the Negative Binomial of Loan Servicing Actions

	Restructurings			
Independent Variable	OL 1yr	OL 7yr	FO	EM
Intercept	−0.297	0.805	0.333	2.582*
AGE	−0.008	−0.019	0.018	−0.028
FEMALE	0.050	0.178	2.057	−0.687
RACE	−0.863	0.904	3.719	−0.210
NETWORTH	−0.003	−0.003	−0.003	−0.001
NI	0.002	−0.008	−0.004	−0.001
DA	−0.228	0.014	0.190	−0.674
CR	−0.084	−0.102	0.004	−0.034
REPAY	1.297	−0.213	−0.434	−1.020
ATR	−0.160	0.145	0.009	0.169
LEXPHH	0.086	−0.004	−0.047	0.041
FINDIS	−0.930	−0.778	1.379	−0.327
GCFI	0.003	0.006*	0.003	−0.001
CROPREVR	0.578	1.164**	−0.399	0.374
NUMOL	0.545	0.426	0.132	0.341**
NUMFO	0.011	0.620***	−0.069	0.049
NUMEM	0.574**	0.429	−0.058	0.269
LR	0.504	0.416	−0.152	NA
BF	0.602	−0.018	−0.108	NA
SDA	2.379	−0.205	−0.463	NA
BFS	0.805	2.401	−0.414	NA
TIMETO	−0.482	0.227	−0.104	−0.337
No. of Observations	652	526	167	291
χ^2	1,921.4***	1,345.5***	76.8***	512.7***
McFadden Pseudo-R^2	0.415	0.393	0.175	0.373

Notes: Single, double, and triple asterisks (*,**,***) denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively.

(extended . . . →)

The amount of time from origination to October 1, 1996 (*TIMETO*) is negative and significant for EM loan delinquencies. This finding probably reflects that the earlier an EM loan was made, the sooner, on average, a borrower could have paid back the loan and consequently would be less likely to have a delinquency post-1996.

Conclusions

This study sought to identify variables to explain changes in financial well-being and number of loan servicing actions by estimating regression and negative binomial count data models. We used data composed of observations from a 2004 sample of FSA direct loan borrowers who initiated OL, FO, or EM loans in fiscal

Table 5. Extended

	Delinquencies			
Independent Variable	OL 1yr	OL 7yr	FO	EM
Intercept	1.980*	1.090	−1.147	0.888
AGE	−0.021	−0.006	0.053	−0.005
FEMALE	−0.442	0.961	2.887	0.706
RACE	−0.085	1.543	1.557	1.165
NETWORTH	−0.004***	−0.004***	−0.005**	−0.001
NI	0.002	0.010**	0.012	0.002
DA	−0.017	0.139	−0.739	0.158
CR	−0.034	−0.076	−0.017	−0.082
REPAY	−0.742	−0.123	−0.770	−0.218
ATR	0.123	0.044	0.098	−0.099
LEXPHH	−0.041	−0.025	−0.053	0.026
FINDIS	0.415	0.871	1.351	0.920
GCFI	0.002	−0.001	0.000	−0.001
CROPREVR	0.342	0.338	0.135	0.085
NUMOL	0.249	0.072	0.149	0.117
NUMFO	0.022	0.143	−0.324	0.288
NUMEM	0.286**	−0.027	0.785**	0.258**
LR	0.903	0.081	0.291	NA
BF	0.378	0.470	0.349	NA
SDA	0.625	−0.444	−0.551	NA
BFS	1.434	−0.562	−0.484	NA
TIMETO	0.096	−0.123	0.190	−0.461***
No. of Observations	587	486	154	261
χ^2	901.5***	262.9***	97.3***	154.4***
McFadden Pseudo-R^2	0.284	0.133	0.191	0.151

years 1994–1996. In general, the loan servicing actions models are superior to the financial change models in explanatory power.

Descriptive statistical analysis shows significant, positive increases in mean net worth—an indicator of success for FSA direct loan borrowers. The mean debt-to-asset ratio increased significantly, perhaps reflecting expanding enterprises for relatively young farmers or little to no debt for many FSA borrowers at time of loan origination.

The estimated financial change models imply that different types of direct loans are influenced by different variables. Increasing land values are associated with increased net worth of OL borrowers. Those who obtained limited resource loans have significantly smaller increases in net worth for OL borrowers and larger increases in net worth for FO borrowers relative to nonlimited resource (regular program) borrowers. Change in the debt-to-asset ratio is negatively related to the debt-to-asset ratio at origination. The negative effect of the initial

debt-to-asset ratio may reflect reluctance by FSA and other creditors to make a marginal financial situation more perilous by extending more credit. We find that the time spans between observations of initial and subsequent net worth and debt-to-asset ratio are statistically significant and lead to improvement for both financial measures. Longevity in the FSA direct loan program has a positive effect on financial well-being.

The results from the loan servicing models generally imply that net worth and the number of EM loans at origination are important for FSA borrowers. Decreased borrower net worth and additional EM loans at origination lead to more loan servicing actions. Existing EM loans at origination indicate a borrower who will be more challenged to pay back loans.

Special program variables representing beginning farmers, socially disadvantaged farmers, and the combination of these two programs are insignificant 35 of the 36 times they appear in the models. These results indicate changes in financial well-being and numbers of loan servicing actions for borrowers receiving loans from special programs targeted to farmers who are beginning or who belong to groups considered to be socially disadvantaged do not differ markedly from borrowers receiving nontargeted loans. This can be viewed as a form of success for the beginning farmer and socially disadvantaged farmer programs since these special program borrowers are being put in neither an advantageous nor disadvantageous situation with respect to financial improvement and loan servicing actions vis-à-vis nonprogram participants.

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