Analyzing FSA Direct Loan Borrower Payback Histories:

Predictors of Financial Improvement and Loan Servicing Actions

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1. Introduction

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 the market. This financial assistance takes the form of guaranteeing conventionally sourced loans or granting direct loans so that credit is available to eligible credit-worthy, farm borrowers. A guaranteed loan is made by commercial lenders and FSA guarantees the majority of any loan loss that may occur. Direct loans, on the other hand, are loans sourced by the U.S. Treasury and originated by FSA to farmers who do not meet the requirements for guaranteed loans. Both direct and guaranteed loans provide operating (OL) loans, which can be both short and intermediate term loans, and long term farm ownership (FO) loans.

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 strategic goal of the FSA in their strategic plan for years 2005-2011.[1] 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.

[1] Farm Service Agency (FSA) 2005-2011 Strategic Plan, USDA. http://www.fsa.usda.gov/Internet/FSA_File/fsa-strategicplanfy2005-2011.pdf. Accessed January 19, 2009. "FSA Strategic Goal 1: Supporting productive farm and ranches".

In addition to furthering the financial well-being of farmers, FSA is mandated by Congress to allocate various proportions of loans to socially disadvantaged (SDA) farmers and beginning (BF) farmers. This mandate emphasizes a goal of 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 ten or fewer years of farming experience with specific requirements differing between OL and FO loans.

Different loan types have different purposes. Operating loans can be used to purchase farm materials (e.g., seeds, fertilizers, and feeds) and equipment, livestock, and other farm operating expenses. Conversely, FO loans are used to purchase land intended for farming, for the construction of buildings, or for other farm improvements. Borrowers can apply for direct OL and FO loans to a maximum of $300,000 for each type of loan and $1,094,000 for combined guaranteed loans for fiscal year (FY) 2009. Loan maturities and interest rates vary according to the loan type and the borrower repayment capacity. Emergency (EM) loans are offered only as a direct loan. EM loans are available to farmers in counties that the President declares as a disaster area or that the Secretary of Agriculture declares as a quarantine area. EM loans can help farmers recover from farm losses due to drought, flood and other natural calamities. The maximum total EM loan indebtedness allowed per borrower by FSA is $500,000.

2. Study Objectives

FSA screens direct loan applicants so that only those considered as creditworthy receive loans. FSA screens potential borrowers by 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 successful if the loan is made. However, because FSA direct borrowers are on the financial margin since they must first be denied credit by a commercial lender, they can have more difficulty paying their debts than commercial borrowers. These difficulties are reflected by loan servicing actions 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 like farm profitability, solvency and liquidity.

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

The objectives of the study are:

(1) To estimate how loan and borrower characteristics at loan origination are related to changes in borrower financial characteristics—net worth, debt-to-asset ratio and current ratio—over approximately nine years.

(2) To estimate how the frequency and variety of loan servicing actions—restructurings and delinquencies—are related to financial and loan characteristics at loan origination.[2]

[2] The number of write downs was recorded for each loan observation. But write downs were

3. Related Studies

Our primary interest lies in predicting how characteristics at loan origination influence subsequent financial well-being and number of servicing actions. Most of the credit-related literature in agriculture relates to predicting the likelihood of loan approval and whether the loan is successful in terms of being paid back. Our concern is looking at a more intermediate approach to loan success. While FSA is strongly concerned with borrowers graduating from their direct loan program, part of evaluating borrower success is continual improvement in financial health and minimal loan servicing actions. Because we could find few studies specifically related to intermediate measures of loan progress, we look primarily to the loan approval/loan success literature for concepts and variables that predict borrower success during loan payback. If such models are useful for predicting borrower success or failure, they should also be useful for predicting intermediate improvement in financial measures and loan servicing actions.

Impact of Farm Structure

Featherstone, et al. (2005) describe changes in U.S. farm financial and physical structure over time that have motivated farmers to acquire loans. Capital substitution for labor and the consequent increased farm size has led to increasing capital debt. These, in turn, influence farm financial ratios. Featherstone, et al., report a U.S. farm debt-to-asset ratio of 0.15 in 2002. Though this is relatively low, young farmers without much capital are likely to have higher debt-to-asset compared with older farmers. Return on assets (ROA), a measure of farm profitability, shows variable changes in U.S. farms from 1960 to 2002. To the extent these changes are due in part to increasing farm size; we would

expect measures of farm size to be important in explaining financial variables' fluctuations.

Factors Determining Loan Approval

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. Agricultural Resource Management Study (ARMS) farm level data are used in the study. 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. These include total farm acres, land tenure[3], contract use[4], debt-to-asset ratio, total debt, gross farm income, return on assets, use of crop insurance and government payments received.

A probit model was estimated as a function of personal and farm characteristics that influence whether a farmer has debt. Farmer's attitude toward risk significantly influenced whether a farmer used credit. Farm attributes such as gross farm income, government payments, contracts use, crop insurance, and farmer's age also had a significant impact on credit use.

A truncated regression and Poisson models are used to estimate factors associated with determining the amount of debt and influencing the number of loans, respectively. Farmer's age is the only variable that significantly affects degree of farm indebtedness. Whereas, gross farm income and use of crop insurance were the important factors that significantly affect the number of loans approved.

[3] Land tenure is the ratio of owned to operated land.
[4] Contract use in Katchova's study is the proportion of production under marketing or production contracts.

Escalante et al. (2006) identify significant financial, structural and demographic factors that influence loan approval for FSA direct and guaranteed loans. Financial factors considered were debt-to-asset ratio, return on assets, net farm income ratio, current ratio, asset turnover ratio and repayment margin ratio. Structural factors such as farm size, loan type (direct or guaranteed), and borrower's region within the state and demographic factors such as borrower race and gender (whether female or not) were included as independent variables in a logit model predicting loan approval.

Logistic regression results of the credit-scoring related variables show that repayment margin ratio and current ratio are significant for the model pooling all observations. Repayment margin ratio is significant in both direct and guaranteed loan models. Return on assets and current ratio are significant in the guaranteed and direct loan models, respectively. In the models that segment observations by race, repayment margin ratios are significant for white borrowers and current ratio is significant for non-white borrowers.

Gender and region are significant factors for loan approval in the full-sample, loan application model and the direct loan model. Only two significant structural variables influence credit approval for non-white borrowers—farm size and region. For the white borrower sample, gender, direct loans and region are significant factors influencing loan approval.

Featherstone et al. (2007) survey agricultural lenders in Kansas and Indiana. Their objective is to identify important borrower and lender characteristics that influence loan approval and interest rate levels. Agricultural lenders—commercial banks and Farm Credit offices—received a hypothetical request for an agricultural loan as part of a survey

instrument. Each loan request had a different borrower character, financial record keeping accuracy, "productive standing", credit risk and Fair Isaac credit bureau score.

Results from this study show that 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.

Loan Performance Determinants

Zech and Pederson (2003) identify factors that can best predict the overall performance and repayment capacity of borrowers. Data on farm operators were acquired from the Southwestern Minnesota Farm Business Management Association. The data included detailed information about general farm characteristics, balance sheet and income statement information, itemized enterprise data and the year-end-analysis of the farm for 1987-1998. Term debt coverage ratio (TDCR) and net worth growth ratio[5] (NWGR) are the two dependent variables in the estimated regression models. TDCR measures borrower repayment capacity while NWGR measures the overall borrower financial performance.

Ordinary least squares models are estimated to explain variation in TDCR and NWGR for three six-year periods within the sample: 1987-1992, 1990-1995 and 1993-1998. The initial set of explanatory variables contains measures of liquidity, solvency, profitability, financial efficiency, repayment ability and other financial and demographic variables. Explanatory variables in the final NWGR model are crop acres, equity-to-asset ratio, asset turnover ratio, net farm income ratio, living expenses and net nonfarm income. Among those variables, asset turnover ratio has a positive, significant effect

[5] Net worth growth is calculated as the change in net worth over a year divided by average total assets.

whereas family living expenses turns out to be negatively significant to NWGR for all three time periods. Debt-to-asset is the only significant variable that influences TDCR for all three time periods and its influence is negative.

Credit Score Migration

Phillips and Katchova (2004) 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. The existence of path dependence is also tested. A single, unconditional transition matrix was used to estimate the migration rates across different business cycles. The Markov property of independence[6] was tested for evidence of path dependence.

Annual (1985-2002) farm-level data from the Illinois Farm Business Farm Management Association (FBFMA) are used to estimate migration rates on the basis of the farmer's calculated credit scores.[7] Based on the credit scores, farms were sorted into five classes. The study concludes that credit ratings improve during upticks in the business cycle and decline during general economic downturns. Evidence of trend reversal—upgrades followed by downgrades or vice versa—is found.

Success Measured as Graduation from FSA Direct Loan Program

FSA direct loans are intended to be a transitory step for borrowers to guaranteed loans or conventional commercial loans. Dixon et al. (2007) analyze graduation rates of borrowers and their reasons for remaining in or exiting the FSA direct loan program.

[6] Markov property of independence states that loan migration is independent of the previous migration outcomes.

[7] The credit scoring models use financial ratios as explanatory variables suggested by the Farm Financial Standards Task Force (FFSTF). Financial ratios measure liquidity, solvency, profitability, repayment capacity and financial efficiency.

Data were obtained from a survey where FSA farm loan managers obtained the actual data from borrower files at the county office level.[8] Observations were collected on three types of direct loans—OL loans, FO loans and EM loans. A borrower was considered as exited from the direct loan program if they had no outstanding direct loans as of November 30, 2004, otherwise the borrower was considered to be an active FSA borrower. Seven different types of exits are identified and condensed into three categories in the multinomial logit model: 1) continuing to farm without an FSA direct loan, 2) voluntarily left farming or retired, and 3) involuntarily left farming.

Results from the multinomial logit regression model show that the numbers of active FO, OL and EM loans, debt-to-asset ratio, race and borrower age were significant for borrowers with active direct loans, i.e., borrowers that had not exited the FSA direct loan program. Borrowers who had received an FO loan show a 0.14 increase in probability of still being in the program. Financial factors like net worth, debt-to-asset ratio and the nonfarm income to gross cash farm ratio and the numbers of OL and EM loans at time of loan origination for the given loan are significant for continuing farmers using or not using conventional credit post graduation. Six variables are significant for borrowers who voluntarily left farming or retired and no longer had an active loan with the FSA. These are 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. Number of FO loans held at origination, race and net worth were significant for borrowers who left farming involuntarily and no longer had active direct loans with FSA.

[8] The present study uses the same data as those used by Dixon et al. (2007).

4. Methods and Models

Ordinary Least Squares (OLS) is used to estimate models to identify those factors that influence the changes in the three selected financial characteristics. Because the two forms of loan servicing actions are reported as count data, the negative binomial count variable model is estimated.

The Hypothesized Financial Variables Models

Three financial variables are modeled in this study. These dependent variables are the changes in net worth, debt-to-asset ratio and the current ratio. Changes in these financial measures are computed by dividing the difference between the most recently observed value of the variable and its value at loan origination by the number of years between the two observations. The difference of the two given values divided by the number of years between observations gives the average annual change.

There are many possible independent variables as indicated by the literature review. It is not possible to use all the variables used in past studies due to the limitations of the present data set. These limitations are imposed in part by the data FSA collected. Table 1 shows a list of the independent variables used in the present study. Variables in this study are similar to those used by Nwoha, et al., since the same sample data are used. The expected signs of the variables are given in Table 2. In general, AGE should improve financial measures but the sign expectations on GENDER and RACE are ambiguous.

Increases in the financial independent variables, except debt-to-asset ratio and FINDIS, should increase net worth and current ratio and decrease debt-to-asset ratio. It was felt farm type should be important. Conceptually farm type was measured as revenue from crops (CROPREV) or from livestock (LIVREV). For the debt-to-asset,

current ratio and loan servicing models, the ratio of crop revenue to the sum of crop and livestock revenue (CROPREVR) was used. In general, crop farming has greater volatility in revenues.

In general, variables measured in levels are regressed on variables measured in levels. Likewise, ratio variables are regressed on ratios. An exception to this is the numbers of concurrent direct loans at origination (NUMOL, NUMFO, and NUMEM). The observations on these variables tend to be small integers. Other loan characteristics could influence changes in net worth and current ratio in either positive or negative ways. A borrower with FO loans has improving equity making net worth and current ratios increase and debt-to-asset-ratios decrease. EM loans indicate a past disaster so their number should make financial indicators worse. The sign effect of NUMOL could be positive or negative.

Timing variables were also included to account for temporal effects. For the financial variables increased length of time between measurements would typically indicate the subsequent measurements taken in 2002 or later when agricultural income generally increased so that financial indicators should improve. So TIMENW, TIMEDA and TIMECR measure the length of time in years between the measurements of the respective variables.

Hypothesized Models Explaining Variation in Loan Servicing Actions

As with the financial variables, the measurements on the loan servicing actions are specific to the borrower. That is, the specific loan that selected the borrower into the sample is not necessarily the loan that received the servicing. On the questionnaire the Farm Loan Managers (FLMs) were asked to report the number of loan servicing actions for the borrower on all FSA direct loans between October 1, 1996 and November 2004.

Independent variables for explaining loan servicing actions are largely the same as with the change in net worth models. However, the signs of the independent variables are often expected to be the opposite unless the signs are ambiguous. Financial characteristics such as NETWORTH and NONFINC should be inversely related to loan servicing actions. Conversely, we expect that CROPREVR could have a positive influence of loan servicing actions. Crop revenues are volatile and this could influence the ability to make payments as scheduled. As for loan characteristics, the numbers of concurrent direct loans are expected to be directly related to loan servicing actions.

The length of time a borrower is in the direct loan program is crucial for loan servicing actions since the longer they are in, the more likely they are to experience a loan servicing. 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 direct loan programs and fewer loans servicing actions post October 1, 1996.

5. Data Sources

The observational unit is the borrower associated with a particular loan. There were a total of 34,026 OL, 3,083 FO and 8,358 EM loans originated over FY 1994-1996 (Nwoha, et al.). White males made up the vast majority of FSA direct loan borrowers. Because they were the most numerous borrowers, loans to them were sampled at a rate of 1 in 18 for both OL and EM loans. Regardless of gender and race, FO loans were sampled at a rate of 1 in 9. The FSA FLMs were surveyed through an online instrument that was posted on the secured FSA intranet site. The instrument was designed by a research team at the University of Arkansas but was administered by FSA in Washington, D.C.

FSA direct loans originated in FY 1994-1996 were sampled from the states and territories such as Puerto Rico. Borrowers' personal and loan information was collected by the FLMs based on a stratified, systematic sampling of loans. Three fiscal years were selected to prevent the unique, macro factors of one year from disproportionately influencing loan originations. The FYs 1994-1996 were representative of U.S. farm income in the 1990s. FY 1994 represents the lowest and 1996 had the highest U.S. farm income in the 1990s.[9]

After data cleaning, 2,715 responses were considered as usable. These usable responses made for a 90% response rate from the total 3,004 sampled loans. The data are of good quality because the responses were from the FLMs and many of these FLMs probably exercised supervisory discretion when the original application forms were completed by the borrowers. Further description for the data collection and methods are discussed in Nwoha et al. (2005). The actual survey instrument is included in Nwoha et al. (2005) in Appendix 2.B.[10]

For a given loan sampled, both data observed at loan origination and data observed subsequent to loan origination were collected. Data on all the independent variables in table 1 were observed as of origination of the loan selected into the sample except for the time variables. The subsequent observation on a borrower's net worth, current ratio and debt-to-asset ratio could have been before or after the loan that was selected in the original sample was paid off or not. So, changes in these variables may be influenced by other FSA loans of the borrower in addition to the loan selected for sampling purposes.

[9] U.S. Department of Agriculture. Data Sets: Farm Income – Summary Totals for 50 States. Internet site: http://www.ers.usda.gov/Data/FarmIncome/50State/50STMENUXls.HTM. Date accessed: March 24, 2009.

[10] Farm Service Agency Direct Loan Program Effectiveness Study. Can be downloaded at http://www.uark.edu/depts/agripub/Publications/bulletins/977.pdf.

The subsequent values of net worth, debt-to-asset ratio and current ratio were observed at various points in time. The observation points varied among borrowers and were not uniform. The numbers of servicing actions (restructurings and delinquencies) were from October 1, 1996 until November 2004 and counted such actions on all direct loans held by the borrower during that time span.

6. Results and Discussion

Descriptive statistics of the five dependent variables are displayed in Table 3. The maximum change in net worth is $248,248 with a statistically significant (p = 0.000) mean value of $9,097. The mean value for the change in debt-to-asset ratio is 0.08 (p = 0.0013). An average increase is somewhat unexpected. Since FSA direct loan borrowers are typically younger than the population of farmers, an increasing debt-to-asset ratio might imply operators increasing the scale of operation through debt. The mean change in current ratio is small at 0.007 and statistically insignificant (p = 0.9021). The maximum numbers of loan restructurings and delinquencies a borrower had are 72 and 53, respectively. However, the sampled borrowers only 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 levels of significance. The variability in loan servicing actions is generally better explained by the models than variability in the financial indicators.

Variation in the Financial Measures

Results of the financial regression models are presented in Table 4. The overall fit for each of the nine models is significant at 0.01. Coefficients of determination are not

high but this is not unusual for cross sectional data nor at large variance with those in Zech and Pederson who estimate similar models. Sample sizes differ among loan types and the particular financial characteristic. OL loans have the largest sample sizes and FO loans are the smallest reflecting the preponderance of OL loans in the sampling frame. Observations with missing values on one or more variables in a model were not included in the regression sample. Visual inspection of Tables 4 and 5 indicate that for a given dependent variable, say change in net worth, the coefficients differ by loan type so that estimation of separate models by loan type is clearly justified. The explanatory powers of the three financial measure models are higher than what was reported in Nwoha, et al. who included all loan types in each of the three financial measure models. Segmenting the sample by different loan types improves the explanatory power of the models.

There are relatively few significant variables for change in net worth. AGE is significant for FO loans. The negative value (−564) on AGE is an unexpected finding. This means the older farmers generally accumulated less net worth per year (−$564) for each year older they are at time of loan origination, *ceteris paribus*. This might be indicative of younger farmers building the enterprise while older farmers are cutting back. But since this result is not evident in the other two loan type models, the finding is tenuous. Livestock revenue (LIVREV) is positive and significant for OL loans. But LIVREV is not significant for the other two loan types. Net worth at origination (NETWORTH) is significantly positive for FO loans but significantly negative for EM loans. The negative association for EM loans may indicate the difficulty in overcoming a disaster. TIMENW is significant and positive for both OL and EM loans supporting the notion that longer time spans captured part of more prosperous times for agriculture.

Debt-to-asset ratio at origination (DA) is significantly negative for the change in debt-to-asset for all loan types. This indicates that farmers with higher DA at time of loan origination generally experienced less of an increase in DA per year. The mean values of debt-to-asset at origination for OL and EM loan borrowers are 0.73 and 0.72, respectively. FO loans have a lower mean of 0.50. Since the OL and EM borrowers are already at very high levels, we would expect FSA and other creditors to be reluctant to add debt since it would make an already perilous situation worse so the negative sign is believable. The FO borrowers can handle additional debt more easily but there still appears to be a reluctance to add to an already high level of indebtedness. However for all farm borrowers, DA can only go so high before the farmer is technically insolvent, i.e., DA is equal to or greater than one. Therefore, farmers with DA near one are limited to how much the DA can increase. Number of EM loans (NUMEM) is positively and significantly related for the FO model. Alternatively, number of FO loans (NUMFO) is significantly negative for the EM model. For OL and EM loans the time between observing the original and last observation on debt-to-asset ratio is significantly positive for OL and EM loans but negative for FO loans. The unexpected positive signs might indicate that these borrowers are in the direct loan program longer and trying to build their operations by taking on more debt, whereas the negative sign for the FO model indicates the real estate asset secured by the FO loan had more opportunity to appreciate in value resulting in lower debt-to-asset ratio.

For the change in current ratio, RACE has a negative, significant effect on OL loans. This indicates that non-white borrowers have less short term liquidity improvement than white borrowers. Current ratio at origination (CR) is significant for all loan types for the change in current ratio but unexpectedly negative. This may indicate borrowers

becoming less liquid because they were able to take on more debt and/or applied some of their liquidity toward a down payment associated with the loan origination. Additionally, highly liquid borrowers may find it advantageous to be less liquid. TIMECR is insignificant which is expected given that the observed current ratios changed so little as evident in Table 3.

Across the three models, the patterns present in the insignificant variables show some surprising findings. Demographics, particularly GENDER, are not significant in this model. Programmatic (BF, SDA, and BFS) variables are not significant. This suggests that changes in financial characteristics are not influenced by special loan programs. Both special program and regular borrowers appear to be on an equal footing in improving their financial status. This can be viewed as a form of success for these programs since special program borrowers are being put in neither an advantageous nor disadvantageous situation in regards to financial improvement vis-à-vis non program participants. The numbers of EM, OL, and FO loans in general did not significantly affect the changes in financial characteristics for all types of loans.[11] This differs from Dixon, et al. who found number of existing direct loans to increase the likelihood that borrowers remain in the direct loan program.

Variation in Loan Servicing Actions

The estimated coefficients of the negative binomial for loan servicing actions are displayed in Table 5. Negative binomial regression is used instead of the Poisson regression because of the over-dispersion of the data. We used the customary negative binomial model of Cameron and Trivedi (1986). The overall fits of all these models are

[11] Only two of 27 coefficients were significant. The magnitudes of the significant coefficients suggest a minimal impact.

generally better than those of the financial variables models. Both models are highly significant as measured by the likelihood ratio statistic (χ^2). The explanatory power as measured by the McFadden pseudo R^2 for the loan servicing models are generally higher than the R^2's in the financial variable models. However, these two R^2s are not fully comparable.

Other than sign, the parameters in Table 5 are difficult to interpret. So the marginal effects are presented in Table 6 which gives 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.[12] Demographic and programmatic variables are not significant for loan servicing actions, similar to the changes in the financial variables models.

Financial characteristics variables are significant for OL loans for both restructurings and delinquencies. This does not hold generally for FO and EM loans. NETWORTH and total cash farm income (TCFI) are significant for OL loans. Increases in NETWORTH imply fewer restructurings and delinquencies. The opposite is true with TCFI, indicating a farm size effect. Additionally, increasing non farm income (NONFINC) is associated with more delinquencies for OL borrowers indicating that financial stress may result in going off farm for more income. As expected, a higher proportion of revenue from crops results in more restructurings and delinquencies for OL loans. A similar effect is not found for FO and EM loans.

Increases in NUMOL or NUMEM significantly increase the number of restructurings and delinquencies except for restructurings by FO borrowers. Dixon et al.

[12] See Greene (2007) for more discussion of marginal effects.

(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.

The FO and EM loan models do not have nearly as many significant variables as the OL models. This may be due to diminished sample sizes compared with OL loans. It is interesting that the amount of time from origination to October 1, 1996 (TIMETO), is negative and significant for EM loans. This probably reflects that the earlier an EM loan was made, the sooner, on the average, a borrower pays back the loan and therefore would be less likely to have a restructuring or delinquency post 1996. But a similar effect is not observed for OL or FO loans for restructuring or delinquency. FO loans have longer times to termination than OL or EM loans (Nwoha et al. (2005)) so such borrowers are likely to be in the FSA direct program longer and therefore more exposed to loan servicing actions. Borrowers' originating OL loans on average have more FSA direct loans so may be more reliant on FSA direct loans and stay in the program longer.

7. Conclusion

We set out to identify variables to explain changes in financial well being and number of loan servicing actions. Samples to estimate the models are composed of observations of FSA direct loan borrowers who initiated OL, FO or EM loans in fiscal years 1994-1996. For both sets of estimated models the explanatory powers are about what would be typically expected for cross sectional data. In general the two loan servicing models were superior to the three financial change models.

The estimated financial change models imply that different types of loans are influenced by different variables. Changes in the debt-to-asset ratio and current ratio for

all loan types were negatively related to the levels of these ratios at origination. The negative effect of the initial debt-to-asset ratio may reflect reluctance on FSA and other creditors' part to make a marginal financial situation more perilous by extending more credit. We did find that the time spans between observations of initial and subsequent net worth and current ratio were significant. This suggests that events subsequent to origination are important. The latter part of the 1990s and early 2000s were not good overall for agriculture so this might be causing this effect. Despite the lack of model explanatory power, simple statistical analysis showed significant, positive increases in mean net worth. This indicates success for FSA direct loans. The mean debt-to-asset ratio increased, perhaps reflecting expanding enterprises for relatively young farmers or little to no debt for many FSA borrowers at time of loan origination.

The estimated marginal effects for loan servicing actions implies that financial variables and the number of FSA direct loans at origination were important for borrowers getting OL loans. Increased borrower net worth decreases the numbers of restructurings and delinquencies for OL loan borrowers but larger farms as indicated larger gross cash farm income implies more loan servicing actions. Additional numbers of FSA direct loans at origination imply increased restructuring and delinquency activity for OL and EM loans. This finding suggests that too many existing FSA direct loans at origination of another loan may indicate a borrower who will be challenged to pay back loans.

The fact that SDA and BF assistance types were not significant in any of the models indicates that changes in financial well being and numbers of loan servicing actions for such borrowers do not differ from non program borrowers. This indicates SDA and BF programs are succeeding in helping such farmers compete evenly with other farmers.

Table 1. Variable Descriptions

Dependent Variables	Description
ΔNET WORTH	Average annual change in net worth ($).
ΔDA	Average annual change in debt-to-asset ratio.
ΔCR	Average annual change in current ratio.
RESTRUC	Number of restructurings
DELINQ	Number of delinquencies
Independent Variables	
A. Demographic	
AGE	The primary age of the borrower (years).
GENDER	Binary variable, 1 if female; 0 otherwise.
RACE	Binary variable, 1 if nonwhite; 0 otherwise.
B. Financial Characteristics	
CR	Liquidity measure—current assets divided by current liabilities.
DA	Leverage measure—total debt divided by total assets.
NETWORTH	Solvency measure—total assets less total liabilities ($1000).
REPAY	Repayment capacity—available balances to service debt divided by payments due in the current year.
NONFINC	Non-farm income ($1000s).
FINDIS	Binary variable, 1 if borrower experienced receivership, was discharged in bankruptcy, or petitioned for reorganization under bankruptcy; 0 otherwise.
TCFI	Total cash farm income from crop, livestock and other farm income ($1000s).
NETINCR	Net farm and household income divided by TCFI.
LIVREV	Livestock revenue ($).
CROPREV	Crop revenue ($).
CROPREVR	Crop revenue divided by crop plus livestock revenue ratio.
C. Loan Characteristics	
NUMFO	Number of FSA direct farm ownership loans at origination.
NUMEM	Number of FSA direct emergency loans at loan origination.
NUMOL	Number of FSA direct operating loans at origination.
BF	Binary variable, 1 if BF loan assistance code; 0 otherwise.
SDA	Binary variable, 1 if SDA farmer loan assistance code; 0 otherwise.
BFS	Binary variable, 1 if BF and SDA farmer loan assistance codes; 0 otherwise.
TIMETO	Time from loan origination to October 1, 1996 (years).
TIMENW	Time between initial and final observation of net worth (years).
TIMEDA	Time between initial and final observation of debt-to-asset ratio (years).
TIMECR	Time between initial and final observation of current ratio (years).

Table 2. Expected Signs of the Independent Variables

Independent Variables	Change per year in:			Number of Restructurings or Delinquencies
	Net worth	Debt-to-Asset Ratio	Current Ratio	
A. Demographic				
AGE	+	–	+	–
GENDER	+/–	+/–	+/–	+/–
RACE	+/–	+/–	+/–	+/–
B. Financial Characteristics				
CR		–	+	
DA		+/–	+/–	
NETWORTH	+			–
REPAY	+	–	+	
NONFINC	+	–	+	–
FINDIS	–	+	–	+
TCFI	+	–	+	+/–
PCTHFINC	+	–	+	
LIVREV	+			
CROPREV	+			
CROPREVR		+/–	+/–	+
C. Loan Characteristics				
NUMFO	+	–	+	+
NUMEM	–	+	–	+
NUMOL	+/–	+/–	+/–	+
BF	+/–	+	+/–	+/–
SDA	+/–	+/–	+/–	+/–
BFS	+/–	+/–	+/–	+/–
TIMTO				–
TIMENW	+			
TIMEDA		–		
TIMECR			+	

Table 3. Dependent Variables' Descriptive Statistics

Dependent Variables	Mean	Std. Deviation	Minimum	Maximum
ΔNW	$9097***[a]	$39,438	$–279,633	$248,248
ΔDA	0.065***	0.802	–1.118	34.270
ΔCR	0.007	0.551	–6.547	6.659
RESTRUC	2.266***	4.780	0	72
DELINQ	1.801***	3.111	0	53

[a] * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 4. OLS Regression Estimates of the Changes in Financial Variables[a]

Independent variables	ΔNet worth			ΔDebt-to-asset ratio			ΔCurrent ratio		
	OL	FO	EM	OL	FO	EM	OL	FO	EM
AGE	−42.2	−564.3**[b]	−16.3	0.00	−0.00	−0.00	0.00	−0.01	0.00
RACE	−16860.5	9264.6	1386.9	0.02	0.07	0.09	−0.43*	−0.20	−0.00
GENDER	−8282.5	−14907.3	9649.9	−0.01	0.07	−0.05	−0.35	0.17	−0.05
CR				−0.00	0.01***	−0.01	−0.21***	−0.14***	−0.17***
DA				−0.10***	−0.10***	−0.12***	−0.08**	0.03	0.00
NETWORTH	14.1	95.7***	−47.6*						
REPAY				−0.02	−0.02	−0.02	0.18	0.09	−0.00
NONFINC	−21.1	169.1	145.3						
FINDIS	−4815.3	−11189.0	11567.4	0.01	0.03	−0.11**	0.04	−0.15	0.03
TCFI	−29.4	170.3	134.1						
NETINCR				−0.01	−0.00	0.03	−0.05	0.00	0.04***
LIVREV	0.4*	−0.2	0.0						
CROPREV	0.0	−0.2	−0.1						
CROPREVR				0.03	−0.00	−0.05	−0.04	−0.22	0.03
NUMFO	−619.2	−724.8	−4609.6	0.00	0.01	−0.02*	0.00	−0.02	−0.00
NUMEM	1626.5	1523.4	−1145.8	0.02	0.01**	0.00	0.02	0.03	−0.01
NUMOL	−581.7	−313.6	−338.3	0.01	−0.01	0.00	0.00	0.00	0.01
BF	−1359.7	3094.3		0.03	−0.01		−0.03	−0.23	
SDA	3650.3	−22.2		−0.01	−0.06		0.36	−0.17	
BFS	7545.1	−7540.2		0.08	0.01		0.38	−0.43	
TIMENW	3112.3***	932.4	4392.3***						
TIMEDA				0.03**	−0.01*	0.01*			
TIMECR							0.00	−0.10	0.01
n	1206	224	273	822	119	208	958	127	227
F	8.45***	3.43***	2.51***	2.48***	5.36***	4.48***	23.49***	2.32***	12.11***
R^2	0.10	0.21	0.11	0.05	0.46	0.23	0.29	0.25	0.43
Adjusted R^2	0.09	0.15	0.07	0.03	0.37	0.18	0.27	0.14	0.39

[a] Standard errors are computed by White's heteroscedastic covariance matrix.
[b] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Negative Binomial Estimates of Loan Servicing Actions

Independent variables	Restructuring			Delinquency		
	OL	FO	EM	OL	FO	EM
AGE	–0.0080	0.0529*	–0.0284**	–0.0032	0.0198	0.0008
RACE	–0.1937	1.2224	–0.5558	0.3442	0.0950	0.4887**
GENDER	0.0220	1.5756	–0.7341	–0.1184	0.5058	0.4666
NETWORTH	–0.0011**	–0.0084**	–0.0001	–0.0026***	–0.0027	–0.0007
NONFINC	–0.0036	–0.0131	–0.0016	0.0045**	0.0103	0.0040
FINDIS	–0.4604** [a]	–0.5876	–0.2237	0.2671	1.0293	0.4395
TCFI	0.0014***	0.0050	0.0005	0.0008**	0.0027	0.0004
CROPREVR	0.4132***	–0.0056	0.5967	0.2123**	–0.0476	0.2041
NUMFO	0.1315***	–0.4172	0.0349	0.0375	–0.2343	0.2445**
NUMEM	0.2387***	–0.0238	0.2408*	0.0819*	0.5504***	0.1495*
NUMOL	0.1836***	0.7676***	0.3395***	0.0699***	0.3750**	0.1139**
BF	–0.0859	0.3133		–0.0720	0.1707	
SDA	0.4440	–1.3441		–0.0103	0.6173	
BFS	0.5393	–0.7414		0.1767	0.4433	
TIMETO	–0.0581	–0.0100	–0.3528**	–0.0333	–0.2397	–0.3244***
n	1451	255	360	1331	241	321
χ^2	4680.7***	341.6***	676.9***	1516.1***	209.2***	198.4***
R^{2b}	0.45	0.36	0.40	0.23	0.23	0.16

[a] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[b] McFadden pseudo R-squared.

Table 6. Estimated Marginal Effects of the Negative Binomial of Loan Servicing Actions

Independent variables	Restructuring			Delinquency		
	OL	FO	EM	OL	FO	EM
AGE	–0.0190	0.0376	–0.0313	–0.0058	0.0205	–0.0012
RACE	–0.4265	1.4598	–0.5159	0.7369	0.1022	0.8332
GENDER	0.0530	2.3776	–0.5860	–0.2071	0.6568	0.8377
NETWORTH	–0.0027**[a]	–0.0060***	–0.0002	–0.0049***	–0.0028	–0.0010
NONFINC	–0.0086	–0.0093	–0.0018	0.0083**	0.0107	0.0057
FINDIS	–0.8999	–0.3223	–0.2239	0.5573	1.7978	0.7682
TCFI	0.0034***	0.0036	–0.0005	0.0014**	0.0028	0.0005
CROPREVR	0.9844***	0.0040	0.6579	0.3918**	–0.0494	0.2912
NUMFO	0.3133***	–0.2964	0.0384	0.0691	–0.2433	0.3488
NUMEM	0.5786***	–0.0169	0.2656*	0.1511*	0.5715**	0.2133*
NUMOL	0.4374***	0.5453**	0.3744***	0.1289***	0.3894*	0.1625**
BF	–0.1990	0.2193		–0.1298	0.1753	
SDA	1.2822	–0.5898		–0.0190	0.8423	
BFS	1.6725	–0.4035		0.3544	0.5532	
TIMETO	–0.1385	–0.0071	–0.3890**	–0.0615	0.2489	–0.4628***

[a] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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