USING FINANCIAL RATIOS AND LENDER RELATIONSHIP THEORY TO ASSESS FARM CREDITWORTHINESS

Alan Reichert, Cleveland State University
Raymond Posey, Mount Union College

ABSTRACT

This study examines the determinants of farm loan delinquencies, and in particular, the influence of multiple loans and multiple lenders on delinquency. The number of lenders used by a borrower, the number of loans outstanding, and the interaction of the two factors are all positively related to loan delinquency rates. In fact, these factors are at least as significant as standard financial ratios in explaining farm loan delinquency. The most consistent finding is that borrowers who have been denied credit in the past five years are more likely to be delinquent. Furthermore, borrowers using multiple lenders appear to be able to bargain for lower interest rates.

JEL: G2; M1; M4

KEYWORDS: Credit scoring, lending relationships, farm credit

INTRODUCTION

The current financial crisis in general and the problems associated with CTI, a major small businesses lender, demonstrates the importance of a prosperous small business sector in terms of supporting economic growth and employment. Small businesses in the US are responsible for approximately half the economic activity and more than 50% of the job growth. At the same time, small business generally do not have the same direct access to the money markets that larger firms have and hence are more reliant on their local bank for funding. Using a unique data set this paper focuses on a frequently neglected small business sector, namely small farms. While agricultural commodity prices rose dramatically from 2003-2007, the financial crises ultimately caught up to this sector in the guise of falling land and crop prices and increasingly tight credit conditions. The focus of this paper is to examine the factors that influence the creditworthiness of small farm borrowers. While small farms are similar in many respects to other small businesses, the farm owner-operator often resides on the farm and the distinction between personal and corporate assets may blur. For example, farmland may serve as collateral for loans to both the farm operation and to secure a mortgage on the residence. Alternatively, the residence and other personal assets may serve as collateral for farm operating loans. Thus, researchers often make a distinction between the farm-household and the farm-firm.

LITERATURE

A few authors have examined the determinants of bank loans to agricultural firms. Zech and Pederson (2003) found that the debt-to-asset ratio is a strong predictor of the farm borrower's ability to repay the loan. They further found that asset turnover and family living expenses are good predictors of farm performance. Durguner and Katchova (2007) find that the prior year's working capital to gross farm return, debt-to-asset ratio, and return on farm assets are the most pertinent factors explaining creditworthiness. In earlier work, Splett, Barry, Dixon, and Ellinger (1994) developed a five-factor credit-scoring model. The five factors measure liquidity (current ratio), solvency (equity-asset ratio), profitability (ROE), repayment capacity (capital debt-repayment margin), and efficiency (net income from operations ratio). Weights are applied to each factor to arrive at an overall credit score. Some

authors estimate separate credit scoring models for different types of farms (e.g., livestock vs. crop farms) and for unique regions of country.

The Farm Financial Standards Council (FFSC), a cooperative of agricultural producers, lenders, academics, and other interested parties has developed a standardized set of 16 financial ratios for use in financial reporting and analysis of the farm-firm. They are grouped in five categories: liquidity, solvency, profitability, repayment capacity, and efficiency. These groups are consistent with those used by Splett, et al (1994) as mentioned above.

Alternatively, Moody's Investor Services, provides credit rating for both firms and the individual securities they issue. In addition to their public firm credit ratings, Moody's has developed a credit-scoring model for private companies. Most farms are small privately owned businesses and would fall under the general category of business for which Moody's private sector credit model would apply. A detailed description of the model is provided by Falkenstein, et. al. (2000), although pertinent details of the specific variable transformations employed are not publicly available. Financial ratios are selected based on their univariate relationship with the likelihood of default. Moody further transforms each variable to achieve better explanatory power in the model. The ratios included in their model are similar, but not identical to those recommended by the FFSC. A comparison of the ratios used by the two organizations is provided in the Table 1. As noted, both have measures of liquidity, solvency/capital structure, profitability, and repayment capacity. Moody's model includes two other categories relating to trading accounts and growth, but does not include distinct efficiency measures.

Much of the prior research is conducted with farm level data from a single geographic region. An exception is provided by Walraven and Barry (2004) who use loan level data from the national Survey of Terms of Bank Lending to Farms conducted by the Federal Reserve Board. The focus of their research is to examine the factors that determine the interest rate applied to farms loans. In addition, to macro factor which impact all interest rates, several loan-specific risk rating categories were included to identify whether farm loan rates are set on a risk-adjusted basis. Included among the explanatory variables are five risk rating categories. They show that the risk rating levels, along with other non-price loan characteristics, and certain bank characteristics affect interest rates.

There is also a body of research addressing transition rates found in risk migration tables which indicate the probability of a borrower moving from one risk category to another (e.g., Aaa to Aa). In addition to using Moody's or Standard and Poor's (S&P) ratings to construct the matrix for publicly traded firms, credit scores may be used to estimate the risk ratings in the matrix for non-publicly traded firms. A credit score is assigned based upon the data taken from loan applications and various financial statements. Presumably loan risk will affect both the priced and non-price terms of the loans. Consistent with Basle II, lenders may then use a credit migration matrix to estimate capital requirements. As reported in Walraven & Barry (2004), approximately 20% of lenders did not credit score their farm loans, while an additional 25% did not show any variation in their assigned risk categories. The purpose of this research is to determine which financial performance variables are associated with farm-firms that become delinquent on their loans. A delinquent borrower, as distinct from a defaulted borrower, is identified in the survey when the borrower self-reports paying less than the amount required by their lender(s) during the year. Credit scoring ratios as recommended by both the FFSC and Moody's will be used in the analysis, although the primary focus will be on the Moody data. The reminder of this paper is organized as follows. Section 2 reviews the prior literature. Section 3 discusses the methodology and the empirical model. Section 4 presents the empirical findings, while Section 5 presents the conclusion.

METHODOLOGY AND DATA

The data, described in the next section, provides considerable detailed information about small farms and their financial condition. Included in the data are important lending relationship variables that indicate the amount of debt outstanding at year end, the number of loans outstanding, the number of lenders used for those loans, and whether any loans were delinquent at the time of survey. There is also information about whether a borrower has been denied credit in the past five years, or whether a borrower reported no new loans because credit is denied in the current year. Based on this information, it is possible to segregate farm businesses into two broad categories: 1) borrowers which are: a) current on all loans, b) delinquent on at least one loan, and c) those that have had trouble obtaining credit in the past, and 2) non-borrowers which: a) don't currently require external financing, b) those who are currently unable to obtain credit, and c) those where the terms of credit are unacceptable due to high interest rates and/or collateral requirements, and d) those borrowers who have had trouble obtaining credit in the past. Based on these categories of borrowers and non-borrowers, the followings research questions are addressed:

1) How are farm borrowers different than non-borrowers? That is, what operating characteristics determine when a farm requires external bank financing?
2) When a farm does require external funds, what factors determine the number of loans outstanding and the number of unique banks a borrower uses to obtain credit? Furthermore, what influence does the number of lenders a borrower has have on the borrowing relationship?
3) How are delinquent borrowers different from non-delinquent borrowers? In particular, is the number of loans outstanding from various lenders a significant factor in explaining the differences?

Testable Hypotheses

Weak liquidity, low profitability, and high leverage are likely indicators of financial distress for farms. Furthermore, it is possible that financial difficulties, which contributed to the denial of credit in the past, may be an indication of continued financial distress or financial mismanagement. This might be called the "persistence hypothesis". However, it can also be argued that borrowers who have been denied credit have an incentive to reform their financial management practices to enable them to borrow in the future. This might be called the "reformation" hypothesis. Furthermore, the existence of multiple outstanding loans is potentially another contributor toward default. This is analogous to individual borrowers with numerous credit cards issued by multiple lenders who become overextended. On the other hand, farm borrowers using multiple lenders can possibly negotiate more favorable terms and may possibly be more readily assured of obtaining credit during periods of banking distress. On the negative side it is also possible that using multiple lenders may diminish the value of the borrower's primary banking relationship. These propositions will be formally tested as follows:

H1: The standard set of financial ratios proposed by both Moody's and FFSC to measure a borrower's creditworthiness should be effective in predicting farm loan delinquencies.

H2: Borrowers who have had difficulty getting credit in the past are more likely to be delinquent on their current loan(s).

H3: Delinquent borrowers are more likely to have a larger number of outstanding loans and deal with a greater number of lenders than non-delinquent borrowers.

H4: Borrowers using multiple lenders should be able to negotiate more favorable lending terms such as lower effective interest rates, longer maturity loans, lower collateral requirements, and have access to a larger and more stable flow of credit.

Data

The data used for this study is the ARMS (Agricultural Resource Management Survey) data, developed by the United States Department of Agriculture (USDA) and provided through the Economic Research Service (ERS). This is a large annual survey of farms, which includes data on farming practices as well as other operational and financial information. The most recent surveys conducted in 2006 and 2007 include more information about farm debt and borrowing practices than have past surveys. This study will focus on the 2007 survey data since certain key information is only available in the 2007 survey. The 2007 survey contains data on 18,709 farms.

In addition to the loan relationship variables, numerous financial ratios variables are included in the analysis. As mentioned above, various financial metrics suggested by Moody's and FFSC to predict creditworthiness are computed. Other variables are created to test each specific research hypotheses. Several control variables were included such as farm type, legal form of organization, age and education of the primary business operator, as well as variables representing each of the nine geographic survey regions. A detailed description of these variables is presented in Table 1.

Table 2 provides descriptive statistics for each variable. Average total assets are approximately $2.6 million. Furthermore, the delinquent variable (DELINQYN) is an indicator variable and equals one if any loans outstanding at year end are delinquent. There were 121 farms with delinquent loans in 2007. Furthermore, there are a total of 7,708 loans made to farms (LOANSTOT#) and a total of 4,580 lenders identified in the survey (LEANDERNO). The weighted average interest rate (RATEWTAVG) is 6.7%. The weighted average term of the outstanding loans is 127.4 months (TERMWTAVG). Most of the farms are not limited liability organizations but are typically partnerships or sole proprietorships. A total of 2,704 farms are limited liability C or S corporations. This represents 12.9% of the farms surveyed. The majority of the farms are categorized as crop farms (58.4%) with the remaining being livestock farms (FTYPE; 1=livestock). In general the farms appear to be highly liquid with the current ratios averaging almost 60, and the quick ratio of over 34. However, it does not appear that current assets include large cash reserves as the cash/asset ratio has a mean value of only three percent. The average debt to asset ratio equals 20.2%. The total number of farms denied credit over the past five years is 183 (DENIED5YR).

An analysis of the difference between borrowers and non-borrowers reveals the following statistically significant differences: 1) The number of non-borrowers greatly exceeds the number of borrowers (14,540 vs. 4,169), 2) Borrowers are larger in terms of total assets, hold more cash (scaled by assets), turn their inventories more slowly, grow net income more rapidly, have higher levels of working capital but lower operating margins, 3) Borrowers report greater net income, higher capital replacement margins, and greater levels of interest expense, 4) Livestock farms and farms organized as limited liability organizations have a higher proportion of borrowers versus non-borrowers, and 5) Comparing personal characteristics, borrowers are younger and have a higher proportion of college education.

Many of the Moody's ratios have low correlation coefficients with one another and they tend to be below 5%, with two exceptions. ROA is correlated with liabilities over assets (65.6%) and net income over assets (97%). The binary variable DELINQYN is not highly correlated with any of the ratio variables, and none of the correlations are significant. There are three hypothesis variables that capture loan/lender characteristics: 1) the number of different lenders per farm (LENDERNO), 2) the total number of loans per farm (LOANSTOT#), and 3) LOANS*LENDERS, which is the product of the previous two variables.

LENDERNO and LOANSTOT# are significantly correlated with a coefficient of 67%. Because of high correlation, the model will include only one of these two variables at the same time. The weighted average interest rate (RATEWTAVG) has a negative and significant correlation with the number of lenders, but the correlation with the number of loans (LOANSTOT#) is positive, but not significant.

As is true of the Moody's data mentioned above, correlations among the FFSC ratios are generally low or not significant, with a few exceptions. Many of the significant correlations are size related. For example, working capital, net income, and the capital replacement margin are dollar amounts and are therefore jointly affected by the size of the farm. Other significant correlations are operating margin, operating expense ratio, and depreciation expense ratio. The issue of multicollinearity will be examined detail in the results section (Both correlation matrices and the analysis of borrower vs. non-borrower characteristics are available from the authors upon request).

The ARMS database includes a variable for each loan indicating whether the borrower paid the amount due, paid more than the amount due, or paid less than the amount due during the year. This variable can either specified as a binary variable DELINQYN (1=delinquent) or as a continuous variable, such as, the percent of the total dollar amount of loans outstanding, which are delinquent per borrower (i.e., $ of loans delinquent/ $ total loans). The two forms of the delinquency variable will then be used as the dependent variable in logistic and multiple regression models, where the appropriate lending relationship, financial ratios, and control variables are included as explanatory variables. As mentioned before, there are a total of 121 farms with delinquent loans in the 2007 survey. This represents 0.65% of the total farms in the survey and 1.83% of the loans outstanding. The rate of delinquency is consistent with that reported in the Federal Reserve Board's Agricultural Finance Databook.

The following model (equation 1) will be estimated using a binary variable (DELINQYN) as the dependent variable. In this case, a logistics procedure will be used.

$$DELINQ = \alpha + \gamma_m HYPOTHESIS_m + \beta_n RATIO_n + \delta_p CONTROL_p + \varepsilon \quad (1)$$

where, HYPOTHESIS is a vector of 'm' lending relationship variables, RATIO is a vector of 'n' financial ratios, and CONTROL is a vector of 'p' control variables for farm type, location, and farmer characteristics, such as, age and experience.

For each dependent variable, two regression models were estimate for each year: one using the FFSC recommended ratios and the other using Moody's. Given the large number of tables generate the paper focuses on the Mood's variables (The FFSC results are available upon request). Because there are multiple loan/lender variables that are correlated, several versions of each equation will be estimated to reduce the effects of multi-collinearity. To test hypothesis H3, two additional models will be analyzed. These are as follows:

$$RATEWTAVG = \alpha + \gamma_m HYPOTHESIS_m + \beta_n RATIO_n + \delta_p CONTROL_p + \varepsilon \quad (2)$$

where, RATEWTAVG is the weighted average of the interest rate on the loans, HYPOTHESIS is a vector of hypothesis variables, which are primarily the number of lenders and the number of loans; RATIO is a vector of financial ratios and metrics, and CONTROL is a vector of control variables.

$$TERMWTAVG = \alpha + \gamma_m HYPOTHESIS_m + \beta_n RATIO_n + \delta_p CONTROL_p + \varepsilon \quad (3)$$

where, TERMWTAVG is the weighted average original loan maturity, HYPOTHESIS is a vector of hypothesis variables, which are primarily the number of lenders and the number of loans, RATIO is a vector of financial ratios and metrics, and CONTROL is a vector of control variables.

For the estimation of both equations 2 and 3, only the population borrowers will be included.

EMPIRICAL RESULTS

Parsimonious Model

Because some of the ratio variables are correlated (especially among the FFSC ratios) a parsimonious model with fewer independent variables is developed as follows. One variable from each of five broad financial performance categories (liquidity, solvency, repayment capacity, efficiency/productivity, and profitability) is selected. The selection is based upon which variable has the highest level of statistical significance from either of the two equations estimated using the Moody's and FFSC data. The results of this parsimonious model are provided in Table 3. Each of the three lending relationship variables: the number of lenders (LENDERNO), the number of loans (LOANSTOT#), and the interaction of the two variables (LOANS*LENDERS) are entered one at time in the logistic regression model to evaluate the potential impact of multicollinearity. The following discussion relates to Model 4, which includes all three relationship variables.

The regression coefficient on number of lenders (LENDERNO) is positive and statistically significant, suggesting that borrowers who "shop" for a lender are more likely to be delinquent. On the other hand, the number of outstanding loans (LOANSTOT#) is not significant and neither is the interaction term (LOANS*LENDERS). The size of coefficient on LENDERNO in Model 4 is roughly the same size as the coefficient in Model 1 (0.359 vs.0.365), all though the level of statistical significant declines from 1% to 5%. The coefficient on the previous credit denial variable (DENIED5YR) is positive and highly significant in all three models. Among the six financial ratios, four are statistically significant: 1) the debt to asset ratio (DEBTASSET), 2) return on equity (ROE), 3) fixed payment coverage ratio (TERMDEBTCOV), and 4) the asset turn over ratio (ASSETTURNOVER). Both DEBTASSET and ASSETTURNOVER have the expected positive coefficient. The length of the loan (TERMWTAVG) has a negative coefficient possibly due to the fact that mortgage loans are included in the sample and that mortgage loans, prior to recent financial crisis, have historically had a low delinquency rate. The level of education attained by the principal farm operator (COLLEGE) has a weak but statistically significant impact, as a college education appears to reduce the likelihood of default. The firm type (FTYPE) is negative and statistically significant suggesting that livestock farms are less risky than crop farms. The pseudo R-square for the logistic regression is 0.099 and the model produced a 69.7% concordant ratio.

To address hypothesis H3, which states that borrowers with multiple lenders will obtain lower interest rates and longer loan terms, two different regression models are used. As discussed below, one uses the weighted average loan interest rate (RATEWTAVG) as the dependent variable, and the other uses weighted average term or maturity of the loan (TERMWTAVG) as the dependent variable.

Interest Rate Model

Looking at Model 4 in Table 4, where the dependent variable is the weighted average loan rate (RATEWTAVG), of the three lending relationship variables only the number of lenders (LENDERNO) is statistically significant and negatively related to the average loan rate. This suggests that the borrowers who deal with multiple lenders can negotiate lower interest rates. It should be noted that the absolute size of the regression coefficient increases substantially when the both the number of loans (LOANSTOT#) and the interaction term (LOANS*LENDERS) are included into the model.

Table 1: Variable Definitions

Source and Type	Definitions	
Moody's Ratios:	TOTASSETS	Total assets/1000000
	QUICKRATIO	Quick ratio
	LIABOVRASSETS	Liabilities divided by total assets
	CASHOVRASSETS	Cash divided by total assets
	NIOVRASSETS	Net Income divided by total assets
	DEBTSVCCOV	Debt Service coverage ratio
	INVTURNS	Inventory Turns
	NIGROWTH	Net Income growth (1 year)
	ROA	Net Income divided by total assets
FFSC Ratios:	CURRENT	Current assets divided by current liabilities
	WORKCAP	Current assets less current liabilities / 1000000
	DEBTASSET	Total debt divided by total assets
	EQUITYASSET	Book equity divided by total assets
	DEBTEQUITY	Total debt divided by book equity
	ROE	Net Income divided by book equity
	OPMARGIN	Operating income divided by sales
	NETINC	Before tax income / 1000000
	TERMDEBTCOV	Annual after-tax cash flow divided by annual debt and least payment obligations
	CAPREPLACE	Dollar amount, cash flow after all debt and least payments / 1000000
	ASSETTURNOVER	Gross revenue divided by total assets
	OPEXPRATIO	Operating expenses less depreciation/amortization divided by revenue
	DEPREXPRATIO	Depreciation/amortization divided by revenue
	INTEXPRATIO	Total interest expense divided by revenue
	NETFARMINCRATIO	Net farm income divided by revenue
Hypothesis Variables:	DELINQYN	Binary - 1 if any loan is delinquent, otherwise 0
	DELTOT	Total number of delinquent loans
	DELINQAMT	Dollar amount of delinquent loans
	DELINQPCT	Delinquent divided by total debt
	LENDERNO	Number of different lenders used
	LOANNBR	Number of loans detailed (4 or 5 max, depending on survey year)
	LOANNBRTOT	Total number of loans
	FIXEDPCT	Weighted average (by dollar amount) of fixed rate loans
	BORROWER10	Binary - 1 if farm has debt, 0 otherwise
	BORROWER123	Discrete: 1 for good borrower; 2 for delinquent borrower; 3 if denied in year
	NONBORROWER	Binary - 1 if farm is a non-borrower, 0 otherwise
	RATEWTAVG	Weighted average (by dollar amount) of interest rate
	TERMWTAVG	Weighted average (by dollar amount) of original maturity or term of debt (in months)
	DENIED5YR	Binary - 1 if farm has been denied credit in past 5 years, otherwise 0
Control Variables:	AGE	Age of principal in farm, in years
	COLLEGE	Binary - 1 if principal in farm has attended college
	LIMLIAB	Binary - 1 if farm is a limited liability legal form (e.g. S or C corp)
	FTYPE	Binary - Farm type, 1=livestock, 0 = agricultural

List of variable definitions and their source Moody's or Farm Financial Standards Council (FFSC); grouped by type of variable

The coefficient on the previous credit denial variable (DENIED5YR) is consistently positive and averages approximately 0.45 across all four model specifications. Thus, borrowers that have been denied credit over the past five years pay approximate 45 basis points higher interest rates. Larger borrowers, as measured by total assets, (TOTASSETS) pay lower interest rates suggesting that they have more bargaining power and that lending institutions can charge a lower interest as they spread the fixed costs of making a loan across a larger loan. Of the traditional financial ratios only the rate of inventory turnover (INVTURNS) is statistically significant and surprisingly carries a positive coefficient. Perhaps this high turnover ratio is simply an indication of lower levels of inventory which provide less collateral for loans. Somewhat surprisingly, borrowers that are currently delinquent are charged similar rates compared to non-delinquent borrowers since DELINQYN is not statistically significant.

Table 2: Descriptive Statistics

Variable	N	Mean	Std Dev
Totassets	18709	2.586	6.290
Quickratio	18573	34.183	764.0
liabovrassets	18697	0.202	8.057
cashovrassets	18697	0.030	0.117
NIovrassets	18697	0.174	6.862
DebtSvcCov	11771	32.813	1,183
Invturns	18706	0.626	7.846
Nigrowth	5132	6.183	82.825
ROA	18697	0.101	6.233
Delinqyn	18709	0.006	0.080
Deltot	18709	56.398	36.518
Delinqamt	18709	3,814	92,634
Delinqpct	18573	0.005	0.080
lenderno	18709	0.245	0.590
loannbrtot	6614	1.165	1.972
loansxlenders	6614	1.891	4.223
fixedpct	3307	0.667	0.434
borrower10	18709	0.223	0.416
nonborrower	2571	1.270	0.823
ratewtavg	3307	6.699	1.625
termwtavg	3307	127.400	103.114
denied5yr	18709	0.010	0.098
age	18709	55.722	12.201
college	18709	0.539	0.498
limliab	18709	0.129	0.335
ftype	18709	0.416	0.493
Current	18573	59.561	913.387
workcap	18709	0.244	1.185
debtasset	18697	0.202	8.057
equityasset	18697	0.798	8.057
debtequity	18705	0.146	8.825
ROE	18705	-0.412	59.023
OpMargin	18597	-1.259	46.160
NetInc	18709	0.165	1.047
Termdebtcov	10916	22.490	354.652
capreplace	18709	0.186	1.104
Assetturnover	18697	0.820	27.693
Opexpratio	18597	1.279	23.921
Deprexpratio	18597	0.095	1.768
intexpratio	18597	0.079	1.236
Netfarmincratio	18597	-1.339	46.267

Basic statistics for each of the variables included in the study. Note: the provider of the data prohibits the publication of minimum or maximum values as they may reveal proprietary information

This suggests that the delinquency was entirely unexpected as the lender failed to properly price the risk of default. The proportion of fixed rate debt (FIXEDPCT) carries a statistically significant negative coefficient, suggesting that as the proportion of fixed rate debt increases, the interest rate is lower. As mentioned before, this may reflect the fact that mortgage debt is often fixed rate and lower than other rates on less well collateralized loans. Also reported in this table are variance inflation factors (VIF) for Model 4. The financial variables are not highly correlated so there is little variance inflation among those variables. However, the number of lenders (LENDERNO), number of loans (LOANSTOT#) and their interaction (LOANS*LENDERS) are highly correlated and when included together, show evidence of substantial variance inflation (VIF = 2.4 to 8.7). This suggests that it is most appropriate to use these variables individually in a regression model. The R-square for the model is 0.036 and the F-value is 5.05.

Table 3: Logistic Regression Results for Parsimonious Model

		Model 1			**Model 2**			**Model 3**			**Model 4**		
Parameter	Exp. sign	Estimate	Std Error		Estimate	Std Error		Estimate	Std Error		Estimate	Std Error	
Intercept		-3.09	-0.756	***	-2.729	-0.74	***	-2.732	-0.737	***	-3.106	-0.785	***
Lenderno	+	0.365	-0.132	***							0.359	-0.196	**
loantot#	+				0.045	-0.035					0.013	-0.102	
loans*lenders	+							0.023	-0.012	*	-0.002	-0.045	
denied5yr	+	1.142	-0.277	***	1.18	-0.277	***	1.177	-0.277	***	1.14	-0.278	***
Quickratio	-	-0.044	-0.032		-0.047	-0.032		-0.046	-0.032		-0.044	-0.032	
Debtasset	+	0.861	-0.329	***	0.849	-0.328	***	0.848	-0.328	***	0.854	-0.332	***
ROE	-	0.039	-0.016	**	0.038	-0.016	**	0.039	-0.016	**	0.039	-0.016	**
termtebtcov	-	0.0004	-0.0001	***	0.0004	-0.0001	***	0.0004	-0.0001	***	0.0004	-0.0001	***
assetturnover	-	-0.797	-0.274	***	-0.771	-0.269	***	-0.772	-0.27	***	-0.796	-0.274	***
invturns	-	-0.227	-0.202		-0.179	-0.195		-0.184	-0.197		-0.225	-0.202	
ratewtavg	-	0.042	-0.059		0.037	-0.059		0.038	-0.059		0.042	-0.059	
termwtavg	?	-0.003	-0.001	***	-0.003	-0.001	***	-0.003	-0.001	***	-0.003	-0.001	***
fixedpct	?	-0.363	-0.224		-0.312	-0.221		-0.316	-0.221		-0.363	-0.224	
age	-	-0.001	-0.008		-0.001	-0.008		-0.001	-0.008		-0.001	-0.008	
limliab	+	0.219	-0.256		0.205	-0.255		0.213	-0.256		0.218	-0.256	
college	-	-0.352	-0.198	*	-0.337	-0.197	*	-0.337	-0.197	*	-0.353	-0.198	*
ftype	?	-0.525	-0.208	***	-0.566	-0.207	***	-0.554	-0.208	***	-0.527	-0.209	***
totassets	?	-0.04	-0.027		-0.041	-0.0275		-0.043	-0.0278		-0.041	-0.0275	
R square		0.027			0.025			0.025			0.027		
Likelihood Ratio		89.039	***		83.339	***		84.844	***		89.084	***	
Concordant		69.7			69.6			69.9			69.9		
Discordant		28.1			28.2			27.9			28		

Logistic regression of DELINQ = α + γmHYPOTHESISm + βnRATIOn +δpCONTROLp + ε where Delinq is a binary variable (1 = one or more delinquent loans) and HYPOTHESIS is a vector of 'm' lending relationship variables, RATIO is a vector of 'n' financial ratios, and CONTROL is a vector of 'p' control variables for farm type, location, and farmer characteristics, such as, age and experience. The 4 models include the loan/lender variables individually and in model 4 are all included. Eight regional dummies included but not reported .

Term to Maturity Model

In Table 5 a regression model is estimated where the dependent variables is the weighted average loan term to maturity (TERMWTAVG). Once again, among the three loan relationship variables, the number of lenders (LENDERNO) is positive and statistically significant. This suggests that borrowers that deal with multiple lenders are able to negotiate longer-term loans. It is somewhat surprising that maturity is not influenced by prior delinquencies as the coefficient on DENIED5YR is insignificant. Among the traditional financial ratios, the coefficient on the variable liabilities divided by total assets

Table 4: OLS Regression Results for Interest Rate Model Using Moody's Ratios

		Model 1			**Model 2**			**Model 3**			**Model 4**			
Parameter	Exp. sign	Estimate	Std. Error		Estimate	Std. Error		Estimate	Std. Error		Estimate	Std. Error	Sig.	VIF
intercept		7.300	(0.193)	***	7.022	(0.187)	***	7.061	(0.185)	***	7.337	(0.203)	***	
lenderno	-	-0.198	(0.046)	***							-0.294	(0.069)	***	2.4
loantot#	-				0.009	(0.014)					0.013	(0.032)		6.0
loans*lenders	-							-0.004	(0.006)		0.015	(0.016)		8.7
denied5yr	+	0.476	(0.139)	***	0.439	(0.139)	***	0.450	(0.139)	***	0.466	(0.139)	***	1.0
totassets	-	-0.032	(0.006)	***	-0.034	(0.007)	***	-0.033	(0.007)	***	-0.035	(0.007)	***	1.2
quickratio	-	-0.004	(0.003)		-0.003	(0.003)		-0.004	(0.003)		-0.004	(0.003)		1.1
liabovrassets	+	0.211	(0.121)	*	0.169	(0.122)		0.192	(0.122)		0.172	(0.122)		1.2
cashovrassets	-	-0.179	(0.27)		-0.192	(0.271)		-0.188	(0.271)		-0.184	(0.269)		1.3
debtsvccov	+	0.000	(0.0002)		0.000	(0.0002)		0.000	(0.0002)		0.000	(0.0002)		1.1
invturns	+	0.105	(0.043)	**	0.096	(0.044)	**	0.097	(0.044)	**	0.107	(0.043)	**	1.3
nigrowth	+	0.000	(0.0003)		0.000	(0.0003)		0.000	(0.0003)		0.000	(0.0003)	*	1.0
ROA	-	0.161	0.110		0.133	0.111		0.139	0.111		0.160	0.110		1.1
delinqyn	+	0.1090	(0.173)		0.0720	(0.173)		0.0790	(0.173)		0.1050	(0.172)		
termwtavg	+	0.000	(0.0003)		0.000	(0.00003)	**	0.000	(0.001)		0.000	(0.0003)		
fixedpct	?	-0.259	(0.071)	***	-0.011	(0.008)		-0.276	(0.071)	***	-0.258	(0.07)	***	
age	-	-0.004	(0.002)		0.000	(0.0003)		-0.004	(0.003)		-0.004	(0.003)		
limliab	?	0.022	(0.083)		0.008	(0.009)		0.034	(0.083)		0.025	(0.083)		
college	-	-0.070	(0.061)		-0.009	(0.007)		-0.079	(0.062)		-0.072	(0.061)		
ftype	?	0.074	(0.064)		-0.020	(0.007)	***	0.081	(0.064)		0.071	(0.064)		
F statistic		5.050	***		4.310	***		4.310	***		4.970	***		
Adjusted R-square		0.036			0.030			0.030			0.038			

This table presents the results of an OLS regresion of the form $RATEWTAVG = \alpha + \gamma_m HYPOTHESIS_m + \beta_n RATIO_n + \delta_p CONTROL_p + \varepsilon$ Where, RATEWTAVG is the weighted average of the interest rate on the loans, HYPOTHESIS is a vector of hypothesis variables, which are primarily the number of lenders and the number of loans; RATIO is a vector of financial ratios and metrics, and CONTROL is a vector of control variables. The 4 models include the loan/lender variables individually and then are all included in Model 4. VIF values are reported for Model 4. Eight region dummies were included but not reported

(LIABOVRASSETS) is positive and significant, suggesting that as total debt increases the loan maturity also increases. The variable cash divided by assets (CASHOVRASSETS) has a negative and significant relationship with maturity, suggesting that borrowers with more cash receive shorter-term loans. This seems logical since farms with greater liquidity can pursue a more aggressive funding strategy by borrower shorter term at lower rates. For the same reasons the coefficient on the debt service coverage ratio (DEBTSVCCOV) is also negative and statistically significant. It is also not surprising that delinquent borrowers (DELINQYN) have shorter-term debt, by an average of approximately 21 months, since one way to ration credit to risky borrowers is to reduce maturity. The proportion of debt that is fixed rate (FIXEDPCT) is significant and positively related to maturity, which likely shows the influence of mortgage debt as discussed above. The coefficient on the limited liability variable (LIMLIAB) is negative and significant indicating that corporate borrowers generally receive shorter-term debt. The coefficient

on type of farm (FTYPE) is positively indicating that livestock farms receive long-term debt, consistent with the finding in Table 3 that livestock farms appear to be less risky than crop farms. The R-square of the equation is 0.06 with an F-value of 7.9.

Table 5: OLS Regression Results for Maturity Model Using Moody's Ratios

		Model 1			**Model 2**			**Model 3**		
Parameter	Exp.	Estimate	(Std. Error)		Estimate	(Std. Error)		Estimate	(Std.	
intercept		85.969	(15.253)	***	98.539	(14.667)	***	98.816	(14.629)	***
lenderno	+	9.720	(2.971)	***						
loantot#	+				1.244	(0.873)				
loans*lenders	+							0.552	(0.361)	
denied5yr	?	6.790	(8.93)		7.868	(8.941)		7.769	(8.941)	
totassets	?	0.328	(0.419)		0.289	(0.424)		0.309	(0.422)	
quickratio	-	-0.006	(0.2)		-0.024	(0.201)		-0.023	(0.201)	
liabovrassets	+	43.470	(7.73)	***	43.366	(7.815)	***	43.620	(7.781)	***
cashovrassets	-	-51.784	(17.289)	***	-51.727	(17.318)	***	-51.777	(17.317)	***
debtsvccov	-	-0.027	(0.012)	**	-0.027	(0.012)	**	-0.028	(0.012)	**
invturns	?	0.073	(2.808)		0.529	(2.809)		0.464	(2.809)	
nigrowth	-	-0.002	(0.017)		-0.002	(0.018)		-0.002	(0.018)	
ROA	-	-11.543	(7.07)		-10.647	(7.075)		-10.659	(7.074)	
delinqyn	?	-21.6260	(11.06)	*	-20.3440	(11.07)	*	-20.6060	(11.074)	*
ratewtavg	+	-1.506	(1.243)		-1.873	(1.24)		-1.821	(1.24)	
fixedpct	?	27.306	(4.52)	***	28.006	(4.519)	***	28.014	(4.518)	***
age	?	0.181	(0.173)		0.179	(0.173)		0.179	(0.173)	
limliab	?	-18.682	(5.309)		-19.262	(5.315)	***	-19.138	(5.317)	***
college	?	-1.194	(3.938)		-0.884	(3.944)		-0.909	(3.944)	
ftype	?	8.845	(4.084)	**	8.435	(4.089)	**	8.569	(4.089)	**
F statistic		7.880***			7.510***			7.520***		
Adj. R-squared		0.060			0.057			0.057		

This *table presents the results of an OLS regresion of the form TERMWTAVG = α + γmHYPOTHESISm + βnRATIOn +δpCONTROLp + ε where, TERMWTAVG is the weighted average of the interest rate on the loans, HYPOTHESIS is a vector of hypothesis variables, which are primarily the number of lenders and the number of loans, RATIO is a vector of financial ratios and metrics, and CONTROL is a vector of control variables. The 3 models include one of the loan/lender variables each. Eight region dummies were included but not reported.*

CONCLUSION

The focus of this research is on the factors associated with farm loan delinquency, the use of two sets of financial ratios as determinants of those delinquencies, the effect of multiple lenders and multiple loans on delinquencies and other terms of lending. The results of this study find that one or more measures in each of the five categories are associated with loan delinquencies. Measures of liquidity, solvency, repayment capacity, and profitability are typically significant. Measures of efficiency are generally not significant. Fro example, the number of inventory turns is never significant. In terms of lending relationship variables, the number of lenders influences both loan delinquencies and loan interest rates. As the number of lenders increases the likelihood of delinquency increases and the loan rate declines. The number of loans is consistently insignificant.

Credit denial in the past five years is the most consistent predictor of current loan delinquencies. A priori, it was not clear whether this variable would have a positive or negative sign. One explanation is that borrowers that have had difficulty getting credit in the past are more likely to continue to struggle financially, so the sign should be positive. However, it is also possible that borrowers that have had prior credit difficulties may reform their behavior in order to get credit in the future. The results suggest that strongly suggests that prior credit denial is an important predictor of future loan delinquency. In this case, the analyses indicate that past credit difficulties tend to "persistent" rather than "reformative".

The number of lenders plays a role in interest rate determination. Farms using more lenders have a significantly lower average interest rate. This finding supports the hypothesis that borrowers are able to use competition among lenders to negotiate lower rates. On the other hand, the number of loans and the loan/lender interaction variable are never significant when the weighted average interest rate is the dependent variable. Prior credit denial is not a factor in the weighted average term of the loan. The size of the farm is also not significant. Limited liability organizations have shorter-term debt. Farms with higher liabilities relative to assets have longer-term debt, perhaps because of higher level of liabilities. The liquidity position of the farm does not explain the term of its debt.

Overall, either set of financial ratios is helpful in explaining farm borrower delinquencies, but many of the factors are not always significant. There are eleven financial measures that are significant at least once. At least one measure in each of five major categories is significant one or more times. When multiple measures in each category are used, multi-collinearity can confound the results, so simple models are more effective. Thus, five categories representing some mix of liquidity, solvency, repayment capacity, efficiency/productivity and profitability seem appropriate. Difficulty with getting credit seems to be persist as the most consistent explanation for loan delinquency is prior credit denial.

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BIOGRAPHY

Dr. Alan K. Reichert is a Professor of Finance at Cleveland State University. He can be contacted at Department of Finance, College of Business, Cleveland State University, 2121 Euclid Avenue, Cleveland, Ohio 44115. Email: a.reichert@csuohio.edu

Dr. Ray Posey is Department Chair and Professor of Business Administration, Mount Union College. He can be contacted at Department of Business Administration , Mount Union, Ohio,
Alliance, Ohio 44601. Email: Poseyra@muc.edu.