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Farmers' Choice of Credit among the Farm Credit System, Commercial Banks, and Nontraditional Lenders

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Understanding the factors that affect a farmer's credit source is useful for lending institutions to more effectively target customers and provides insight into credit sources that would be affected sooner if a credit crisis would occur and the characteristics that are correlated with a customer using a particular lending institution. Results of this paper suggest that the customers of commercial banks would be the most at risk as they are the most leveraged. Results also show that as conditions deteriorate, farmers add more lending institutions and are also more likely to use a commercial bank or nontraditional lender.

Key words: banking

Introduction

Traditionally, the Farm Credit System (FCS) and commercial banks have dominated the agricultural lending market (Dodson and Koenig, 2004). However, nontraditional lenders, including vendor credit programs, have recently gained market share and the choices a farmer has to obtain credit have increased. The total loan volume sourced from nontraditional lenders doubled from 2008 to 2012, when nontraditional lenders accounted for 30% of the total number of active loans (Figure 1) and 16% of the total loan volume (Figure 2) based on Kansas Farm Management Association (KFMA) data. As lending institutions in the agricultural sector compete for customers, farmers have many options to obtain credit. Knowing the characteristics of farmers who are customers of each of the respective types of lending institutions is useful for understanding the credit market servicing production agriculture. In particular, this study focuses on where a farmer obtains credit and how the agricultural credit market may change in an agricultural downturn.

If the liquidity or solvency of farms in the agricultural sector were to deteriorate, knowing the types of borrowers at each lending institution and the defining characteristics of those borrowers would be useful for anticipating stress on different types of lending institutions (Landstreet, 2015). Debt was an important component in the farm financial credit crisis in the 1980s. Briggeman, Gunderson, and Gloy (2009) argue that agricultural lenders are well positioned to weather a tumultuous environment. Ellinger (2009) concurs with this assessment but indicated that the increase in nonperforming loans during 2008 and 2009 should be a warning to the agriculture industry. However, much has changed in the agricultural credit market since 2009, as land prices have continued to rise, plateau, and subsequently fall and nontraditional lenders have increased market share. In a survey of agricultural lenders in March 2015 across the United States, lenders expected

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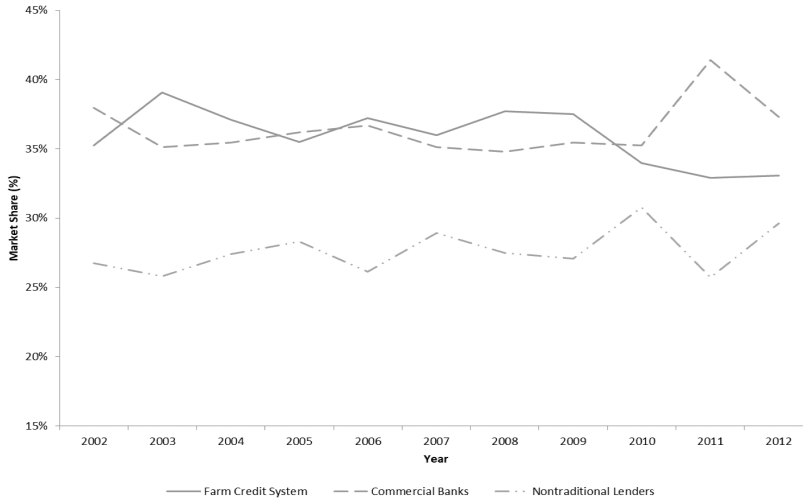

Figure 1. Market Share for Lending Institution Types by Number of Active Loans, Kansas

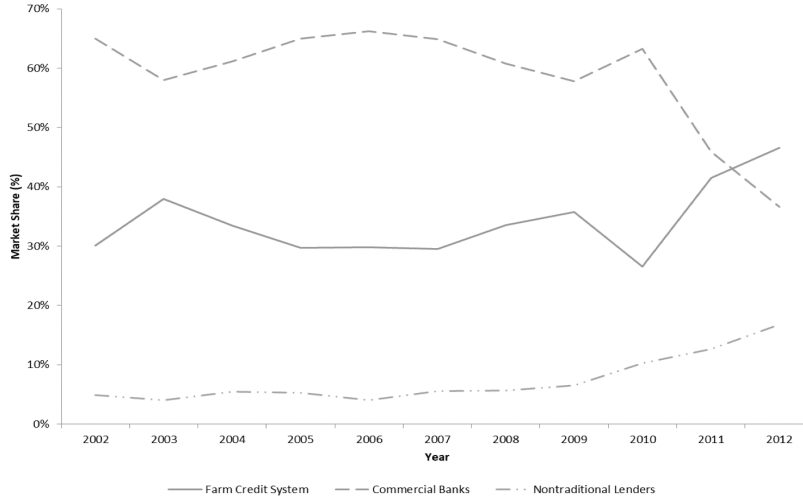

Figure 2. Market Share for Lending Institution Types by Total Loan Volume, Kansas

land values to fall and for nonperforming loans to increase in the next 2–5 years (Brewer et al., 2015). Lenders have some expectations that the agricultural sector could be due for a downturn in the same time period. However, with nontraditional lenders gaining market share, this may affect the credit quality of the industry and affect the burden on commercial banks and the FCS. Knowing which institutions lend to the most leveraged borrowers would be useful in knowing how different lending institutions would perform if a downturn in the financial health of the agriculture sector were to occur.

This study introduces a new empirical approach for analyzing farmers' lending decisions by presenting a method for estimating marginal effects from joint and conditional probabilities in discrete choice models. This approach allows a modeler to assess the marginal factors impacting farmers' lending or adoption decisions (i.e., adding a new lender) conditional on past lending decisions (i.e., lenders that the farmer already uses) as well as the joint probabilities of selecting multiple types of lenders.

The FCS, commercial banks, and nontraditional lenders are the categories of lending institutions for this study. Sherrick, Sonka, and Monke (1994) define the difference between traditional and nontraditional lenders based on the primary purpose of contact with the customer. If the primary function of the business is to provide credit, it is a traditional lender, while a nontraditional lender's primary contact with the producer is for another good or service. Sherrick, Sonka, and Monke (1994) also note what qualifies as credit. Terminology such as "net-thirty days payable" and other short-term accounts payable that require no formal acceptance or terms are not considered credit.

We develop a modeling framework identifying borrower characteristics associated with lender choice. The contribution of this paper to the existing literature is the inclusion of nontraditional lenders and the extension of the multinomial logistic regression model to estimate bivariate and conditional probabilities as well as associated marginal effects in an applied setting. This empirical framework allows us to analyze the characteristics of farmers associated with each type of lending institution and how the agricultural credit market may change if farmers experience severe financial stress in the future.

Agricultural Lending Market

The FCS and commercial banks have dominated the agricultural credit market. Since 2008, nontraditional lenders have increased their market share as a percentage of total loan volume (Figure 2). Previous research has looked at the differences between customers of the FCS and commercial banks. Dodson and Koenig (2004) find that customers of the FCS are larger farms with a full-time farm operator, where the number of acres operated, total farm assets, and value of farm production measures farm size. They find similar levels of credit risk, as measured by the debt-to-asset ratio, for customers of both the FCS and commercial banks. Commercial banks and the FCS have many operational equivalencies, one of which is that they are regulated by a third party. Lending limits may affect smaller banks, causing those banks to ration credit to select borrowers (Gustafson, 1989). Any difference between these two lending institutions may be due to the strategic plan of each lending institution since the product offered is similar (Dodson and Koenig, 2004).

Nontraditional lenders offer a different product. The U.S. Department of Agriculture lists nontraditional lenders under the category of "individuals and others" (Park et al., 2010). In 1988, this type of lender held 19% of the non–real estate agricultural credit market and by 1996 held 23% of the market, an increase from $11.8 billion dollars to $17 billion (Brunoehler, 1997). Nontraditional lenders may have a competitive advantage over traditional lenders. Sherrick, Sonka, and Monke (1994) argue that several, but not all, nontraditional lenders are able to offer below-market interest rates to entice new customers. The ability to offer credit even when it is not self-sustaining allows the company to use financing as a differentiation tool to enhance sales of inputs to farmers who use credit to finance the purchase. This can be a key marketing tool when attempting to differentiate a homogeneous product.

Conceptual Model

Katchova (2005) states that credit decisions are joint decisions between a lender and farmer. A lending institution may decline a farmer credit if they are not credit worthy, and a farmer chooses the lending institution based on the price of the debt and services provided. The lending institution also sets the interest rate of the debt, which affects where a farmer will obtain credit. While a farmer minimizes his or her cost of debt, the lender maximizes expected profit. A farmer will seek out the lending institution that will help him or her minimize the cost of debt and associated transaction costs, while the lender selects those customers who maximize expected profit given the lending institution's risk appetite for defaulted loans. The cost of debt for the farmer, the relationship between farmer and banker, and the risk of both the farmer and lending institution all affect which lending institutions a farmer uses. This study examines this relationship from a farmer's perspective.

Interest rates, fees from the lending institution, and convenience of the lending institution affect the total cost of debt. Interest rates are the price of obtaining debt. Lenders use interest rates the same way a retailer use prices for physical products. Each lending institution is able to offer different interest rates to entice farmers to use them as their source of credit. Besides interest rates, the fees associated with the debt and the convenience (i.e., transaction costs) affect the cost of the debt. The time it takes for a farmer to service their debt can remove the farmer from other activities. Most rural communities have a commercial bank, while FCS institutions and nontraditional lenders have fewer locations, which may make it a more costly choice for some farmers.

The relationships between the farmer and lending institution plays an important role in obtaining credit. Berger and Udell (1995) find that as the relationship between the bank and the firm matures and grows stronger, the requirements for obtaining and pricing a loan for that respective firm change. This occurs because, as the relationship matures, lenders gather private information on the firm that would not otherwise be available to the lender. A study by Boot (2000) suggests that a relationship may be essential for lending to occur. Boot also states that a long-term relationship permits funding of loans that might not be profitable for the bank in the short run but may be profitable in the long run.

Risk, transaction costs, and other factors indicated above play an important part in determining how many lending institutions a farmer uses. Detragiache, Garella, and Guiso (2000) model the process of a firm searching for credit. Based on their framework, we use a multivariate extension of their model to examine a farmer's profit maximization problem for choosing the optimal number and type of lenders to borrow from:

$$\max_{\boldsymbol{n}} \pi(\boldsymbol{n}) = \sum_{b=1}^{B} \pi_b\left(n_b; \boldsymbol{z}\right), \tag{1}$$

where $\boldsymbol{n} = (n_1, \ldots, n_b, \ldots, n_N)$; n_b is the number of lending relationships for lender type b for $b = 1, \ldots, B$; π_b is the profit (function) for credit obtained from lender type b; and $\boldsymbol{z}$ is a vector of farmer and lender characteristics that includes the farmer's probability of obtaining credit, the farm's credit needs, and the probability of a farmer defaulting.

The profit maximization function defined by equation (1) assumes that the decision for how many lending institutions a farmer chooses is additively separable by institutional type. This assumption follows from the differences for each type of lending institution (as previously outlined). The probability of default for each farmer includes farm characteristics such as farm size, debt-to-asset ratio, value of assets, age, experience, and institutional relationships. Previous studies have shown these factors to be good proxies for probability of default (see Katchova and Barry, 2005; Featherstone, Roessler, and Barry, 2006). The lending institution types (b) examined here are the FCS, commercial banks, and nontraditional lenders. Given that the model in equation (1) is an additive form over the different lending institution types (b) proposed by Detragiache, Garella, and Guiso (2000), an optimal solution for the number of lending institutions and type of lending institution does exist following the results proved by Detragiache, Garella, and Guiso.

A farmer wants to ensure that credit will be available in the future if needed. If a lending institution denies credit to a farmer because they are not creditworthy and the farmer has no other lending relationships, both the farmer and any potential new lending institution will incur additional transaction costs. The farmer spends time searching for potential creditors, while any new lending institution must gather additional information from the farmer to make their credit decision (Boot, 2000). This search cost could cause the farmer to lose access to inputs that would result in a decrease in profits to the farmer. Using multiple lending institutions increases the probability of obtaining debt in the future since this establishes multiple relationships with lending institutions that have information on the farmer (Detragiache, Garella, and Guiso, 2000). Brewer et al. (2014) find that increasing the probability of credit being extended to a farmer positively affects that farmer's expectation of revenues.

However, each additional lending relationship a farmer has also increases the cost of credit. Thus, a farmer will add additional lending relationships when the increase in expected revenues exceeds the increase in costs incurred by adding the additional lending relationship. In addition to the number of lending institutions with which the farmer does business, the type of lending institution also affects the expectation of profit for the farm as each lending institution offers different pricing packages and characteristics that affect farmer profit. This leads the farmer to select the number and type of lending institutions that maximize expected profit.

A key characteristic that helps determine this relationship is the farmer's default risk, which plays a critical role in determining whether a lending institution extends a farmer credit. Farmers with a higher risk of default will have a lower probability of receiving credit for any one particular lending institution. However, the more lending institutions a farmer uses, the higher the probability of receiving credit. This potential benefit provides an incentive for these farmers to potentially search for more lending institutions and more types of institutions to increase the probability of obtaining credit.

Empirical Model

The choice of lending institutions with which a farmer does business is a joint process, as depicted in the profit maximization problem in equation (1). That is, the farmer's decision to use additional lenders and what type of lender to use is a joint decision on the margin. Thus, a number of explanatory factors impact the choice of lending institutions, as outlined in the conceptual framework. The data show the observed choice of types of lending institution made by a farmer. We observe the dichotomous response of choosing lender type b for the three lender types. We denote this decision as D_b for $b = 1, 2, 3$, where b is the index of lender types: FCS (1), commercial bank (2), and nontraditional lender (3), respectively. D_b equals 1 when $n_b > 0$ (a farmer chooses to work with at least one lending institutions of type b) and 0 otherwise. Therefore, the chosen lender combinations available to a farmer are (i) FCS only, (ii) commercial bank only, (iii) nontraditional lender only, (iv) FCS and commercial bank, (v) FCS and nontraditional lender, (vi) commercial bank and nontraditional lender, and (vii) FCS, commercial bank, and nontraditional lender.

Based on this framework, one can model the probability that a farmer will choose a particular combination of lender types as $\Pr(D_1, D_2, D_3) = \Pr(Y_i = j)$, where Y_i is a polychotomous index of lender choice combinations that takes a value of 1–7. A particularly useful approach that can capture the joint process is the multinomial logistic regression model. Under this framework, the independence of irrelevant alternatives will hold between farmer choice combinations but not between the binary choices of institutional type (i.e., the individual binary variables). This framework can capture the dependence or association between choosing different institutional types (Bergtold and Molnar, 2010).

Given that $n_b^* = n_b^*(z)$ factors such as age, income of farm, current financial position of the farm, farm size, asset values, debt-to-asset ratio, etc. affect the decision of how many and which types of lenders to use. Using the multinomial framework, the probability that farmer i chooses lender choice combination j is given by

$$\Pr(Y_i = j) = \frac{\exp\left(\beta_j' \boldsymbol{x}_{is}\right)}{\sum_{k=1}^{l} \exp\left(\beta_k' \boldsymbol{x}_{is}\right)}, \tag{2}$$

where l equals the total number of possible lender choice combinations, j is the lender choice combination farmer i chooses, k is an index of lender choice combinations available, and $\boldsymbol{x}_{is}$ is a vector of s farmer/farm characteristics for farmer i (Maddala, 1983). The multinomial model provides a more parsimonious and richer framework than just modeling the individual choice combination probabilities, as illustrated in the next subsection (Bergtold and Onukwugha, 2014).

The coefficient estimates of the multinomial logistic model are not directly interpretable. To obtain a meaningful marginal interpretation for each decision variable in the model, the marginal effect estimates can be used (Greene, 2012). Marginal effects are the derivative of the probability of selecting lending choice combination j from the multinomial logit model with respect to particular explanatory factor x_{is} (Greene, 2012):

$$\frac{\partial \Pr(Y_i = j)}{\partial x_{is}} = \Pr(Y_i = j)\left(x_{is} - \sum_{k=1}^{l} \Pr(Y_i = k)\, x_{is}\right). \tag{3}$$

These are not the only marginal effects of interest in this study that are obtainable from the multinomial logistic regression framework.

Conditional and Joint Probabilities and Associated Marginal Effects

One of the key innovations of this study is to analyze the marginal effect of a farmer choosing a particular lender conditional on them already having an existing relationship with another type of lender. The multinomial logistic regression model allows us to capture this marginal choice in a probabilistic framework. To calculate the conditional probability, one must first calculate the unconditional probabilities for each type of lending institution and the joint probabilities of using different combinations of lending institutions.

The unconditional probability of using lending institution b is the sum of all the probabilities of choosing a lending choice combination where lending institution b is included in those choice combinations:

$$\Pr(D_b = 1) = \sum_{\{j:b\in j,\, j=1\ldots l\}} \Pr(Y_i = j),\ b = 1,2,3. \tag{4}$$

For example, the unconditional probability of a farmer using an FCS institution would be the sum of the probability they use only an FCS institution, an FCS institution and a commercial bank, an FCS institution and a nontraditional lender, and the probability they use all three types of lending institution.

The unconditional joint probability, $\Pr(D_b = 1, D_a = 1\}$ for $b \neq a$, of farmer i choosing both lending institutions b and a is the sum of the probabilities for all the choice combinations where lending institutions b and a both appear in choice combination j:

$$\Pr(D_b = 1, D_a = 1) = \sum_{\{j:b,a\in j,\, j=1\ldots l\}} \Pr(Y_i = j). \tag{5}$$

For example, the joint unconditional probability of a farmer using an FCS institution and a commercial bank would be the sum of the probabilities that they use an FCS institution and a commercial bank and the probability they use all three lending institution types.

The unconditional probabilities given by equations (4) and (5) allow us to derive conditional probabilities. These probabilities are of particular interest and have not been extensively explored in the economics literature. The conditional probability of farmer i utilizing lender type b, conditional on the fact that they already use lender type a, can be represented by

$$\Pr(D_b = 1 | D_a = 1) = \frac{\Pr(D_b = 1, D_a = 1\}}{\Pr(D_a = 1)},\ \text{for } b \neq a, \tag{6}$$

which is the unconditional joint probability of farmer i using both lending institution types b and a divided by the unconditional probability of farmer i using lending institution type a. An example of this would be the conditional probability of a farmer choosing to do business with a commercial bank conditional on the fact that they already use an FCS institution for credit. The conditional

probabilities derived add additional explanatory power to the multinomial logistic regression model and provide a way to assess the sequence of decisions in a cross-sectional framework.

Of particular interest is the marginal effect of a change in an explanatory variable (e.g., the debt-to-asset ratio) on the conditional probabilities of doing business with a new type of lending institution. To estimate the marginal effect of these conditional probabilities, the derivative of equation (6) is taken with respect to x_{is}. This makes the change in the probability of farmer i using lending institution type b conditional on them already using lending institution type a:

$$\frac{\partial \Pr(D_b = 1 | D_a = 1)}{\partial x_{is}} = \frac{\left(\left(\frac{\partial \Pr(D_b=1, D_a=1)}{\partial x_{is}} \times \Pr(D_a = 1)\right) - \left(\frac{\partial \Pr(D_a=1)}{\partial x_{is}} \times \Pr(D_b = 1, D_a = 1)\right)\right)}{(\Pr(D_a = 1))^2}. \tag{7}$$

The derivatives of the unconditional probabilities are the sum of all the marginal effects calculated by equation (3), where lending institution a is contained in choice combination j:

$$\frac{\partial \Pr(D_a = 1)}{\partial x_{is}} = \sum_{\{j:a \in j, j=1 \ldots l\}} \frac{\partial \Pr(Y_i = j)}{\partial x_{is}}. \tag{8}$$

The derivative of the joint unconditional probability is the sum of all the marginal effects calculated by equation (4), where lending institution b and a are both contained in choice combination j:

$$\frac{\partial \Pr(D_b = 1, D_a = 1)}{\partial x_{is}} = \sum_{\{j:a,b \in j, j=1 \ldots l\}} \frac{\partial Pr(Y_i = j)}{\partial x_{is}}. \tag{9}$$

When calculating these marginal effects, we adopt the convention of using the partial average marginal effects (Greene, 2012). That is, the marginal effect is calculated for each farmer and the partial average marginal effect is the average taken over farmers. To calculate the asymptotic standard errors for the marginal effects and conditional probabilities, we use a Monte Carlo method following Krinsky and Robb (1991).

Data

Individual farm loan data used for this study are from the Kansas Farm Management Association (KFMA), which maintains a nonrandom, farmer-level database that includes farmer demographic data (Langemeier, 2010) and yielded 4,463 usable farm observations for this study.[1] Farms with no loans were omitted from the analysis.[2] The farmers who participate in the database must be members of KFMA and enrolled for their services. This self-selection could result in the overrepresentation of production type, capacity, and geographical areas. Some of the variables included in the analysis were not available before 2002. Thus, the timeframe for the study is from 2002 to 2012. Individual farmers contribute their loan data into the KFMA database using one of several methods, including handwritten ledgers, Quickbooks®, FarmBooks accounting software, and Financial Plus.

We classified each loan as belonging, if applicable, to one of three lending institutions: FCS, commercial bank, or nontraditional lender. Any loan financed by an FCS member institution was classified as FCS. The commercial bank category includes small rural banks and large national banks (e.g., Bank of America®). Nontraditional lenders include of vendor financers (e.g., John Deere® Credit, Case® Credit) and cooperatives. Only farms for which all loans could be classified were kept for analysis.

The independent variables for this study(x_{is}) are the age of the primary farm operator, debt-to-asset ratio of the farm, inverse current ratio of the farm, return on assets of the farm, total

[1] Each of the 4,463 observations represents one farm in one particular year. Overall, there are 1,928 unique farms in the data.

[2] Of all farm observations, only 11.33% had no loans.

Table 1. Variable Definitions and Means, 2002–2012, Kansas

Variable	Description	Mean	Std. Dev.	Min.	Max.
Operator age	Age of primary farm operator (years)	55.87	12.07	19.00	91.00
Debt/asset	Total farm liabilities/total farm assets	0.32	0.23	0.00	1.00
Inverse current ratio	Total current liabilities/total current assets	0.68	4.91	0.00	247.19
ROA	Net farm income/total farm assets	0.04	0.11	−1.67	1.09
No. of operators	Number of full time farm operators (appears as a fraction if farm operator has off-farm duties)	0.99	0.46	0.10	7.30
No. of workers	Number of farm workers	1.41	1.09	0.10	14.50
No. of dependents	Total number of people dependent on farm income	2.69	1.52	0.00	20.00
Wage income	Off-farm wage income ($)	14,059.72	23,019.02	0.00	394,674.05
Rent and royalties	Rent and royalties earned ($)	7,403.02	25,494.95	0.00	555,310.59
Machinery inventory	Machinery inventory ($thousands)	100.50	126.46	0.00	2,119.46
Land inventory	Owned land inventory ($thousands)	673.75	961.68	0.00	14,242.31
Livestock inventory	Livestock inventory ($thousands)	58.67	104.43	0.00	2,254.00

number of farm operators, number of workers the farm employs, number of dependents reliant on the income from the farm, off-farm wages in dollars, rent and royalty income in dollars, machinery and equipment inventory in thousands of dollars, owned land inventory in thousands of dollars, and livestock inventory in thousands of dollars. Table 1 lists all the variables used, with their description and summary statistics.

The independent variables included describe a farm's financial health, profitability, management structure, off-farm activities, operational focus, and size. Financial health, liquidity, and profitability are included since different lender types use these measures to rate and benchmark farms seeking credit. Leverage is measured by the debt-to-asset ratio, liquidity is measured by the inverse current ratio, and profitability is measured by return on assets. The farm operator's age reveals whether there is a change in preferences for lender type based on the farmer's experience. The number of workers shows the farm's management structure. A farm operator with more farm workers may have more time to focus on management and will not be as concerned with convenience. The number of dependents of a farm also shows the management structure since a farm with more dependents is likely to have fewer outside workers. Rent and royalty income, along with off-farm wages, also reveal the management structure and dependency on farm income as the sole source of income for the operator. Machinery inventory, owned land inventory, and livestock inventory show the farm's asset structure of the farm, operational focus, and size.

Results

Table 2 reports the averages for selected farmer characteristics by lender choice combination, and Table 3 shows the parameter estimates and standard errors for the multinomial logit model

Table 2. Selected Variable Means by Lender Choice Combination, 2002–2012, Kansas

	1	2	3	1 & 2	1 & 3	2 & 3	1, 2, & 3
Operator age	58.65	54.7	56.88	55.93	54.79	52.4	54.16
Debt/asset	0.25	0.37	0.17	0.36	0.32	0.43	0.40
Inverse current ratio	0.43	0.78	0.35	0.6	0.86	0.69	0.66
ROA	0.02	0.03	0.04	0.05	0.06	0.05	0.06
No. of operators	0.93	0.94	1.05	0.98	1.06	1.07	1.10
No. of workers	1.31	1.21	1.53	1.43	1.68	1.52	1.81
No. of dependents	2.63	2.6	2.42	2.84	3.03	2.76	2.95
Wage income	14,989.73	14,574.20	9,688.86	16,642.56	12,819.28	14,179.15	14,988.83
Rent and royalties	8,073.74	6,692.07	8,137.78	9,094.71	6,784.54	5,625.61	7,725.43
Machinery inventory	89.55	68.95	112.25	103.07	132.17	127.16	164.55
Land inventory	749.15	539.96	590.47	809.04	810.69	558.76	945.79
Livestock inventory	49.80	54.49	49.49	56.89	77.88	73.14	82.61
No. of obs.	1,175	1,179	544	384	460	497	251

Notes: 1 = Farm Credit System, 2 = commercial bank, 3 = nontraditional lender.

estimated. The multinomial logit model was statistically significant, with a pseudo-R^2 of 0.072 and a $Prob > \chi^2 = 0.00$, rejecting the null hypothesis that the variables are jointly equal to 0. The remainder of this section presents the marginal effect results from the model, as the parameter estimates are not directly interpretable. We analyze the results two ways. The first is the current market conditions and segmentation of the agricultural credit market by customer characteristics. Analyzing the current customers of each lending institution allows us to examine which lending institutions may experience financial stress if farmer liquidity or solvency becomes an issue. The second is the overall credit conditions of the agricultural sector if a downturn in the agricultural sector were to occur. This analysis will focus on how the lending practices and customers of the lending institutions might change in the event of a downturn.

Current Market Conditions

Examining the agricultural credit market by the farmer characteristics unique to each particular lending institution's customers provides insight into market trends and how the farmer's financial risk affects the farmer's choice of lenders. Table 2 shows the average of selected farmer characteristics by lender choice combination. First, when analyzing farmer solvency across choice combinations, farmers who use both a commercial bank and a nontraditional lender are the most leveraged, with a debt-to-asset ratio of 0.43, followed by farmers who use all three types of lending institutions then farmers who only use a commercial bank, with debt-to-asset ratios of 0.40 and 0.37, respectively (Table 2). The commercial bank lending category appears in each of those choice combinations; thus, if farmers' solvency position were to deteriorate, commercial banks would be first to be at risk to experience stress as they have the most leveraged farmers.

If industry liquidity were to become an issue, those farmers with lower current ratios, or in this case higher inverse current ratios, would be most at risk. The choice combinations with the highest average inverse current ratio are the FCS and nontraditional lender category, commercial bank category, and commercial bank and nontraditional lender category. All three lending institution categories appear in the listed choice combinations. However, the FCS and nontraditional lenders also appear in choice combinations with improved liquidity, these choice combinations are the FCS solely and nontraditional lender solely. This pattern indicates that if industry liquidity were to become a concern, not all of the customers of those lending institutions would experience liquidity trouble, at least in the short run. Once again, commercial banks would experience the most stress in this scenario.

Table 3. Coefficient Estimates of Multinomial Logistic Model of Farmer Lender Choice Combination (*N*=4,463)

	Commercial Bank	Nontraditional Lender	Farm Credit System & Commercial Bank	Farm Credit System & Nontraditional Lender	Commercial Bank & Nontraditional Lender	Farm Credit System, Commercial Bank, & Nontraditional Lender
Operator age	−0.014**	−0.030**	0.000	−0.009	−0.021**	−0.006
	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Debt/asset	2.367**	−3.488**	2.519**	1.628**	3.294**	3.245**
	(0.219)	(0.357)	(0.292)	(0.287)	(0.275)	(0.346)
Inverse current ratio	0.000	0.000	0.000	0.000	−0.002	−0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
ROA	1.410**	0.291	2.169**	2.049**	1.383**	2.208**
	(0.426)	(0.556)	(0.603)	(0.575)	(0.527)	(0.710)
No. of operators	0.323**	0.224	0.119	0.169	0.514**	0.317
	(0.147)	(0.150)	(0.185)	(0.157)	(0.161)	(0.184)
No. of workers	−0.178**	0.148**	0.003	0.021	−0.146*	−0.017**
	(0.080)	(0.073)	(0.086)	(0.072)	(0.086)	(0.086)
No. of dependents	−0.110**	−0.178**	0.020	0.064*	−0.105**	0.003*
	(0.033)	(0.042)	(0.042)	(0.037)	(0.041)	(0.050)
Wage income	0.000	0.000*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rent and royalties	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Machinery inventory	−0.003**	0.003**	0.000	0.002**	0.004**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Land inventory	0.000	−0.001**	0.000	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Livestock inventory	0.001*	−0.001	0.001	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.473	1.996**	−2.301**	−1.613**	−1.116**	−3.136**
	(0.345)	(0.427)	(0.489)	(0.456)	(0.429)	(0.573)

Notes: Farm Credit System is the reference category for this model. Pseudo-$R^2 = 0.072$, Log-likelihood = −7,484.00, $Prob > \chi^2 = 0.00$. Standard errors are in parentheses. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

Table 4. Partial Average Marginal Effects for Each Type of Lending Institution and Choice Combination

	Farm Credit System	Commercial Bank	Nontraditional Lender	Farm Credit System & Commercial Bank	Farm Credit System & Nontraditional Lender	Commercial Bank & Nontraditional Lender	Farm Credit System, Commercial Bank, & Nontraditional Lender
Operator age	0.003**	−0.001	−0.002**	0.001**	0.000	−0.001**	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt/asset	−0.225**	0.270**	−0.489**	0.106**	0.036*	0.200**	0.103**
	(0.033)	(0.028)	(0.031)	(0.018)	(0.020)	(0.020)	(0.016)
Inverse current ratio	−0.011*	0.004	0.003	−0.001	0.002**	0.002**	0.000
	(0.006)	(0.003)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)
ROA	−0.274**	0.084	−0.073	0.087**	0.101**	0.022	0.053
	(0.066)	(0.060)	(0.047)	(0.041)	(0.045)	(0.040)	(0.033)
No. of operators	−0.053**	0.027	0.004	−0.008	−0.004	0.030**	0.004
	(0.020)	(0.022)	(0.012)	(0.013)	(0.012)	(0.013)	(0.008)
No. of workers	0.010	−0.032**	0.020**	0.005	0.007	−0.010	0.002
	(0.010)	(0.013)	(0.006)	(0.006)	(0.005)	(0.007)	(0.004)
No. of dependents	0.014**	−0.014**	−0.014**	0.006**	0.012**	−0.006*	0.003
	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Wage income	0.000*	0.000	0.000**	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rent and royalties	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Machinery inventory	0.000	−0.001**	0.000**	0.000	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Land inventory	0.000**	0.000**	0.000**	0.000**	0.000	0.000**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Livestock inventory	0.000**	0.000	0.000**	0.000	0.000**	0.000**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: 1 = Farm Credit System, 2 = commercial bank, 3 = nontraditional lender. Standard errors are in parentheses. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

Analyzing farm assets for each lending institution shows how farmers with different balance sheets use each of the lending institutions. Table 2 shows that farmers who use only the FCS own more assets than farmers who use only a commercial bank or nontraditional lender. Farmers who use only a nontraditional lender have the highest machinery inventory and farmers who use only a commercial bank have the highest livestock inventory.

Examining the averages gives insight on the characteristics of the current customers of each lending institution. However, analyzing how a change in a farmer's characteristics (such as taking on new debt) might impact the probability that a farmer will use a particular lending institution is useful in predicting which lending institution a farmer would do business with. Table 3 shows the coefficient estimates for the multinomial logit. Table 4 shows the partial marginal effects for each choice combination, calculated from equation (2), which allow us to examine the effect of a 1-unit change in x_i on the percentage increase or decrease in the average probability across farmers in the sample for each respective choice combination of lending institutions. For example, if a farmer experiences a 1-unit increase in return on assets (i.e., from 1% to 2% or 0.01 to 0.02),[3] the probability that the farmer does business with an FCS institution only decreases by 0.002% (Table 4).

For farmers who use the FCS, the marginal effects indicate that an increase in the probability of only using an FCS institution is correlated with a lower debt-to-asset ratio and a larger inventory of owned land (Table 4). These results concur with Dodson and KoenigâĂŹs (2004) results for customers who use the FCS. They find that these farmers are less leveraged and have more assets. However, a higher debt-to-asset ratio is correlated with a higher probability that the farmer uses a commercial bank. As commercial banks offer credit ranging from short-term lines of credit to long-term financing for land assets, those riskier farmers are using the lending institution that services all of the farm's debt needs as the prior relationship increases the probability of obtaining credit (Berger and Udell, 1995). These farmers might also be the most active in seeking additional lending relationships if the farms financial position were to worsen.

Being less leveraged, having more machinery inventory, having less land inventory, and having less livestock inventory are correlated with a farmer using a nontraditional lender. Since nontraditional lenders typically do not offer credit for products they do not sell, the results suggest that farmers who only use nontraditional lenders operate smaller farms with smaller amounts of nonmachinery assets. Examples of these farms could be beginning farmers who are part of a larger farming operation that have just begun to acquire assets of their own. Without existing lending relationships for farmers of this type, the convenience of the nontraditional lender could be a factor in attracting these customers (Table 4).

Having more leverage is correlated with farmers using multiple lending institution types. This result supports the conceptual framework that argues the more financial risk a person seeking credit has (as measured by their debt-to-asset ratio), the more likely they are to seek out multiple lending relationships (Detragiache, Garella, and Guiso, 2000). Specifically, among the multiple lending relationship categories, those farmers who use a commercial bank and a nontraditional lender are correlated with being the most leveraged (Table 2). A 0.5 increase in a farmer's debt-to-asset ratio is correlated with a 10% increase in the probability that the farmer uses both a commercial bank and nontraditional lender (Table 4). Since commercial banks offer all types of debt (i.e., short- and long-term loans) and are conveniently located in most rural communities, farmers who use commercial banks could move to nontraditional lenders if the commercial bank declined further credit. The nontraditional lender, which offers credit for a product they sell through their retail store, may be willing to accept the higher risk of these more leveraged farmers since the nontraditional lender would have lower costs if the farmer defaulted on the credit. The emergence of nontraditional lenders provides a source of credit for those farmers who may be a credit risk for a traditional lender. The use of all three types of lending institutions is positively correlated with farm size and assets in all three categories (machinery, land, and livestock). (Table 4).

[3] Returns are expressed as a decimal. Thus, a 1% return on assets is shown in the data as 0.01.

Table 5. Partial Average Unconditional Marginal Effects for Each Type of Lending Institution and Choice Combination

	Farm Credit System	Commercial Bank	Nontraditional Lender	Farm Credit System & Commercial Bank	Farm Credit System & Nontraditional Lender	Commercial Bank & Nontraditional Lender
Operator age	0.003**	−0.001	−0.003**	0.001**	0.000	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)**
Debt/asset	0.184**	0.679**	−0.151**	0.209**	0.139**	0.303
	(0.037)	(0.032)	(0.037)	(0.023)	(0.024)	(0.023)
Inverse current ratio	−0.010*	0.006	0.007*	−0.001	0.002	0.002
	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)
ROA	−0.112	0.247**	0.103	0.140**	0.154**	0.075
	(0.072)	(0.071)	(0.070)	(0.050)	(0.052)	(0.050)**
No. of operators	−0.027	0.053**	0.034	−0.004	0.000	0.034
	(0.023)	(0.022)	(0.021)	(0.015)	(0.015)	(0.015)
No. of workers	0.005	−0.036**	0.018*	0.006	0.008	−0.009
	(0.012)	(0.011)	(0.011)	(0.007)	(0.007)	(0.008)
No. of dependents	0.017**	−0.011**	−0.005	0.009**	0.015**	−0.003
	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Wage income	0.000**	0.000	0.000*	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rent and royalties	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)**
Machinery inventory	0.000**	0.000**	0.001**	0.000**	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)**
Land inventory	0.000**	0.000*	0.000**	0.000**	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)**
Livestock inventory	0.000	0.000**	0.000	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Standard errors are in parentheses. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

Farmer demographics also appear to differ among choice combinations. Age is negatively correlated with using only a nontraditional lender or a commercial bank and nontraditional lender together. Age is positively correlated with using the FCS or FCS along with a commercial bank. Given the recent increase in availability of nontraditional lenders, this may be due to the FCS having existing relationships with older farmers, thus making older farmers less likely to add a nontraditional lender to their debt portfolio.

Table 5 shows the unconditional marginal effects of each lending institution. These were calculated using equations (8) and (9). For example, the column labeled FCS reports the marginal effect for a 1-unit change in x_{is} on the unconditional probability of a farmer choosing to use the FCS. The marginal effects for the FCS represent the change in the probability that a farmer uses the FCS, independent of the fact that the farm may use a commercial bank or nontraditional lender, both or none. These results represent the complete portfolio of each lending institution.[4]

An increase in leverage is associated with a higher probability of using multiple lending institutions. This relationship implies that farmers are spreading out their debt and increasing the likelihood of obtaining credit when needed in the future. A further implication is that at-risk debt is spread among several lending institutions, which eases the stress put on any one lending institution, particularly commercial banks, and makes it less likely that any one bank would experience enough stress to cause it to stop extending credit. The most-leveraged farmers are customers of commercial banks, while the FCS has some of the least leveraged farmers. Nontraditional lenders also had some of the more leveraged farmers; however, this was only in the presence of that farmer having a relationship with a commercial bank. When a farmer has a relationship with a commercial bank and is a financial risk, nontraditional lenders may be a viable source of credit, as nontraditional lenders may be willing to take on more risk. Those farmers who have a better liquidity position are better positioned to weather a downturn in the agricultural sector. Farmers who use the FCS have more liquid assets, while farmers who use a nontraditional lender have less liquid assets.

Agricultural Credit Quality in a Downturn

The amount of leverage farmers have is a major part of the overall condition of the agricultural credit market. A downturn in the agricultural sector would affect farmers who are already over-leveraged or at risk of becoming over-leveraged first. A lending institution could deny them access to credit. To ensure access to credit, a farmer will act accordingly by seeking out other lending institutions. The previous section discussed which lending institutions have the most farmers at risk and the probability of a farmer having a relationship with a particular lending institution given certain characteristics; however, knowing how this could change given the farmer's current choice of lending institution and a deterioration in liquidity or solvency would be useful in predicting market outcomes.

For those farmers with multiple lending institutions, the conditional marginal effects provide insight on why a farmer adds another type of lending institution. Table 6 reports the conditional marginal effects for a farmer potentially choosing another lending institution given they already have a relationship with at least one other type of lending institution. These marginal effects are estimated using equation (7) and examine the effect of a 1-unit change in x_{is} on the probability a farmer will use a new type of lending institution conditional on the other lending institutions the farmer already uses.

For a farmer who uses a commercial bank, the correlation between leverage and the probability they add an FCS institution is not statistically significant (Table 6). This lack of correlation signals that a farmer using a commercial bank and who is increasing in leverage does not turn to the FCS

[4] These results may seem to contradict previous results. However, these results represent the complete portfolio of the lending institution. As an example, an increase in a farmer's leverage position is correlated with using the FCS (Table 5). This reflects the overall need for debt as an input in the production process.

Table 6. Partial Average Conditional Marginal Effects of Each Type of Lending Institution and Choice Combination

	Farm Credit System Given Bank	Farm Credit System Given Nontraditional Lender	Commercial Bank Given Farm Credit	Commercial Bank Given Nontraditional Lender	Nontraditional Lender Given Farm Credit System	Nontraditional Lender Given Commercial Bank	Farm Credit System Given Commercial Bank & Nontraditional Lender	Commercial Bank Given Farm Credit System & Nontraditional Lender	Nontraditional Lender Given Farm Credit System & Commercial Bank
Operator age	0.003**	0.004**	0.001	0.000	−0.001	−0.001	0.003**	0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Debt/asset	0.038	0.451**	0.307**	0.819**	0.132**	0.177**	0.004	0.373**	0.171**
	(0.043)	(0.049)	(0.042)	(0.041)	(0.045)	(0.040)	(0.079)	(0.075)	(0.083)
Inverse current ratio	−0.006	−0.002	0.002	−0.002	0.010	0.001	−0.006	−0.006	0.002
	(0.006)	(0.003)	(0.007)	(0.003)	(0.006)	(0.003)	(0.009)	(0.009)	(0.011)
ROA	0.139	0.277**	0.333**	0.073	0.365**	0.007	0.164	0.012	0.004
	(0.086)	(0.106)	(0.090)	(0.101)	(0.092)	(0.083)	(0.157)	(0.167)	(0.178)
No. of operators	−0.037	−0.037	0.000	0.050*	0.009	0.034	−0.045	0.028	0.041
	(0.027)	(0.029)	(0.026)	(0.026)	(0.026)	(0.027)	(0.042)	(0.039)	(0.047)
No. of workers	0.031**	0.004	0.009	−0.038**	0.014	0.004	0.028	−0.009	−0.005
	(0.014)	(0.014)	(0.012)	(0.013)	(0.012)	(0.014)	(0.021)	(0.018)	(0.022)
No. of dependents	0.023*	0.041**	0.010	−0.005	0.021**	0.001	0.023**	−0.013	−0.004
	(0.007)	(0.008)	(0.006)	(0.007)	(0.006)	(0.006)	(0.012)	(0.011)	(0.012)
Wage income	0.000**	0.000	0.000	0.000**	0.000*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rent and royalties	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Machinery inventory	0.000**	0.000	0.000	0.000**	0.000**	0.001**	−0.001	0.000	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Land inventory	0.000**	0.000**	0.000**	0.000	0.000	0.000**	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Livestock inventory	0.000	0.000**	0.000	0.000**	0.000**	0.000*	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Standard errors are in parentheses. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

for additional credit; however, the correlation between debt-to-asset ratio and the probability of adding a nontraditional lender conditional on using a commercial bank or an FCS institution are both positive and statistically significant. If farmer leverage positions were to deteriorate, we might see more farmers add a nontraditional lender to their lender choice bundle.

The probability of a farmer with higher leverage adding a commercial bank (conditional on the farmer already using an FCS institution) is positive and statistically significant (Table 6). Since both commercial banks and FCS institutions offer both short- and long-term debt, the farmer must have an incentive or obligation to use both of these lending institutions since using one would minimize their cost of debt (Brewer et al., 2014). For these farmers, leverage is statistically significant in adding a commercial bank given the use of the FCS but not in the case of adding an FCS institution given the use of a commercial bank.

For farmers adding a third lending institution, as leverage increases (conditional on already having a relationship with the other two types of lending institutions), leverage is statistically significant for adding a commercial bank and nontraditional lender but not statistically significant for adding an FCS institution (Table 6). Thus, when a farmer has an existing relationship with an FCS institution and a commercial bank, a deteriorating financial position increases the probability that the farmer uses a nontraditional lender. The same effect occurs when a farmer has an existing relationship with an FCS institution and a nontraditional lender. In that case, deterioration in a farmer's leverage position increases the probability the farmer uses a commercial bank.

The difference between the current situation and the 1980 credit crisis is that nontraditional lenders hold 20% of the debt in the agricultural credit market (Figure 1), much of which is with farmers who also use a commercial bank. The increasing importance of nontraditional lenders in the agricultural credit market may keep commercial banks from experiencing the stress that occurred in the 1980s. During a downturn in the agricultural sector, it is likely that more farmers would use a nontraditional lender as a source of credit and farmers who borrow from the FCS would use a commercial bank.

Conclusions

This article examines the characteristics affecting where farmers obtain agricultural credit in the agricultural credit market. Nontraditional lenders are included as a lending institution type for the first time in this type of analysis, and we develop and apply a new method for calculating conditional probabilities and marginal effects from a multinomial logistic regression model. We use conditional marginal effects to examine the change in probability of a farmer using a lending institution given that they use another type of lending institution.

Farmers who only use the FCS are associated with being less leveraged and having more assets.[5] Farmers who use a commercial bank are more leveraged and farmers who use nontraditional lenders are younger with more machinery and equipment and less owned land. A farmer using a nontraditional lender as a complement to the FCS or a commercial bank is correlated with that farmer being more leveraged. If a credit crisis were to occur in the agricultural sector, the customers of commercial banks would be the most at risk as they are the most leveraged. Customers of the FCS have the most land inventory and would be affected more if land prices were to drop. However, customers of the FCS are the least leveraged and have the most liquidity, so the drop in land prices or farm income may not have an immediate impact on their creditworthiness.

If a downturn in the agricultural economy were to occur, the conditional marginal effects suggest that highly leveraged farms would be more likely to add a second and third lending institution. This finding supports the conceptual model prediction that adding another lending relationship increases expected profit for the farm (Brewer et al., 2014). In particular, if a downturn in the agricultural

[5] As pointed out earlier, the debt decision is a joint decision between the lender and borrower. It may be that we are observing the strategies of each particular lender choice combination. For instance, the FCS may not be willing to lend to high-risk farmers, which is why we see a negative marginal effect for the debt-to-asset ratio.

sector were to occur and a farmer's financial position were to deteriorate, the farmer would be more likely to use a commercial bank or a nontraditional lender.

Different from the 1980s credit crisis, nontraditional lenders hold a higher percentage of the debt in the agricultural credit market, and results show that they lend to some of the more at-risk customers along with commercial banks. In this case, an increase in the debt-to-asset ratio increases the probability that a farmer uses a nontraditional lender if they already have a relationship with an FCS institution or a commercial bank. This could ease the stress put on commercial banks if a portion of the debt held by those lending institutions becomes at risk as nontraditional lenders provide credit to more leveraged farmers.

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