DETERMINANTS OF LENDER CHOICE AND BANKING STRATEGY FOR KANSAS FARMERS

by

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Abstract

The objectives of this thesis are to examine the banking strategy of Kansas farmers and to analyze the determinants of lender choice among Kansas farmers. To meet these objectives, econometric analysis was used to examine the financial characteristics of the farm that affect the number of banking relationships and the probability a farmer has a loan with a respective lender. The financial characteristics include variables representing the solvency, liquidity, and profitability of the farm.

To analyze banking strategy, a poisson model was estimated to determine how the financial characteristics of the farm affect the number of banking relationships used by the farmer. The solvency, liquidity, and profitability of a farmer was analyzed to examine how these measures affect how many banking relationships the respective farmer has. Additionally, a panel data fixed effects model was used to analyze how the number of banking relationships affects the net farm income of the farm.

To analyze the determinants of lender choice for Kansas farmers, six probit models were used to determine how farm and financial characteristics, including dollar amount of inventory for certain assets and dollar amount of loans, affect the probabililty the farmer has a loan with the respective lender. A Heckman selection model was used to further analyze the dollar amount of loans a farmer has with a respective lender using information from the probit models.

Results of the study show that the higher the debt to asset ratio the farmer has, the more banking relationships the respective farmer has. It was also found that the amount of inventory for certain asset classifications, dollar amount loans, and the financial characteristics affect the lender the farmer chooses to use.

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Chapter 1 - Introduction

Due to the 2008 credit crisis, banks across the nation have tightened regulations and become stricter regarding to whom they extend credit. This coupled with an 89 percent increase in delinquent and nonperforming agricultural loans from 2008 to 2009[1] puts an emphasis on the changing financial characteristics of agriculture. However, despite these increased concerns for farmers defaulting and the recent global recession, the financial health of the agriculture industry remains strong (Park, et al. 2010).

Many sectors of the United States economy have suffered from the 2008 credit crisis and subsequent downturn in the global economy, the agriculture industry has remained strong. In particular, the health of financial lenders remains strong. Briggeman, Gunderson and Gloy (2009) state that agriculture lenders are well positioned to weather any tumultuous environment. Ellinger (2009) concurs with this assessment; however, Ellinger is less optimistic saying that the recent increase in non-performing loans offers a warning to the agriculture industry.

The Kansas economy relies heavily on the agriculture industry. With this reliance on the agriculture industry, the importance of monitoring the agricultural sector is important to the Kansas economy. The ability to expand, adopt new technology, acquire working capital, and obtain lines of credit is essential to the viability of Kansas farmers. Financing is a key ingredient in the growth and sustainability of a farm. A farmer who is unable to obtain credit is at a considerable disadvantage. A greater importance must be placed on agricultural lending sources and farm banking strategies to ensure the farm has available credit at the lowest possible cost.

[1] According to the *2010 Agricultural Income and Finance Outlook* by the USDA Economic Research Service.

This thesis will look at the number of banking relationships a farm is engaged in and the correlation of the number of banking relationships to net farm income. Current trends in the sources of agricultural debt that Kansas farmers use will also be analyzed. Using the farms financial health and its correlation to the number of banking relationships, the current banking strategy will be discussed. This strategy will be compared to the banking strategy that has been developed for other industries. An important trend this thesis will analyze is the use of nontraditional lenders, those institutions whose primary purpose is not lending, in the agricultural credit market. This thesis will apply theory on how many lending relationships a firm should engage in that has never been applied to the agricultural sector and will analyze the trends in financing characteristics of Kansas farmers.

1.1 Objectives

The primary objective of this thesis is to analyze the financing characteristics of Kansas farmers. This thesis will benefit Kansas farmers in helping them analyze the number of lending relationships for their financing as well as help Kansas lenders in this decision.

The thesis will focus on the following specific objectives:

1. Develop an understanding of the overall lending conditions during the time period that is being studied.
2. Conduct an analysis to determine the key farm characteristics affecting the number of banking relationships and lender choice.
    a. Analyze the factors influencing the use of nontraditional lenders by Kansas farmers.
3. Analyze “Multiple vs. Single Banking Relationship Theory” for Kansas farms.

4. Examine the relationship between net income and the number of lending relationships for Kansas farms.
5. Summarize and draw conclusions for both farms and lenders.

1.2 Background of Kansas Agricultural Credit Market

The Kansas agricultural credit market can be divided into the following major categories: Farm Credit System, commercial banks, credit unions, nontraditional lenders and government agencies. These lending institutions offer the farmer a broad selection to choose from for their source of credit. Each of these sources of credit has unique attributes that may entice a particular farmer to borrow from that respective lending institution. From convenience, to a personal relationship with financier, to a diversity of product offering or low cost of debt, each institution offers something different to the farmer.

In Kansas, a farmer may have two or more small rural banks to choose from, the financing from the local equipment dealership as well as the regional Farm Credit System that are all in close proximity to the farmer. This availability of multiple options for sources of credit for the farmer creates competition among lending institutions in Kansas. This is important for this particular study since some states do not have the number of small rural banks that Kansas farmers have. Farmers in other states have limited options from which to choose to obtain financing.

Chapter 2 - Literature Review

The theoretical framework for the number of banking relationships a firm should have has been discussed in previous research from a variety of perspectives. These studies have looked at the relationship between the firm and lender, variations of transaction costs, information sharing among lenders and the risk of lender default and how each of these affect a firm's strategy on where to obtain credit. These studies on non-agricultural firms provide a basis for the theoretical framework in this study that is applied to Kansas farms. For the second part of this thesis, nontraditional lenders are prevalent in the agricultural credit markets. A nontraditional lender is an institution whose primary objective is selling some other service or product other than credit. Previous research looks at the advantages and disadvantages for farmers using nontraditional lenders and provides empirical results to compare to this thesis. This chapter will first look at existing literature on single versus multiple banking relationships strategy then it will look at existing literature for nontraditional lenders in the agricultural credit market.

2.1 Existing Theoretical Frameworks, Single Versus Multiple Banking Relationships

There have been multiple studies concerning single versus multiple banking relationships; however, no studies have looked at agricultural firms. Topics discussed in previous studies include: debt versus equity, the role of relationship banking, the extent of information disclosure, small versus large firm strategies, costs associated with a banking relationship and the availability of credit. These previous studies provide the foundation for the theoretical framework in this thesis.

The first study, *Multiple versus Single Banking Relationships: Theory and Evidence*, creates a framework that follows the logical decision of a risk neutral and rational firm seeking credit (Detragiache, Garella and Guiso 2000). The main question addressed is why firms, even small ones, use more than one bank. It is proposed that the reason for this is that a bank might be unwilling to extend credit to the firm or otherwise be unable to extend credit to the firm in the future. For this study, it is assumed that if the firm is unable to obtain the credit needed, there is lost profit due not being able to make a capital expenditure for which debt was needed. Another aspect is the addition of a lending relationship creating competition for the firm's business. Thus, a firm engaging in multiple banking relationships restores competition that lowers their cost of debt. These costs, however, must negate the increased transaction costs of maintaining multiple banking relationships.

Detragiache, Garella and Guiso (2000) argue that the theoretical framework for a risk-neutral firm seeking financial resources is as follows. At date 0, the firm seeks funds with the initial amount of investment sought of I_0. This yields a return of K at date 2 with probability p, and a zero return with the probability of $1 - p$. While the probability of success is not known, it is assumed it falls in the distribution $F(p)$. Next, it is assumed the project needs a second allotment of funds at date 1, that will be called I_1. If the amount of $I_1$is not obtained, liquidation will occur. It is important to note that there is an assumption that the expected payout (i.e. revenues) of the firm for this time period is greater than the investment cost. This assumption, therefore, can be expressed as the following relationship shown in Equation (2.1) below:

$$pK - I \geq 0 \tag{2.1}$$

which makes the assumption of a profitable firm.

Before the framework analyzes the number of relationships to have at date 0, it first examines the decision at date 1 under the assumption that the firm will find credit, whether it is through an informed or uninformed bank. An informed bank is one that has access to all of the firm's data, in this study, it is the bank that the firm currently has a loan with. An uninformed bank is one that the firm does not have a loan. It is assumed that the informed bank, due to its near perfect information on the firm, is able to set the correct interest rate. As long as the interest rate for the firm is below a set interest rate ceiling, R^*, the bank, whether it is informed or uninformed, will opt to lend to the firm. This break-even interest rate for the informed bank is

$$R^i = 1/p \tag{2.2}$$

with the uninformed bank's break-even interest being

$$R^u = \frac{1}{E^u(p|R^u)} \tag{2.3}$$

where

$$E^u(p|R) = \frac{\varepsilon^n E(p) + (1-\varepsilon^n)\int_p^{\frac{1}{R}} pf(p)dp}{\varepsilon^n + (1-\varepsilon^n)F(1/R)} \tag{2.4}$$

which is the inverse of the expected probability of success of the firm given that the interest rate the firm is facing is from an uninformed lender at date 1. In the above equations, ε^n is the probability the firm will be liquidated prematurely and n is the number of banking relationships in which the firm engages. Equation (2.4) is bigger than $E(p)$, the refinancing of the firm to an uninformed lender at date 1 must reveal unfavorable information about the firm. Therefore, it is determined that it is preferable to finance at date 1 through an informed lender. If it must, financing through an uninformed lender is preferable to liquidation.

The previous equations assume that the firm is able to find financing, whether it is through an informed or uninformed lender. However, this is not always the case. This presents

the question of "how many banks should the firm borrow from" at date 0 to increase the likelihood there is a bank willing to lend? For this section of the analysis, Detragiache, Garella and Guiso (2000) make the assumption that uniformed banks are not willing to lend to the firm. The reason for this is that if uninformed banks are willing, then it has been proven the optimal number of relationships is one to diminish costs. However, if uninformed banks are not willing, then the firm must safeguard against premature liquidation and increase the likelihood that an informed lender will extend credit.

As stated earlier, an informed bank will be willing to lend at date 1 as long as the break-even interest rate is below the bank's threshold. As long as this is the case, then the optimal number of banking relationships is one, thus reducing transaction costs and increasing profit. However, even when this is not the case, banks are willing to take on the risky customer. This is due to the liquidation cost for the bank outweighing the loss of the refinancing. The profit function for the firm who has entered in multiple banking relationships is defined as

$$\pi(n) = (1 - \varepsilon^n)\left(\int_{\frac{I_1}{K}}^{1}(pK - I_1)f(p)dp\right) - (I_0 + cn) \tag{2.5}$$

which is the inverse probability of liquidation multiplied by the integral of the expected cash flow less the initial investment as the probability of the success of the firm changes less the investment and transactions costs. From Equation (2.5), it is shown that increasing the number of initial banking relationship affects profit in two ways. It lowers profits for the firm due to increased transaction costs but increases profits because it makes it more likely that the firm will not be prematurely liquidated due to lack of to credit.

The model Detragiache, Garella and Guiso (2000) propose to optimize the number of banking relationships by:

$$n^* = \frac{lnc - \ln(-Zln\varepsilon)}{ln\varepsilon} \tag{2.6}$$

where

$$Z \equiv \int_{I_1/K}^{1} (pK - I_1) f(p) dp. \tag{2.7}$$

From these equations, it is shown that the optimal number of relationships is generally greater than one, although it could be one for some firms. Using simulated probabilities, the authors use this model to determine the optimal number of relationships given different scenarios. These results can be found in Table 2-1. Table 2-1shows how the optimal number of banking relationships for a firm changes given a low or high cost of setting up a banking relationship, a low or high profitability for the firm and given a change in the probability of a liquidity shock that would cause the bank to be unable to refinance. The results show that the more profitable the firm and the riskier the bank results in a higher number of optimal banking relationships for the firm.

2.1.1 Relationship Lending's Affect on Rural Banking

The previous section looked at a theoretical model to determine the optimal number of banking relationships for a firm. One of the major factors ignored is the role of the relationship between the lender and the farmer. With many farmers using small rural banks, relationships play an important role in the transactions between the two parties.

Berger and Udell (1995) find that as the relationship between the bank and the firm matures and grows stronger, the requirements and pricing on the loan for that respective firm change. This is due to the lender gathering private information on the firm as the relationship matures that would not otherwise be available to that lender. A study by Boot (1999) goes as far to say that "the need for such lending and monitoring may make the proximity of a relationship financier essential; otherwise, lending might not occur at all." Boot also states that a long term

relationship also permits funding of loans that might not be profitable for the bank in the short run, but may be profitable in the long run. This analysis by the bank is only possible due to the extensive relationship between bank and the firm.

Unlike the previous studies, Boot (1999) addresses some negatives for extensive bank-firm relationships. The first is whether a bank can credibly deny additional credit when problems arise. That is, if a firm is close to default, will the bank be able to avoid a bad outcome by renegotiating a bad loan? The second negative that Boot (1999) points to is for the firm. Claiming that an information monopoly may be created by the bank that allows them to extract rents from the firm. This idea is also supported by Detragiache, Garella and Guiso (2000) who state that "after (the lending institution) acquires private information about the quality of the borrower, a relationship bank may be able to use this information to extract rents." The solution that Boot (1999) points to for this is the entry of the firm into multiple banking relationships as long as the transactions cost is not too high.

There are contradicting opinions on how a firm that establishes a relationship with only one bank is affected. Akhavein, Goldberg and White (2004) conclude that this results in more funds and lower costs of borrowing for the firm. However, it is also argued that not engaging in a single lending relationship can induce ex post competition among lenders, thus avoiding the monopoly of information suggested by Boot (2000) while lowering the cost of lending for the firm due to the increased competition among lenders (Cosci and Meliciani 2002). This, in turn, is opposite to Detragiache, Garella and Guiso (2000) who state that "multiple banking should be costly: dealing with more than one bank may involve significant transaction costs." Farinha and Santos (2000) state that the longer the relationship is maintained with the bank, the more a "lemon's premium" is developed if the firm were to approach another bank. That is, the new

bank will question the firm's decision not to seek funding from the bank that the firm currently has a relationship with.

2.2 Previous Studies on Nontraditional Lenders

Novak (1999) analyzed nontraditional lender use for farms in north central Kansas. The increased or decreased use, background information concerning nontraditional lenders and behavior of nontraditional lenders in agricultural credit markets is reviewed in this section.

The emergence of nontraditional lenders in the agricultural credit markets in the mid 1980s has provided farmers with increased opportunities for credit. Sherrick, Sonka and Monke (1994) researched the characteristics of nontraditional lenders, the key features and differences among traditional and nontraditional lending programs and the emerging strategy concepts in evaluating the competitive implications of nontraditional lenders in agricultrual credit markets.

Before discussing implications and findings, Sherrick, Sonka and Monke (1994) define the difference between a traditional lender and a nontraditional lender as:

> "…traditional credit suppliers or lenders refer to those whose traditional (historic) contact with the producers was primarily to provide credit (i.e., commercial banks, Farm Credit System, insurance companies, Farmers' Home Administration, etc.). Nontraditional credit suppliers or lenders, on the other hand, are those whose primary contacts with producers historically have been for goods and services other than credit (i.e., input suppliers, cooperatives, machinery suppliers, processors, etc.)."

They also note what qualifies as credit for this study. Terminology such as "net-thirty days payable" and other short term accounts payable that require no formal acceptance or terms does not qualify as credit.

2.2.1 Emergence of Nontradtional Lenders and Empirical Results

John Deere and Pioneer Hi-Bred International both began offering credit to its customers for the products and services they respectively provide in the mid 1980s. Both companies have experienced increased profits as a result of these ventures, and have joined into a business alliance that offers operating loans to farmers, continuing the expansion into the agricultural credit market (Brunoehler 1997). This has led to John Deere becoming one of the 25 largest financial institutions in the country (B. Sherrick 1998).

Following these two companies' lead, many farm equipment manufacturers and agricultural input suppliers offer credit for their customers according to Brunoehler (1997). With the use of the commercial paper market and asset based lending techniques employed by many lenders, a lower cost structure was obtained (B. Sherrick 1998). Boehlje et al. (1999) indicated that companies are experimenting with entire product service offerings that include an optimized set of inputs (e.g. fertilizer and seed), financing to acquire this optimized input bundle, a risk management program including warranties, options and forward contracting services, insurance products and then contracting for the final product. Thus, financing is part of the total product or service bundle and will continue to be offered this way into the future.

The USDA lists nontraditional lenders under the category of "individuals and others." In 1988, this sector held 19 percent of the non-real estate agricultural credit market and by 1996 held 23 percent of the market, an increase from $11.8 billion dollars of business to $17 billion during this same time period for non-real estate debt (Brunoehler 1997). According to the

Agricultural Income & Finance Situation Outlook Report (December 2010), in 2009 the category labeled as "Individual and others" held $11.1 million of non-real estate agricultural debt, a decrease of $5.9 billion and 10 percent of the market. For north central Kansas, Novak reported that from 1988 to 1997, nontraditional lenders increased market share from 2 percent to 7 percent. The results were similar when categorized as intermediate and long term debt.

2.2.2 Competitive Differences in Lending Programs

Nontraditional lenders have the ability to sustain a competitive advantage over traditional lenders. Sherrick, Sonka and Monke (1994) find that several, but not all, nontraditional lenders are able to offer below market interest rates to entice new customers. The ability to maintain the credit program even when it is not self sustaining allows the company to use their credit program as a differentiation tool to enhance whatever input the farmer is using the credit to finance. This can be a key marketing tool when attempting to differentiate a homogenous product, or group of products, that are otherwise not easily differentiated.

The source of funding for the credit program can lead to a competitive advantage, with nontraditional lenders having the ability to finance the credit activities from their own balance sheet if they have a big enough balance sheet. If they do not, then nontraditional lenders have a broad selection of sources to obtain funds from outside the parent company. These sources range from the commercial paper market to a correspondent banking relationship that allows the lender to borrow in bulk. However, it may simply be the case that the lender is choosing to subsidize the credit activity with revenues from other portions of the business. If this is the case, then the lending department will be subsidized with revenues from other business activities.

Regulatory differences also occur with traditional lenders in the form of extra controls and limitations. The FDIC, Comptroller of the Currency, Federal Reserve System, state and

federal banking regulations, Congress and other organizations such as the Securities and Exchange Commission all regulate traditional lenders. Also according to Sherrick, Sonka and Monke (1994), "Although nontraditional lenders are also bound by property, lien, usury, and security laws, they operate in relative autonomy from formal regulators who can impose capital standards, loan quality ratings, and the like." However, it can be difficult to quantify these regulation differences.

Another difference that grants an advantage to nontraditional lenders is the overhead and cost structure of lenders. Because nontraditional lenders typically center around point-of-sale lending, the traditional "brick and mortar" investment is significantly lower. Nontraditional lenders typically also share facilities with other operations of the business. Thus lowering overhead and maintenance expenses associated with the lending activities. Along with this, a farmer can obtain all inputs from one supplier in addition to the credit for those inputs reducing transaction costs (Sherrick, Sonka and Monke 1994).

The last way that competitive differences exist is the convenience factor. The ability to provide "one-stop-shopping" for products and financial inputs is appealing to customers. This reduces transaction time and lessens disclosure requirements. Sherrick, Sonka and Monke (1994) found that they could obtain credit in less than 12 minutes from time of entry into an implement dealership. This advantage is enhanced when nontraditional lenders finance extensions of their product (e.g., a hog feed manufacturer financing the purchase of the feeder hogs).

Table 2-1, Regions of Multiple Banking and Optimal Number of Relations for Various Parameter Values

Parameter Values		Boundaries of the Multiple Banking Region		Optimal Number of Relations for Different Values of the Probability of a Liquidity Shock (ε)		
Profitability	Enforcement	Lower Bound (ε^-)	Upper Bound (ε^+)	$\varepsilon = 0.2$	$\varepsilon = 0.3$	$\varepsilon = 0.4$
Panel A: Low Cost of Setting Up a Relationship $c = 1/1000$						
	$\nu = 0.5$	0.013	0.51	5	6	10
Low Profitability	$\nu = 0.6$	0.013	0.34	5	6	1
$(K = 3, I_o = I_1 = 0.2)$	$\nu = 0.8$	0.013	0.17	1	1	1
	$\nu = 0.9$	0.013	0.11	1	1	1
	$\nu = 0.5$	0.016	1.00	5	6	10
High Profitability	$\nu = 0.6$	0.016	1.00	5	6	10
$(K = 3, I_o = I_1 = 0.33)$	$\nu = 0.8$	0.018	0.54	5	6	10
	$\nu = 0.9$	0.018	0.43	5	6	1
Panel B: High Cost of Setting Up a Relationship $c = 1/100$						
	$\nu = 0.5$	0.013	0.53	3	4	6
Low Profitability	$\nu = 0.6$	0.013	0.36	3	4	1
$(K = 3, I_o = I_1 = 0.2)$	$\nu = 0.8$	0.013	0.18	1	1	1
	$\nu = 0.9$	0.013	0.13	1	1	1
	$\nu = 0.5$	0.054	1.00	3	4	6
High Profitability	$\nu = 0.6$	0.054	1.00	3	4	6
$(K = 3, I_o = I_1 = 0.33)$	$\nu = 0.8$	0.055	0.56	3	4	6
	$\nu = 0.9$	0.055	0.43	3	4	1

Source: Detragiache, Garella and Guiso, 2000, Pg. 1146

Chapter 3 - Single versus Multiple Banking Strategy Theory

This chapter discusses the theory behind single versus multiple banking strategy for Kansas farms. The main issues addressed are why a farm would choose to engage in multiple banking relationships and how many would be optimal. This chapter assumes homogeneity across all lenders for interest rates and transaction fees for simplicity and that an additional lending relationship is for a loan used for a capital purchase that would make the farm more profitable.

3.1 Theory for Single versus Multiple Banking Relationships

The question that needs to be addressed is why any farm would engage in multiple banking relationships. The basic assumption underlying this strategy is that both banks and firms are risk averse. Due to both parties being risk averse, this leads to the firm seeking additional lending relationships to ensure that credit is available if needed and the bank to deny credit to the firm to keep its own balance sheet healthy, thus causing the firm to seek other lenders. If either party deems the other unsatisfactory, it will lead to the firm seeking credit from other sources.

Firms seek multiple banking relationships if one of two things occur. The first is if the firm deems its current lender, assuming all firms start with only one lender, as risky or that there is probability that the bank would not extend further credit. This scenario is specifically addressed in Detragiache, Garella, and Guiso (2000). In this case, the firm believes the bank has potential to default or would otherwise have insufficient funds to extend credit in the future. This incident will only occur in large firm-bank relationships where the amount of debt requested by the firm is large enough that it would alter the bank's balance sheet.

The second condition is if the bank believes that the firm's financial condition is unsatisfactory. This would cause the firm to seek additional banking relationships to spread its

debt load across multiple lending institutions so that the credit sought by the firm can be managed. In this scenario, it is not the firms decision that causes them to initiate the multiple banking relationships but the banks denial of credit that causes the firm to seek additional relationships. For this thesis, a firms financial condition will be measured by the debt-to-asset ratio, current ratio and the return on assets.

3.2 Cost of Multiple Banking Relationships

For each additional banking relationship that a firm engages in, it is assumed that multiple fees and costs of transactions occur for each additional relationship. Thus, by engaging in multiple relationships, the firm increases the cost of their debt. It follows that for a firm to engage in an additional lending relationship, the change in its expected profit resulting from the capital expenditure must be greater that than the extra costs associated with the additional lending relationship. This results in the following condition for a farm to seek an additional lending relationship:

$$[E(\pi_1) - E(\pi_2)] - C > 0, \tag{3.1}$$

where $E(\pi_1)$ is the expected profit after the capital investment is made, $E(\pi_2)$ is the expected profit for the farm if it is unable to secure a loan for the capital investment and C is the added cost of the additional lending relationship. This added cost, C, includes the duplicate fees the farm will incur along with the increased management costs for oversight of their debt for the farm.

However, if the assumption of homogeneity across lenders for interest rate and fees is lifted, then there is a possibility of initiating another lending relationship to decrease the cost of debt. As an example, suppose a firm currently has one lending institution and is contemplating

obtaining credit from an additional lender due to a more desirable interest rate. If the equality in Equation (3.2) holds:

$$D_0(I_0 - I_1) - C > 0, \tag{3.2}$$

where D_0 is the loan amount, I_0 is the interest rate from the initial lending institution, $I_1$is the interest rate of the new lending institution and C is the increase in fees and transaction costs for initiating another banking relationship, the firm would choose to initiate the additional relationship . This is to say that the decrease in interest cost must be greater than the increased costs of obtaining the additional lending relationship. An example of this is a nontraditional lender offering a low interest rate as a loss leader to enhance their product sales.

3.3 Length of Lending Relationships Effect on Cost

Because small firms, in this case farms, tend to rely on commercial banks for credit and have little incentive to release financial and business information, banks privately gather information on the borrower that allows them to set loan contract terms, interest rate and the collateral requirements of the loan. The bank-firm relationship may play a significant role in this process of gathering information and setting the terms of the loan contract (Berger and Udell 1995).

Akhavein, Goldberg, and White (2004) conclude that farms with a "longer pre-existing relationship with its bank should have greater availability of funds and/or lower cost of funds." This decrease in costs for the farm means that any farm that is in a healthy financial position where the bank is willing to extend additional credit should maintain their current single banking relationship to maintain the lowest possible cost of debt.

Berger and Udell (1995) find that collateral requirements and the interest rate both decrease as the relationship matures for firms engaged in a single lending relationship. Along

these same lines, Akhavein, Goldberg and White (2004) also conclude that farms with a "longer pre-existing relationship with its bank should have greater availability of funds and/or lower costs of funds." Both studies found the length of tenure for the relationship between bank and the firm to be statistically significant when analyzing the cost and effectiveness of the relationship. This decrease in lending costs as a relationship matures leads to a farm keeping only one banking relationship as long as their financial health does not decrease enough for that bank to deny credit, thus forcing the farm to seek funds elsewhere.

3.4 Summary of Proposed Banking Strategy for Farmers

In conclusion, the hypothesis is that farms in Kansas will seek additional lending relationships when they want to ensure the option of obtaining credit at a future date is available. If either the farm or the bank believes the other is risky, then the end result is that the farm will seek additional lending relationships. Thus as the debt to asset ratio of a farm increases, then this should correlated to an increase in banking relationships. While it has been established that a farm may seek an additional relationship if there is a possibility it will not get credit in the future, the question still remains as to how many banking relationships are needed. The answer to this is different for each farm. As a farm needs additional lending relationships, then the farm would choose to add another lending relationship.

Chapter 4 - Data and Methods

4.1 KFMA Data

The data used for this thesis were obtained through the Kansas Farm Management Association (KFMA). The data are entered by the individual farmer using one of several methods. These methods include a handwritten ledger, Quickbooks®, FarmBooks accounting software, and Financial Plus. The data are then inputted into a statewide database. The data for this thesis are from this statewide database. Farms are identified only by a unique farm number, no personal information was shared in any data obtained so all farmers remain anonymous.

The farmer benefits from KFMA by obtaining: "Sound farm accounting systems" and "Year-end tax planning and management" and "Guidance for business entity and structure planning," among others. The data are as detailed as each farmer reports for their records. In some cases, not all detailed loan information for a particular farmer could be identified or classified due to vagueness on the part of the farmer.

These data are at the farm level for the entire state of Kansas, though it is not a random survey. The farmers who participate must be a member of KFMA and enrolled for their services. This self selection could result in production type, capacity ,and geographical areas to be over represented.

Individual farm loan data were obtained through the aggregated statewide database while other data were obtained through the KFMA Data Bank. Some of the variables included in the analysis were not available before 2002. Therefore the timeframe for the thesis is from 2002 to 2010. For a complete list of all variables available see Langemeier (2010).

4.1.1 Dependent Variables

This section will detail the variables analyzed in this thesis. If applicable, it will explain how that variable was calculated, and the motivation behind including it in the thesis. In certain cases it will detail any assumptions that were used in calculating that particular variable. This thesis uses four different sets of dependent variables for each of the four different types of models. The first two data sets discussed are comprised of only one dependent variable while the last two have six dependent variables per set. A complete list of the variables, their symbols, and a short summary may be found in Table 4-1.

The variable net farm income is defined as the value of farm production for the respective farm less operating expenses less depreciation less accrued income-expense adjustment. This amount does not include income from off farm activities. This dependent variable will be used to analyze the relationship between the number of banking relationships and the profitability of a farm.

The variable for the number of lending relationships the farmer engages in, number of lending relationships, is specifically the number of lenders a farmer has including those between the same type of lenders. A farmer who has a loan with two small town banks would be classified as having two lending relationships even though banks are in the same category. Another example is if a farmer used financing from two different equipment dealerships and obtained two different loans from these nontraditional lenders (e.g., one loan from John Deere and one from CNH).

The next set of dependent variables are six binary variables. These six variables are: Farm Credit, banks, nontraditional, credit union, government and credit card. Each of these

variables takes on the value of "1" if the respective farm has a portion of their debt held by that particular type of lending institution.

The last set of dependent variables consists of six variables detailing the dollar amount of loans a farmer has with a particular type of lending institution. These six variables are: Farm Credit dollars, bank dollars, nontraditional dollars, credit union dollars, government dollars and credit card dollars. This set of dependent variables will be used to estimate the dollar amount that a farm has with a particular type of lending institution given the farms financial characteristics.

4.2 Econometric Methods

Econometric models were developed to estimate the relationships between various farm characteristics and dependant variables. These models include a model for how financial characteristics relate to the number of lender relationships a farmer has and a model that regresses bank choice and financial information on the net farm income of a farm. Additionally, discrete choice models were developed to determine how farm financial characteristics affect the likelihood a farmer has a banking relationship with a certain type of lender.

4.2.1 Number of Lending Relationships Poisson Model

The model developed in this section estimates the relationship between the financial characteristics of a farm and how many lending relationships that respective farm has. For this model, the dependant variable, number of lending relationships, is a count variable. A common regression technique for this type of analysis is a Poisson regression.

Count data are different from the classical linear regression since the dependant variable is a discrete value limited to non-negative integers. Since it is a discrete integer, this results in a non-linear function. The function that is used is defined below:

(4.1) $$Prob(y_t = Y|x_{it}) = e^{\beta' x_{it}} = \lambda_t$$

where y_t represents the number of lending relationships a farmer has, x_{it} are the independent variables used in the analysis and β are the coefficients for the independent variables. Also, λ_t follows the Poisson distribution property that $E[Y] = \lambda_t$ and $V[Y] = \lambda_t$, that is, the mean and the variance are equal (Cameron and Trivedi 1999). Given that this regression technique is nonlinear in nature, it is estimated using maximum likelihood estimation (MLE).

To determine how the financial characteristics of a farm correlate to the number of banking relationships that a farm has, the following Poisson model was estimated:

(4.2) $$(Number\ of\ Lending\ Relationships)_t = \beta_o + \beta_1(Year)_t + \beta_2(Current\ Ratio)_t + \beta_3(Debt\ to\ Asset)_t + \beta_4(Age)_t + \beta_5(Return\ on\ Assets)_t + \varepsilon_t.$$

The dependent variable is the number of lending relationships used by the respective farm for the given year with the independent variables being the year, current ratio, debt to asset ratio, age of farm operator and the return on assets for the respective farm.

For this model, it is expected that the coefficient of the year variable is positive since the average number of lending relationships has increased over the time period of this thesis. The sign for the current ratio and debt to asset variables should be opposite in value with the current ratio being negative and debt to asset being positive. Debt to asset should be positive since an increase in debt to asset indicates a worse financial position for the farmer which banking theory suggests will correlate to more lending relationships. The coefficient for age should be negative, since an older farmer should have less debt and fewer lending relationships. The coefficient for

return on assets should be negative as the more profitable the farm is relative to assets, the farm should need less liabilities.

To calculate the marginal effects for a Poisson model, the partial derivative of the equation must be taken with respect to the variable being analyzed. That is, $\frac{\partial e^{\beta' x_{it}}}{\partial x_{it}}$ yields $\beta e^{\beta' x_{it}}$ which is equivalent to $\beta \lambda_t$. Thus the marginal effect is the coefficient multiplied by the conditional mean, λ_t, of the model.

4.2.2 Fixed Effects Net Farm Income Model

When data are cross-sectional, that is, it represents multiple firms over time, the variance of the error terms of the model may be correlated with one of the dependent variables (Griffiths, Hill and Judge 1992). There are two different ways to correct for this complication: fixed effects and random effects. Both of these methods increase the efficiency of the estimation procedure. Since fixed effects is used in this thesis, only this procedure will be discussed below. For a more comprehensive overview of these methods please see Maddala and Lahiri (2009).

The fixed effects model, also known as the "least squares with dummy variables" (LSDV) model, assumes that there is no correlation between the error terms of the same cross sectional unit. For this thesis, the cross-sectional unit that defines a farm is the county in Kansas that the farm is located. This method estimates fixed constants for each of the cross-sectional units. From this, the parameter estimates are calculated and the overall constant for the model is determined (Maddala and Lahiri 2009).

Using the method above, the following fixed effects model was estimated:

$$(4.3)(Net\ Farm\ Income)_{it} = \beta_0 + \beta_1(Number\ of\ Lending\ Relationships)_{it} +$$

$$\beta_2(Current\ Ratio)_{it} + \beta_3(Debt\ to\ Asset)_{it} + \beta_4(Age)_{it} + \beta_5(VFP)_{it} + \mu_{it}$$

where β_0 is the averaged group constant and μ_t is the error term. In Equation (4.3), the subscript "i" signifies the cross-sectional group and "t" is the individual observations within the cross-sectional group.

For this model, the coefficient for number of lending relationships is expected to be negative due to an increase in transaction costs from having multiple lenders. In addition, less profitable farms are likely to have more relationships. The coefficient for value of farm production will be interpreted as the average profit margin, thus it will be positive and should be between the values of zero and one. It is unclear what value the debt to asset ratio will take. The assumption is made that extra debt is used for profitable capital expenses; however, extra debt increases the total costs of liabilities. The current ratio should have a positive coefficient as an increase in current assets relative to current liabilities should correlate to more profit.

A Hausman specification test will be used to test for the statistical significance of the fixed effects. The Hausman test is represented below:

$$(4.4)\left(\hat{\beta}_{Fixed} - \hat{\beta}_{Random}\right)'\left[\left(\hat{V}\left(\hat{\beta}_{Fixed}\right) - \hat{V}\left(\hat{\beta}_{Random}\right)\right]^{-1}\left(\hat{\beta}_{Fixed} - \hat{\beta}_{Random}\right),$$

where $\hat{\beta}_{Fixed}$ is a matrix of all the coefficients for the fixed effects model, $\hat{\beta}_{Random}$ is a matrix of all the coefficients for the random effects model and $\hat{V}(\hat{\beta}_{Fixed})$ and $\hat{V}(\hat{\beta}_{Random})$ are the variance matrices for the fixed and random effects models respectively. In the above test, the null hypothesis is that the independent variables and the error terms are independent, with the alternative hypothesis being that the independent variables and the error terms are not independent of each other. Having a Hausman test statistic higher than the critical value would

lead to the rejection of the null hypothesis and the use of the fixed effects model (Maddala and Lahiri 2009).

4.2.3 Discrete Choice Probit Model

When a dependent variable is binary, it can only take on the values of zero and one. Using Ordinary Least Squares (OLS) to estimate a linear probability model has several problems: 1) a linear model may result in a probability greater than one or less than zero, 2) the probability follows a non-linear relationship with the dependent variables, and 3) marginal effects are non-linear. Six models using a set of dependent variables that take on the value of "1" if the farmer has a loan with a particular type of lending institution and are "0" otherwise are estimated. This non-linear relationship of the discrete dependent variable and a set of continuous independent variables is modeled with binary choice methods.

A probit model is used for this analysis. A probit model is a non-linear statistical model that uses a binary variable for each individual observation. This is transformed by a cumulative distribution function. In the case of a probit model, the cumulative distribution function is the standard normal distribution. By using the cumulative distribution function, it creates a non-linear relationship between the binary dependent variable and also restricts the value of the expected probability of the dependent variable between zero and one, thus solving one of the problems of a linear probability model using OLS. The following model was estimated:

$$(4.5) P_{it} = F[\beta_{0,i} + \beta_{1,i}(Owned\ Land\ Inventory)_{it} + \beta_{2,i}(Machinery\ Inventory)_{it} +$$
$$\beta_{3,i}(Livestock\ Inventory)_{it} + \beta_{4,i}(Current\ Liabilities)_{it} +$$
$$\beta_{5,i}(Intermediate\ Liabilities)_{it} + \beta_{6,i}(Long - Term\ Liabilities)_{it} +$$

$$\beta_{7,i}(Operator\ Age)_{it} + \beta_{8,i}(Debt\ to\ Asset)_{it} + \beta_{9,i}(Current\ Ratio)_{it} +$$

$$\beta_{10,i}(Return\ on\ Assets)_{it} + \varepsilon_{it}].$$

In the model above, the subscript "i" represents the six lender types modeled and "t" is the individual observation for "i" lender. P_{it} is the probability that the "t" farm has a loan with "i" lender for the respective year, $F[\cdot]$ is the cumulative distribution function.

The three inventory variables will be positive or negative depending on the lender type being modeled. Each lender focuses on lending to different farmer needs, such as nontraditional focusing on machinery loans. The three liability categories will be positive or negative depending on the lender type being modeled as well. Each lender focuses on a different type of debt which leads these variables to vary from lender to lender. The coefficient for farm operator age should be negative as older farmers have less debt. Debt to asset should be positive for all models except for Farm Credit. A farmer who is more leveraged will be less likely to obtain credit from Farm Credit due to loan limits from smaller rural banks. Additionally, a higher debt to asset indicates a larger debt load which according to the banking theory discussed, would lead to a farmer having multiple lenders, thus increasing the probability of having a loan with all lender types. Current ratio follows the same theory as debt to asset ratio, except the sign is reversed.

To interpret the marginal effects of each independent variable on the dependent variable, a derivative of the cumulative distribution function must be taken with respect to the independent variable being observed.

(4.6) $$\frac{\partial P_i}{\partial x_{it}} = \frac{\partial F[\cdot]}{\partial x_{it}} = f(\boldsymbol{X}'_{it}\boldsymbol{\beta})\beta_i,$$

which is the density function multiplied by the coefficient of the independent variable (Griffiths, Hill and Judge 1992).

4.2.4 Loan Amount Two Step Heckman Model

One objective is to predict the dollar amount of loans a respective farmer will have given their financial characteristics. To address this objective a two step Heckman model was developed using the probit models. The two step Heckman model is used due to possible endogeneity within the model. If endogeneity is not present, then a tobit model could be used. This section will give a brief analysis of a tobit model, the problem that this model experiences, and a discussion of the two step Heckman model and the correction for endogeneity.

When a dependent variable is truncated, that is, the variable has many observations clustered around a limiting value; it presents several problems for the estimation. In this instance, there is a lower limit at the value of zero. The first problem is that an (OLS) regression will not show the true line of best fit. One alternative would be to "throw out" those observations that are below the limit and run an OLS on only those observations above the limit. While this method will estimate the true relationships for those observations above the limit, it is biased since all of the data are not used. It also reveals little about the observations at or below the limit.

One technique to account for this is tobit analysis. A tobit analysis uses a non-linear relationship to determine both the changes in the probability of being above the limit and the changes in the value of the dependent variable if it is already above the limit (McDonald and Moffitt 1980). The dependent variable is the dollar amount of loans the farmer has from that particular type of lender. Many of the observations for each dependent variable in this data set have the value of zero if the farmer does not have any loans with that type of lender. This makes

tobit analysis appropriate to use to estimate the probability the farmer has a loan with a particular type of lender and if they are above the limit, the change in the dollar amount of loans the farmer has given the respective financial characteristics of the farm.

Tobit analysis can be shown by two equations:

(4.7) $$if\ X\beta + \varepsilon > 0, then\ y = X\beta + \varepsilon$$

and

(4.8) $$if\ X\beta + \varepsilon \leq 0, then\ y = 0,$$

where X is a matrix consisting of the independent variables, β represents the coefficients for the independent variables and ε is the error term that has a normal distribution.

The set of variables that determine whether the respective farmer has a loan with a particular lending institution may be endogenous to the dependent variable, which is the dollar amount of loans the farmer has from the respective lender. This creates a selection bias within the model that must be corrected. To correct for that, the tobit model will be split into two parts with the first part being the probit model, the same models described previously. From these probit models, the inverse mills ratio is calculated. The inverse mills ratio is:

(4.9) $$\lambda_i = \frac{\phi\left(\frac{\beta' X_i}{\sigma}\right)}{\Phi\left(\frac{\beta' X_i}{\sigma}\right)}$$

where β is the vector of parameters and X is the vector of variables. This inverse mills ratio, is used in an OLS model for those non-truncated observations as a regressor. This gives the model below:

$$Y_i = B'X + \rho\sigma\lambda_i + \varepsilon_i. \tag{4.10}$$

for those observations above the limit of zero. The estimated model is:

$$(Loan\ Dollar\ Amount)_{it} = \beta_{0,i} + \beta_{1,i}(Owned\ Land\ Inventory)_{it} + \beta_{2,i}(Machinery\ Inventory)_{it} + \beta_{3,i}(Livestock\ Inventory)_{it} + \beta_{4,i}(Operator\ Age)_{it} + \beta_{5,i}(Debt\ to\ Asset)_{it} + \beta_{6,i}(Current\ Ratio)_{it} + \beta_{7,i}(Return\ on\ Assets)_{it} + \sigma\rho\lambda_i + \varepsilon_{it}. \tag{4.11}$$

For the Heckman model, the interpretation of the coefficients is that given the farmer has a loan with the respective lender type, the model predicts what the dollar amount of loan will be. Given this interpretation, it is expected that the three inventory variables will be positive. As a farm grows in size, the dollar amount of liabilities it has, on average, will be larger. The operator age variable should have a negative value since older farmers tend to have less debt. Debt to asset should be positive. Given that a farmer has a loan with the respective lender type, a higher debt to asset indicates the farmer is more leveraged and will thus have a bigger dollar amount of loans. The current ratio will have the same interpretation as the debt to asset variable with a negative sign. Return on assets will have a negative sign, as the more profitable a farm is, the less debt they may have due to the ability to finance from retained earnings.

The set of variables may be endogenous, and are removed from this model, are the amount of current liabilities, intermediate liabilities and noncurrent liabilities a farmer has. This endogeneity is from each of these variables, or the sum of these variables, being a function of the dependent variables, the dollar amount of loans from each lender type. These variables being a function of the dependent variable creates selection bias. That is, the farmer is assumed to self select what lender they will use based on their loan size. This endogeneity and self selection means that the true coefficients for the population are different than the sample estimates since the sample estimates are biased.

For more information on the Heckman two-step model, please see Heckman (1979).

4.3 Panel Data

To determine how a farms financial health correlates to the number of banks a farmer uses and how the number of banks correlates to net farm income is affected by farms appearing in certain years of the data (non-cross sectional data), a second data set was created. This second data set is a subset of the entire KFMA data that contains those farms that had data points in every year of the data set. The resulting data set comprises a panel of 101 farms from the years 2002 to 2010. The objective of this panel is to determine if the results are robust to entry and exit from the sample of farms.

Table 4-1, Variable Definitions

Variable Name	*Description*
Net Farm Income	Value of farm production less cash operating expenses less depreciation less accrued income-expense adjustment
Debt to Asset	Total liabilities divided by total assets
Current Ratio	Current assets divided by current liabilities
Operator Age	Primary farm operator age for year measured
Year	Year data is representing (Starting in 2002 as "1")
Number of Lending Relationships	Number of lending relationships a farm has
Value of Farm Production	Proxy for gross revenue of farm
Return on Assets	Net Farm Income plus interest less unpaid family labor and operator labor divided average total assets
Owned Land Inventory	Dollar amount of owned land
Machinery Inventory	Dollar amount of machinery
Livestock Inventory	Dollar amount of all breeding stock and feeders
Current Liabilities	Dollar amount of current liabilities
Intermediate Liabilities	Dollar amount of intermediate liabilities
Long-Term Liabilities	Dollar amount of noncurrent liabilities
Farm Credit	Value of 1 if farm has a loan with Farm Credit
Bank	Value of 1 if farm has a loan with bank
Nontraditional	Value of 1 if farm has a loan with a nontraditional lender
Credit Union	Value of 1 if farm has a loan with a credit union
Government	Value of 1 if farm has a loan with a government agency
Credit Card	Value of 1 if farm has a loan with a credit card
Farm Credit Dollars	Dollar amount of loans with a Farm Credit
Bank Dollars	Dollar amount of loans with a bank
Nontraditional Dollars	Dollar amount of loans with a nontraditional lender
Credit Union Dollars	Dollar amount of loans with a credit union
Government Dollars	Dollar amount of loans with a government agency
Credit Card Dollars	Dollar amount of loans with a credit card

Chapter 5 - Descriptive Results

This chapter will summarize the data used in this thesis. These summaries include the aggregate numbers for both the data set and the panel data set comprised of only farms with observations for all years. It will also include market share information for the different types of lenders in Kansas as well as information pertaining to the number of single banking relationships in Kansas. The lender types are Farm Credit, banks, nontraditional, credit union, government, and credit card. Table 5-1 has the descriptive statistics for each variable used in this thesis.

Market share numbers were calculated using two different methods. The first was calculated using the total number of lending relationships. The second method calculated market share as a function of the total dollar volume amount of loans. Figure 5-1 illustrates the market share for each lender type by the number of lending relationships from 2002 to 2010. Farm Credit and commercial banks are the predominant source of loans consisting of around 30% of relationships. After 2006, both Farm Credit and the banks share decline slowly through 2010. Commercial and rural banks were the market leader in 2002 with a share of 30.44% of the number of loans and ending at 27.18% in 2010. Farm Credit saw the same gradual decline in market share beginning with a 31.35% share of the market in 2002 increasing to 34.16% a year later. From 2003 to 2010, the Farm Credit share continued to decline, ending with a 27.27% share of the market in 2010. Nontraditional lenders share increased, starting at a 21.92% share of the relationships in the market in 2002 to 30.39% in 2010. In 2007, loans from government agencies, predominantly Farm Service Agency (FSA) and Federal Home Administration (FHA), increased from 8.24% of the market in 2007 to 11.30% in 2008. The two lowest categories for market share when analyzed by number of relationships are credit unions and credit cards. Both categories were below 5% for the duration of the thesis.

Figure 5-2 illustrates the market shares by the dollar volume amount that each lending institution holds. When calculated using dollar volume, market shares are quite different from those calculated in Figure 5-1. The commercial bank category has the highest share of loan volume starting with over half of the market at 59.75% in 2002. Over the nine years in this thesis, this decreased to 54.15% in 2010. This significant share of the market is further explained when looking at the average credit per farmer for a bank relationship. Banks have the highest credit sought with an average of $311,489 of credit per farmer. The average credit sought per lending institution is shown in Table 5-2. The second market leader is Farm Credit. Farm Credit held 27.53% of the market in 2002 and showed a slight increase through the time period ending with 31.04% of the market in 2010. Banks and Farm Credit have a negative correlation of -0.91 indicating that these two categories have replaced each other. Nontraditional lenders have a smaller portion of market share when analyzed by dollar volume. Nontraditional lender's market share increases from a market share of 4.84% in 2006 to 9.35% of the market in 2010.

The market share numbers for the panel data are represented in Figure 5-3 and Figure 5-4. There is little difference between the panel data market share numbers and the data set market share numbers. This slight difference indicates that the overall data set is robust from farms entering and exiting out of the data set. For the panel data set, the market share of nontraditional lenders decreased in both the dollar volume market share and the number of lending relationships market share.

Nontraditional lenders saw growth in the number of farmers that held debt. The average loan size for a nontraditional lender increased by nearly $30,000 from $26,450 in 2002 to $56,196 in 2010. This increase in loan size for nontraditional lenders indicates farmers are using nontraditional lenders more extensively.

Figure 5-5 shows the average number of lending relationships per farmer by lending institution type. The interpretation of this graph is any farmer who engages in a lending relationship with a nontraditional lender, will have 2.9 lending relationships on average. From Figure 5-5, it is shown that the farmers who engage in lending relationships with nontraditional lenders, credit unions and government agencies have the highest average for number of lending relationship with averages of 2.89, 2.71 and 3.00 respectively. Farmers who engage in lending relationships with a credit card, Farm Credit and banks have the lowest average for number of lending relationships at 2.00, 2.19 and 2.22 respectively. This is expected since Farm Credit and banks have the majority of the single banking relationships.

A point of interest in this thesis is the trend in single lending relationships for Kansas farmers. Figure 5-6 shows the percent of single lending relationships in Kansas by KFMA farms and compares this to the average debt to asset ratio for the entire KFMA data. This shows that the percent of single banking relationships remained stable during the years 2000 to 2010. The average debt to asset ratio over the same time period has declined. This indicates that as the aggregate financial health of the KFMA farms has improved, the relative amount of farms having single banking relationships has not changed. Most of these single banking relationships are held by the Farm Credit System and commercial banks. Figure 5-7 shows that single banking relationships are the most frequent with 49.59% of all farmers only having one banking relationship. Looking at the entire data set by year, Table 5-3 shows that the average number of lending relationships per farm has increased from 1.81 in 2001 to 1.97 in 2010, indicating that farmers are using more lending relationships to finance their farms.

Table 5-4 shows the descriptive statistics for those farms engaging in a single lending relationship and those farms with multiple lending relationships. Farmers with a single lending

relationship are smaller with an average of 928 crop acres compared to 1180 for those farms with multiple lending relationships. Farmers that engage in single banking relationships are also less leveraged with a debt to asset ratio of 0.23. Farmers with multiple lending relationships had an average of 0.35. Farmers who have a single lending relationship have $138,489 of total liabilities. Farmers who have multiple lending relationships have $282,729 of total liabilities. These averages show that farmers with a single lending relationship are, on average, less leveraged and smaller than those farmers with multiple lending relationships.

Table 5-1, Descriptive Statistics of Variables Used in Study

Variable	N	Mean	Std. Dev.	Min	Max
Net Farm Income	5298	67504.75	126360.4	-489041	1609500
Debt to Asset Ratio	5298	0.294596	0.510632	-0.022	15.2
Current Ratio	5298	16.94907	88.22948	-575.365	988.147
Operator Age	5298	56.26972	15.07355	0	92
Year	5298	5.313703	2.574714	1	9
Number of Lending Relationships	5298	1.828048	1.039375	1	7
Value of Farm Production	5298	273975.5	316029.8	-240423	4300000
Return on Assets	5298	0.011824	0.83292	-56.539	5.127
Owned Land Inventory	5298	495499.4	632274.7	0	1.14E+07
Machinery Inventory	5298	64099.21	74122.43	0	778044
Livestock Inventory	5298	64099.21	74122.43	0	778044
Current Liabilities	5298	78177.37	190148	-12771.9	5374631
Intermediate Liabilities	5298	43541.38	88434.95	0	1053706
Noncurrent Liabilities	5298	85900.88	165121.8	0	4333932
Farm Credit	5298	0.397509	0.489429	0	1
Bank	5298	0.388826	0.48753	0	1
Nontraditional	5298	0.308985	0.462118	0	1
Credit Union	5298	0.026425	0.160411	0	1
Government	5298	0.12835	0.334511	0	1
Credit Card	5298	0.023783	0.152386	0	1
Farm Credit Dollars	5298	58332.43	182001.1	0	5705358
Bank Dollars	5298	115352.7	243281.2	0	6945408
Nontraditional Dollars	5298	10992.13	40827.2	0	1218930
Credit Union Dollars	5298	402.253	3384.957	0	113382
Government Dollars	5298	11034.25	43654.51	0	739175
Credit Card Dollars	5298	238.9705	2713.415	0	63900.6

Table 5-2, Average Loan Amount per Lending Relationship

Year	Farm Credit	Banks	Nontraditional	Credit Union	Government	Credit Card
2002	$116,592.17	$246,017.93	$26,450.24	$17,703.84	$83,682.25	$16,028.19
2003	$144,195.13	$249,998.88	$24,664.35	$16,155.71	$67,085.31	$9,785.06
2004	$135,904.82	$266,769.71	$30,162.87	$16,649.59	$86,120.39	$9,043.94
2005	$136,654.76	$301,462.75	$31,173.90	$16,055.98	$92,468.82	$15,610.70
2006	$140,976.45	$325,620.19	$27,895.70	$14,621.13	$87,183.25	$14,837.55
2007	$137,682.43	$319,021.86	$33,535.42	$12,127.39	$103,736.37	$5,052.62
2008	$215,071.89	$354,811.20	$49,227.45	$12,676.97	$80,999.42	$11,380.28
2009	$264,823.09	$376,132.04	$58,870.24	$12,206.29	$92,088.73	$18,790.74
2010	$207,005.09	$363,566.74	$56,196.31	$14,966.53	$88,921.61	$7,862.14
Average	$166,545.09	$311,489.03	$37,575.17	$14,795.94	$86,920.68	$12,043.47

Table 5-3, Number of Loans Per Farm and Lending Relationships Per Farm by Year

Year	# Farms	#Loans	Number of Loans/Farm			Number of Lending Relationships/Farm		
			Min	Max	Average	Min	Max	Average
2002	507	1560	1	11	3.08	1	7	1.81
2003	445	1395	1	13	3.13	1	6	1.79
2004	570	1848	1	12	3.24	1	6	1.79
2005	575	1904	1	22	3.31	1	7	1.76
2006	576	1911	1	13	3.32	1	6	1.70
2007	625	2203	1	17	3.52	1	7	1.91
2008	617	1727	1	12	1.18	1	6	1.80
2009	651	1868	1	12	1.26	1	6	1.83
2010	732	2452	1	13	1.79	1	7	1.97

Table 5-4, Descriptive Statistics Between Farms with Single Lending Relationships and Multiple

Variable	Single Banking Relationships		Multiple Lending Relationships	
	Mean	Median	Mean	Median
Number of Farms	2628	--	2670	--
Net Farm Income	$61,968.10	$32,281	$72,954.30	$41,755.06
Total Liabilities	$138,489	$54,960.68	$282,729	$188,205.6
Crop Acres	928	650	1180	941
Operator Age	58	60	55	55
ROA	1.7%	0.01	0.6%	0.02
Current Ratio	24.13	1.19	9.87	1.49
Debt to Asset	0.23	0.09	0.35	0.29
Debt to Equity	0.18	0.08	1.27	0.35

Figure 5-1, Market Share by Lending Relationships (Full Data)

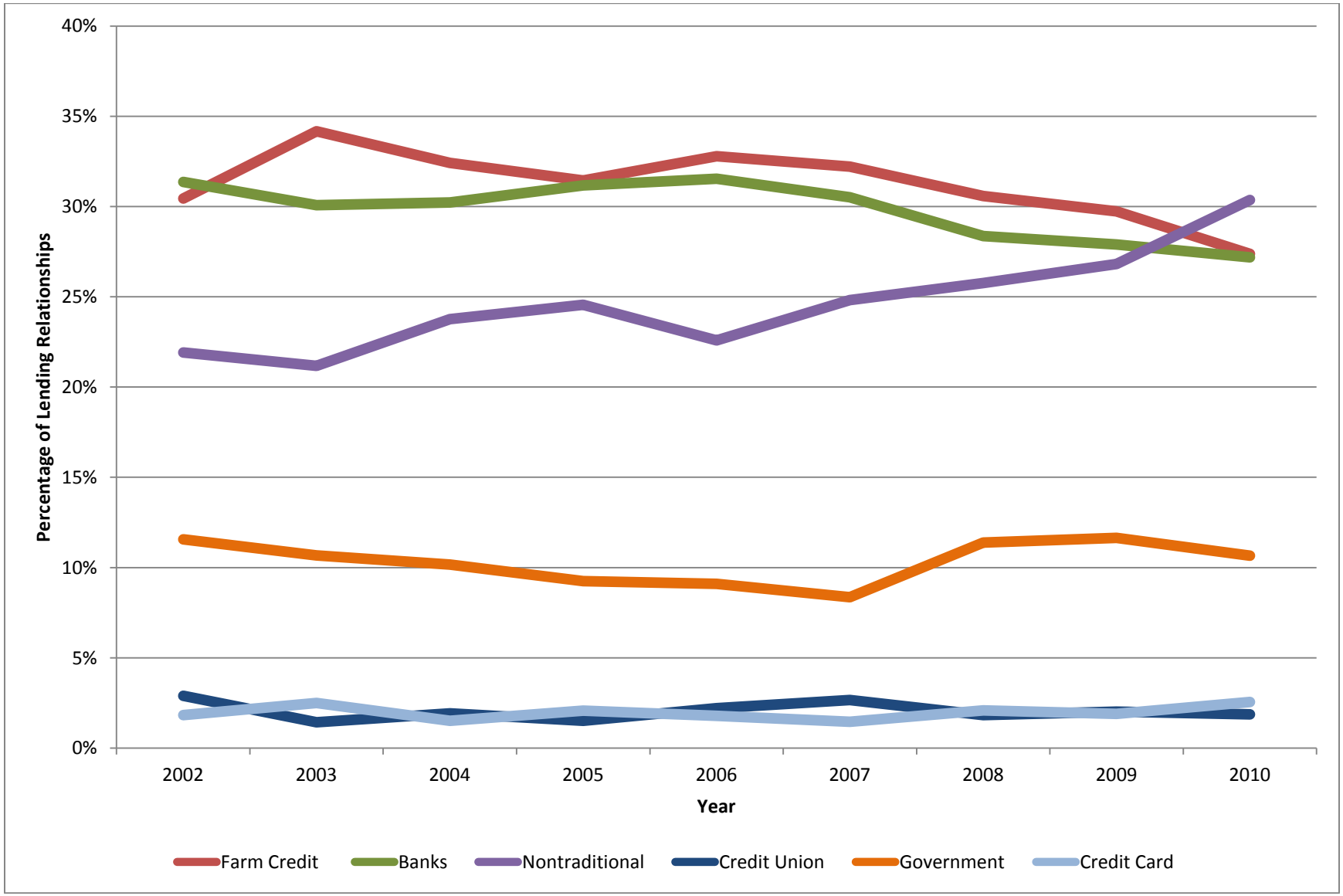


Figure 5-2, Market Share by Dollar Volume Amount (Full Data)

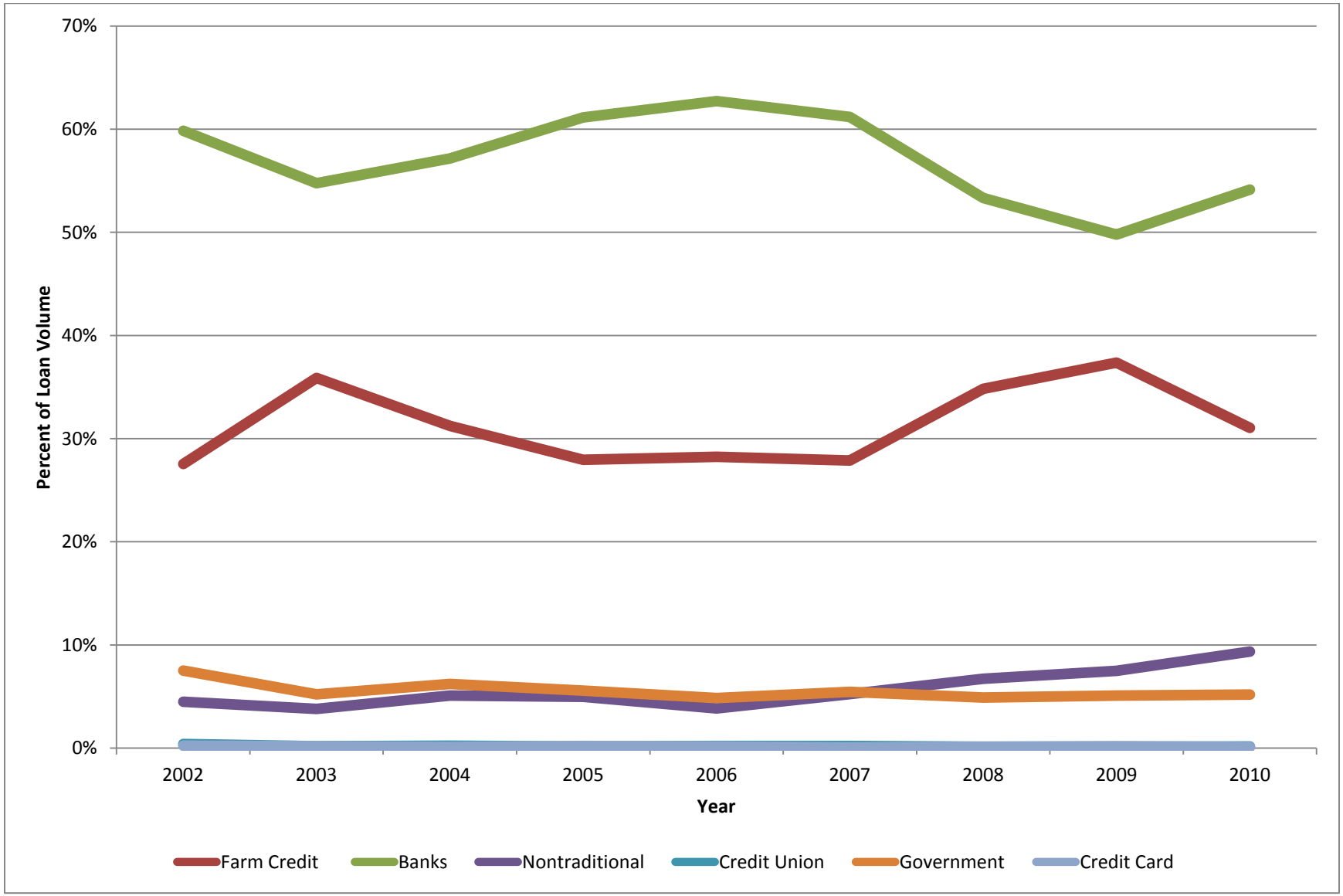


Figure 5-3, Market Share by Lender Relationships (Panel Data)

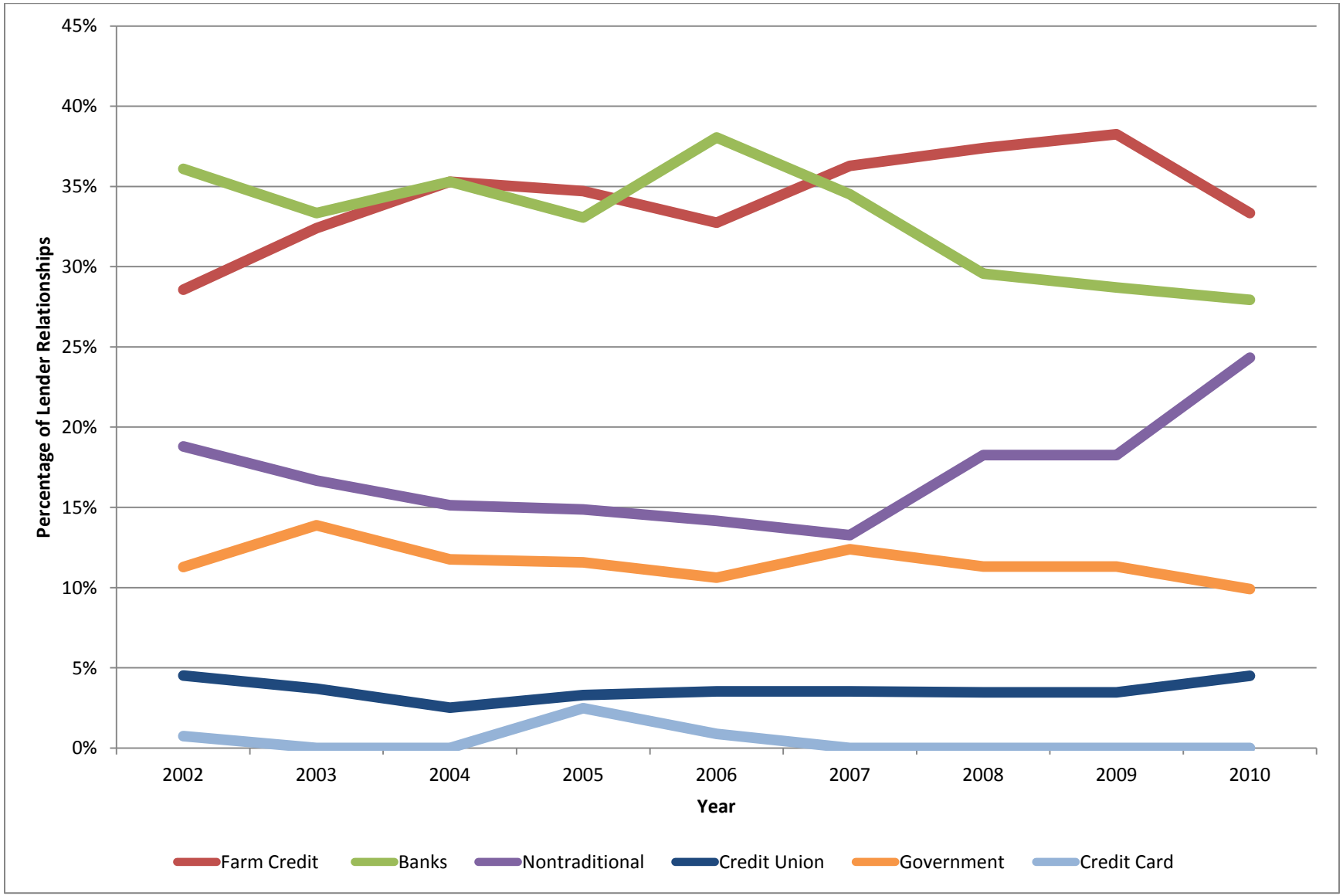


Figure 5-4, Market Share by Dollar Volume Amount (Panel Data)

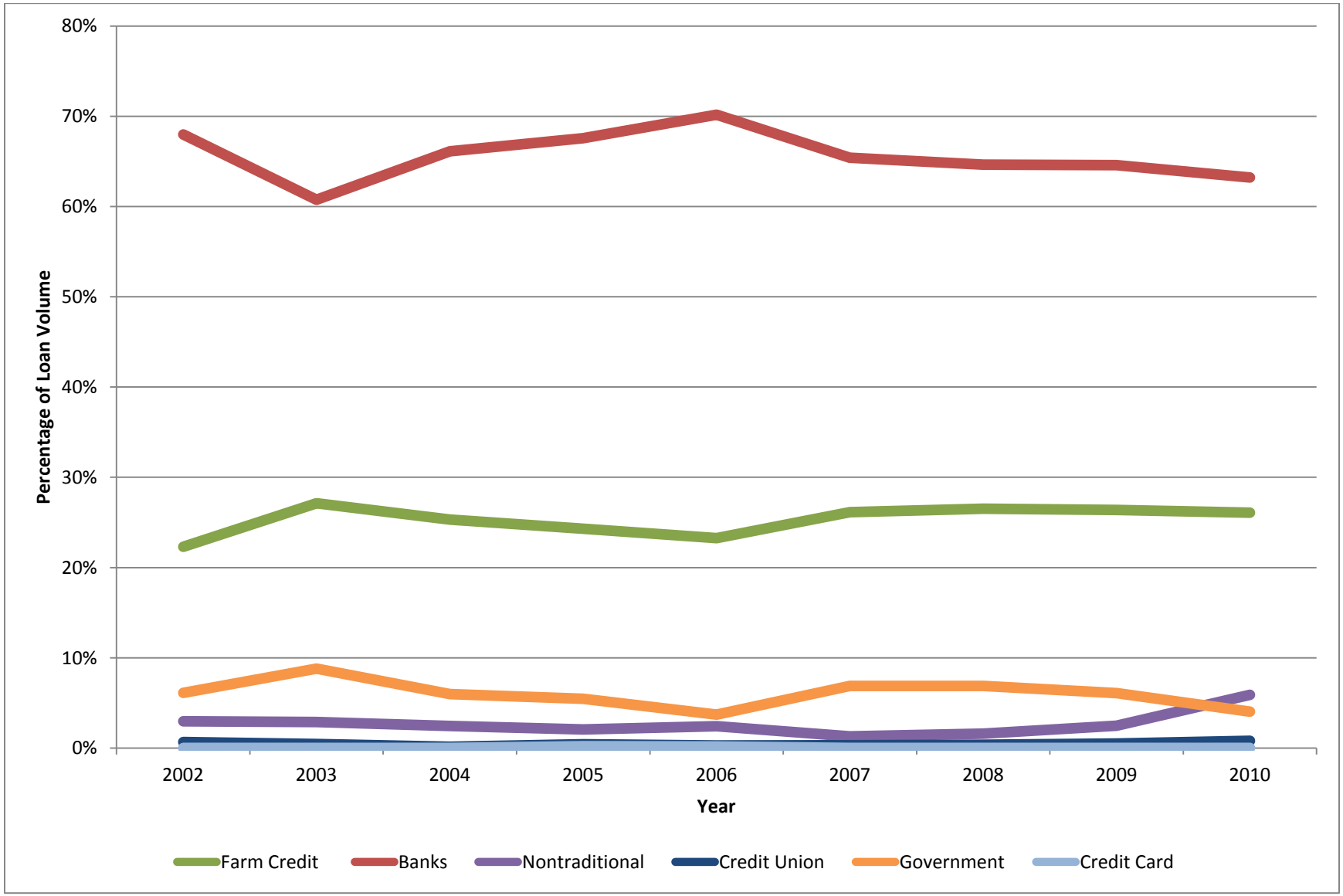


Figure 5-5, Average Number of Lending Relationships per Farmer by Lending Institution Type

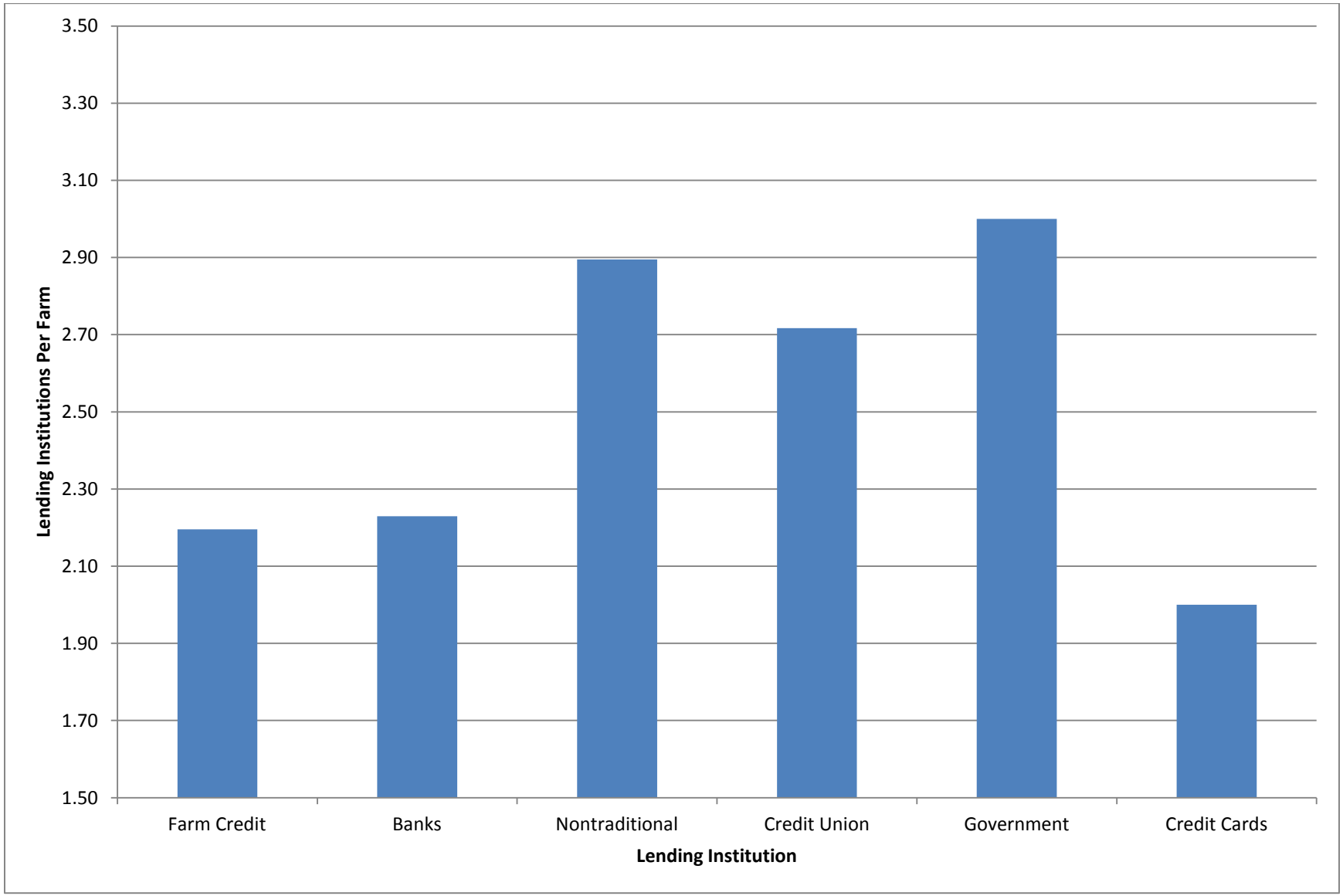


Figure 5-6, Percent of Farms Engaging in a Single Lender Relationship by Year and Average Debt to Asset Ratio

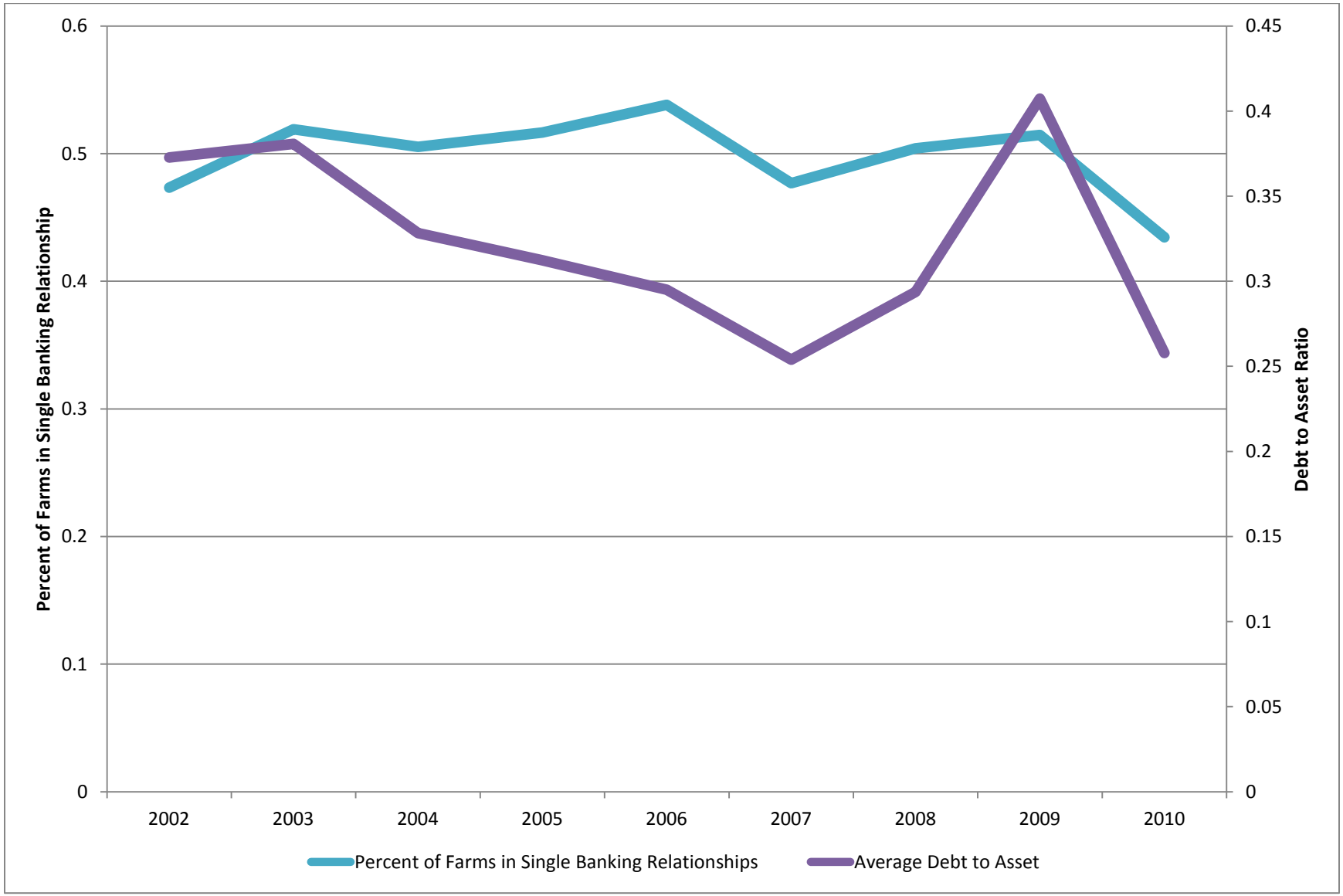
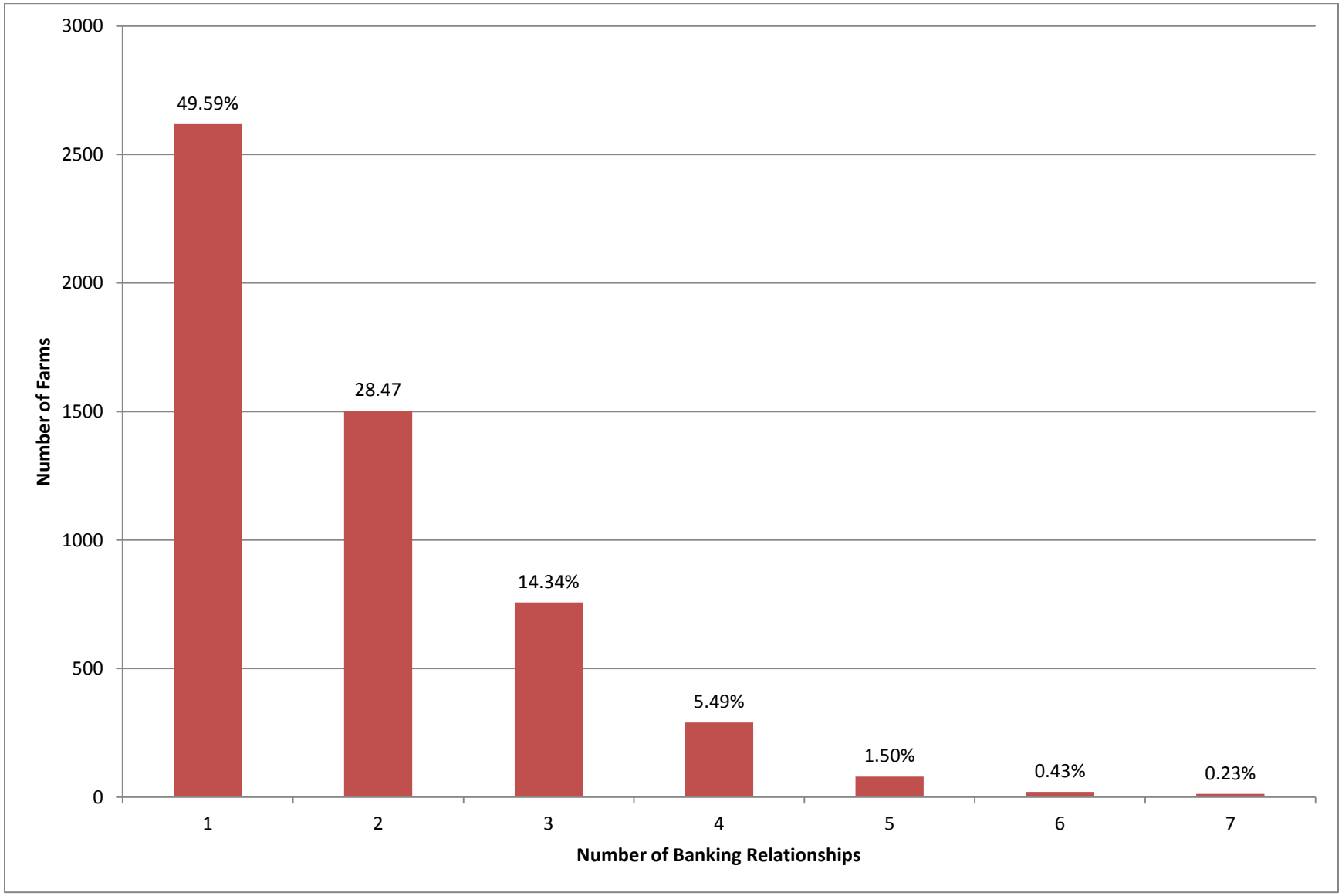


Figure 5-7, Distribution of Banking Relationships



Chapter 6 - Econometric Results

This chapter will discuss the results from the models developed in Chapter 5.. The tables for all model results, marginal effects and probability predictions discussed in this chapter are at the end of the chapter. Additionally, other results not discussed in this chapter may be found in the Appendices.

6.1 Net Farm Income Model Results

Table 6-1 and Table 6-2 contain the output for the net farm income models using the full data set and the panel data set, respectively. The purpose of these models was to determine whether the number of lending relationships a farmer has is correlated to the profitability of the farm.

The most statistically significant coefficient is that of gross farm income (value of farm production) with a value of 0.32. This value can be interpreted as the "average profit margin" for the farms. The coefficient for the number of lending relationshipa a farmer uses is negative at -2,504.83, indicating that the more lending relationships that a farmer has, the less profit the farmer has for the respective year. Another statistically significant coefficient at the 5% level is that of the debt to asset ratio. Debt to asset has a coefficient of -55,500.20. This result means that the higher the debt load, the less profitable they are. The other statistically significant coefficient was for the age of the operator with a value of -377.59. This negative value for age indicates that the older the farmer is, the less profitable they are.

For the panel data, no variable became statistically insignificant that was statistically significant in the previous model. Additionally, no variables switched from positive to negative or vice versa. This indicates that the model utilizing the full data set is not significantly affected by the entrance or leaving of farms from year to year.

6.2 Number of Lending Relationships Model Results

Table 6-3 and Table 6-4 contain the output for the number of lending relationships model using the full data set and the panel data, respectively. The results from this model show that some farm characteristics are correlated with the number of lending relationships a farmer has. Statistically significant at the 95% confidence level were the variables: year, current ratio, debt to asset ratio, and the constant term.

The debt to asset ratio has a coefficient of 0.55. The positive value for the debt to asset ratio indicates that Kansas farmers have more banking relationships on average as they become more leveraged financially, consistent with the theoretical model. A firm has additional banking relationships as the farm becomes more risky. These results show that as the farmer becomes more leveraged and is thus more risky, the farmer will seek additional lending relationships.

The current ratio and year were also statistically significant factors in determining the number of lending institutions a Kansas farmer has. The coefficient for the current ratio was negative. The more current assets the farmer has relative to their current debt, the fewer banking relationships the respective farmer will have. The coefficient for the year had a positive coefficient. This positive coefficient shows that there was a significant time trend and that on average, the number of lending institutions a Kansas farmer has increased during the duration of this thesis.

One caveat of this thesis is that it cannot be determined what exactly drives the farmer to seek additional lending relationships. Does a farmer who is more leveraged seek these additional lending relationships without outside influence or does their first lending institutions decline additional credit that is requested forcing the farmer to seek credit from another lending institution. The value and significance of the debt to asset variable in this thesis shows a high

positive correlation between the debt to asset ratio of a respective farmer and the number of lending institutions that a farmer utilizes. Additionally, the negative value of the current ratio further supports this conclusion as the higher the current ratio the healthier financially, in the short term, the farm is.

The panel data model had one change in sign for the variables for the return on assets variable; however, return on assets was not statistically significant in either model. Additionally, there were only small differences in magnitude of partial derivatives for each variable. The only variable that was statistically significant in the full data set and not statistically significant in the panel data set was that for the current ratio. However, the sign still supports the theoretical model.

6.3 Probit Model Results

Table 6-5 through Table 6-16 contain the output for the discrete choice probit models. This includes all coefficient estimates and their corresponding standard errors (tables ending in odd numbers) as well as the marginal effects for each variable and the corresponding standard errors (tables ending in even numbers). These models show the effect of the explanatory variables on the probability that the respective farmer has at least one loan with a particular lending institution. All marginal effects are the partial derivative of the function with respect to the variable of interest evaluated at the mean value.

6.3.1 Farm Credit

The results for the Farm Credit probit model are in Table 6-5 and Table 6-6. Seven variables for the Farm Credit probit model were statistically significant at the 95% confidence level. Those variables were: land owned inventory, livestock inventory, long-term liabilities, operator age, debt to asset, return on assets and the intercept. The most statistically significant

variable was the dollar amount of long-term liabilities that a Kansas farmer has for the respective year. This indicates that the more long-term liabilities a farmer has, the more likely that farmer is to have a loan through Farm Credit. The dollar amount of current and intermediate liabilities were not statistically significant.

Among the three asset inventory variables, the dollar amount of land owned by the farmer and the dollar amount of livestock owned by the farmer were statistically significant at the 99% confidence level (Table 6-5). The coefficient for land owned is positive indicating that the more land a Kansas farmer owns, the more likely they are to do business with Farm Credit. This model was the only model to have a positive coefficient for the owned land inventory variable. Alternatively, the coefficient for livestock inventory was negative, thus the higher the dollar amount of livestock owned, the less likely the farmer has a loan with Farm Credit. The dollar about of machinery inventory for a farmer was not statistically significant.

The debt to asset variable is statistically significant at the 99% confidence level and negative. The negative coefficient for debt to asset indicates that farmers that are more leveraged, thus viewed as riskier for the lending institution to lend to, are less likely to have a loan with Farm Credit. The marginal effect of the debt to asset variable is largest for the Farm Credit model (Table 6-6). An increase in the debt to asset variable from 0.1 to 0.5 decreases the probability a farmer has a loan with Farm Credit by 4.1%. The age of the farm operator was statistically significant and positive. The older the farmer, the more likely they will have a loan with Farm Credit.

6.3.2 Banks

Nine variables for the bank probit model were statistically significant at the 95% confidence level (Table 6-7). First, the three asset inventory variables were all significant and

negative, indicating that the more assets the farmer has, the less likely they are to borrow from a bank. Additionally, the three liability categories were statistically significant at the 99% confidence level and positive. Intermediate liabilities had the largest marginal effect of the three categories with noncurrent liabilities having the smallest (Table 6-8).

The debt to asset coefficient was significant and positive (Table 6-7). Farmers that are more leveraged have a higher probability of using a bank. The coefficient for the current ratio was significant and negative indicating that farmers that are more solvent are less likely to have a loan from a bank. This result is from commercial and rural banks lending the most, in terms of dollar amount, of current liabilities and lines of credit for farmers, as shown in Table 5-2. The age of the farm operator was also statistically significant, with a negative coefficient indicating that the older the farmer, the less likely they have a loan with a bank. The profitability ratio for this model, return on assets, was not statistically significant.

6.3.3 Nontraditional

In the nontraditional model, six variables were statistically significant at the 95% confidence level (Table 6-9). The dollar amount of machinery inventory was statistically significant and positive. This result is not surprising since many lenders that are classified as nontraditional are equipment dealerships offering financing for the products they sell. The marginal effect of machinery inventory on the probability was large as well (Table 6-10). A farmer with $1,000,000 in machinery inventory has a probability of 94% of having a loan from a nontraditional lender. Farmers with $100,000 in machinery inventory have a probability of 33%, a difference of 64%. The coefficient for owned land inventory is negative. Again, from nontraditional lenders lending primarily for their own goods and services and most nontraditional

lenders being equipment dealers, land owned inventory being negative makes sense since equipment dealers do not usually provide credit for land purchases.

For the three liability variables, only the intermediate liabilities variable was statistically significant (Table 6-9). Just like for the machinery inventory variable, since most of the lenders classified as nontraditional are equipment dealerships, this result is expected. Additionally, loans for land are classified as long-term liabilities and nontraditional lenders typically only lend credit for those goods or services which they offer. Intermediate liabilities has a large effect on the probability that a farmer would have a loan from a nontraditional lender. A farmer with zero dollars of intermediate liabilities had a 27% chance of doing business with a nontraditional lender. That probability increased to 91% if the farmer had $1,000,000 of intermediate loans, an increase of 64% probability.

The age of the farm operator was statistically significant and negative. Older farm operators are less likely to obtain their credit through a nontraditional lender. The results for the debt to asset variable and the current ratio, are opposite, in terms of statistical significance, from the results shown for Farm Credit and the banks category. For this model, the debt to asset variable was not statistically significant and the current ratio was statistically significant showing that farmers who have less liquidity are less likely to have a loan with a nontraditional lender. This signifies that the overall debt and financial health is less important to someone who is obtaining credit from a nontraditional lender because that debt is tied to a piece of collateral that is easily sellable.

6.3.4 Government

For the government probit model, a total of seven variables were statistically significant at the 95% confidence level (Table 6-11). For the three inventory variables, the dollar amount of

land owned and machinery inventory were statistically significant with both variables having a negative coefficient. The coefficient for age was statistically significant with a negative value. This indicates that smaller farms that are less established are more likely to have a loan through a government agency.

Of the three liability variables, both intermediate liabilities and long-term liabilities were statistically significant and positive at the 95% confidence level. The current liabilities variable was not statistically significant. These results reflect that FHA and FSA land loans that are classified as government in this data are intermediate and noncurrent. Additionally, the debt to asset variable was positive and statistically significant indicating those farmers with more debt relative to their assets are more likely to use a government agency as a source of credit. The marginal effects are reported in Table 6-12

6.3.5 Credit Card

The results for the credit card probit model, while statistically significant according to the chi squared probability, should be looked at with caution (Table 6-13). Only two variables, land owned inventory and the constant term, were statistically significant at the 95% confidence level. There were only 126 observations out of the possible 5298 that had a loan through a credit card. The land owned inventory variable was statistically significant and negative. Additionally, besides these two variables, the dollar amount of current liabilities was statistically significant at the 90% confidence level with a positive value. Since credit cards are inherently current liabilities, the positive coefficient for this particular variable is expected. The marginal effects are reported in Table 6-14.

6.3.6 Credit Union

The credit union probit model exhibited some of the same problems as the credit card model. There were 140 observations out of 5298 with a loan from a credit union. This model had two variables, machinery inventory and the constant, statistically significant at the 95% confidence level and another variable, livestock inventory, statistically significant at the 90% confidence level. All three inventory variables were negative, indicating that larger farmers who own more assets are less likely to utilize a credit union as a source of credit. The marginal effects are reported in Table 6-16.

6.4 Marginal Effects of Predicted Probabilities for Probit Models

This section discusses the marginal effects of the predicted probabilities for the probit models. The marginal effects for each variable on each lender type are found in Figure 6-1 through Figure 6-10. These marginal effects were calculated by varying each variable from its approximate minimum in the data set to its approximate maximum in the data set with all other variables held at their mean. This allows us the examination of how the probability of having a loan with a lender type changes as the variable goes from its minimum to its maximum. By approximate minimum and maximum, it is meant that the minimum and maximum was rounded to the nearest significant interval. For instance, in the data, the maximum amount of intermediate liabilities of $1,053,706 was rounded to an even $1,000,000 for calculating the probability.

Figure 6-1 through Figure 6-3 examine the change in probability when changing the three inventory variables. Figure 6-1 shows the effect of dollar amount of owned land on the probability a farmer has a loan with a specific lender type. It is shown that as the dollar amount of owned land increases from $0 to $4,000,000, there is a negative correlation between Farm Credit and both banks and nontraditional lenders. This indicates that Farm Credit replaces

relationships with banks and nontraditional lenders as the dollar amount of owned land increases. When varying machinery inventory, there is negative correlation between nontraditional lenders and banks (Figure 6-2). As the dollar amount of machinery inventory increases, farmers are more likely to use a nontraditional lender than a bank for their credit. As the dollar amount of livestock inventory increases, all lender types decrease in probability (Figure 6-3). This indicates that farmers with a larger inventory of livestock do not need credit or may have funding sources not included in this thesis.

Figure 6-4 through Figure 6-6 examine the change in probability of having a loan with a specific lender when changing the three liability variables. When the dollar amount of current liabilities increases the only lender type to exhibit a decrease in probability is Farm Credit (Figure 6-4). When increasing the dollar amount of intermediate liabilities, the categories of banks, nontraditional and government lender types see large increases in probability, indicating that these three lenders loan a significant portion of the intermediate liabilities (Figure 6-5). The dollar amount of long-term liabilities increased the probability a farmer has debt with the respective lender type for Farm Credit, banks, government agencies and credit unions (Figure 6-6).

As the age of the farmer increases, the only lender type to have a decrease in probability is Farm Credit (Figure 6-7). As the debt to asset variable increases, there is a negative correlation between the probability the farmer has a loan with either Farm Credit and nontraditional lenders or a bank (Figure 6-8). Both Farm Credit and nontraditional lenders show that as the debt to asset ratio increases, the farm is less likely to have a loan through these two lender types, indicating that they are risk averse and that highly leveraged farmers to not seek credit through Farm Credit or a nontraditional lender. The current ratio indicates that as the short term position of the farm

gets better, the farm is less likely to have a lending relationship with all categories of lenders (Figure 6-9). As the profitability variable, return on assets, increases so that the farm is more profitable, the probability that the farm has a loan with a Farm Credit or a government agency increases. While this increase agrees with previous findings for Farm Credit, the increase in government lending type is somewhat surprising.

6.5 Heckman Model Results

The next set of models predict the dollar amount of loans that a farmer has with a respective lender type based on the various farm variables. These models use information from the previous probit models to correct for the selection bias that is present in these models using the inverse mills ratio as a monotonically decreasing function of the probability the observation is selected into the sample. Using this ratio as a regressor, these models predict the dollar amount of loans a respective farmer has with a lending institution given characteristics of the farm. The interpretation of the results for this set of models is that given the farm has a loan with this particular lender, this is the size of borrowing from that lender type.

6.5.1 Farm Credit

Eight variables were statistically significant at the 95% confidence level for the Farm Credit model (Table 6-17). The most statistically significant variable was that of debt to asset ratio for the farm with a positive coefficient. The current ratio was not statistically significant for this model. The age of the farm operator had a negative value of 2,800.66. For every year older a farm operator is, this corresponds to $2,801 less loan dollars they have with Farm Credit. The value of the coefficient on the inverse mills ratio (lambda) was statistically significant and negative. Thus, it can be concluded that selection bias was present in the sample.

The three inventory variables were all statistically significant at the 95% confidence level and had positive coefficient values. Thus the larger the farmer, the greater the dollar amount of loans they will have with Farm Credit. The most significant of these variables was that of owned land inventory. For every $1.00 increase in owned land inventory, the dollar amount of loans from Farm Credit increases by $0.10.

6.5.2 Banks

The Heckman model for banks had six variables statistically significant at the 95% confidence level (Table 6-18). Lambda was statistically significant and negative indicating that selection bias was present. The age of the farm operator was statistically significant and positive. A one year increase in the age of the farm operator results in $2,521 more in loans from a bank. For this model, the debt to asset ratio was not statistically significant; however, the current ratio of the respective farmer was statistically significant at the 90% confidence level with a positive coefficient. This indicates that banks focuse on the short term position of the firm.

All three inventory variables were statistically significant and positive. The more assets a farmer has, the larger the borrowing will be from a bank. The most statistically significant of these variables was the dollar amount of livestock inventory, for every $1.00 increase in livestock inventory, the dollar amount of loans from a bank increases by $0.68.

6.5.3 Nontraditional Lenders

Three variables were statistically significant at the 95% confidence which were the land owned inventory, the constant term and lambda (Table 6-19). Two variables, current ratio and operator age, were statistically significant at the 90% confidence interval for the nontraditional lender Heckman model. Lambda was statistically significant and negative indicating that selection bias was present in the model. The current ratio had a positive value. A farmer who has

more current assets relative to current liabilities and is more solvent, has a higher dollar amount of credit from a nontraditional lender. Farm operator age had a positive coefficient. Older farmers that utilize nontraditional lenders borrow $413 more with an increase of one year in age.

Of the three inventory variables, only owned land was statistically significant. Machinery inventory was not statistically significant. The dollar amount of machinery inventory not being statistically significant is contrary to what is expected since nontraditional lenders mainly lend to farmers for the purchase of machinery. Thus, given the farmer uses a nontraditional lender as a source of credit, the dollar amount of machinery that respective farmer has does not reflect the dollar amount of loans the farmer has with the nontraditional lender.

6.5.4 Government Agencies

For the government agency Heckman model, three variables were statistically significant at the 95% confidence level (Table 6-20). These variables were the land owned inventory, the constant term and lambda. One other variable, return on assets, was statistically significant at the 90% confidence level. Lambda was statistically significant and negative indicating that selection bias was present in the model. Land owned inventory had a positive coefficient. Return on assets had a negative coefficient, thus, the more profitable a farmer is relative to their assets, the less dollar amount of loans a farmer has with a government agency.

6.5.5 Credit Card

The credit card Heckman model had three variables statistically significant at the 95% confidence level (Table 6-21). These variables were operator age, debt to asset ratio and return on assets. Operator age had a positive value for the coefficient. The older the farm operator, the higher dollar amount of loans from a credit card a Kansas farmer has. Debt to asset ratio also had a positive value. The more leveraged a Kansas farmer is, the higher the dollar amount of loans

from a credit card they will have. Lambda was not statistically significant indicating there was no selection bias present for farmers who use credit cards as a source of credit.

6.5.6 Credit Unions

The Heckman model for credit unions had no variables statistically significant at the 95% confidence level with the model being not statistically significant with a probability of greater than chi square of 0.334 (Table 6-22). Lambda was not statistically significant indicating there was no selection bias present in the model. The debt to asset ratio was positive, the more leveraged the farmer is, the higher the dollar amount borrowed from a credit union. The current ratio concurred with a negative coefficient, the worse the short term position of the farmer, the more loans the farmer has with a credit union.

Table 6-1, Net Farm Income Model (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Number of Lending Relationships	-2504.83	1090.09	-2.30	0.02
Gross Income	0.32	0.003	91.90	0.00
Operator Age	-377.59	73.93	-5.11	0.00
Current Ratio	12.65	11.99	1.05	0.29
Debt to Asset Ratio	-55500.20	3785.06	-14.66	0.00
Constant	21245.38	5153.66	4.12	0.00

Variance is clustered by the county each farm is located in

Hausman test statistic of 18.03

5298 Observations

R-Squared of 0.62

Table 6-2, Net Farm Income Model (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Number of Lending Relationships	-6455.034	2107.424	-3.06	0.002
Gross Income	0.425	0.013	33.62	0.000
Operator Age	-259.357	140.897	-1.84	0.066
Current Ratio	16.132	17.831	0.90	0.366
Debt to Asset Ratio	-7635.821	2520.949	-3.03	0.003
Constant	-3744.746	9769.561	-0.38	0.702

Variance is clustered by the county each farm is located in

Hausman test statistic of 22.64

910 Observations

R-Squared of 0.58

Table 6-3, Poisson Model Count Data for Number of Lending Relationships (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|	Partial Derivative
Year	0.017	0.004	4.25	0.000	0.007
Current Ratio	-0.0004	0.0001	-2.67	0.008	-0.0006
Debt to Asset Ratio	0.550	0.042	13.11	0.000	0.991
Operator Age	-0.001	0.0007	-1.57	0.115	-0.002
Return on Assets	-0.002	0.012	-0.13	0.897	-0.003
Constant	0.415	0.055	7.57	0.000	-

Prob>Chi Squared=0.000

Mean of Prediction (λ_i)= 1.801

Table 6-4, Poisson Model Count Data for Number of Lending Relationships (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|	Partial Derivative
Year	0.009	0.011	0.88	0.377	0.015
Current Ratio	-0.0001	0.0002	-0.47	0.640	-0.0002
Debt to Asset Ratio	0.488	0.113	4.33	0.000	0.77
Operator Age	-0.001	0.002	-0.58	0.559	-0.002
Return on Assets	0.237	0.232	1.02	0.306	0.376
Constant	0.373	0.161	2.33	0.020	-

Prob>Chi Squared=0.00

Mean of Prediction (λ_i)= 1.588

Table 6-5, Probit Model, Farm Credit (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	1.14e-07	3.50e-08	3.27	0.001
Machinery Inventory	2.74e-07	2.89e-07	0.95	0.344
Livestock Inventory	-3.84e-07	1.28e-07	-3.00	0.003
Current Liabilities	-1.79e-07	1.52e-07	-1.18	0.238
Intermediate Liabilities	1.35e-07	2.29e-07	0.59	0.555
Long-Term Liabilities	1.74e-06	1.46e-07	11.93	0.000
Operator Age	0.004	0.001	3.40	0.001
Debt to Asset Ratio	-0.230	0.052	-4.39	0.000
Current Ratio	-0.00007	0.0002	-0.36	0.718
Return on Assets	0.227	0.092	2.47	0.013
Constant	-0.624	0.079	-7.90	0.000

Dependent variable was “1” if farm had a loan from a Farm Credit

Prob>Chi Squared=0.00

5298 Observations

Table 6-6, Marginal Effects, Farm Credit Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	4.40e-08	1.35e-08	3.27	0.001	495499.00
Machinery Inventory	1.05e-07	1.11e-07	0.95	0.344	64099.20
Livestock Inventory	-1.48e-07	4.93e-08	-3.00	0.003	95357.00
Current Liabilities	-6.90e-08	5.85e-08	-1.18	0.238	78177.40
Intermediate Liabilities	5.19e-08	8.8e-08	0.59	0.555	43541.40
Long-Term Liabilities	6.71e-07	5.63e-08	11.92	0.000	85900.90
Operator Age	0.002	0.0005	3.40	0.001	56.27
Debt to Asset Ratio	-0.089	0.020	-4.40	0.000	0.29
Current Ratio	-0.00003	0.00008	-0.36	0.718	16.95
Return on Assets	0.087	0.035	2.47	0.013	0.01

Table 6-7, Probit Model, Banks (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-1.62e-07	3.62e-08	-4.48	0.000
Machinery Inventory	-1.80e-06	3.09e-07	-5.83	0.000
Livestock Inventory	-2.69e-07	1.18e-07	-2.28	0.023
Current Liabilities	7.33e-07	1.47e-07	4.99	0.000
Intermediate Liabilities	3.27e-06	2.47e-07	13.28	0.000
Long-Term Liabilities	9.77e-07	1.21e-07	8.06	0.000
Operator Age	-0.004	0.001	-3.47	0.001
Debt to Asset Ratio	0.148	0.037	3.99	0.000
Current Ratio	-0.001	0.0003	-4.06	0.000
Return on Assets	0.009	0.025	0.37	0.710
Constant	-0.140	0.077	-1.83	0.068

Dependent variable was “1” if farm had a loan from a Commercial Bank

Prob>Chi Squared=0.00

5298 Observations

Table 6-8, Marginal Effects, Banks Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	-6.19e-08	1.38e-08	-4.48	0.000	495499.00
Machinery Inventory	-6.88e-07	1.18e-07	-5.83	0.000	64099.20
Livestock Inventory	-1.03e-07	4.52e-08	-2.28	0.023	95357.00
Current Liabilities	2.80e-07	5.61e-08	4.99	0.000	78177.40
Intermediate Liabilities	1.25e-06	9.44e-08	13.24	0.000	43541.40
Long-Term Liabilities	3.73e-07	4.63e-08	8.06	0.000	85900.90
Operator Age	-0.001	0.0005	-3.47	0.001	56.27
Debt to Asset Ratio	0.056	0.014	3.99	0.000	0.29
Current Ratio	-0.0004	0.0001	-4.06	0.000	16.95
Return on Assets	0.004	0.009	0.37	0.710	0.01

Table 6-9, Probit Model, Nontraditional Lenders (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-1.07e-07	3.59e-08	-2.97	0.003
Machinery Inventory	2.23e-06	2.85e-07	7.84	0.000
Livestock Inventory	-1.74e-07	1.19e-07	-1.46	0.145
Current Liabilities	2.14e-07	1.53e-07	1.40	0.162
Intermediate Liabilities	1.98e-06	2.28e-07	8.66	0.000
Long-Term Liabilities	-6.90e-08	1.29e-07	-0.53	0.593
Operator Age	-0.005	0.001	-3.64	0.000
Debt to Asset Ratio	-0.092	0.050	-1.85	0.065
Current Ratio	-0.0008	0.0002	-3.25	0.001
Return on Assets	0.019	0.037	0.51	0.609
Constant	-0.383	0.079	-4.84	0.000

Dependent variable was “1” if farm had a loan from a Non-Traditional lender

Prob>Chi Squared=0.00

5298 Observations

Table 6-10, Marginal Effects, Nontraditional Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	-3.72e-08	1.25E-08	-2.97	0.003	495499.00
Machinery Inventory	7.80e-07	9.95E-08	7.84	0.000	64099.20
Livestock Inventory	-6.08e-08	4.16E-08	-1.46	0.145	95357.00
Current Liabilities	7.46e-08	5.33E-08	1.40	0.162	78177.40
Intermediate Liabilities	6.91e-07	7.99E-08	8.65	0.000	43541.40
Long-Term Liabilities	-2.41e-08	4.55E-08	-0.53	0.593	85900.90
Operator Age	-0.001	0.0005	-3.64	0.000	56.27
Debt to Asset Ratio	-0.032	0.017	-1.85	0.065	0.29
Current Ratio	-0.0002	0.00009	-3.25	0.001	16.95
Return on Assets	0.006	0.013	0.51	0.609	0.01

Table 6-11, Probit Model, Government Loan (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-2.05e-07	4.84e-08	-4.24	0.000
Machinery Inventory	-9.05e-07	3.87e-07	-2.34	0.019
Livestock Inventory	-2.94e-07	1.64e-07	-1.79	0.074
Current Liabilities	2.06e-07	1.83e-07	1.13	0.260
Intermediate Liabilities	1.18e-06	2.57e-07	4.59	0.000
Long-Term Liabilities	9.70e-07	1.41e-07	6.86	0.000
Operator Age	-0.005	0.002	-3.21	0.001
Debt to Asset Ratio	0.171	0.039	4.33	0.000
Current Ratio	-0.0004	0.0003	-1.44	0.149
Return on Assets	0.158	0.089	1.76	0.078
Constant	-0.917	0.092	-9.92	0.000

Dependent variable was “1” if farm had a loan from a Government Agency (Excluding Taxes)

Prob>Chi Squared=0.00

5298 Observations

Table 6-12, Marginal Effects, Government Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	-4.05e-08	9.48e-09	-4.27	0.000	495499.00
Machinery Inventory	-1.79e-07	7.65e-08	-2.34	0.019	64099.20
Livestock Inventory	-5.79e-08	3.23e-08	-1.79	0.074	95357.00
Current Liabilities	4.07e-08	3.6e-08	1.13	0.260	78177.40
Intermediate Liabilities	2.33e-07	5.07e-08	4.60	0.000	43541.40
Long-Term Liabilities	1.91e-07	2.77e-08	6.89	0.000	85900.90
Operator Age	-0.0009	0.0003	-3.21	0.001	56.27
Debt to Asset Ratio	0.034	0.008	4.33	0.000	0.29
Current Ratio	-0.00009	0.00007	-1.44	0.149	16.95
Return on Assets	0.031	0.018	1.76	0.078	0.01

Table 6-13, Probit Model, Credit Card (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-2.77e-07	1.02e-07	-2.72	0.007
Machinery Inventory	-1.24e-07	6.40e-07	-0.19	0.846
Livestock Inventory	-8.94e-08	2.36e-07	-0.38	0.705
Current Liabilities	4.78e-07	2.73e-07	1.75	0.080
Intermediate Liabilities	5.48e-07	4.23e-07	1.29	0.196
Long-Term Liabilities	-1.26e-07	3.35e-07	-0.38	0.705
Operator Age	-0.002	0.003	-0.88	0.379
Debt to Asset Ratio	0.060	0.057	1.06	0.290
Current Ratio	-0.0002	0.0005	-0.32	0.751
Return on Assets	-0.004	0.041	-0.09	0.931
Constant	-1.801	0.157	-11.49	0.000

Dependent variable was “1” if farm had a loan from a Credit Card

Prob>Chi Squared=0.003

5298 Observations

Table 6-14, Marginal Effects, Credit Card Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	-1.44e-08	5.12E-09	-2.81	0.005	495499.00
Machinery Inventory	-6.42e-09	3.38E-08	-0.19	0.846	64099.20
Livestock Inventory	-4.63e-09	1.22E-08	-0.38	0.705	95357.00
Current Liabilities	2.47e-08	1.4E-08	1.76	0.079	78177.40
Intermediate Liabilities	2.83e-08	2.18E-08	1.30	0.195	43541.40
Long-Term Liabilities	-6.55e-09	1.72E-08	-0.38	0.706	85900.90
Operator Age	-0.0001	0.0001	-0.88	0.379	56.27
Debt to Asset Ratio	0.003	0.003	1.06	0.291	0.29
Current Ratio	-8.93e-06	0.00003	-0.32	0.751	16.95
Return on Assets	-0.0001	0.002	-0.09	0.931	0.01

Table 6-15, Probit Model, Credit Union (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-4.18e-08	8.61e-08	-0.49	0.627
Machinery Inventory	-2.57e-06	8.17e-07	-3.15	0.002
Livestock Inventory	-6.40e-07	3.30e-07	-1.94	0.052
Current Liabilities	5.40e-07	3.19e-07	1.69	0.090
Intermediate Liabilities	7.09e-07	5.12e-07	1.38	0.166
Long-Term Liabilities	3.08e-07	2.52e-07	1.22	0.223
Operator Age	-0.002	0.002	-0.87	0.387
Debt to Asset Ratio	-0.176	0.147	-1.19	0.233
Current Ratio	0.00003	0.0004	0.07	0.942
Return on Assets	-0.021	0.024	-0.88	0.382
Constant	-1.649	0.159	-10.36	0.000

Dependent variable was “1” if farm had a loan from a Credit Union

Prob>Chi Squared=0.041

5298 Observations

Table 6-16, Marginal Effects, Credit Union Probit Model (Full Data)

Variable	Marginal Effect	Std. Error	Test Statistic	P>|t|	Variable Mean
Land Owned Inventory	-2.40e-09	4.9e-09	-0.49	0.627	495499.00
Machinery Inventory	-1.48e-07	4.51e-08	-3.28	0.001	64099.20
Livestock Inventory	-3.68e-08	1.87e-08	-1.97	0.048	95357.00
Current Liabilities	3.10e-08	1.81e-08	1.71	0.086	78177.40
Intermediate Liabilities	4.07e-08	2.91e-08	1.40	0.163	43541.40
Long-Term Liabilities	1.77e-08	1.44e-08	1.23	0.220	85900.90
Operator Age	-0.0001	0.0001	-0.87	0.386	56.27
Debt to Asset Ratio	-0.010	0.008	-1.20	0.228	0.29
Current Ratio	1.82e-06	0.00003	0.07	0.942	16.95
Return on Assets	-0.001	0.001	-0.87	0.382	0.01

Figure 6-1, Marginal Effect of Owned Land on Probability of Using a Specific Lender Type (Probit)

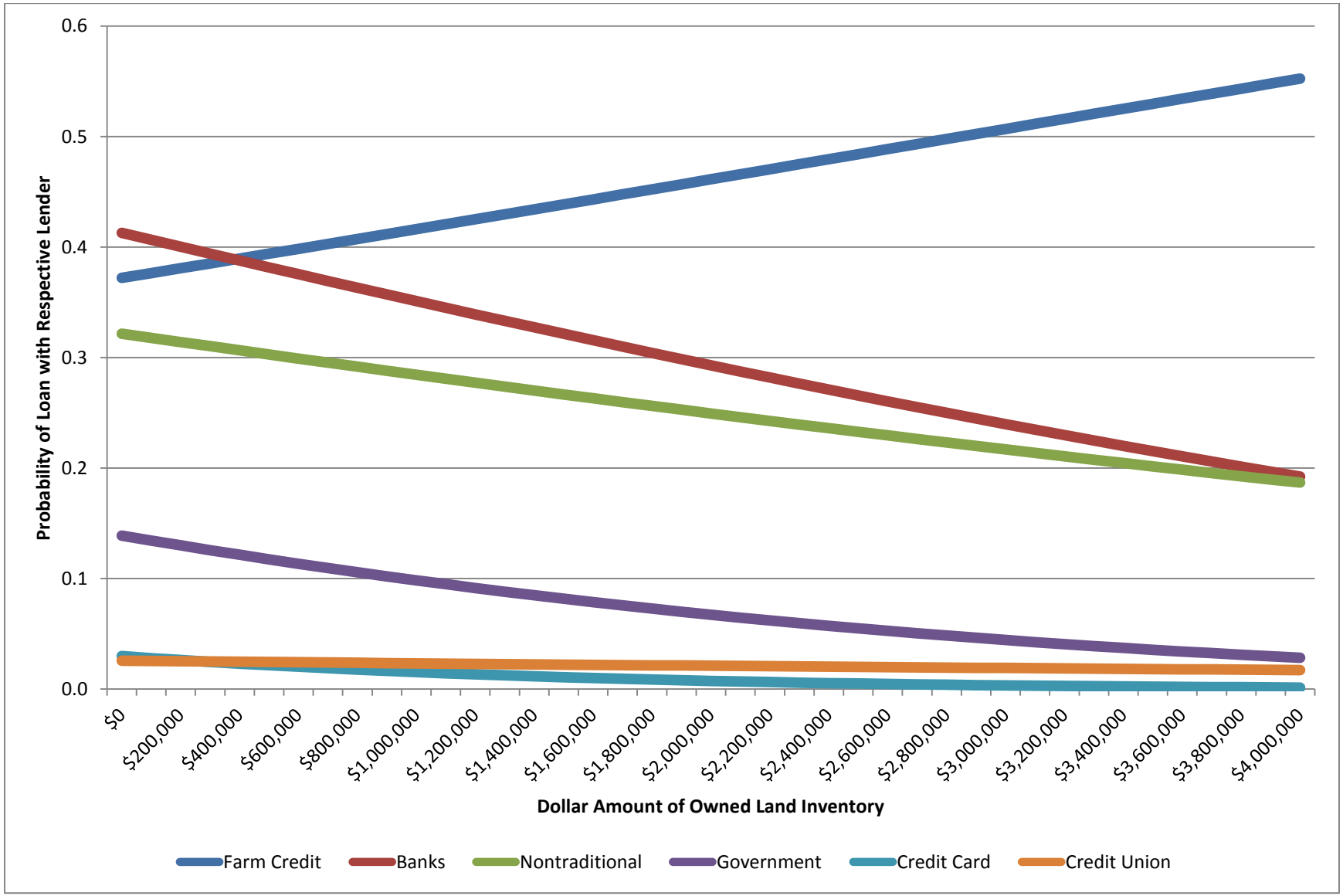


Figure 6-2, Marginal Effect of Machinery Inventory on Probability of Using a Specific Lender Type (Probit)

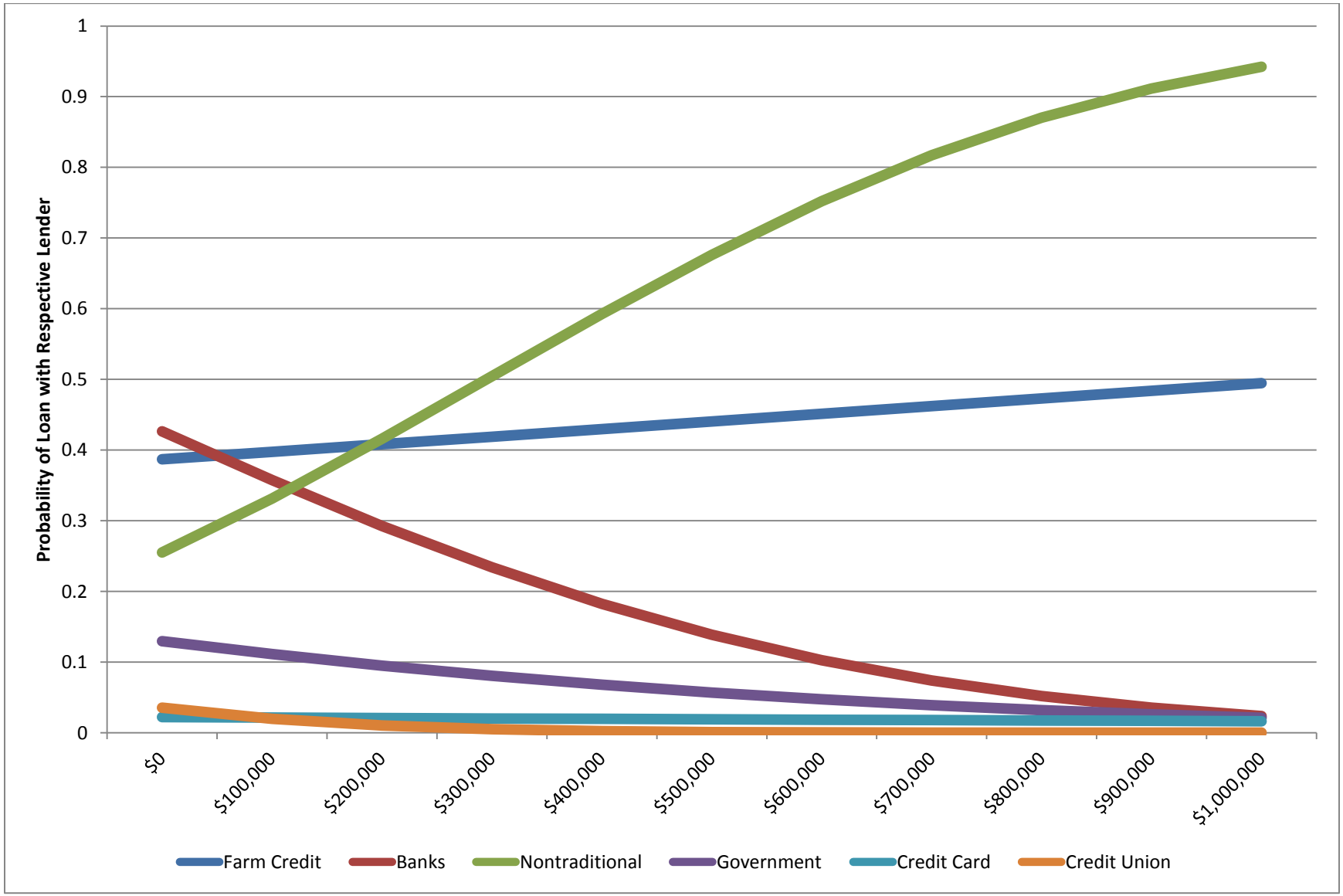


Figure 6-3, Marginal Effect of Livestock Inventory on Probability of Using a Specific Lender Type (Probit)

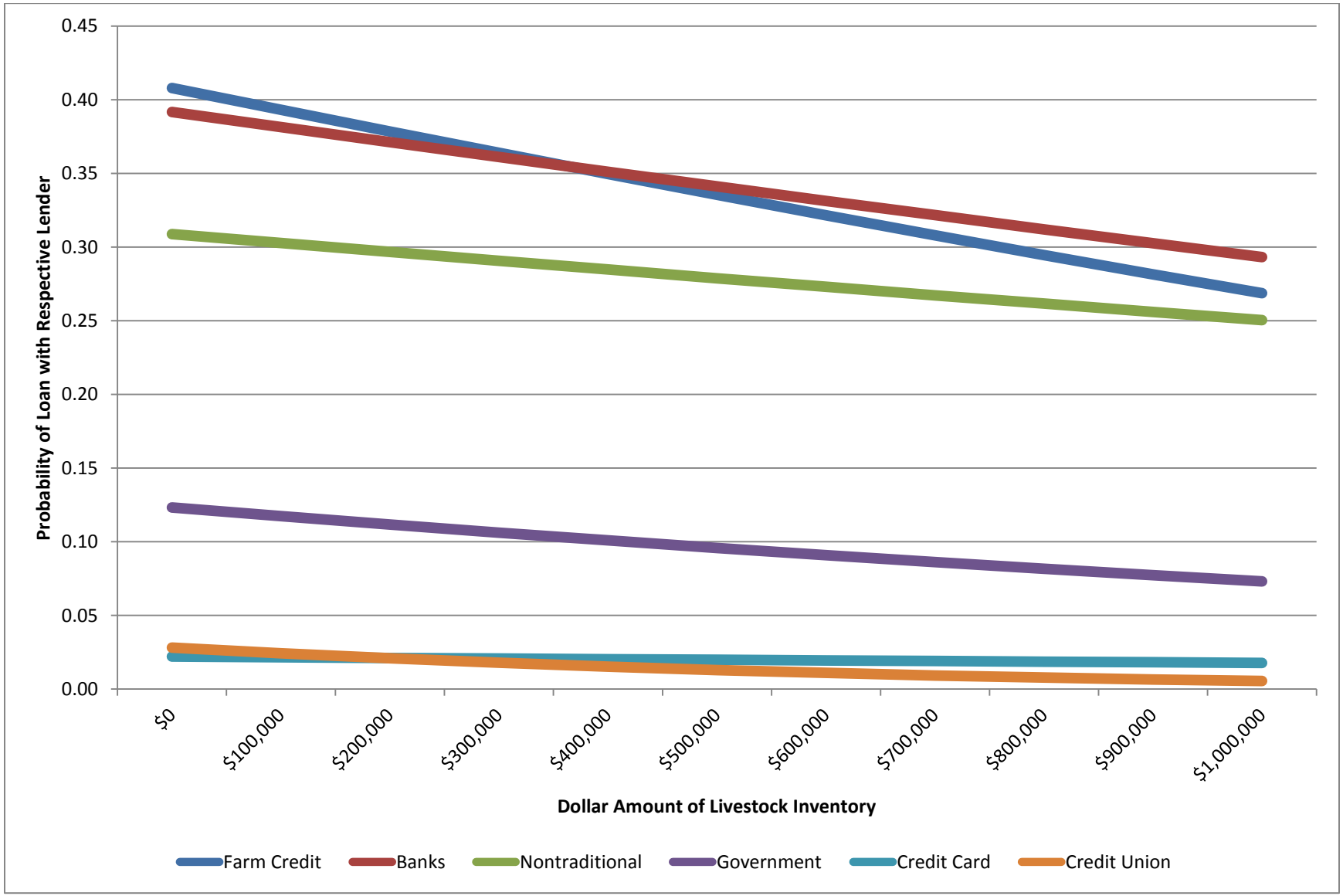


Figure 6-4, Marginal Effect of Current Liabilities on Probability of Using a Specific Lender Type (Probit)

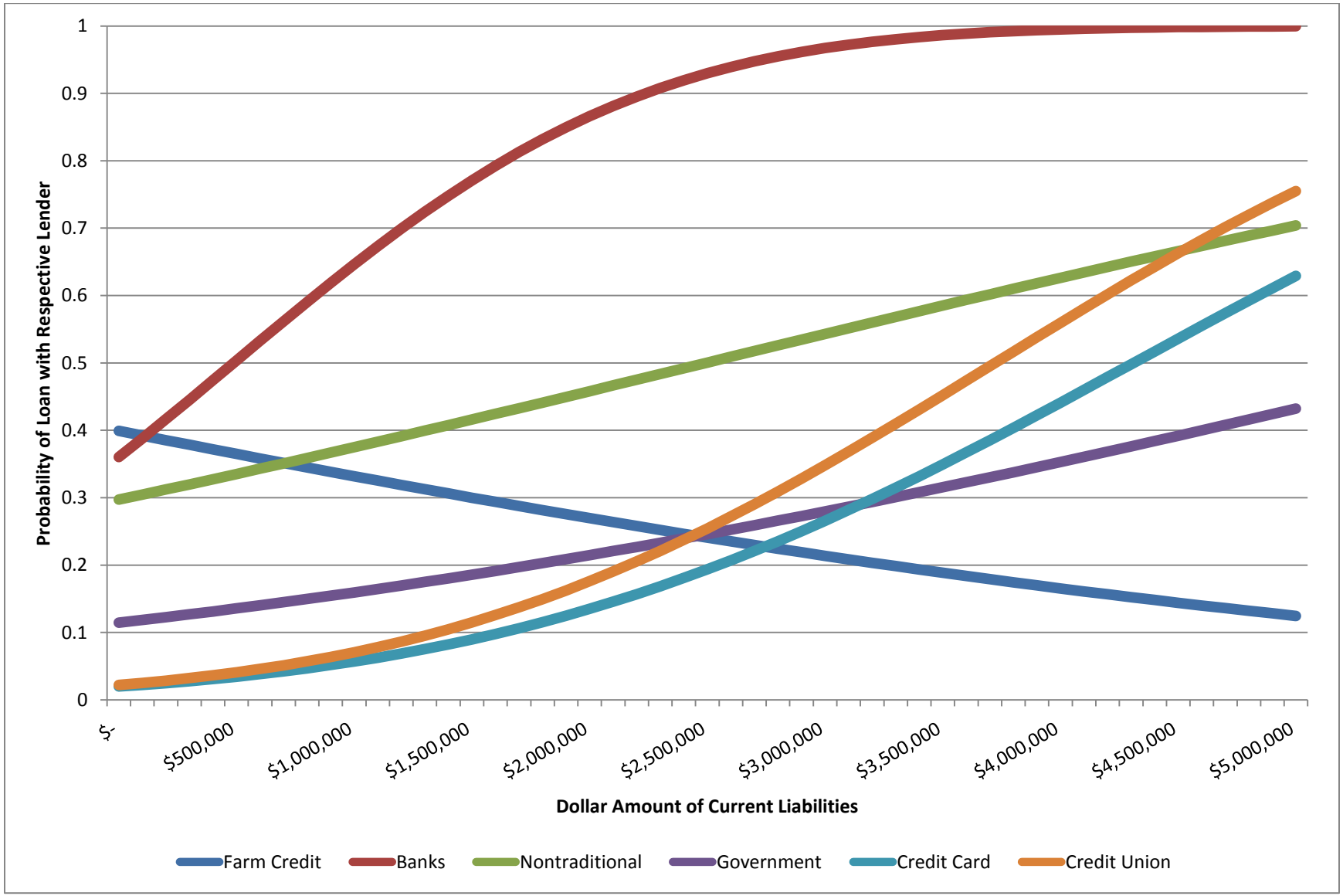


Figure 6-5, Marginal Effects of Intermediate Liabilities on Probability of Using a Specific Lender Type (Probit)

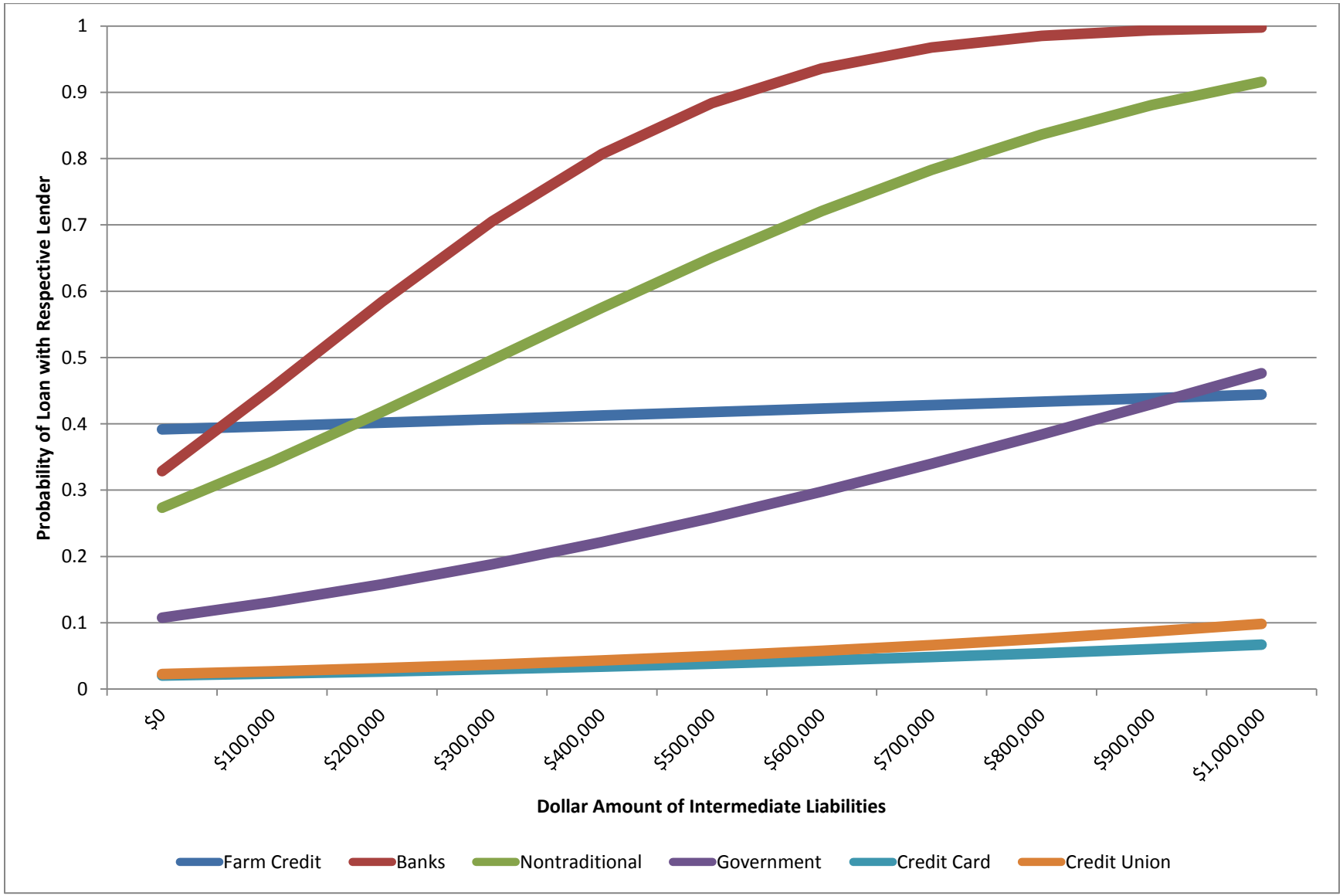


Figure 6-6, Marginal Effects of Long-Term Liabilities on Probability of Using a Specific Lender Type (Probit)

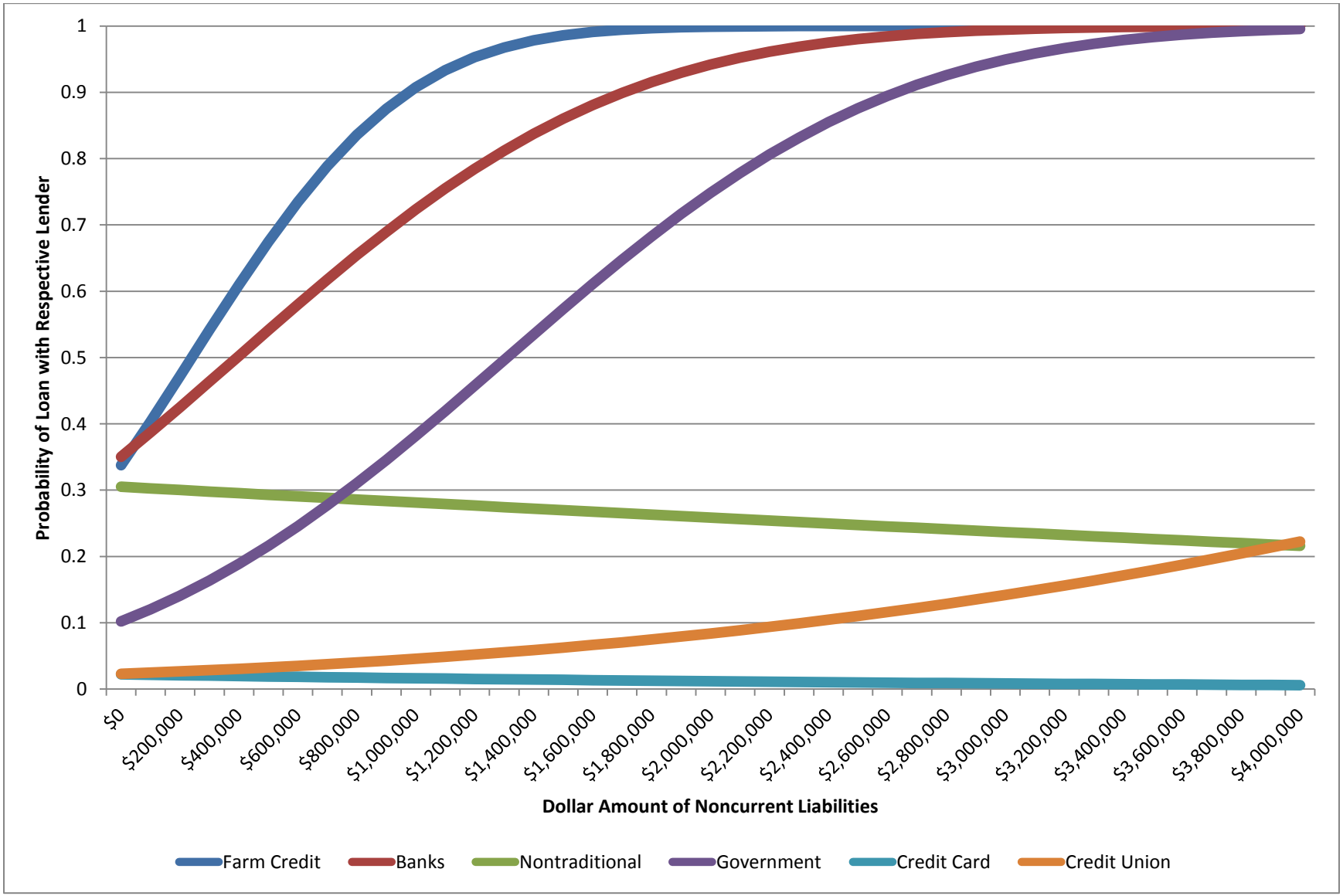


Figure 6-7, Marginal Effect of Farm Operator Age on Probability of Using a Specific Lender Type (Probit)

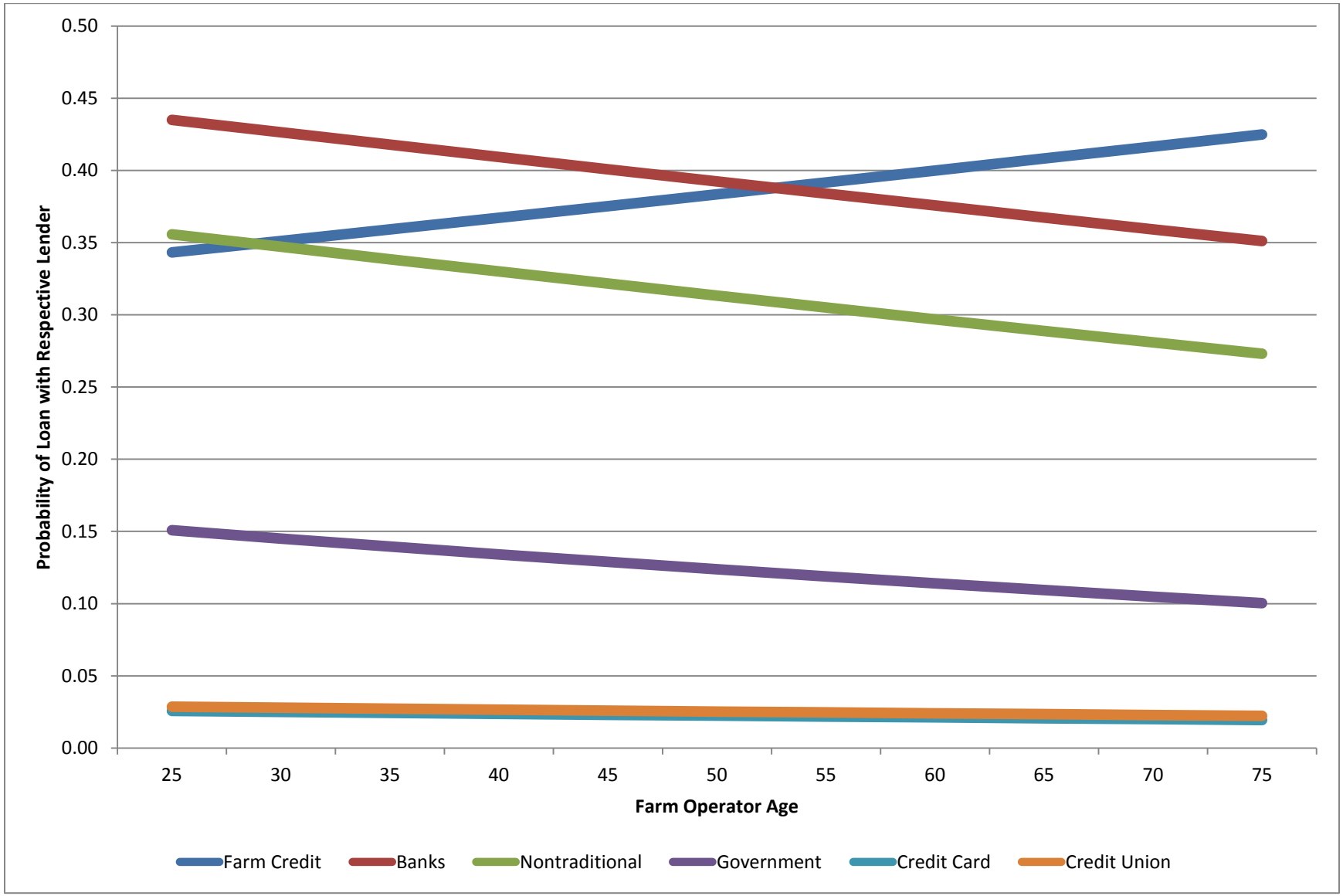


Figure 6-8, Marginal Effect of Debt to Asset on Probability of Using a Specific Lender Type (Probit)

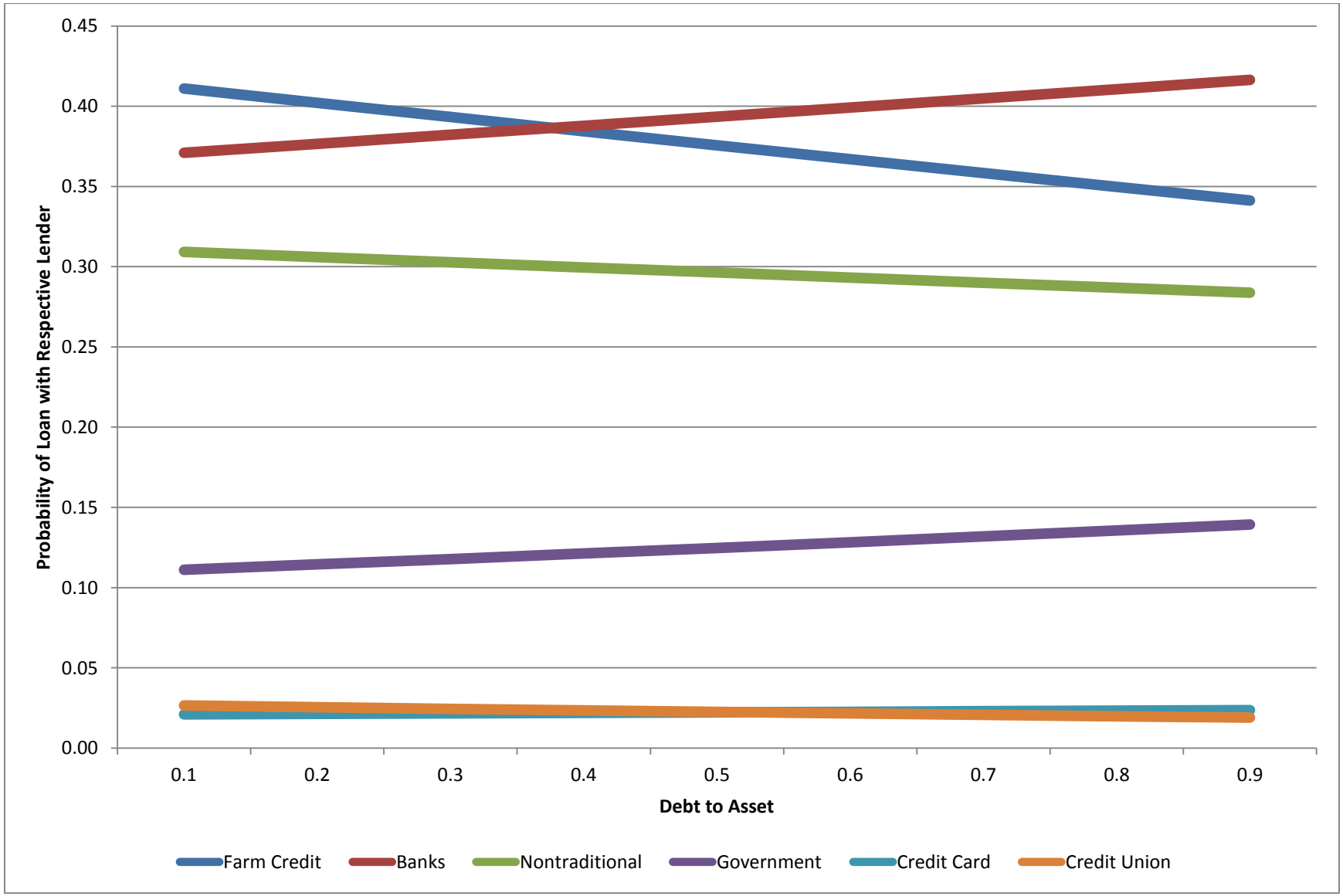


Figure 6-9, Marginal Effect of Current Ratio on Probability of Using a Specific Lender Type (Probit)

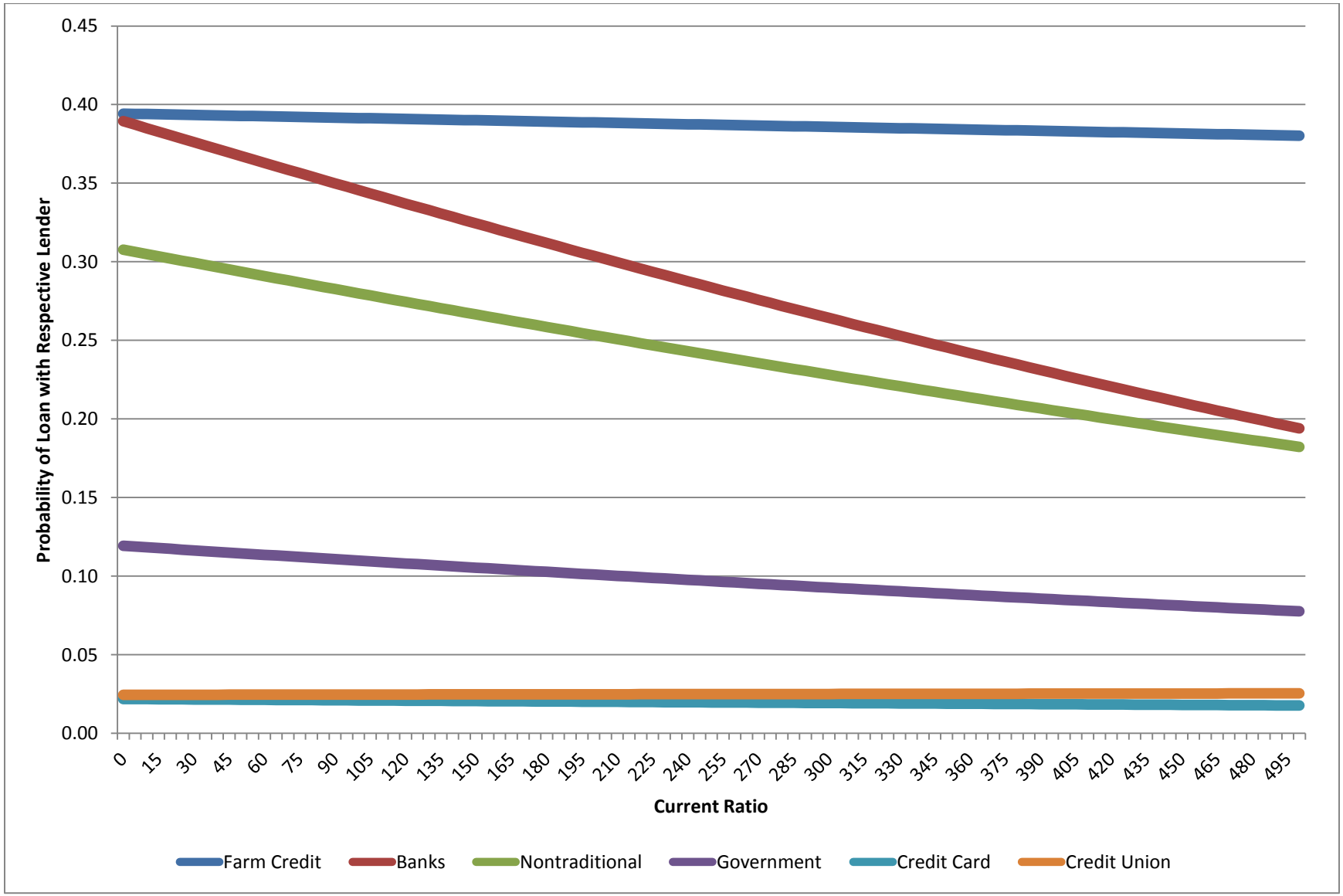


Figure 6-10, Marginal Effect of Return on Assets on Probability of Using a Specific Lender Type (Probit)

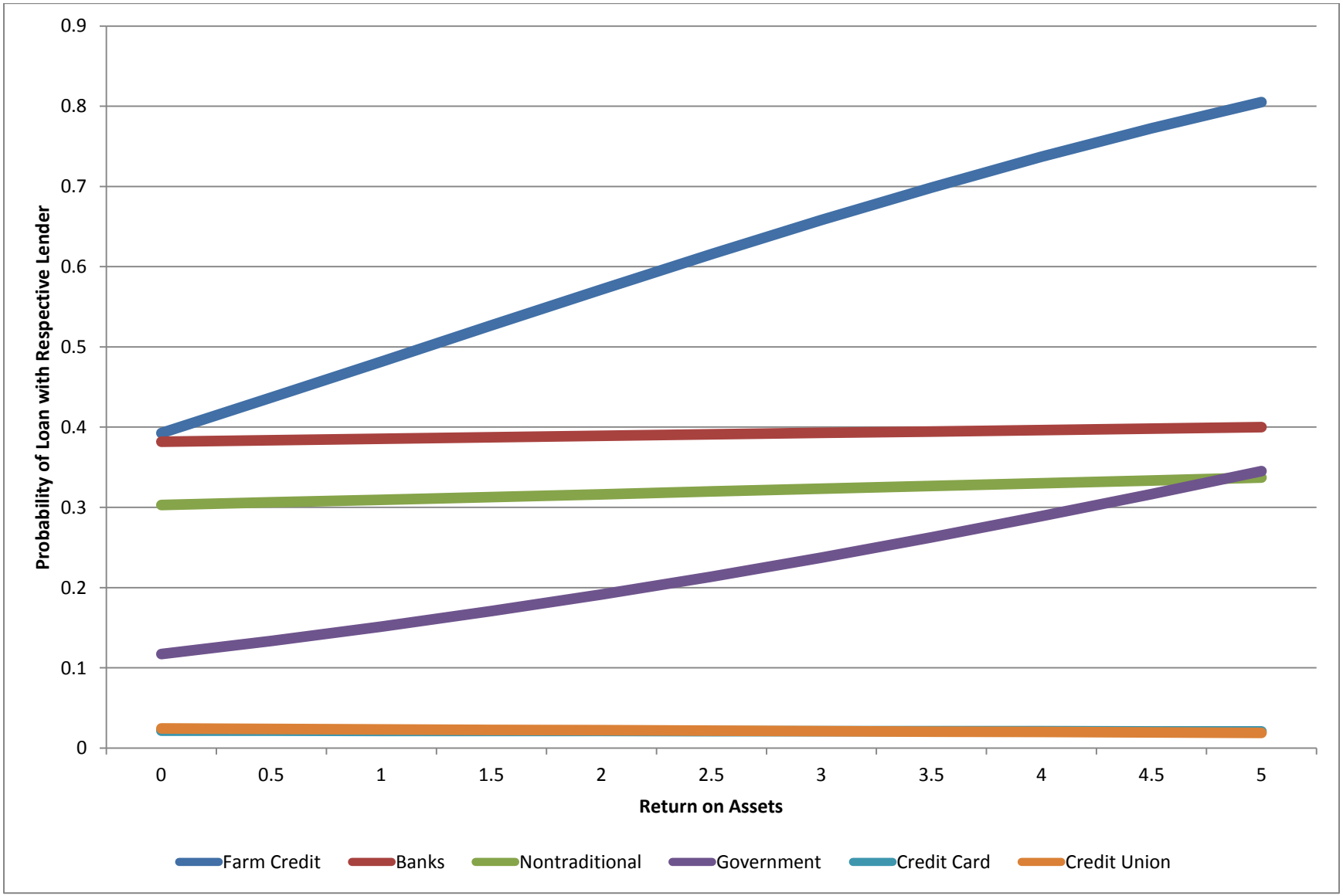


Table 6-17, Heckman Two Step Model, OLS Portion Above Censored Limit, Farm Credit (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.103	0.016	6.30	0.000
Machinery Inventory	0.540	0.114	4.73	0.000
Livestock Inventory	0.170	0.049	3.48	0.001
Operator Age	-2800.664	573.775	-4.88	0.000
Debt to Asset Ratio	176534.8	20840.11	8.47	0.000
Current Ratio	-76.133	89.134	-0.85	0.393
Return on Assets	-102652.6	42094.82	-2.44	0.015
Constant	570981.4	73698.73	7.75	0.000
Lambda	-450664.1	57151.42	-7.89	0.000

Prob>Chi Squared=0.000

2106 of 5298 observations above censored limit of zero

Table 6-18, Heckman Two Step Model, OLS Portion Above Censored Limit, Banks (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.098	0.023	4.27	0.000
Machinery Inventory	0.492	0.185	2.66	0.008
Livestock Inventory	0.681	0.067	10.20	0.000
Operator Age	2521.507	878.436	2.87	0.004
Debt to Asset Ratio	-1424.255	30730.59	-0.05	0.963
Current Ratio	429.9985	231.5686	1.86	0.063
Return on Assets	-11725.74	24819.55	-0.47	0.637
Constant	542156.4	70854.87	7.65	0.000
Lambda	-668381.5	60723.31	-11.01	0.000

Prob>Chi Squared=0.000

2060 of 5298 observations above censored limit of zero

Table 6-19, Heckman Two Step Model, OLS Portion Above Censored Limit, Nontraditional (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.018	0.006	3.05	0.002
Machinery Inventory	-0.007	0.073	-0.10	0.917
Livestock Inventory	0.006	0.013	0.46	0.644
Operator Age	413.2094	237.9913	1.74	0.083
Debt to Asset Ratio	10975.74	7551.424	1.45	0.146
Current Ratio	91.45251	47.56052	1.92	0.054
Return on Assets	1590.156	9200.142	0.17	0.863
Constant	171662.8	31197.1	5.50	0.000
Lambda	-157717.1	27993.89	-5.63	0.000

Prob>Chi Squared=0.000

1637of 5298 observations above censored limit of zero

Table 6-20, Heckman Two Step Model, OLS Portion Above Censored Limit, Government (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.035	0.014	2.53	0.011
Machinery Inventory	0.168	0.108	1.55	0.121
Livestock Inventory	-0.054	0.039	-1.38	0.168
Operator Age	705.9047	498.9196	1.41	0.157
Debt to Asset Ratio	-5355.085	15962.08	-0.34	0.737
Current Ratio	125.2674	101.5319	1.23	0.217
Return on Assets	-44055.61	24968.55	-1.76	0.078
Constant	447916.6	65491.02	6.84	0.000
Lambda	-266937.9	43397.84	-6.15	0.000

Prob>Chi Squared=0.0141

680 of 5298 observations above censored limit of zero

Table 6-21, Heckman Two Step Model, OLS Portion Above Censored Limit, Credit Card (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.002	0.006	-0.42	0.676
Machinery Inventory	-0.009	0.022	-0.40	0.691
Livestock Inventory	0.0002	0.006	0.04	0.965
Operator Age	248.6421	103.3655	2.41	0.016
Debt to Asset Ratio	21852.82	3251.986	6.72	0.000
Current Ratio	-22.40678	22.207	-1.01	0.313
Return on Assets	18158.66	8206.55	2.21	0.027
Constant	-49603.74	41137.74	-1.21	0.228
Lambda	16689.74	18221.87	0.92	0.360

Prob>Chi Squared=0.000

126 of 5298 observations above censored limit of zero

Table 6-22, Heckman Two Step Model, OLS Portion Above Censored Limit, Credit Union (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.003	0.004	0.91	0.362
Machinery Inventory	0.015	0.035	0.44	0.662
Livestock Inventory	-0.009	0.011	-0.85	0.394
Operator Age	-65.12458	104.0183	-0.63	0.531
Debt to Asset Ratio	7683.091	4682.286	1.64	0.101
Current Ratio	-14.27059	13.77085	-1.04	0.300
Return on Assets	627.5374	1110.003	0.57	0.572
Constant	17060.77	39842.52	0.43	0.669
Lambda	-1157.141	18875.11	-0.06	0.951

Prob>Chi Squared=0.334

140 of 5298 observations above censored limit of zero

Chapter 7 - Conclusions

This thesis looked at the relationship between the number of lending relationships and net profit, the characteristics that correlate with the number of lending relationships a Kansas farmer has, and determinants of lender choice for Kansas farmers.

The thesis first looked at relevant literature for banking theory and how many lending relationships a farm should have. A descriptive summary of the data was examined to determine the current lending conditions of Kansas agriculture. Market shares were analyzed for time trends for specific lender types. To determine if Kansas farms follow the banking strategy, a Poisson model was used to analyze how the financial characteristics of a farm determine the number of lending relationships. A model was estimated to examine how the number of lending relationships affect the profitability of the farm. To examine how characteristics of a farm affect the probability a farmer has a lending relationship with a respective lender type, six probit models were estimated. From the probit models, the inverse mills ratio was calculated to estimate six heckman selection models. The heckman selection models estimated the dollar amount of loans a farm has with a particular lender type.

The descriptive summary of the data showed that loan size for Kansas farms has increased from 2002 to 2010. The market shares by number of lender relationships revealed that Farm Credit and banks have been the market share leaders except for the year of 2010 when nontraditional lenders became the market share leader. Nontraditional lenders had a positive time trend starting in the year 2006 and ending in 2010 being the market share leader. When the market share was calculated by the dollar amount of loans for each lender type, banks market share increased and nontraditional lenders market share decreased, when compared to the market

share by number of lender relationships, indicating that banks extend more credit per farmer and nontraditional lenders extend less credit per farmer on average.

For the net farm income model, it was found that the number of banks a farmer engages with is a statistically significant factor in determining net farm income. An additional banking relationship a Kansas farmer engaged in, was correlated with a decrease in net income as suggested theoretically by Detragiache, Garella and Guisso (2000). Operator age was statistically significant showing that as a farmer gets older, there is a decrease in net income. Finally, the debt to asset ratio was statistically significant, as a Kansas farmer increases his/her leverage, net profit is less.

The Poisson model results showed that Kansas farmers increase the number of lending relationships as they become more leveraged. This model also showed that as the current ratio increased, and the farm becomes more solvent, there is a decrease in the number of lending relationships. The coefficients of the debt to asset ratio and the current ratio support the theoretical results developed by Detragiache, Garella and Guisso (2000). A positive time trend was also found to be statistically significant; farmers are using more lending relationships now than in 2002.

The results support the conclusion that Kansas farmers use more lender relationships as a farmer becomes more leveraged, and viewed as a riskier business partner for the bank. This increase in lending relationships helps ensure that Kansas farmers have access to credit for future capital expenses that make the farms more profitable. It also shows that Kansas farmers that were in position to do so, minimized transaction costs by having a single banking relationship. Those farmers who had a single banking relationship were less leveraged, had more working capital, were more profitable relative the his/her amount of assets, and had fewer total liabilities.

The set of probit models predicted the probability a Kansas farmer has a loan with a particular type of lending institution. Farm Credit was found to be more likely used by farmers with less leverage. The less risky that the farmer is when analyzing his/her debt to asset ratio, the higher the probability they have a loan with Farm Credit. All three inventory variables (land owned, machinery, and livestock) were negative for commercial and rural banks indicating that larger farmers are less likely to use a commercial or rural bank. For Farm Credit and banks, the dollar amount of owned land and the dollar amount of machinery inventory were positive, indicating that the larger the farm is, the more likely they will have a loan with a Farm Credit or bank. Machinery inventory was a statistically significant positive factor affecting probability a farmer has a loan with a nontraditional lender.

It was found that older farmers are more likely to use Farm Credit, while younger farmers are more likely to use a nontraditional lender, a bank, or a government agency. An increase in the current ratio decreases the probability that a farmer has a loan with a nontraditional lender or a bank, thus, the more current assets a farmer has relative to his/her current liabilities, the lower the probability they have a loan with a nontraditional lender or a bank. This result indicates that banks and nontraditional lenders do not analyze the current position, or the solvency, of the farmer when making loans. For banks, the result for the current ratio concurs with the result for the debt to asset ratio. The debt to asset ratio has a positive value. The more leveraged the farm is and the less working capital, the higher the probability the farmer has a loan with a bank.

To correct for the self selection bias of farmers for which lending institutions they use, a Heckman selection model was used to predict the dollar amount of loans a Kansas farmer has with a particular type of lending institution. The interpretation of these models is that given a farmer has a loan with a respective lender type, what is the dollar amount of loans the farmer will

have with that respective lender. It was found that selection bias was present in four of the six models. The inventory variables show that the dollar amount of land owned, machinery, and livestock were determinants of the dollar amount of liabilities for Farm Credit and banks since all inventory variables were significant for these two lenders. The amount of owned land was a significant variable in determining dollar amount of loans for four of the six lender types. The amount of livestock inventory had the biggest marginal effect for the banks category. Farmers who have livestock inventory, use a bank for his/her source of financing. The inventory variables were not significant for the credit card and the credit union model, indicating that farmer's do not use credit cards or credit unions for large capital purchases.

The higher a farmer's return on assets was, the fewer dollar amount of loans the farmer had from Farm Credit. The more profitable a farm was relative to its assets, the fewer liabilities the respective farm had. Looking at farm operator age, older farmers have fewer dollar amount of loans from Farm Credit but have more dollar amount of loans from banks a. The debt to asset ratio was positive for Farm Credit.

7.1 Future Research

Several extensions from this thesis are worthy of future research. Determining exactly what causes the farmer to seek an additional lending relationship will confirm the theory and help in determining banking relationships for Kansas farmers. From this thesis, it may also be examined which lending institution is best positioned for the future. As farmers continue to consolidate and loan size increases, it can be determined what lending institution is best suited to meet the future farmer's needs. Another extension of this thesis is examining how the probability that a farmer has a relationship with a particular lender is conditional upon the other lending relationships the farmer has.

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Appendix A, Logistic Regressions

Table A-1, Logit Model, Farm Credit (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	1.65e-07	5.93e-08	2.78	0.005
Machinery Inventory	3.75e-07	4.82e-07	0.78	0.436
Livestock Inventory	-6.66e-07	2.18e-07	-3.06	0.002
Current Liabilities	-2.29e-07	2.55e-07	-0.90	0.368
Intermediate Liabilities	4.33e-07	3.97e-07	1.09	0.276
Long-Term Liabilities	3.13e-06	2.72e-07	11.50	0.000
Operator Age	0.007	0.002	3.27	0.001
Debt To Asset	-0.561	0.129	-4.34	0.000
Current Ratio	-0.0001	0.0003	-0.43	0.667
Return on Assets	0.336	0.158	2.12	0.034
Constant	-0.964	0.136	-7.09	0.000

Dependent variable was “1” if farm had a loan from a Farm Credit

Prob>Chi Squared=0.000

Table A-2, Logit Model, Banks (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-2.78e-07	6.89e-08	-4.03	0.000
Machinery Inventory	-3.46e-06	5.50e-07	-6.29	0.000
Livestock Inventory	-5.57e-07	2.07e-07	-2.69	0.007
Current Liabilities	1.40e-06	2.74e-07	5.09	0.000
Intermediate Liabilities	5.92e-06	4.77e-07	12.41	0.000
Long-Term Liabilities	2.15e-06	2.51e-07	8.57	0.000
Operator Age	-0.006	0.002	-3.04	0.002
Debt To Asset	0.232	0.085	2.75	0.006
Current Ratio	-0.002	0.0005	-3.73	0.000
Return on Assets	0.013	0.042	0.31	0.755
Constant	-0.296	0.128	-2.31	0.021

Dependent variable was “1” if farm had a loan from a commercial bank

Prob>Chi Squared=0.00

Table A-3, Logit Model, Nontraditional Lenders (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-1.91e-07	6.17e-08	-3.09	0.002
Machinery Inventory	3.77e-06	4.85e-07	7.77	0.000
Livestock Inventory	-2.98e-07	2.00e-07	-1.49	0.137
Current Liabilities	3.51e-07	2.57e-07	1.37	0.172
Intermediate Liabilities	3.49e-06	4.16e-07	8.40	0.000
Long-Term Liabilities	-1.06e-07	2.15e-07	-0.49	0.621
Operator Age	-0.007	0.002	-3.58	0.000
Debt To Asset	-0.177	0.094	-1.88	0.061
Current Ratio	-0.001	0.0004	-3.11	0.002
Return on Assets	0.031	0.066	0.47	0.637
Constant	-0.617	0.132	-4.67	0.000

Dependent variable was “1” if farm had a loan from a nontraditional lender

Prob>Chi Squared=0.00

Table A-4, Logit Model, Credit Union (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-1.17e-07	2.02e-07	-0.58	0.562
Machinery Inventory	-6.24e-06	2.03e-06	-3.08	0.002
Livestock Inventory	-1.55e-06	8.03e-07	-1.92	0.054
Current Liabilities	1.24e-06	7.27e-07	1.71	0.088
Intermediate Liabilities	1.70e-06	1.20e-06	1.42	0.157
Long-Term Liabilities	6.78e-07	5.42e-07	1.25	0.212
Operator Age	-0.005	0.006	-0.85	0.397
Debt To Asset	-0.4096585	0.345	-1.19	0.235
Current Ratio	0.00006	0.001	0.07	0.948
Return on Assets	-0.035	0.042	-0.84	0.399
Constant	-2.929	0.361	-8.12	0.000

Dependent variable was “1” if farm had a loan from a credit union

Prob>Chi Squared=0.045

Table A-5, Logit Model, Government (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-5.68e-07	1.14e-07	-4.99	0.000
Machinery Inventory	-2.04e-06	7.61e-07	-2.68	0.007
Livestock Inventory	-6.35e-07	3.23e-07	-1.97	0.049
Current Liabilities	5.24e-07	3.40e-07	1.54	0.124
Intermediate Liabilities	2.12e-06	4.56e-07	4.65	0.000
Long-Term Liabilities	2.15e-06	2.97e-07	7.25	0.000
Operator Age	-0.009	0.003	-2.98	0.003
Debt To Asset	0.242	0.073	3.28	0.001
Current Ratio	-0.0009	0.0007	-1.27	0.205
Return on Assets	0.260	0.155	1.67	0.094
Constant	-1.467	0.168	-8.74	0.000

Dependent variable was “1” if farm had a loan from a government agency

Prob>Chi Squared=0.00

Table A-6, Logit Model, Credit Card (Full Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-7.70e-07	2.75e-07	-2.80	0.005
Machinery Inventory	-1.39e-08	1.44e-06	-0.01	0.992
Livestock Inventory	-2.78e-07	5.55e-07	-0.50	0.616
Current Liabilities	1.07e-06	6.04e-07	1.78	0.076
Intermediate Liabilities	1.21e-06	9.28e-07	1.31	0.191
Long-Term Liabilities	-2.86e-07	8.20e-07	-0.35	0.727
Operator Age	-0.0052031	0.006	-0.85	0.397
Debt To Asset	0.1114738	0.109	1.03	0.305
Current Ratio	-0.0004333	0.001	-0.32	0.746
Return on Assets	-0.0073464	0.085	-0.09	0.931
Constant	-3.265856	0.357	-9.14	0.000

Dependent variable was “1” if farm had a loan from a credit card

Prob>Chi Squared=0.003

Appendix B, Tobit Regressions

Table B-7, Dollar Amount of Loans from Farm Credit

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	0.014	0.008	1.71	0.088
Machinery Inventory	-0.043	0.065	-0.67	0.506
Livestock Inventory	-0.277	0.029	-9.29	0.000
Current Liabilities	0.408	0.031	13.25	0.000
Intermediate Liabilities	0.208	0.046	4.56	0.000
Long-Term Liabilities	0.628	0.023	27.21	0.000
Operator Age	409.390	400.949	1.02	0.307
Debt To Asset	6036.187	2209.403	2.73	0.006
Current Ratio	142.509	65.549	2.17	0.030
Return on Assets	31817.640	24374.890	1.31	0.192
Constant	-366040.100	24172.800	-15.14	0.000

Prob>Chi Squared=0.000

Table B-8, Dollar Amount of Loans from Commercial Banks

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.035	0.003	-10.13	0.000
Machinery Inventory	-0.209	0.027	-7.78	0.000
Livestock Inventory	0.172	0.012	14.69	0.000
Current Liabilities	0.491	0.013	36.55	0.000
Intermediate Liabilities	0.202	0.019	10.32	0.000
Long-Term Liabilities	0.188	0.010	18.28	0.000
Operator Age	185.717	149.847	1.24	0.215
Debt To Asset	-1314.496	1080.570	-1.22	0.224
Current Ratio	-25.938	26.574	-0.98	0.329
Return on Assets	1175.353	2992.936	0.39	0.695
Constant	35061.210	8772.942	4.00	0.000

Prob>Chi Squared=0.000

Table B-9, Dollar Amount of Loans from Nontraditional

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.010	0.003	-3.90	0.000
Machinery Inventory	0.190	0.018	10.55	0.000
Livestock Inventory	-0.052	0.008	-6.20	0.000
Current Liabilities	0.070	0.009	7.84	0.000
Intermediate Liabilities	0.178	0.013	14.09	0.000
Long-Term Liabilities	0.021	0.007	3.02	0.003
Operator Age	-440.600	120.140	-3.67	0.000
Debt To Asset	-223.311	1029.988	-0.22	0.828
Current Ratio	-18.31682	22.346	-0.82	0.412
Return on Assets	11495.080	7393.968	1.55	0.120
Constant	-88349.290	7079.002	-12.48	0.000

Prob>Chi Squared=0.000

Table B-10, Dollar Amount of Loans from Government Agencies

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.080	0.009	-9.06	0.000
Machinery Inventory	-0.316	0.054	-5.87	0.000
Livestock Inventory	-0.108	0.023	-4.70	0.000
Current Liabilities	0.109	0.023	4.83	0.000
Intermediate Liabilities	0.244	0.031	7.90	0.000
Long-Term Liabilities	0.212	0.0179	11.81	0.000
Operator Age	-1594.087	263.227	-6.06	0.000
Debt To Asset	-285.645	1325.485	-0.22	0.829
Current Ratio	-59.354	58.354	-1.02	0.309
Return on Assets	7185.895	12119.900	0.59	0.553
Constant	-147344.000	15494.670	-9.51	0.000

Prob>Chi Squared=0.000

Table B-11, Dollar Amount of Loans from Credit Cards

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.012	0.004	-3.42	0.001
Machinery Inventory	-0.019	0.019	-1.02	0.308
Livestock Inventory	-0.032	0.008	-3.91	0.000
Current Liabilities	0.045	0.008	5.64	0.000
Intermediate Liabilities	0.032	0.010	3.12	0.002
Long-Term Liabilities	0.003	0.007	0.43	0.664
Operator Age	-232.503	97.578	-2.38	0.017
Debt To Asset	76.776	423.811	0.18	0.856
Current Ratio	2.392	20.345	0.12	0.906
Return on Assets	76.304	2237.469	0.03	0.973
Constant	-72330.560	7581.757	-9.54	0.000

Prob>Chi Squared=0.000

Table B-12, Dollar Amount of Loans from Credit Unions

Variable	Tobit Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-0.003	0.003	-1.02	0.308
Machinery Inventory	-0.093	0.027	-3.38	0.001
Livestock Inventory	-0.037	0.012	-3.06	0.002
Current Liabilities	0.025	0.010	2.42	0.015
Intermediate Liabilities	0.027	0.013	2.00	0.046
Long-Term Liabilities	0.016	0.007	2.38	0.018
Operator Age	-91.322	94.963	-0.96	0.336
Debt To Asset	-79.885	491.193	-0.16	0.871
Current Ratio	-35.381	32.755	-1.08	0.280
Return on Assets	335.317	2533.242	0.13	0.895
Constant	-78190.260	8020.332	-9.75	0.000

Prob>Chi Squared=0.000

Appendix C, Panel Data Probit Models

Table C-13, Probit Model, Farm Credit (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	4.77e-07	1.79e-07	2.66	0.008
Machinery Inventory	2.00e-06	1.27e-06	1.57	0.117
Livestock Inventory	-3.03e-06	6.07e-07	-5.00	0.000
Current Liabilities	-2.35e-06	8.59e-07	-2.73	0.006
Intermediate Liabilities	1.53e-06	9.90e-07	1.55	0.122
Long-Term Liabilities	2.07e-06	5.24e-07	3.95	0.000
Operator Age	0.0009	0.004	0.24	0.811
Debt To Asset	-0.420	0.289	-1.45	0.146
Current Ratio	-0.0006	0.0005	-1.30	0.195
Return on Assets	0.247	0.424	0.58	0.560
Constant	-0.429	0.268	-1.60	0.109

Dependent variable was “1” if farm had a loan from a Farm Credit

Prob>Chi Squared=0.00

910 Observations

Table C-14, Probit Model, Banks (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-1.55e-07	1.82e-07	-0.85	0.393
Machinery Inventory	-2.05e-06	1.35e-06	-1.52	0.128
Livestock Inventory	-1.37e-06	5.31e-07	-2.58	0.010
Current Liabilities	6.94e-06	8.64e-07	8.03	0.000
Intermediate Liabilities	4.37e-06	9.35e-07	4.68	0.000
Long-Term Liabilities	2.03e-06	5.02e-07	4.05	0.000
Operator Age	-0.013	0.004	-3.21	0.001
Debt To Asset	-0.039	0.209	-0.19	0.851
Current Ratio	-0.001	0.0007	-1.45	0.146
Return on Assets	1.107	0.407	2.72	0.007
Constant	0.098	0.262	0.37	0.708

Dependent variable was “1” if farm had a loan from a Bank

Prob>Chi Squared=0.00

910 Observations

Table C-15, Probit Model, Nontraditional (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-6.29e-07	2.13e-07	-2.96	0.003
Machinery Inventory	4.24e-06	1.31e-06	3.24	0.001
Livestock Inventory	-1.17e-06	5.27e-07	-2.23	0.026
Current Liabilities	1.33e-06	7.36e-07	1.81	0.070
Intermediate Liabilities	2.77e-06	9.41e-07	2.94	0.003
Long-Term Liabilities	6.27e-07	5.91e-07	1.06	0.289
Operator Age	-0.001	0.005	-0.40	0.686
Debt To Asset	-0.363	0.2886088	-1.26	0.208
Current Ratio	-0.0009	0.0008	-1.12	0.262
Return on Assets	0.161	0.445	0.36	0.718
Constant	-0.712	0.298	-2.39	0.017

Dependent variable was “1” if farm had a loan from a Nontraditional Lender

Prob>Chi Squared=0.00

910 Observations

Table C-16, Probit Model, Government (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	-9.87e-07	2.76e-07	-3.57	0.000
Machinery Inventory	1.39e-06	1.72e-06	0.81	0.420
Livestock Inventory	-3.10e-06	7.78e-07	-3.98	0.000
Current Liabilities	1.61e-06	8.98e-07	1.80	0.072
Intermediate Liabilities	4.07e-06	1.07e-06	3.80	0.000
Long-Term Liabilities	1.79e-06	7.31e-07	2.44	0.015
Operator Age	0.008	0.005	1.52	0.129
Debt To Asset	-0.363	0.336	-1.08	0.280
Current Ratio	0.0003	0.0007	0.47	0.638
Return on Assets	0.198	0.488	0.41	0.685
Constant	-1.360	0.339	-4.00	0.000

Dependent variable was “1” if farm had a loan from a Government Agency

Prob>Chi Squared=0.00

910 Observations

Table C-17, Probit Model, Credit Card (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	4.17e-07	9.16e-07	0.46	0.649
Machinery Inventory	-0.00002	.0000145	-1.44	0.149
Livestock Inventory	-4.24e-06	4.13e-06	-1.03	0.304
Current Liabilities	1.18e-06	2.15e-06	0.55	0.581
Intermediate Liabilities	6.56e-06	3.82e-06	1.72	0.086
Long-Term Liabilities	-1.52e-07	3.21e-06	-0.05	0.962
Operator Age	-0.033	0.014	-2.39	0.017
Debt To Asset	-0.195	0.598	-0.33	0.745
Current Ratio	-0.0006	0.005	-0.12	0.903
Return on Assets	-0.335	1.097	-0.30	0.760
Constant	-0.381	0.745	-0.51	0.609

Dependent variable was “1” if farm had a loan from a Credit Card

Prob>Chi Squared=0.08

910 Observations

Table C-18, Probit Model, Credit Union (Panel Data)

Variable	Coefficient	Std. Error	Test Statistic	P>|t|
Land Owned Inventory	5.53e-07	2.81e-07	1.97	0.049
Machinery Inventory	-6.30e-06	2.86e-06	-2.20	0.028
Livestock Inventory	-5.13e-06	1.76e-06	-2.92	0.003
Current Liabilities	-1.06e-06	1.57e-06	-0.67	0.501
Intermediate Liabilities	-2.42e-07	2.46e-06	-0.10	0.922
Long-Term Liabilities	1.46e-06	9.26e-07	1.58	0.115
Operator Age	-0.011	0.007	-1.52	0.128
Debt To Asset	-0.367	0.289	-1.27	0.203
Current Ratio	-0.002	0.002	-1.00	0.316
Return on Assets	-1.036	0.687	-1.50	0.133
Constant	-0.857	0.455	-1.89	0.059

Dependent variable was “1” if farm had a loan from a Farm Credit

Prob>Chi Squared=0.00

910 Observations