1996

Farmer-borrowers' selection of short- and intermediate-term loan contracts: traditional lenders versus nontraditional lenders

Jauling Tseng
Iowa State University

Farmer-borrowers' selection of short- and intermediate-term loan contracts: Traditional lenders versus nontraditional lenders

by

Jauling Tseng

A Dissertation Submitted to the

Graduate Faculty in Partial Fulfillment of the

Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Department: Economics
Major: Economics

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

Iowa State University
Ames, Iowa

1996

DEDICATION

This dissertation was completed by the abundant grace of God. I would like to thank Him and dedicate this dissertation to Him first. Jesus, the Son of God, loves me so much and has given me the great opportunity and grace to finish my Ph.D. degree. I want to express my sincere thankfulness to my heavenly Father and hence to dedicate this accomplishment to Him.

and

To my parents, Kwang-Tsai Tseng and Zih-Mei Liao Tseng, who have loved me and provided me so much through the years of my life. Their firm belief in the power of education and their endless love for me have always been an inspiration to me. Without their kind words of comfort and encouragement, I could not have walked and passed through this long journey of the road. Hence, this dissertation is especially dedicated to them in recognition of their loving devotion. Thank you, my dear parents, for everything you have been to me.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I wish to express my sincere and grateful thankfulness to my major professor, Dr. Robert W. Jolly, who instructed and guided me during the work of this dissertation. His encouragement and constructive advice helped me to complete this work. I would also like to extend special gratitude to him for his assistance and financial support for this study.

Special thanks are also offered to Dr. Sergio Lence. His helpful comments and suggestions enhanced the contents of my dissertation. I also offer my sincere appreciation to my committee members, Dr. Roger Ginder, Dr. Roger Stover, and Dr. Frances Antonovitz. I am grateful for their support and assistance to the accomplishment of my dissertation.

The seven and a half years I lived in Ames have given me many good memories. I am proud of my association with the Department of Business Administration, where I obtained my M.S. degree, and of my present doctoral studies in the Department of Economics at Iowa State University. I thank the Department of Economics offering me both teaching and research assistantships during the past several years of my doctoral studies. These opportunities allowed me to cooperate and work with several professors in the department.

I also thank all the brothers and sisters of the Chinese Evangelical Free Church of Ames. They encouraged and supported me spiritually during the past years of my Christian life. Several good friends' help from the church was so impressive to me. I, therefore, had the chance to serve God and the body of Jesus Christ. Special thanks are offered to my lovely husband, Shih-Neng Chen, who helped and encouraged me continuously during both the good and difficult times of our lives.

ABSTRACT

The emergence and growth of nontraditional lenders in short- and intermediate-term agricultural credit markets during the 1990s prompted a number of studies on the economic incentives and competitive strategies for input supply or manufacturing firms to create captive finance companies. Comparably, little work, however, has been done on the choice of nontraditional lenders from the borrower's perspective. This dissertation examines the farmer-borrower's decision-making process in choosing between traditional and nontraditional lenders when financing short- and intermediate-term loan contracts. The objective of this research is to provide a better understanding of the factors that influence farm-level demand for traditional and nontraditional credit. In addition, the research identifies factors that lenders could use as a marketing strategy to enhance the borrower's acceptance of a particular loan contract.

The theoretical model describes a joint decision process through which the lenders determine the optimal terms of loan contracts, and the borrower selects the most appealing loan contract. The model suggests that certain cost and informational advantages may allow nontraditional lenders to offer more attractive loan terms or reach riskier borrowers compared to traditional lenders. Further, the model demonstrates that the borrower's loan contract acceptance decision is significantly affected by the contract attributes, such as loan size, interest rate, and collateral requirement, as well as the borrower's socioeconomic characteristics.

An empirical model of the contract participation, or acceptance, decision was estimated from data obtained in the 1993 Iowa Farm Finance Survey. The model was estimated using a two-stage probit procedure. The first stage involved estimating the loan

term variables offered in the lender's loan contract. The second stage involves estimating the borrower's participation equation.

The empirical results support the hypotheses that loan term differentials, financial measures and borrower characteristics do have significant impacts on the farmer-borrower's choice of traditional and nontraditional lenders. However, interest rate, loan size and collateral incentives appear to be the most important factors influencing the borrower's decision. In other words, the financial loan terms appear to outweigh other socioeconomic factors in explaining the farmer-borrower's selection or use of nontraditional credit.

CHAPTER 1.
INTRODUCTION

Production agriculture in the United States is a capital-intensive industry. The current $917 billion in productive assets is financed by $769 billion in equity and $148 billion in debt. Virtually all equity in the sector is retained from earnings because equity markets are, in general, not available to most farmers. Therefore, access to debt capital is of critical importance to U.S. farmers' operating and investment decisions.

Over the past 25 years, U.S. agricultural credit markets and institutions have experienced periods of rapid expansion followed by severe contraction and stagnation along with changes in market composition. For the most part, these changes had their origins, outside the agricultural sector—in the agricultural policy of importing nations and in U.S. macroeconomic policies. Nonetheless, the boom, bust, and stagnation cycles of the agricultural credit industry draw into question the ability of the agricultural credit industry to adequately provide credit and terms appropriate for farmers.

Now, midway through the 1990s, U.S. agriculture seems once again poised on a knife edge between a period of increasing and volatile prices and one of narrow profit margins and a lowered safety net provided by farm commodity programs. Against this backdrop, access to capital and capital costs and terms assume critical importance. Since the mid-1980s, growth in outstanding farm debt has been negligible. Despite this fact, however, market shares held by credit suppliers have fluctuated widely. And, despite the apparent maturity of U.S. agricultural credit markets, new forms of credit suppliers continue to emerge and enter the industry. Therefore, the question of credit supply to production agriculture must also include the characteristics and objectives of the credit supplier.

This thesis examines farmers' choice of lenders or credit suppliers. Specifically, the thesis analyzes factors that influence farmers' choice of a traditional credit suppliers—a commercial bank or the cooperative Farm Credit System, or a nontraditional credit supplier such as a dealer, manufacturer, or an input supplier.

Most of the work to date on nontraditional lenders has focused on the economic motivation for input supply or manufacturing firms to establish captive finance companies and these companies' lending activities and competitive strategies. Some key research questions in this area include the following.

1. Why do nontraditional lenders offer credit to farmer-borrowers? What are the reasons or purposes that induce nontraditional lenders to extend credit to targeted farmers?
2. How are nontraditional lenders able to acquire and provide loanable funds without the financial instruments available to traditional lenders? How does a supply firm perform the special functions of intermediation within the agricultural credit market?
3. Do nontraditional lenders' competitive advantages accrue from a business strategy or from the relatively unregulated environment? Or, should policymakers implement more strict regulation on unregulated nontraditional lenders?

Comparably, little work has been done from the borrower's perspective. In other words, the economic incentives for a farmer-borrower to select one lender over another have not been well examined and analyzed. Therefore, a number of research questions associated with farmer-borrowers' selection of short- and intermediate-term lenders might include the following.

1. What motivates farmer-borrowers to select a nontraditional lender's loan contract over that of a traditional lender? Which factors provide the needed incentives for farmer-borrowers to participate in a nontraditional lender's credit program?

2. Which choice criteria determine the likelihood of a farmer-borrower's participation in a nontraditional lender's credit program?
3. What do the competitive strategies of nontraditional lenders as manifested in their loan contracts imply for the competitive strategies of traditional lenders?

Examination of these questions can provide a better understanding of the responses of a farmer-borrower to different factors affecting his/her choice of a credit supplier and the relative influences of changes in these factors on the selection of each credit supplier. More importantly, this type of examination shows borrower performance, choice criteria, and farm-level demand for traditional and nontraditional credit from the viewpoint of borrower-customers and the demand side of the loan market. In other words, this study departs from previous works in that it interprets outstanding agricultural debt from the farmer-borrower's perspective, or demand side, rather from the lender's perspective, or supply side of credit. Thus, the most important features of this study are its microeconomic analysis of credit from the demand side of the credit market and its implications for lending activities in the agricultural credit market, neither of which are well developed in current literature.

Objectives

This study is driven by two primary objectives.

1. To investigate why the farmer-borrower is willing to borrow short- and intermediate-term credit from nontraditional lenders instead of traditional lenders. Specifically, what are the competitive attributes and strategies that potentially affect the success of nontraditional lenders from the farmer-borrower's perspective? Furthermore, do the borrower-specific attributes or type influence his/her decision-making process concerning use of nontraditional credit?

2. To analyze the potential implications of the emergence and success of nontraditional lenders on the credit activities and business strategies of traditional lenders and on competition within the agricultural credit market.

Organization of Study

This thesis is organized as follows. Chapter 2 provides a general overview of the U.S. agricultural credit market, which provides a fundamental understanding of the effect of changes in agricultural credit markets on the lending activities of borrowers and lenders. Chapter 3 briefly summarizes the economic activities of nontraditional lenders in the agricultural credit market. The literature relevant to this study is reviewed in Chapter 4. Chapter 5 develops the theoretical framework employed in analyzing of lenders and borrowers in the loan contract decision-making process. Chapter 6 describes the estimation procedure and microdata used in this study. Empirical results and corresponding implications are presented in Chapter 7. Finally, the conclusions of this study and some suggestions for further research are discussed in Chapter 8.

CHAPTER 2.

GENERAL OVERVIEW OF THE U.S. AGRICULTURAL CREDIT MARKET

U.S. agriculture is a capital-intensive industry. Farm businesses are heavily reliant on credit markets to finance their operations because equity markets are not generally available. Therefore, "the agricultural credit market and institutions have played a vital role in capitalization and modernization of farm businesses, financing the production and marketing of agricultural commodities, providing risk bearing services, building rural capital, and making other financial services available to agricultural borrowers and others in rural communities. The major credit suppliers to agriculture include the commercial banks, Farm Credit System, Consolidated Farm Service Agency, life insurance companies, merchants and dealers, Commodity Credit Corporation, and individuals" (U.S. Department of Agriculture, 1991, 1). During the 1980s, the agricultural credit market and most agricultural lenders experienced a number of structural changes due to the farm financial crisis. These changes not only significantly affected credit suppliers' lending activities, strategies, and competition in supplying agricultural credit, they also affected farmer-borrowers' reliance on traditional and nontraditional credit sources. In other words, changes in the financial environment and trends in the U.S. agricultural credit market affected both the economic activities of agricultural credit suppliers and those of credit users.

This chapter presents an overview of the U.S. agricultural credit market. The first part of this chapter examines trends and competition in the U.S. agricultural credit market in whole. A more detailed description of the real estate (loan maturity of ten to thirty years) and non-real estate (loan maturity of less than ten years) credit markets are examined in the second and third parts of this chapter.

Trends and Competition in the U.S. Agricultural Credit Market

The agricultural credit market

Over the past 25 years, total outstanding agricultural debt in the United States has experienced a nearly complete cycle of expansion and contraction. Figure 2.1 clearly indicates that the aggregate farm debt reached a peak of $204 billion during the period between 1982 and 1984 and then dropped 30 percent during the next six consecutive years, to $141 billion in 1991 (see Appendix A Table A.1 for detailed data). This contraction was the result of a numbers of factors. As the tight monetary policy pushed the real interest rate up in the early 1980s, rapid increases in capital and operating costs increased the financial burden of farmers. At the same time, U.S. farm products were losing their competitiveness in international markets. Export demand declined, causing an excess supply and inventory of farm products in the domestic market. Many farmers experienced sharp reductions in cash flow as production costs and interest expenses soared. At the same time, land values and farmers' equity plummeted, leaving many lenders in a precarious financial position.

Outstanding farm debt and extension of new credit decreased as farmer-borrowers' repayment ability decreased and lenders applied more stringent loan evaluation standards. The major agricultural lenders became more cautious in supplying agricultural credit. Lenders were severely influenced by the growing delinquencies of farm borrowers, increasing volumes of default loans or net chargeoffs, and commercial banks failures. By the end of the 1980s, more than 300 agricultural banks had failed, which seriously affected sources of funding to the agricultural industry.

By 1985, delinquent non-real estate farm loans at commercial banks had increased to $2.6 billion, from $0.9 billion in 1982. Delinquencies accounted for 7.3 percent of total outstanding debt (Table 2.1). One of the most striking consequences of the farm

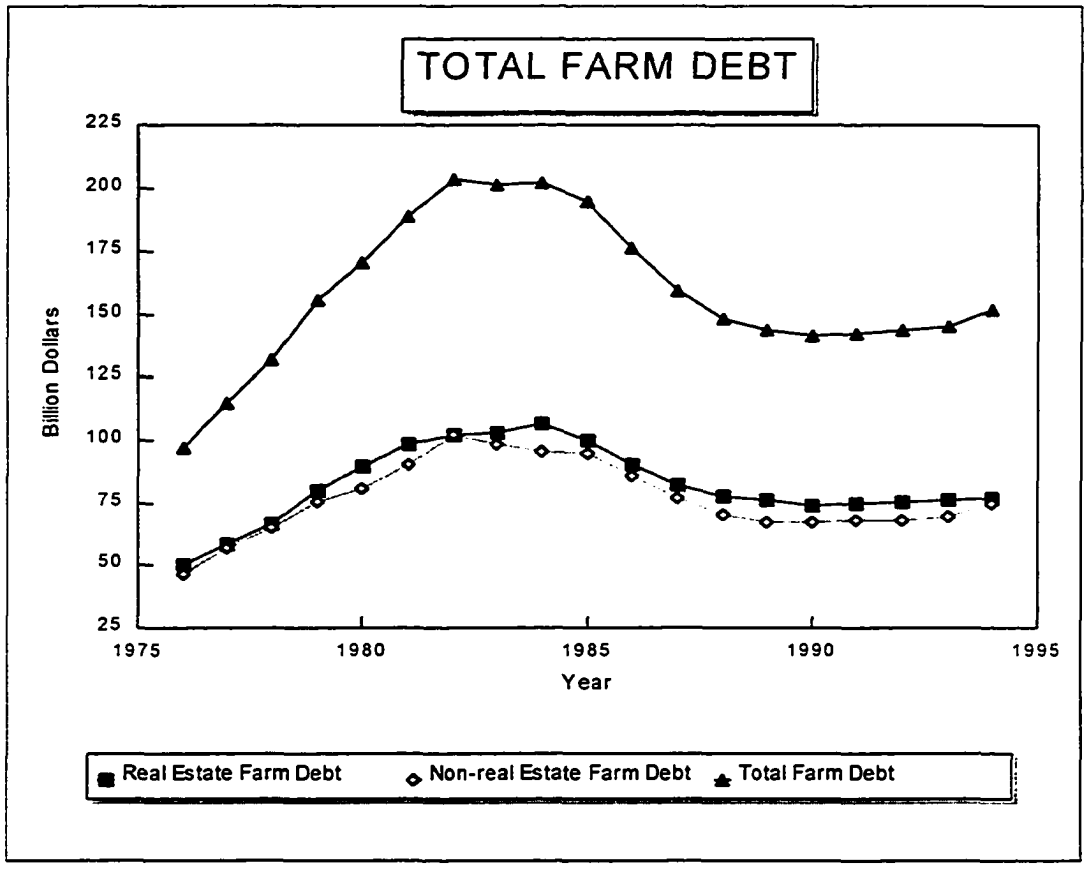


Figure 2.1. Total farm debt outstanding, 1976-94.

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Table 2.1. Delinquent loans and percent of outstanding loans, 1982-93

	Billion Dollars				Percent of Outstanding Loans			
Year	CB[a]	FCS	LIC	CFSA	CB[a]	FCS	LIC	CFSA
1982	0.9	0.7	0.8	9.5	2.5	1.1	6.4	37.9
1983	1.5	1.3	1.3	11.0	3.8	1.8	8.3	43.9
1984	2.1	2.1	1.2	12.1	5.2	3.3	9.6	45.9
1985	2.6[b]	5.3	1.7	11.9	7.3[b]	8.7	15.1	41.5
1986	2.2	7.1[b]	1.8[b]	12.0	7.0	14.4[b]	17.0[b]	42.9
1987	1.4	5.2	1.3	11.8	4.8	9.9	14.3	45.8
1988	1.0	3.3	0.8	12.5[b]	3.3	6.5	8.9	49.8[b]
1989	0.7	2.6	0.4	11.1	2.3	5.0	4.7	47.8
1990	0.6	2.5	0.4	8.1	1.9	6.1	4.2	41.3
1991	0.7	2.2	0.4	7.3	1.9	5.4	3.8	41.7
1992	0.6	1.9	0.3	6.6	1.8	4.6	3.3	42.5
1993	0.5	1.5	0.2	5.8	1.4	3.6	2.2	41.0

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System, LIC: Life Insurance Companies, and CFSA: Consolidated Farm Service Agency.

[a]Farm non-real estate loans only.
[b]Peak level, 1982-93.

crisis is that total delinquent farm loans of the Consolidated Farm Service Agency (CFSA) rose to their highest levels, at $12.1 billion and $12.5 billion in 1984 and 1988, respectively, or about 46 percent and 50 percent of outstanding debt. The Farm Credit System (FCS) and life insurance companies suffered peak delinquent loan rates of 14 percent and 17 percent, respectively, in 1986. Delinquent farm loans rapidly eroded the financial strength of farm lenders.

Loan losses in the non-real estate farm debt of commercial banks expanded to $1.3 billion in 1985, or about 3.3 percent of outstanding loans (Table 2.2). As loan losses grew, the failures of agricultural banks also mounted due to their less diversified lending portfolios compared with those of large commercial banks. Prior to 1983, less than 10 agricultural banks failed each year. However, 68 failed in 1985, 65 failed in 1986, and 69 failed in 1987.

At the same time, large banks took over small rural and regional banks as bank holding companies due to the rural banks' solid deposit base and higher cost structure. Thus, the small local commercial or agricultural banks with less diversified portfolios were often replaced by branches of large regional or national lending institutions. This evolution likely resulted because large banks with more diversified loan portfolios, more efficient overhead costs, and lower costs of capital could dominate the agricultural financial market. However, the lower operational costs via mergers and take-overs could be negated by higher regulatory costs originating from the financial innovations, which increased deposit insurance premiums, limited the amount of insurance offered to an insured, or imposed other rigorous regulations for avoiding losses and risk, such as a requirement for higher levels of capital for banks.

Total loan losses of the FCS rose to 2.3 percent of outstanding debt, equal to $1.3 billion dollars. The volume of life insurance company foreclosures soared to 7.9

Table 2.2. Loans losses and percent of outstanding loans, 1983-93

	Million Dollars				Percent of Outstanding Loans			
Year	CB[a]	FCS	LIC[b]	CFSA	CB[a]	FCS	LIC[b]	CFSA
1983		8	247	77		0.00	1.9	0.3
1984	900	428	289	128	2.3	0.50	2.5	0.5
1985	1,300[c]	1,105	530	257	3.3	1.60	4.8	0.9
1986	1,195	1,321[c]	827[c]	434	3.4[c]	2.30[c]	7.9[c]	1.5
1987	503	488	692	1,199	1.6	0.90	7.5	4.3
1988	128	413	364	2,113	0.4	0.80	4.0	8.4
1989	91	- 5	204	3,297[c]	0.3	0.00	2.3	12.4
1990	51	21	85	3,199	0.2	0.04	0.9	13.5[c]
1991	105	47	95	2,289	0.3	0.09	1.0	10.4
1992	82	19	148	1,887	0.2	0.04	1.8	9.1
1993	54	0	96	1,768	0.2	0.00	1.1	9.4

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System, LIC: Life Insurance Companies, and CFSA: Consolidated Farm Service Agency.

[a]Farm non-real estate loans only.
[b]Foreclosures.
[c]Peak level, 1982-93.

percent of outstanding loans, or $0.8 billion, at their peak in 1984. To increase efficiency in serving agricultural credit markets and reduce overhead and operating costs, the FCS undertook a series of mergers and consolidations under the Farm Credit Act of 1987. However, the FCS faced higher monitoring and regulation costs in the form of more stringent regulations aimed at reducing risk and stabilizing capital reserves. These regulations, for instance, required the FCS to hold a higher capital level (7 percent of risk-adjusted assets and off-balance-sheet activities), increase insurance to protect bondholders against default, prepare an insurance reserve to protect government against further problems, and repay government assistance. Therefore, although reorganization resulted in a direct cost-saving and costs of funds similar to those available to the federal government, the FCS still struggled to offer competitive funds due to the higher costs of operation.

In contrast, the CFSA had insignificant losses before 1987, but had peak volumes and percentages of loan losses in 1989 and 1990, at about $3.3 billion, or 13.5 percent. This delayed response is due, in part, to policy pressures from the government and from the CFSA's own administration. For example, a policy was established to restrict foreclosures and to defer the realization of loan losses due to budgetary concerns. In the late 1980s, the CFSA implemented a new strategy to deal with the large volumes of problem loans in its portfolio. "The new strategy is designed to either move loans back to a more current status or get them off the agency's books through restructuring or other adjustments" (Sullivan, 1991, 23). As a result, the CFSA experienced additional losses in the early of 1990s and cut direct loans for new lending activities. In addition, budget pressure and the proposal of a 20 percent equity participation in the CFSA guarantee program by the CFSA administration shifted the CFSA's lending activities from direct

lending toward the guarantees of loans other lenders offered. These changes reduced the agency's role as a lender of last resort.

After overcoming this adversity, surviving lenders and borrowers cautiously resumed their normal activities in a modestly growing agricultural credit market. Each agricultural lender carefully engaged in a different level of restructuring and began to focus on specific segments of the agricultural credit market. The trends in two specific segments of the agricultural credit market—real estate and non-real estate credit—are reviewed next.

The agricultural real estate credit market

In this and the following section, changes in outstanding debt and market share of major agricultural lenders are examined in the real estate and non-real estate agricultural credit markets. Trends in the agricultural real estate credit market are examined in this section.

Figure 2.1 shows that agricultural real estate debt, or long-term debt, plummeted from $106 billion in 1984 to $74 billion in 1990, which is equivalent to a 30 percent reduction during those six years. This structural change and reorganization extended to the beginning of the 1990s when outstanding agricultural debt slowly began to increase, ending a six-year period of annual reduction. Trends in the agricultural real estate credit market for major lenders are presented in Figures 2.2 and 2.3.

The major suppliers of real estate, or long-term, financing are the FCS and "individuals and others". Individuals and others (I&O) includes individuals (mostly farmers selling on contract), merchants, and dealers. Outstanding debt held by the FCS and I&O decreased by more than 40 percent of outstanding loans over the period of 1984 through 1989. During this period, market shares for the FCS and I&O decreased approximately 10 percent and 6 percent, respectively (see Appendix A Tables A.2 and

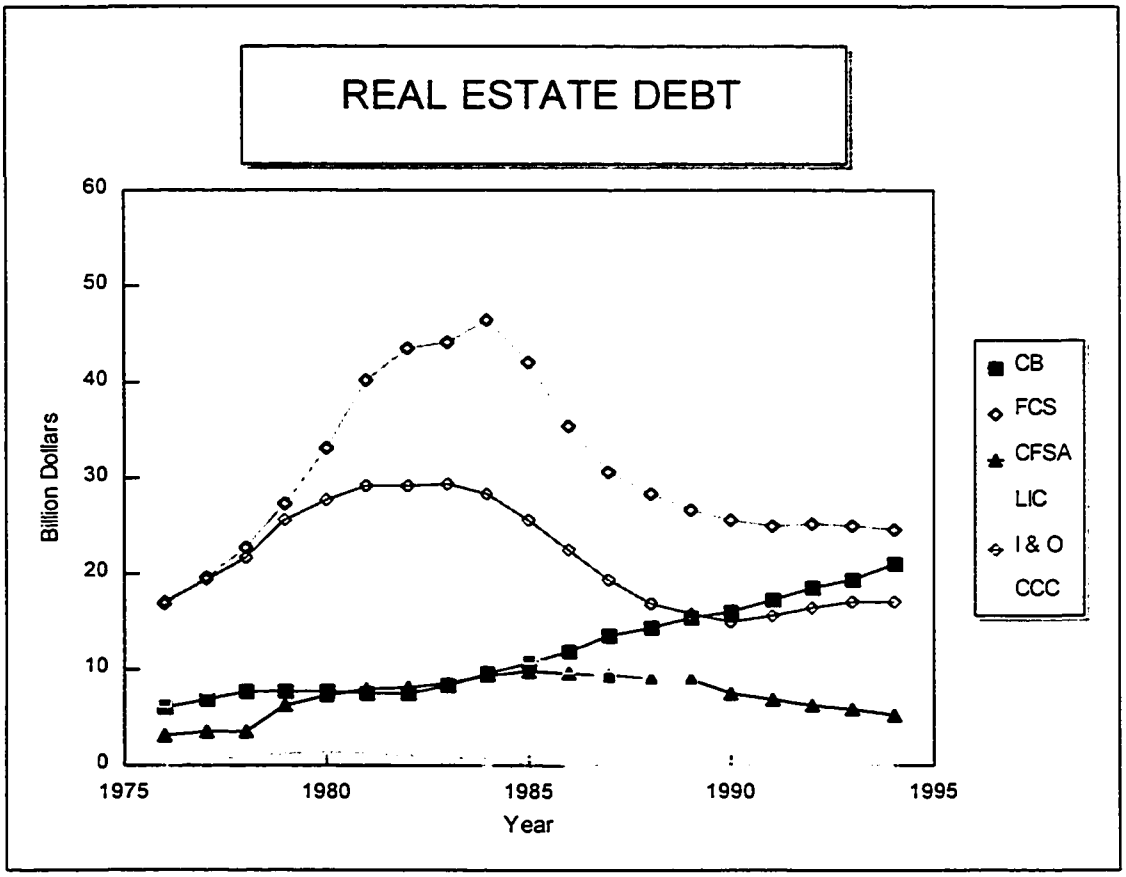


Figure 2.2. Real estate farm debt, by type of lender, 1976-94.

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, LIC: Life Insurance Companies,
I&O: Individuals and Others, and CCC: Commodity Credit Corporation.

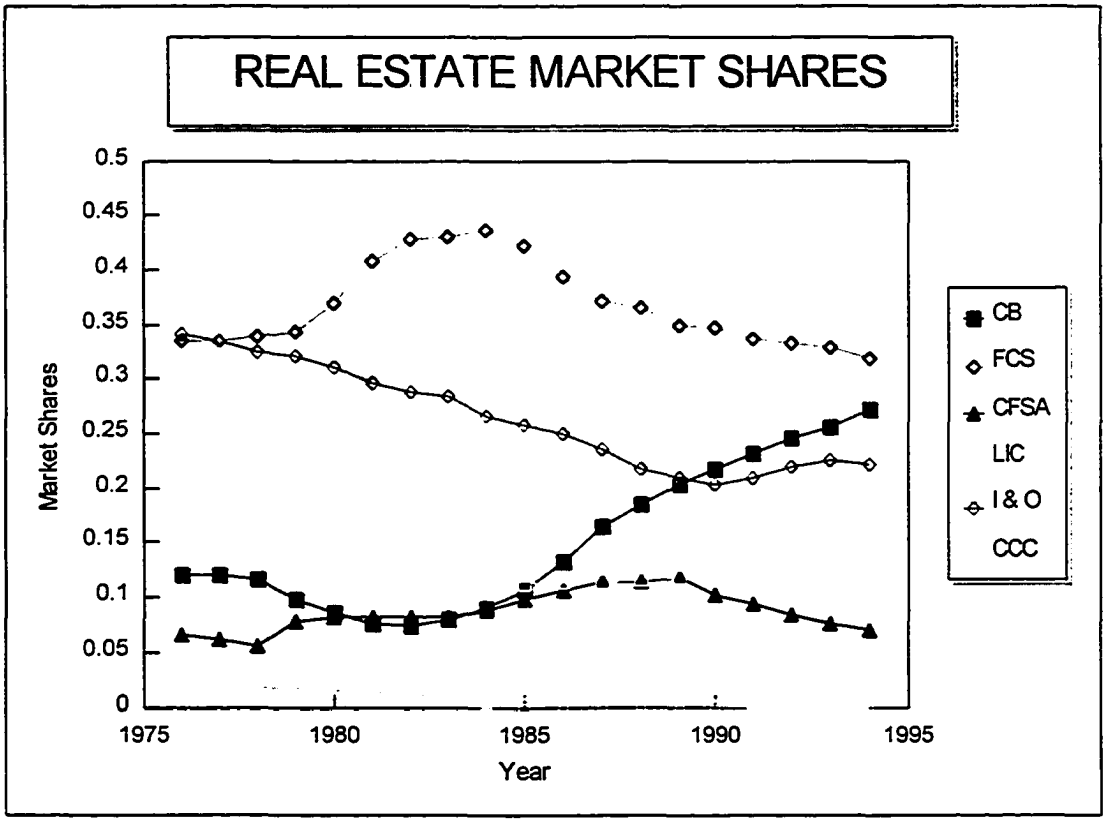


Figure 2.3. Market shares of real estate farm credit market, by type of lender, 1976-94.

Source: U.S. Department of Agriculture, *Agricultural Income and Finance*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, LIC: Life Insurance Companies,
I&O: Individuals and Others, and CCC: Commodity Credit Corporation.

A.3). By contrast, commercial banks markedly enhanced their holdings of real estate loans throughout this recession period and even overtook I&O lenders to become the second largest real estate credit provider in 1990. These facts indicate that the FCS and I&O group lost market share but retained their relative importance in this credit market. However, commercial banks began to play a more vital role in the agricultural real estate loan market than before. This trend probably can be attributed to the higher monitoring and regulation costs of financial restructuring by the FCS following the 1987 Act and to the wave of interstate banking and consolidation faced by commercial banks. The FCS's higher operating costs, used to repay loan losses, reduce operation risk, and secure credit activities, may affect the composition of a loan contract offer. Integration and deregulation in the banking industry, which resulted in superregional commercial banks with more efficient costs and lower costs of funds than those achieved by small local banks, may help the commercial banking sector strengthen its position in the real estate credit market.

Life insurance companies, historically major long-term lenders, had steady outstanding loan volume and stable market share (11 percent) from the 1980s to the 1990s. Farm real estate loans held by the CFSA remained steady in the latter part of the 1980s and then dropped in the early 1990s. This change may reflect the CFSA's inability to resolve bad loans because of prohibiting legislation in the mid-1980s and the shift in emphasis from direct loans to guaranteed loans.

Overall, after the agricultural financial credit crisis, traditional lenders—commercial banks and the FCS—appeared to have a stronger position in the real estate segment of the credit market, especially the commercial banks. The I&O group, including individuals and nontraditional lenders, tended to slow down credit extension in this segment of the credit market. These results seem to indicate that traditional lenders are more likely to serve the real estate segment of the credit market.

The agricultural non-real estate credit market

The agricultural non-real estate credit market provides capital for operating costs and assets such as machinery and breeding stock. The non-real estate credit market declined by 30 percent of outstanding loan, from $102 billion to $67 billion, between 1982 and 1989 (see Appendix A Table A.4). The volume of non-real estate loans held by commercial banks plummeted by about 25 percent in the late 1980s, but their market share has steadily increased since 1988 (see Appendix A Table A.5). In the early 1990s, commercial banks quickly recaptured loan volume and market share, returning to the peak levels of the mid-1980s (Figures 2.4 and 2.5). The I&O group experienced a decrease in loan volume and share in the late 1980s, but quickly recovered from the trough. By the early 1990s, the I&O group gained market share at the expense of the FCS and became the second largest credit supplier in the non-real estate market, with a 20 percent market share. Namely, the I&O group is becoming more important as a supplier of short- and intermediate-term agricultural credit.

The FCS markedly reduced its farm non-real estate debt volume and market share during 1984 through 1987, but has increased both since 1988. However, the FCS loan volume and market share are lower than they were when the decade began. As with the situation in the real estate credit market, the CFSA gained loan volume and market share from 1985 through 1990 and then lost ground in both areas during the early 1990s. These changes again reflects the agency's attempt to resolve poorly performing debt and its shift from direct to guaranteed loans.

The above historical evidence can be summarized as follows:

1. As large commercial banks with diversified loan portfolios and solid credit sources played a more significant role in supplying different financial services, the commercial banks group continued to dominate the non-real estate farm credit market with

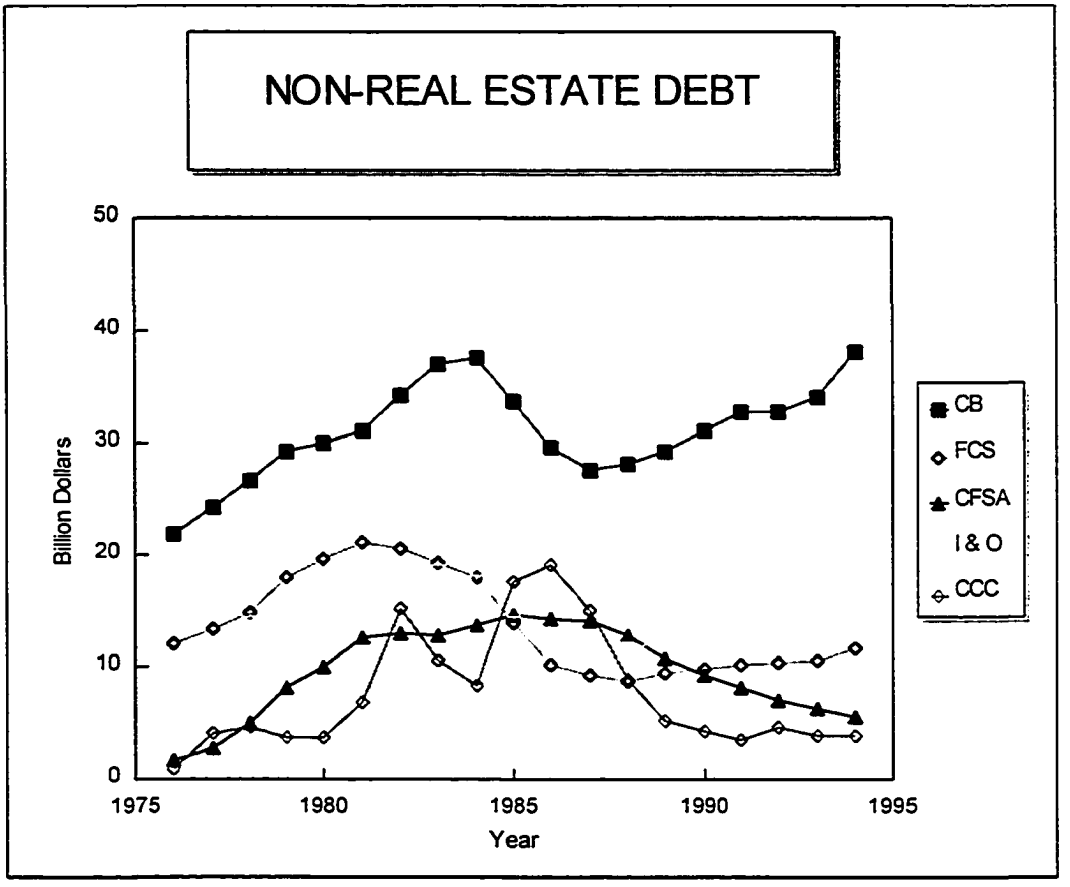
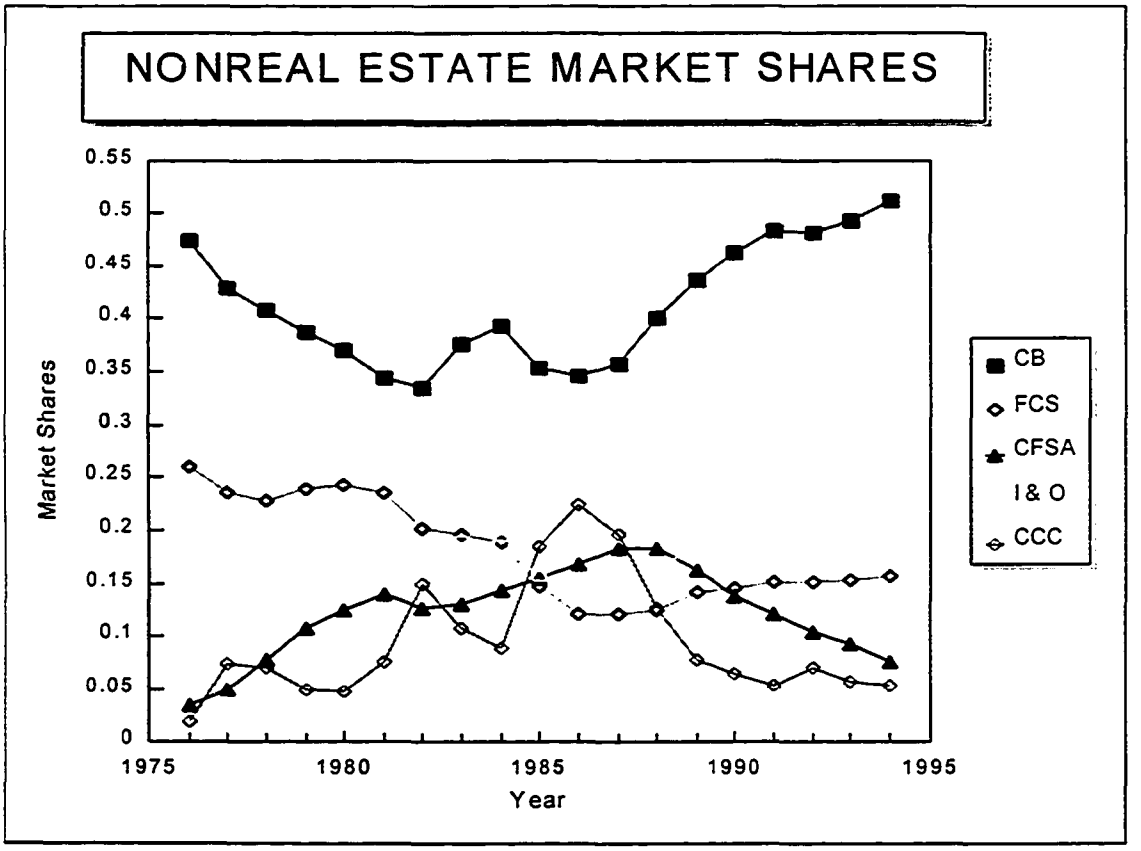


Figure 2.4. Non-real estate farm debt, by type of lender, 1976-94.

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, I&O: Individuals and Others, and
CCC: Commodity Credit Corporation.



Figrure 2.5. Market shares of non-real estate farm credit market, by type of lender, 1976-94.

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, I&O: Individuals and Others, and
CCC: Commodity Credit Corporation.

a market share of 50 percent. Further, the commercial bank group significantly increased market share in the real estate credit market.

2. Even though the FCS remains the largest lender in the real estate credit market, it faces a number of challenges, such as a less diversified loan portfolio compared with commercial banks, the need to repay government assistance from the 1987 restructuring, a regulatory requirement to hold higher capital reserves, and higher costs of insurance premiums. These factors appear to have hampered the recovery of the FCS's market share in both the real estate and non-real estate credit markets.

3. The CFSA, with half of the delinquent loans in U.S. agriculture, reduced direct loans in the agricultural credit market and emphasized on guarantees of loans made by other lenders. This change indicates the diminishing role of government involvement as a provider of capital to agriculture.

4. The I&O group seemed to strengthen its market share in the short- and intermediate-term farm credit market, whereas it maintained its position in the long-term agricultural credit market. Note that the I&O group is heterogeneous and its composition is very different between the two sectors. The I&O group is becoming increasingly prominent as a supplier of non-real estate credit for agriculture. The farm crisis of the 1980s forced some players to alter their strategies in agricultural lending, but it also attracted other kinds of lenders to the game. Finance companies, subsidiaries of merchants and dealers such as input suppliers, cooperatives, machinery suppliers, and processors are increasing their activities to provide short- and intermediate-term agricultural credit. Their existing facilities, dealer networks, and expertise may facilitate their ability to extend credit. Some major agribusinesses, such as John Deere, Pioneer Hi-bred International, Growmark, Farmland Industries, Dekalb Genetics, and Cargill, are currently increasing credit activities, and other agribusinesses are likely to participate in the short- and

intermediate-term agricultural credit market very soon. Thus, the increasing prominence of nontraditional lenders in the non-real estate agricultural credit market is important and can not be neglected in the 1990s. A more detailed analysis with respect to the motivation and characteristics of nontraditional lenders is carefully examined in next chapter.

CHAPTER 3.

NONTRADITIONAL LENDERS IN THE AGRICULTURAL CREDIT MARKET

This chapter defines and describes the characteristics and economic objectives of nontraditional lenders serving U.S. agriculture. One of the trends identified in the previous chapter was the dramatic change in market shares occurring in an ostensibly mature agricultural credit market. Consequently, one focal point for this chapter is to clearly delineate some of the potential advantages possessed by nontraditional lenders that may strengthen their competitive position relative to that of traditional lenders.

This chapter is organized as follows. The definition and importance of nontraditional lenders in the agricultural non-real estate credit market are more precisely and carefully restated in the first two sections, respectively. The motivations for nontraditional lenders to extend credit to farmers are discussed in the third section. Finally, intermediary functions of nontraditional lenders are described in the fourth section. In particular, we focus on how nontraditional lenders successfully engage in the extension of short- and intermediate-term agricultural credit, and even compete with traditional lenders with a number of financial instruments availabe to use, diversified loan portfolios, government assistance, or professional funding agencies.

Definition of Nontraditional Lenders

Nontraditional lenders are usually defined as firms that provide credit to their customers to facilitate or promote purchases of the firm's own goods and services. In agriculture, nontraditional lenders include input suppliers, local and regional cooperatives, machinery manufacturers, dealers, and other agricultural input processors of feed, seed, chemicals, fertilizer, petroleum, machinery, and equipment. Nontraditional lenders supply

credit through extensive and different programs targeted toward specific segments of farmers in a flexible and largely unregulated environment. Some nontraditional lenders, such as Pioneer Hi-Bred International, Farmland Industries, and Growmark, provide product and credit for input purchases for the entire growing season or production cycle. Others, such as Case-International Harvester and Deere & Company, offer intermediate-term credit for farm equipment and machinery purchases. Credit provided by these firms is extended through formal lending agreements or contracts with specific purpose, amount, maturity, and loan terms. Such contracts significantly differ from the normal 10- to 30-day trade or convenience credit. In other words, nontraditional lenders are not only dealers who provide goods and services, but also lenders who perform some of the same functions of financial intermediation as do traditional lenders.

The Importance of Nontraditional Lenders in the Agricultural Credit Market

In the previous chapter, the growth of market share of the I&O group in non-real estate credit market was discussed. In this section, the composition of the I&O group and the prominence of merchants and dealers is examined more completely.

Loan volume and market shares held by nontraditional lenders are not well documented. The USDA annually reports the aggregate level of debt provided by the I&O group. This group includes individuals, as well as merchants and dealers. The U.S. Census of Agriculture did report actual "merchants and dealers" credit in 1969 and 1978. Based on this information, nontraditional lenders held 13.5 percent and 13.8 percent of the non-real estate market share in providing non-real estate loans to farm operators in 1969 and 1978, respectively. This level is equivalent to 80.8 percent and 75.4 percent of market share in the I&O category of the non-real estate market. In contrast, the census data indicated that merchants and dealers supplied only 0.2 percent and 0.3 percent of real

estate credit to farm operators in 1969 and 1978, respectively. This level is equal to 0.7 percent and 0.1 percent of share in the I&O category for the real estate credit market. The preceding results show that the major component of the USDA's I&O category for non-real estate debt is likely made up of nontraditional lenders.

A recent paper by Monke, Sherrick, and Sonka (1992) also shows that nontraditional lenders have aggressively attempted to build market share by offering more comprehensive and flexible programs. Interviews conducted with nontraditional lenders in 1991 revealed their expectation that by 1996 loan volumes will be two to three times their 1990 levels. In addition, several papers (Thompson, 1987; Monke, Sherrick, and Sonka, 1992; Monke, 1993; Sherrick and Lubben, 1993; Sherrick, Sonka, and Monke, 1994; Sullivan, 1991; U.S. Department of Agriculture, 1993) discuss the emergence and growth of nontraditional lenders in short- and intermediate-term agricultural credit market in the 1990s.

Motivations for Extending Credit by Nontraditional Lenders

Nontraditional lenders extend credit to targeted segments of farmer-borrowers for a variety of reasons. However, the four main motivations are to

1. stimulate sales or solidify market share,
2. generate profits from credit sales,
3. make use of information advantages, and
4. provide convenience for agricultural borrowers; in other words, to reduce the transaction, searching and contracting costs to agricultural borrowers.

These four motivations help to explain not only the emergence of nontraditional lenders, but also their unique goals, advantages, and benefits for serving specific niche markets. A detailed examination of each motivation follows.

Stimulating input product sales and financial product (credit) sales

The original motivation for nontraditional lenders to enter the credit market was to enhance sales of company products. Monke (1993) pointed out that credit is a marketing tool or promotional device that can stimulate sales and profits of product lines for some nontraditional lenders who do not view lending programs as stand-alone profit centers. These nontraditional lenders believe the total profits of both manufacturing margin from sales of products and credit margin from sales of credit exceed the profits of manufacturing margin alone. In fact, by increasing the volume of business generated by offering low-cost credit, the manufacturing margin (sales profit) can be used to subsidize the break-even, or negative, credit margin as long as total profits (sales profit and credit profit) are higher (Sherrick and Lubben, 1993). That is one of the reasons why nontraditional lenders without well-diversified portfolios and lower capital costs are able to offer a more attractive interest rate than can traditional lenders with more diversified portfolios and lower capital costs.

Other nontraditional lenders operate their credit programs as stand-alone profit centers or separate business entities, often as wholly-owned subsidiaries of parent companies. Some finance companies (subsidiaries of merchants and dealers) seek to increase sales of member companies' products or to solidify their relationship with farmers through credit extension. These kinds of nontraditional lenders not only help the parent company to benefit from additional sales, but also yield their own profits internally through flexible financial strategies. Reinforcing customer relationships is another impetus of extending credit. By offering credit, along with financial management and production consulting services, customer loyalty and market share may be easier to solidify. Hence, by incorporating the credit activity in the total business portfolio, a nontraditional lender

can improve the performance of the whole business due to the effects of cross subsidization and improved or strengthened customer relationships (Sherrick, Sonka, and Monke, 1994).

Making use of informational advantages

Nontraditional lenders may have informational advantages compared with traditional lenders. When extending "point-of-sale" credit, nontraditional lenders already have free and superior access to background information about borrowers based on past noncredit contacts, which may not be freely released to traditional lenders. Therefore, nontraditional lenders with more accurate and inside information could more effectively evaluate the riskworthiness of a credit applicant or facilitate the credit-risk assessment process. Namely, the product supply relationship and related information enable the nontraditional lender to more precisely determine the best credit contract, interest rate, and collateral charged and to reduce moral hazard and adverse selection problems. Furthermore, this ongoing supplier relationship conveys information about a borrower's current operation and management status, which helps reduce the lender's monitoring costs. In contrast, traditional lenders without this type of relationship may need to monitor borrowers more often, thereby increasing the monitoring cost, and to protect themselves from default risk and risk of moral hazard. In addition, sharing the information among different departments or among member corporations could reduce the informational collection cost and result in a cost advantage for credit delivery by nontraditional lenders.

Providing convenience to agricultural borrowers

Owing to the nature of nontraditional lenders, "point-of-sale" credit may be regarded as a complement to a firm's product line, providing convenient "one-stop-shopping" for product and financial inputs. Obviously, this one-stop-shopping

saves the transaction cost of credit applicants at the time of searching for lenders and making a formal loan application. In an example mentioned by Sherrick, Sonka, and Monke (1994), a potential borrower could obtain a John Deere Credit card in less than 12 minutes from time of entry into the dealership until the account was created and debited. Acquisition of capital in such a convenient way may attract particular segments of farmers to evaluate the credit decision and input requirement decision together. Customer convenience is another reason (and a competitive advantage) why merchants and dealers extend credit programs in the short- and intermediate-term loan market.

The Intermediary Functions of Nontraditional Lenders

This section discusses how nontraditional lenders, despite the lack of various financial instruments, well-diversified loan portfolios, and government assistance or agency status, can obtain loanable funds. Because nontraditional lenders are not required to report information as traditional lenders, the most detailed information concerning the intermediary characteristics of nontraditional lenders was obtained through interviews with agricultural input supply firms during the summer of 1991 in a study conducted by Monke, Sherrick, and Sonka. The major intermediary characteristics of nontraditional lenders are summarized next.

Funding sources

Agricultural credit markets are highly integrated into the national and international capital and money market. Therefore, interest rates charged in different segments of the national financial market will directly affect costs of funds to agricultural lenders and thereby affect the interest rate charged to borrowers. Obtaining loanable funds efficiently and in the desired volume tends to be a critical factor for nontraditional lenders as they

compete with traditional lenders having depository authority, government agency status, or quasi-agency status to finance low-cost and stable funds.

The primary funding sources of the nontraditional lender's loan portfolio are commercial paper sold either by themselves or the parent or member company, credits with commercial banks, and their own or their parent or member company's equity capital. Because most nontraditional lenders are subsidiaries of parent companies, they are not large and well-known enough to successfully borrow loanable funds by issuing their own commercial paper. Therefore, commercial paper sold by reputable parent or member companies is a vital source of short-term and low-cost funds. In general, nontraditional lenders often pay the commercial paper rate plus a fixed margin to acquire the funds. These rates are then offered to borrowers by charging a variable interest rate which ties to the prime interest rate to reduce interest rate risk. Credit lines provided by commercial banks also represent another source of loanable funds. Sherrick, Sonka, and Monke (1994), argued that in this financing segment the credit supplier is a traditional lender and that the nontraditional lenders serve primarily as originators. This relationship allows nontraditional lenders to borrow "in bulk" and relend to their customers. However, why would a traditional lender be willing to offer credit to competitors? This question can be explained by the theory of indirect lending, which states that the traditional lender's strategy is to reduce the costs of screening the borrower and the costs of lending by encouraging higher-risk borrowers to self-select nontraditional lenders. Thus, the interest premiums charged to nontraditional credit users are higher due to their higher risk than those charged to traditional credit users. Furthermore, the internal funds and equity capital of nontraditional lenders or parent companies still serve as a fundamental sources of loanable funds.

Risk and the security evaluation process

The cost of funds and overhead costs are included in the basic loan rate of the lender's loan portfolio. However, the riskiness of each loan applicant is also a key determinant of the borrower's loan rate. The default risk premium, an additional charge on the basic loan rate, is used to compensate lenders for bearing potential risk in case of default. Hence, risk evaluation plays a crucial role for lenders in determining the interest rate and the collateral or security requirement of each loan contract.

Credit scoring is widely exploited by nontraditional lenders in the loan approval process, but the weights of various factors used in various models probably are different, depending on the nature and characteristic of the individual business. However, due to the advance information released through sales of input products, nontraditional lenders are likely to use this superior information to enhance the correctness of results of the credit scoring model and to charge the appropriate interest rate and collateral on a specific loan, which could improve loan profitability. In addition, nontraditional lenders can take advantage of their existing expertise and knowledge in the agricultural industry to efficiently manage specialized collateral and save more collateralization cost than can traditional lenders. In sum, like traditional lenders, nontraditional lenders employ credit scoring techniques to evaluate the riskworthiness of a particular applicant, but the superior access to information may benefit nontraditional lenders in offering competitive and profitable credit terms.

Services

As the agricultural credit market becomes more competitive, nontraditional lenders tend to provide more complex lines of credit and more comprehensive services. According to a survey conducted by the American Banker, service-related factors strongly determine

the financing decisions of corporate financial decisionmakers (Duncan, 1991). Therefore, like credit lines, services gradually come to be regarded as supplementary and attractive product lines. Nontraditional lenders not only provide professional production consulting services and lending services, they also provide other financial services, such as brokerage, hedging, tax preparation, and financial management advice, which will enhance their understanding of and strengthen their relationships with a particular group of borrowers. The professional knowledge and expertise owned by nontraditional lenders can strengthen their financial services and production consulting services, which are other overriding competitive advantages.

Regulation

Traditional lenders are restricted or protected by regulations and laws of government agencies, including the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve System, the Comptroller of the Currency, state and federal banking regulators, the Security and Exchange Commission (SEC), and Congress, who are required to ensure the soundness of the U.S. financial market, promote the provision of information, and protect depositors. Because nontraditional lenders do not place small depositors at risk as do traditional lenders, they are regulated only by property, lien, usury, and security laws. Because of their distinct funding sources, nontraditional lenders are not required to report the same detailed information traditional lenders must report. Traditional lenders often claim one-sided regulatory requirements place them at a competitive disadvantage compared with nontraditional lenders. Because "banking regulations protect depositors and not borrowers" (Monke, Sherrick, and Sonka, 1992, 7), however, the adjustment of current regulation seems unlikely. In fact, the bondholders and stockholders of nontraditional lenders and their parent companies bear both the operational

(business) and financial risks of the whole business entity. The absence of reporting requirements and government regulating may reduce some costs for nontraditional lenders and increases their advantages in keeping confidential information.

In summary, nontraditional lenders' potential advantages due to unique operating features, credit activities, and business strategies, such as flexible organizational structure allowing internal cross-subsidization and exchanges of financial and information inputs, close relationships with targeted segments of farmer-borrowers, and unique market strategies, lead to their obvious success in offering short- and intermediate-term loan contracts. In the next chapter, these nontraditional lenders' advantageous features are applied to analyze the determination of a loan contract and the competition of a loan contract offering.

CHAPTER 4.
LITERATURE REVIEW

This study examines the competitive relationship between traditional lenders and nontraditional lenders and its implication for farmer-borrowers in the U.S. agricultural credit market. The microeconomic basis for farm-level demand and supply for traditional and nontraditional credit can be viewed in terms of an optimal loan contract between borrowers and lenders. The contract reflects a number of factors or issues evaluated by lenders in their offering decision and by farmer-borrowers in their participation, or acceptance, decision. These factors or issues substantially influence the equilibrium loan contract and the specific financial relationship between farmer-borrowers and lenders in their credit activities. Consequently, the research questions and objectives identified in this thesis initially will be addressed by examining the existing literature on the decision-making process of borrowers and lenders as reflected in the loan contract.

There are several areas of literature relevant to understanding the farmer-borrower's selection of a lender and a loan contract. One broad area examines the role of information, collateral, and interest rates in managing problems of moral hazard and adverse selection. Specifically, reviewing the structure and determination of an optimal loan contract and the interrelationships among its component instruments, such as collateral, interest rates, the borrower's creditworthiness, transaction costs, and related information problems, provides a general insight into the interaction between borrowers and lenders. A second area of literature focuses on the incentives for firms to establish captive finance companies. The literature regarding indirect lending or vendor financing further helps to explain the emergence of nontraditional lenders, the strategic differences between the two types of commercial lenders, and their relationship with borrowers. A

third line of inquiry uses scoring and evaluation models to capture lenders' credit underwriting decisions. The literature regarding credit scoring models, widely exploited by lenders to assess the creditworthiness of borrowers and to price loans in terms of default, provides additional insights into the lender's empirical loan evaluation process. Finally, a fourth area of literature, contributed primarily by labor economics, helps to develop an understanding of how a farmer-borrower's choice of a loan contract can be modeled as a participation decision. These discrete choice models (or random utility models) facilitate analysis of the participation and self-selection that occur in the farmer-borrower's decision-making process on financing operating credit.

This chapter proceeds as follows. The first section reviews issues pertaining to how information affects a lender's efficient design of a loan contract in the presence of moral hazard and adverse selection. This approach explains the interrelationship among the component instruments of a loan contract on the basis of different information sets. The second section reviews issues about how specific economic and managerial characteristics of two different types of commercial lenders affect their lending activities and the resulting loan contracts. In the third section, several credit scoring models are reviewed to give a clearer picture of the lender's loan approval and loan pricing processes in practice. Finally, discrete choice models are reviewed as a possible way to capture how a farmer-borrower selects traditional or nontraditional lenders as short- or intermediate-term credit suppliers.

Collateral, Interest Rates, and Asymmetric Information

The theme centering on information asymmetry between borrowers and lenders in financial transactions occupies an important position in the current literature in debt markets. Several initial studies, such as Akerlof (1970), Jaffee and Russell (1976), and

Stiglitz and Weiss (1981), have demonstrated that information problems in credit markets may raise the price of loan contracts for some classes of borrowers, change the combination of loan contract terms, or even cause markets to break down. To some extent, imperfect information characterizes the complexity of the financial relationship between borrowers and lenders. Under such a setting, when two commercial lenders compete for loans, their distinct credit policy attributes, institutional factors, cost differences, and access to information can result in contracts with unique profitability and risk characteristics. These differences also result in distinct utility values for a farmer-borrower when selecting an optimal loan contract. In this section, the research literature pertaining to the determination of the loan contract under specific information regimes is reviewed.

The collateral pledged by the borrower and the rate of interest charged by the lender are two of the most important factors of a loan contract. Traditionally, it is believed that a higher interest rate and collateral requirement are usually required by lenders to reduce default risk and to generate higher expected returns if there is no imperfect, or asymmetric, information. Asymmetric information, in this case, is defined as the situation in which lenders and borrowers possess different information sets. So, under the conventional setting, collateral has been widely used as a mechanism to secure or enforce a loan contract. Specifically, the value of collateral after liquidation determines the lender's security margin should default occur. Similarly, the interest rate charged reflects not only the lender's cost of funds, overhead cost, required rate of return, and own interest-rate risk, but also the borrower's unique financial and business risk. However, because the literature regarding asymmetric information is applied to the borrower-lender relationship in the credit market in the 1970s, the interactions between the interest rate, collateral, quality, and risk behavior of a borrower and the expected return of a lender

differ dramatically from the original analysis without emphasis on the asymmetric information issue. Specifically, in the presence of asymmetric information, a higher interest rate and collateral requirement may no longer produce a higher expected return and a lower default risk for lenders. Rather, it might attract higher-risk borrowers and reduce lenders' security and profit margins. In other words, asymmetric information, adverse selection, and moral hazard significantly influence the determination of a loan contract package and result in interrelationships among contract provisions that significantly deviate from conventional wisdom.

The basic concepts associated with information problems were first introduced by Akerlof in 1970. These concepts and the possibility of market failure were then applied in credit markets by Jaffee and Russell (1976). Akerlof modeled the behavior of sellers and buyers in used car markets. He showed, theoretically, that when buyers only can observe the average quality of an asset and pay average-quality price, then only sellers of low-quality goods (lemons) are active by selling them at the average-quality price. Sellers of high-quality goods withdraw from the market because they are not fully rewarded. Akerlof showed that asymmetric information may distort the transaction behavior of market participants. Jaffee and Russell applied these concepts to lending activities. They showed that when borrowers and lenders have asymmetric information about the borrower's risk of default, assuming that default probability increases with loan size, good borrowers are more willing to accept a smaller loan size, which reduces the average default rate and lowers the interest rate premium charged, and bad borrowers are forced to accept a smaller loan size to hide their high default rate. However, Jaffee and Russell's model only considers the influences of loan size and interest rate premium, and ignores those of collateral, equity requirement, and non-price terms. Thus, this classic argument reveals

that, in addition to price terms, the information problem plays an important role in determining a loan contract package through its effect on borrower-lender behavior.

Another strand of early literature (Barro, 1976) examined the effect of the probability of default on several influential factors of the credit contract, such as collateral, interest rate, and transaction costs. Barro's paper pointed out that owing to the costs of collection and liquidation of collateral and the transaction costs of collateral to the lender, there is an asymmetric collateral valuation between the borrower and the lender that causes "divergence between the borrower's expected interest rate, the explicit loan rate, and the lender's expected interest rate" (p. 455). This paper provides insights into the composition of a loan price which should incorporate both the explicit interest rate and the specification of collateral, as well as on the impacts of transaction costs on the collateral requirement and interest rate charged by a lender.

These early studies provide a foundation for two strands of thought—the sorting-by-private-information paradigm and the sorting-by-observed-risk paradigm. Each strand is based on different assumptions of the borrower's risk due to the asymmetric information problem in the credit market. By reviewing the relevant literature of these two lines of inquiry, the interaction between borrowers and lenders via terms of the loan contract can be further understood.

The sorting-by-private-information paradigm

A number of theoretical papers argue that, in the real world, the borrower has more accurate private information regarding his or her own creditworthiness. In this case, asymmetric information with respect to the borrower's quality results in low-risk borrowers being required to pledge more collateral but pay a lower interest rate than are high-risk borrowers. In other words, there is a negative relationship between the amount

of collateral pledged and the borrower's risk. Most of the theoretical papers associated with information asymmetry focus on the sorting-by-private-information paradigm.

The fundamental relationship among collateral, interest rate, and asymmetric information was not elaborated in the theoretical literature until the notable paper published by Stiglitz and Weiss in 1981. Prior to their work, the conventional argument implied that a higher interest rate and collateral requirement would improve a bank's expected return and security in case of default, assuming no ex ante imperfect information. Stiglitz and Weiss, however, carefully illustrated that, through adverse selection and moral hazard resulting from asymmetric information, a higher interest rate or collateral requirement could, after a point, adversely produce lower expected returns to banks and credit rationing on loans instead of reducing the bank's default risk and increasing the expected returns. According to this theoretical framework, an increase in the interest rate or collateral requirement in a loan market with imperfect information may (1) attract bad borrowers (those with riskier projects and a higher default rate), (2) increase the average riskiness of the pool of borrowers ex ante, (3) ration out the good borrowers (those with safer projects and higher probabilities of repaying the loans), and (4) reduce banks' profits because of adverse selection (sorting) problems. In addition, such actions may (1) induce borrowers to invest in riskier projects ex post with higher payoffs but lower probabilities of success, (2) push up the default rate, and (3) decrease the returns to the banks because of moral hazard (incentive) problems.

If a borrower's credit risk can not be identified by a lender before contracting, or if the borrower's behavior can not be stipulated by the lender after contracting, increases in the interest rate and collateral requirement may actually reduce the lender's profits, making the loan supply curve bend backwards when there is an excess credit demand. Therefore, in this case, lenders would choose to ration credit. In other words, they would reject some

potential borrowers who are observationally equivalent to those who receive credit, even though these potential borrowers are willing to pay a higher interest rate or offer more collateral. This important research clearly illustrates the complicated relationship between the borrower and the lender due to asymmetric information. However, Stiglitz and Weiss do not consider the costs of collateralization (transaction costs related to the collateral requirement), and lenders are only allowed to vary either the interest rate or the collateral requirement for loans, but not both.

After this influential theoretical paper, several theoretical and empirical studies were completed in which lenders could simultaneously choose the interest rate and the collateral requirement in the presence of collateralization costs. These studies carefully elaborate the relationship between riskiness of borrowers and the function of interest rate and collateral under imperfect information and provide additional insight into the existence of different combinations of terms of a loan contract.

Bester (1985), and Chan and Kanatas (1985) developed more realistic models in which lenders could simultaneously choose the collateral requirement and interest rate of a loan contract to avoid adverse selection problems. Both models arrived at similar conclusions that different contracts with various combinations of interest rate and collateral requirement can serve as a self-selection mechanism to sort good and bad borrowers. Specifically, if the use of collateral is costly, different collateral requirements of different loan contracts will be viewed as a self-selection mechanism. Risky borrowers can be identified in this case because they are more inclined to choose a contract with a lower collateral requirement and higher interest. Less-risky borrowers would accept higher collateral requirements, thereby signaling their creditworthiness. In other words, borrowers' risk information is revealed to lenders through their selection of different contracts, and no borrower is rejected by lenders. These two papers address an important

issue for my study. Even though economic agents do have asymmetric information, appropriate design of the credit contract by lenders may force borrowers to reveal or signal their private information. Then, lenders could successfully classify borrowers according to their creditworthiness.

Besanko and Thakor examined aspects of admissible credit contracts under asymmetric information in their two 1987 papers. The first equilibrium result is consistent with the sorting-by-private-information paradigm, that is, low-risk borrowers offer more collateral than do high-risk borrowers. The second equilibrium result reverses the traditional positive relationship between interest rate and borrower risk and hypothesizes that low-risk borrowers will receive more credit and pay a higher interest rate than will high-risk borrowers. This result shows that a loan contract should be viewed as a bundle, so different combinations of component instruments significantly affect their interrelationships.

Another related paper, published in 1987 by Chan and Thakor, explored both adverse selection and moral hazard under two different concepts of competitive equilibrium models: "all rents accrue to borrowers" and "all rents accrue to depositors" (p. 345). Chan and Thakor examined the economic role of collateral under these specifications, assuming unconstrained access to collateral by borrowers, systematic evaluation between banks and borrowers, and no collateralization costs. Under their first notion of competitive equilibrium involving "banks competing for loans, with a perfectly elastic deposit supply at market-determined bank borrowing rate" (p. 348), full collateralization avoids credit rationing either when both the adverse selection and moral hazard case occur or when only the moral hazard case occurs. However, under the second notion of competitive equilibrium involving "banks competing for a limited quantity of deposits" (p. 349) rather than for loans, even if full collateralization is feasible, credit rationing may occur in the

presence of adverse selection and moral hazard. However, rationing disappears in the case with only moral hazard. Therefore, as shown by the results of previous studies, good borrowers are inclined to put up more collateral, and collateral provides a means to solve problems of moral hazard and adverse selection.

In summary, the literature regarding the sorting-by-private-information paradigm creates a better understanding of the strategies and mechanisms used by lenders to overcome the asymmetric information problem and to correctly distinguish borrowers based on their different risk levels. The literature shows that by skillfully structuring the loan contract, a lender may reduce his/her asymmetric information problem. In turn, this leads to the situation in which the collateral requirement is negatively related to the interest rate charged and positively related to the borrower's quality.

Collateralization costs and access to collateral As previously mentioned, collateral can be regarded as a signaling mechanism to reveal a borrower's creditworthiness. Therefore, unlimited access to collateral and collateralization costs (transaction costs to collateral) are two important factors affecting borrowers' likeliness to reveal their private information or distinguish themselves by self-selecting the designed contracts. The effects of these two factors on the borrower's riskiness identification, the collateral submitted, the interest rate charged, and credit rationing should not be neglected. Most of the papers discussing the relationship of a borrower's creditworthiness, collateral, and credit rationing either neglect both the effects of limited access to collateral and collateralization costs or just incorporate one of them. However, Besanko and Thakor (1987) and Gale (1990) incorporate the impacts of these two crucial factors in their competitive models, which only focus on the adverse selection issue.

Besanko and Thakor and Gale found that if low-risk borrowers are unable to post enough collateral to signal their creditworthiness due to insufficient wealth, then banks

have some likelihood of rationing credit on low-risk borrowers because they can not perfectly sort borrowers into different risk categories. One way out of this dilemma, suggested by Besanko and Thakor, is the presence of a co-signer who knows the low-risk borrower better than the bank does. The approach suggested by Gale relies on the presence of government subsidy programs—a direct or guaranteed loan to the low-risk borrower. But Gale warned that if the government can not correctly identify the right borrowers (low-risk borrowers) to grant the subsidies as a well-informed co-signer, the subsidy program may result in further credit rationing by private lenders, which crowds out private credit, instead of improving rationing and efficiency.

In addition, both papers showed that, in the case of unlimited access to collateral, high collateralization costs push up the interest rate charged and reduce the collateral posted on low-risk borrowers, but have no effect on those charged on high-risk borrowers. However, in the constrained collateral case, collateralization costs only positively affect the interest rate on low-risk borrowers.

These papers reinforce the importance of collateralization costs and access to collateral on the loan contract. Because these two factors significantly affect the success and usefulness of a lender's strategy and contract mechanism when there is information asymmetry, they should not be ignored in the theoretical model with information asymmetry.

The sorting-by-observed-risk paradigm

Most of the conventional literature, referred to as the sorting-by-observed-risk paradigm, assumes that banks have enough information provided by the applicant to assess the applicant's riskiness and the required collateral. In this case, observable risky borrowers are required to pledge more collateral than are safer borrowers. The main

theoretical work supporting the sorting-by-observed-risk paradigm is presented in a paper by Boot, Thakor, and Udell (1988), which illustrated that if "the borrower's project is observable to both borrower and lender, while borrower effort is only privately known, higher collateral is pledged by observable riskier borrowers under certain conditions" (p. 24). This argument is supported by the empirical findings discussed next. Generally speaking, theoretical work supporting this paradigm is limited. Most current theoretical work considers or focuses on the influence of information asymmetry.

Empirical study

Unfortunately, although the theoretical literature in this area is abundant, empirical tests or applications are limited, due in part to the privacy of banks' credit contracts. Berger and Udell (1990) and Martin and Smyth (1991) recently published empirical studies of credit rationing and granting behavior.

To analyze the relationship between collateral and risk, Berger and Udell used a pooled time-series cross-sectional data set, "Federal Reserve's Survey of Terms of Bank Lending," which includes information on one million business loans from 1977 to 1988 provided by 460 different banks. The empirical findings indicate that risky borrowers are likely to pledge more collateral than are safer borrowers in general, which strongly suggests that the sorting-by-observed-risk paradigm is empirically dominant. This conclusion implies that banks either produce information by themselves or share the information with other banks in advance of offering the contract. The results also show that the loans secured by collateral are more risky than the loans not secured by collateral.

Martin and Smyth (1991) empirically tested the Stiglitz and Weiss hypothesis in the home mortgage market. Their results indicate that the collateral requirement decreases as the interest rate increases up to the optimal interest rate. Beyond the optimal interest rate,

however, the collateral requirement increases as the interest rate increases. This finding supports not only the viewpoint of Bester, that banks strategically offer sets of self-selecting contracts, but also that of Stiglitz and Weiss, which hypothesizes a backward-bending credit supply curve. Martin and Smyth's work supports the sorting-by-private-information paradigm.

In summary, most theoretical papers associated with information asymmetry support the sorting-by-private-information paradigm, which concludes that low-risk borrowers pledge higher collateral but pay lower interest rates than do high-risk borrowers. Little theoretical work has been done to support the sorting-by-observed-risk paradigm except the paper by Boot, Thakor, and Udell (1988). Their paper illustrated that if the borrower's project is observable but his/her effort is unknown to the lender, higher collateral is pledged by observable riskier borrowers, given certain conditions. Combining both strands of thought provides a more complete theoretical foundation in analyzing the multi-dimensional nature of an optimal loan contract and the complex financial relationship between borrower and lender in a loan market.

Vendor Financing

In the classical models of financial and product markets with the absence of transaction costs and asymmetric information, active earning-driven financial intermediaries play no role in financial markets (Brennan, Maksimovic, and Zechner, 1988). In the real world, however, the existence of transaction costs and imperfect information in the financial market not only provides a reason for the existence of financial intermediaries, but also for that of vendors. In addition to traditional financial intermediaries, such as commercial banks, vendors (or sellers of goods and services) can also supply credit and services to heterogeneous customers. The following literature gives

a clear picture of the motivation, economic incentives, strategic instruments, and niche strategy of vendor financing. Reviewing these features of vendor financing from a different perspective enhances the comprehensive understanding of the lending activities and behavior of nontraditional lenders and their connections with niche market customers.

Brennan, Maksimovic, and Zechner (1988) related the emergence of vendor financing to heterogeneous customers and market structure. Their model showed that a vendor, viewed as a monopolist in the product market, will earn a profit by offering distinct terms of the loan contract that attract different types of customers when cash customers and credit customers have different reservation prices. Even though cash and credit customers have the same reservation prices, adverse selection provides an incentive for price discrimination and makes vendor financing profitable for a monopolist. Brennan, Maksimovic, and Zechner further demonstrated that the total gain from vendor financing in a duopoly market, where two firms offer vendor financing, dominates that in a monopoly market. But the profits of a duopolist are less than those of a monopolist. This result suggests that vendor financing is advantageous as a strategic instrument if only some of the firms with some market power provide vendor financing, not all of them. In other words, the market structure is shown to significantly affect the emergence of vendor financing.

Staten, Gilley, and Umbeck (1990) discussed vendor financing from the perspective of indirect lending. Their model examined the interaction among banks, dealers, and two risk categories of borrowers. Because the borrowers are indistinguishable to lenders, if lenders do not screen and sort borrowers, adverse selection will force lenders to ration credit. Banks, therefore, could charge a higher test fee but a lower interest rate on direct lending. On indirect lending, no test fee is required but a higher interest rate is charged. This "two-desk" strategy serves as a mechanism for inducing borrowers to sort or self-select themselves and to signal their creditworthiness through their choice of financing.

The advantage to employing separate desks or locations is that the bank could save not only the costs of verification or screening by persuading applicants themselves to reveal information about their inherent default risk, but also the cost of loan origination and serving when the physical distance between the dealer and bank increases the borrower's transaction costs. In sum, the theory demonstrates that commercial banks could implement indirect lending to reduce the costs of lending across risk categories and the costs of expanding the bank's customer base. Furthermore, "both bank and borrower gain from the convenient point-of-sale financing on part of the bank's portfolio" (p. 527). The comparison of personal and contract characteristics between direct loans and indirect, non-recourse loans, based on 1979 new automobile loan data, indicates that direct and indirect borrowers on average have significantly different borrower characteristics and contract margins. This result implies that banks do take advantage of the two-desk strategy to screen credit applicants, which is consistent with the theory offered by Staten, Gilley, and Umbeck. Clearly, their study is helpful in interpreting the cooperative and mutually beneficial relationship between traditional and nontraditional lenders if information asymmetry exists.

Sherrick and Lubben (1993) investigated the economic incentives of vendor financing in conjunction with the vendors' products. They employed an economic framework that included market power, information identification, and internal cross-subsidized activities to demonstrate the distinct strategic behavior between pure intermediaries and vendor financing units.

In cases where the vendor has market power and both lenders and vendors compete for lending, the vendor finance operation with better expertise in disposing of specialized collateral or/and with subsidized manufacturing margins will always be optimal to finance riskier borrowers than will traditional lenders. In the case of two classes of borrowers—

rich low-risk and poor high-risk— the vendors are able to judiciously set product price and terms of loans in order to induce rich low-risk borrowers to self-select cash payment due to a higher risk premium included in the interest rate on financing. Poor high-risk borrowers, on the other hand, self-select loans due to the unaffordable higher product price. The total profits for the firms offering a vendor finance program increase because of the positive manufacturing margins generated on incremental sales. Furthermore, traditional lenders without subsidized positive manufacturing margins are not able to compete with vendors. However, if the borrower's return distribution is unobservable to lenders, then "the credit market breaks down if borrowers fully self-select" (Sherrick and Lubben, 1993, 14). But vendors still have advantages in the credit market because of their superior knowledge, expertise on collateralization, better assessment ability, and lower bonding costs. The empirical "case" evidence presented by Sherrick and Lubben based on a farm cooperative's credit program is broadly in line with the theory, that suggests that a vendor's loan portfolio is riskier than that of a bank and the vendor's performance should reflect the cross-subsidization effect.

Remolona and Wulfekuhler (1992) discussed the competition and differential performance of banks and finance companies. Their evidence shows that, in spite of heavier capital burdens and the absence of deposit insurance, the success of finance companies has been driven by the emergence of the securities market, especially in commercial paper and corporate bond markets, and by their business strategy in niche markets. As a result, the credit ratings of a finance company and a parent company significantly influence the sources and costs of funds to the finance company. Furthermore, the parent company's credit rating dominates factors affecting the credit rating of a subsidiary finance company. Good credit ratings not only lower the explicit cost of funds, but also ease large debt issuances in securities markets. Large companies

with good credit ratings have dominated the finance company industry through wholly-owned subsidiaries and captive finance companies. The niche strategy enables finance companies to quickly, efficiently, and profitably penetrate specific markets where they have special expertise and information to manage relatively risky borrowers. The emergence and success of large finance companies is due not only to their higher leverage and lower cost of capital sources, but also to their ability to penetrate niche markets that are not feasible for commercial banks.

In summary, these studies integrate different aspects of vendor financing. It has been shown that the emergence and success of vendor financing (or say nontraditional financing) strongly relies on vendors' market power, flexible internal cross-subsidized and transferable structure, information and knowledge advantages, and the different preferences of heterogeneous borrowers. These special features, reflected in the loan contract offered by vendors, help to explain why and how the competitive strategies used and loan contract offered by different lenders are different.

Credit Scoring Models

Credit scoring (assessment) models have been widely used by lenders to evaluate both loan applicants and existing borrowers. Recently, a number of researchers have attempted to apply statistical approaches to assess the creditworthiness of loans. These models use "the economic, financial and qualitative variables to objectively screen loan applications in terms of their probability of default, to price loans in terms of default risk, and establish loan loss provisions" (Turvey, 1991, 43). Consequently, credit scoring models not only provide some insight into the lender's empirical loan evaluation process, but also reveal the effects of the loan applicant's financial ratios and personal

characteristics on his or her loan participation decision. The following sections review a number of credit scoring models widely applied in various industries.

Stover, Teas, and Gardner (1985) examined the relative effects of various criteria on the agricultural loan decision process from the perspective of the individual loan officer. The analysis testing the theoretical utility function with multi-dimensional attributes indicates that a measure of managerial ability, reflecting the borrower's ability and character, and the repayment variable, reflecting the source of repayment, are the most important attributes influencing loan approval. The collateral variable, reflecting the collateral's liquid and certain value, and the purpose variable, reflecting the borrower's compliance with loan policy, are secondarily important. The yield variable and the market variable are less important. This study demonstrates the order of significant factors affecting the loan approval decisions of loan officers.

Miller and LaDue (1989) developed credit scoring models relating loan default to some financial and borrower-specific measures for dairy farm borrowers. Weighted logit models, including measures of farm size, liquidity, profitability, solvency, capital efficiency, and operating efficiency indicating borrower quality, were used to discriminate between acceptable borrowers and defaulting borrowers. Their results show that "larger borrowers can be classified well using financial ratios" (p. 22), but small borrowers can not. The characteristics revealing a borrower's quality should be identified individually for large borrowers and small borrowers. In addition, financial ratios of liquidity, profitability, and operating efficiency were found to usefully inform borrowers' quality through a credit assessment model.

Turvey (1991) reviewed and empirically estimated four alternative credit scoring models for Canada's Agricultural Credit Corporation. He found that both qualitative and quantitative variables should be considered in the credit scoring model. He also

summarized that most of the literature applying credit scoring models to agricultural lending use measures of liquidity, profitability, leverage, efficiency and repayment ability as explanatory variables, such as the current ratio, return on assets, and the debt-to-asset ratio.

Siles, Hanson, and Robison (1994) recently extended a credit scoring model by incorporating the dummy business and social variable to demonstrate that "in addition to financial variables, the quality of business and social relationships also significantly affect the probability of loan approval, especially when the financial strength of the loan applicant is mixed" (p. 363). In other words, when the financial status of a borrower is ambiguous, the effects of these relationships on loan approval are strongest. However, if the financial status is strong or weak, the impacts are diminished; namely, "the loan is likely to be approved or rejected regardless of the applicant's relationship with lenders" (p. 363). This study supports the effects of business and social relationships on the loan approval decision and highlights the effects of socioeconomic factors between borrowers and lenders.

In brief, financial ratios and borrower-specific characteristics are found to substantially affect the lenders' evaluation of a borrower's creditworthiness and the loan approval decision and pricing process. However, the extent and significance of these factors vary with different industries. These studies provide an empirical specification on the lender's formation of terms of the loan contract package in terms of default risk.

Self-Selection, Participation, and the Discrete Choice Model

In the previous three sections, both the theoretical economic frameworks and empirical econometric techniques used in this study were reviewed. These models help to explain how traditional and nontraditional lenders' choice criteria are established and

affected by information problems, their unique institutional characteristics, and other economic factors. In this section, the literature relating to how a farmer-borrower self-selects the most appealing credit contract, given the optimal loan contract packages offered by two types of commercial lenders and the corresponding probability of participation, will be reviewed. Studies of discrete choice, primarily developed in labor economics, provide the appropriate framework for analyzing farmer-borrower's participation behavior.

The discrete choice, or dichotomous choice, model has been widely employed to analyze the self-selection, participation, and migration decisions of economic agents. This model suggests appropriate econometric tchniques for examining the role of incentive and probability in the farmer-borrower's choice of a loan contract. It explains the motivation of the agent's decision, quantifies the decision-making process, and statistically models the agent's likelihood of selecting a best alternative among competing alternatives. Its binary-choice nature perfectly represents this dichotomous participation-nonparticipation decision (Bell et al., 1994). However, when rational economic agents select their chosen alternative, some econometric problems can occur due to the truncated sample. The studies and methods initiated by Lee in 1978 and Heckman in 1979 are now universally applied to solve this problem, usually referred to as selectivity bias.

Lee (1978) used "a variant of a traditional simultaneous equations model with a binary qualitative variable and limited dependent variable" (p. 415) to analyze the extent of unionism and the effects of unions on wage rate, which already addressed the selectivity bias problem. However, the sample selection bias issue was fully developed and elaborated in Heckman's 1979 paper. The simple estimation method presented in Heckman's paper "enables analysts to use simple regression techniques to estimate behavioral relationships free of selection bias in case of a nonrandomly selected or

censored sample" (p. 160). It also can be applied to a variety of statistical cases, including sample selection and the limited dependent variable, and to simultaneous equation models with endogenous variables. More importantly, the correct asymptotic standard errors of the estimators were also derived in this paper. This successful technique is broadly extended to handle this double selection problem by a number of current papers, such as Vijverberg (1993, 1995) and Osberg, Gordon, and Lin (1994).

Nakosteen and Zimmer (1980) exploited this technique, including the decision to migrate, returns to migration, and self-selection, to describe migrant behavior. The estimated returns to migration based on comparisons of the anticipated incremental returns of movers and those of stayers may cause selectivity bias; therefore, the selectivity variable is incorporated to account for the problem of migrant self-selection. Nakosteen and Zimmer estimated separated earnings equations for migrants and nonmigrants and then used the fitted value of these equations to examine the most significant factors for the decision to migrate. Robinson and Tomes (1982) also took into account the self-selection process when estimating a model of individual migration behavior by using 1971 census microdata. This basic framework has been used with considerable success in analyzing an agent's binary decision.

Chambers and Foster (1983), and Konyar and Osborn (1990) used a theoretical choice model and discrete econometrics, based on a random utility model, to evaluate farmer participation in the farmer-owned reserve program and conservation reserve program. Two categories of explanatory variables were suggested for incorporation in the participation decision: the attributes of each alternative or choice as perceived by the decisionmaker and the socioeconomic characteristics of the decisionmaker. Bell et al. (1994) also used a random utility model to determine the likelihood that a landowner would choose to participate in the Tennessee forest stewardship program and suggested the

incentives helpful in promoting this program. Caswell and Zilberman (1985) used a discrete choice model to analyze the factors affecting the land shares of alternative irrigation technologies and estimated the likelihood that fruit growers would use alternative irrigation technologies in the Central Valley of California.

This category of literature introduces a fundamental and practical econometric framework to approach the center of my research objectives—why a farmer-borrower chooses nontraditional lenders over traditional lenders. This research employs the binary probabilistic choice model to identify the incentives and criteria affecting the farmer-borrower's loan contract selection decision and the predicted probability of participation.

Summary

The farmer-borrower's loan contract participation or acceptance decision can be regarded as a two-stage decision process. First, the optimal terms of a multi-dimensional loan contract are determined in terms of the borrower's default risk by two types of lenders. Second, given two distinct loan contract bundles offered by two types of lenders, the farmer-borrower self-selects one loan contract over another. The first decision-making process can be understood by reviewing the monetary economic studies associated with the formation of an optimal loan contract by different types of lenders as discussed in the first three sections.

The first section begins with the current literature, which stresses the significance of financial interaction between asymmetric information and the component instruments of a loan contract in the credit supply process. A main theme in this section is that the determination of loan contract terms is sensitive to asymmetric information problems. Namely, information plays an important role in determining an optimal loan contract

offered by lenders. Thus, the lender will skillfully design his/her optimal loan contract as an information signaling tool. The second section continues the review by examining the differential business strategies of nontraditional lenders affecting the loan contract offered and competition with traditional lenders. It is shown that the success of nontraditional lenders' credit activities can be attributed to their flexible organizational structure, unique business and market niche strategy, and power in the product market. Empirical analysis indicates that the lender's loan approval and pricing decision highly depend on the borrower's financial status and personal characteristics. In sum, these studies offer several perspectives on how loan contracts are established by different types of lenders and how the lenders' credit contract decision-making processes when providing operating credit might differ.

Given several competitive loan contracts, the borrower will choose the one with the most favorable return. The second decision-making process could, therefore, be described by a discrete choice model. The discrete choice model literature, which has been widely applied in labor economics, helps to explain the factors motivating the borrower's decision. The attributes of each loan contract, such as collateral, interest rate, and loan size, as perceived by the borrower, are discussed. In addition, socioeconomic characteristics, including financial and personal characteristics, are found to significantly affect the borrower's loan contract decision-making process.

In the next chapter, a theoretical model is developed that describes the lender's offering decision in the determination of optimal terms of the loan contract and the borrower's selection decision in choosing a lender based on the optimization framework.

CHAPTER 5.
THEORETICAL MODEL

In this chapter, a theoretical model is developed to describe a competitive credit market in which risk-neutral farmers can request a production loan to finance a short-term or intermediate-term project from two different categories of agricultural lenders—traditional and nontraditional. This model provides a theoretical framework that helps to examine the economic incentives for a farmer-borrower to select one lender over another. The basis for the model is the determination of an equilibrium loan contract, reflecting a number of factors relevant to a lender's offering decision and a farmer-borrower's participation decision, in the competitive credit market. The development of the model procedures requires, first, that we specify how the component instruments of a multidimensional loan contract are determined by two categories of lenders, and, second, that we specify how a farmer-borrower chooses between distinct loan contract packages. In the first section of this chapter, the basic framework and structure of the model are described. In the second section, the theoretical model, explaining how a lender determines the optimal terms of a loan contract under a competitive credit market where lenders compete for offering loans, is developed and employed to examine the borrower's self-selection problem. Finally, the farmer-borrower's decision-making process in selecting between a traditional lender and a nontraditional lender is modeled.

Model Structure

The initial model is based on several assumptions. There are many lenders and borrowers (farmers) in the agricultural credit market. All agents are risk-neutral; thus,

there is no aggregate risk, risk-sharing, or insurance included in the model.[1] The borrowers are indexed by i = 1, ..., Z. The lenders fall into two groups, traditional lenders and nontraditional lenders, indexed by j = T, N. For simplicity, it is assumed that traditional lenders are those institutions that only provide credit to borrowers, and that nontraditional lenders are those firms that provide credit to their customers to facilitate or promote purchases of the firms' own goods and services.

At the beginning of the period, the representative farmer-borrower i requests a production loan up to an amount L_i to finance inputs needed for a project. It is assumed that L_i can be financed from debt and owner equity. The project will yield a stochastic revenue of y_i at the end of the period if the initial L_i of inputs is invested, assuming that y_i is bounded between zero and $Y < \infty$, $y_i \in [0,Y] \subseteq \Re_+$, where $\Re_+$ denotes a set of real positive numbers. The variable y_i is a random variable with the probability distribution $F(y_i)$ and the probability density function $f(y_i)$.

We assume that after the initial loan interview, y_i is freely observed by lenders due to the homogeneity of agricultural products. Although the lenders already know the probability density function of the borrower's project, the riskiness of the borrower is significantly influenced by the borrower's characteristics, ability, financial status, and so on. However, in view of the literature, nontraditional lenders have superior information advantages because they extend "point-of-sale" credit, whereas traditional lenders are commonly regarded as delegated monitors, performing information collection and sharing roles. In other words, these two types of lenders possess their own informational advantages in assessing the borrower's creditworthiness before contracting. Therefore,

---

[1] An interesting discussion by Dowd (1992) concludes that the most reasonable alternative for the above universal risk-neutrality assumption is to assume that the borrower is risk-averse but the lender is risk-neutral and diversified in loan investments because the risk-neutrality combining with the diversification will cancel out the lender's risks. However, if the lender does not have a diversified portfolio, this assumption will be awkward and will result in an inverse debt contract requiring the lender to bear all the risk.

assuming the necessary personal, business, and financial information of borrower i is available to lenders ex ante, lenders not only have the same symmetric expectation and valuation of the outcome y_i as borrower i, but also are able to perfectly identify the borrower's type and then correctly measure the terms of the loan contract charged, contingent on a vector of socioeconomic factors.[2]

Let $d_{ij} \in [0,1]$ be the loan-approval (granting) ratio, which describes the percentage of a requested loan L_i approved by lender j. Accordingly, the actual credit extended by lender j is $d_{ij}L_i$, and d_{ij} percent of the project would be financed by an external loan from lender j and $(1 - d_{ij})$ percent would be financed from equity of borrower i. At the end of the period, borrower i will pay back the full principal, $d_{ij}L_i$, plus interest payment, $i_{ij}d_{ij}L_i$, to lender j, which can be written as $(1 + i_{ij})d_{ij}L_i \equiv R_{ij}d_{ij}L_i$, where $R_{ij} = 1 + i_{ij}$. We assume that i_{ij} is dependent on the size of the loan extended, $d_{ij}L_i$, by lender j, and contingent on the personal, business, and financial status of borrower i, as vector $\underline{w}_i$, where $\underline{w}_i$ indexes borrower creditworthiness. Thus, holding $\underline{w}_i$ fixed, a larger loan is hypothesized to result in increased lending risk and, in turn, a higher interest factor charged by lenders. However, holding d_{ij} fixed, a borrower with higher creditworthiness is hypothesized to be charged a lower interest factor by lenders. Specifically, the interest factor charged, conditional on $\underline{w}_i$ consisting of a vector of socioeconomic factors, is denoted as $R_{ij}(d_{ij}L_i \mid \underline{w}_i)$, where $\partial R_{ij}/\partial d_{ij} > 0$ and $\partial R_{ij}/\partial \underline{w}_i < 0$. If the revenue from sale of output, y_i, is greater than the contractual repayment, $R_{ij}(d_{ij}L_i \mid \underline{w}_i)d_{ij}L_i$, borrower i just repays the loan in full, assuming there is no significant effect of inflation for this one-period loan. However, if the terminal proceeds of this project are insufficient to cover

---

[2] This analysis focuses on the case where borrowers' types are known by lenders a priori; that is, there is no adverse selection problem. If borrowers' types are unknown ex ante, several different loan contracts with different terms of loan offered by a lender may cause borrowers to self-select themselves according to their risk. In this case, information about a borrower's type is released through the borrower's self-selection mechanism.

the contractual repayment, default occurs and lender j is entitled to the collateral owned and pledged by borrower i. Hence, the proceeds of collateral are used to compensate the nonperforming loan up to the value of $R_{ij}(d_{ij}L_i \mid \underline{w}_i)d_{ij}L_i$.

Clearly, the loan has to be secured by collateral against default. The output of the project is normally pledged as collateral by the farmer-borrower, and the value of output, y_i, is assumed to be identically valued by the borrower and lender because they agree on the probability distribution of y_i. If a very low value of y_i occurs, then the lender's security cushion may not be adequate. Therefore, in addition to y_i requested as collateral, a lender may require other assets be held by the borrower as a secondary source of collateral. Let c_{ij} denote the value of additional collateral and C_{ij} denote the total value of collateral, $y_i + c_{ij}$, pledged by borrower i. We assume that there is no divergence in lender-borrower evaluation of the total value of the collateral.

After a series of credit analyses on borrower i, lender j will offer a loan contract characterized by (d_{ij}, c_{ij}). Borrower i chooses only the loan contract, that maximizes his/her expected return among those offered by different lenders. The model describing the farmer-borrower's and lender's decision-making processes is developed next.

The Lender's Problem

The most crucial decisions a lender makes is whether to approve a given loan request and how the loan should be structured. As mentioned previously, although the lender already knows the riskiness of the project, the borrower's characteristics, management, and financial status still significantly influence the success of the project. Lenders are assumed to be capable of perfectly screening the borrower's type and correctly forming the conditional expectation of y_i ex ante, contingent on a creditworthiness index $\underline{w}_i$, which represents a vector of influential factors. The borrower is also assumed to be

able to make these decisions. Let $f(y_i|\underline{w}_i)$ be the conditional probability density function for y_i, given level $\underline{w}_i$. In addition, ρ_{ij} denotes the lender's costs of funds, which are exogenously determined. Normally, ρ_{ij} is composed of the direct costs of funds, the required rate of return, and other administrative or overhead costs expressed in percentage terms.

Using collateral to secure the loan, or enforce the contract, results in collateralization costs for the lender, such as legal fees, administrative costs, and other costs required to transfer property rights from the defaulting borrower to the lender. Let $\Phi_{ij}(C_{ij})$ denote the collateralization cost paid by lender j with respect to borrower i's collateral, where $\Phi_{ij}(0) = 0$ and $\Phi'_{ij}(C_{ij}) \geq 0$. In addition, borrower i's probability of default associated with lender j's loan contract, P_{ij}, is assumed to be described by

$$P_{ij} \equiv pr[y_i \leq \delta_{ij}] = \int_0^{\delta_{ij}} f(y_i|\underline{w}_i)\,dy_i \tag{5.1}$$

where *pr* denotes probability and δ_{ij} denotes $R_{ij}(d_{ij}L_i|\underline{w}_i)d_{ij}L_i$. Thus,

$$\frac{\partial P_{ij}}{\partial d_{ij}} = [R_{ij}L_i + \frac{\partial R_{ij}}{\partial d_{ij}L_i} d_{ij}L_i^{\,2}]f(\delta_{ij}|\underline{w}_i) > 0 \tag{5.2}$$

which shows that a higher loan-approval ratio or interest rate may increase the borrower's probability of default.

Furthermore,

$$\frac{\partial P_{ij}}{\partial \underline{w}_i} = \frac{\partial R_{ij}}{\partial \underline{w}_i} d_{ij}L_i\, f(\delta_{ij}|\underline{w}_i) + \int_0^{\delta_{ij}} [\frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i}]dy_i < 0 \tag{5.3}$$

The first term on the right-hand side of Eq. (5.3) is negative because a higher index of borrower creditworthiness reduces the interest rate charged by lenders based on the assumption above. The second term is the marginal effect of a change in the creditworthiness index on the conditional probability density function of y_i when the loan is not performing. A borrower's probability density function of nonperformance decreases, when his/her creditworthiness increases, which results in a negative sign of the second term. Therefore, a farmer-borrower with higher creditworthiness is inclined to have a lower probability of default.

The competitive credit market

In a perfectly competitive credit market, competition among lenders generates a zero-profit contract to each lender. We assume that lenders compete to offer loans and face a perfectly elastic deposit supply schedule at some (exogenously given) market-determined borrowing rate from a capital market, which affects lenders' costs of capital. Therefore, the lender's optimization problem in a competitive credit market is to choose loan contract terms at his/her break-even level under the institutional constraint that the proceeds of total collateral available to him/her are limited to the accrued principal plus interest payment. Specifically, if the revenue of a project is greater than the contractual repayment (i.e., $y_i > \delta_{ij}$), the borrower pays in full and there is no default. If the project fails (i.e., $y_i < \delta_{ij}$), the borrower defaults and collateralization costs apply to the lender. Then, two cases should be discussed.

First, if the total collateral, $y_i + c_{ij}$, is less than the contractual repayment, δ_{ij}, when the borrower defaults, the lender can claim all the collateral assets, $y_i + c_{ij}$, that have been pledged by the borrower. Second, if the total collateral is greater than the contractual repayment (i.e., $C_{ij} > \delta_{ij}$), the lender only has access to the collateral up to the loan and

accrued interest payment (i.e., δ_{ij}). However, in both cases, the lender must pay the collateralization costs used to take possession of and liquidate the corresponding collateral. Technically, the optimal loan contract characterized by (d_{ij}, c_{ij}) for borrower i offered by lender j must solve[3]

$$\int_0^{\delta_{ij}-c_{ij}} [y_i + c_{ij} - \Phi_{ij}(C_{ij})] f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} [\delta_{ij} - \Phi_{ij}(\delta_{ij})] f(y_i|\underline{w}_i)\, dy_i$$
$$+ \int_{\delta_{ij}}^{Y} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i = d_{ij} L_i (1 + \rho_{ij}) \tag{5.4}$$

The left-hand side of Eq. (5.4) represents the lender's expected profit, which equals the expected value of the liquidated collateral net of collateralization costs in case of default, plus the probability of nondefault times the full repayment. The right-hand side of Eq. (5.4) represents total costs of funds to the lender. Consequently, Eq. (5.4) describes an equilibrium condition that each lender earns zero expected profits. It also states that, in the case of default, the lender can take only the assets of the defaulting borrower that have been pledged as collateral. That is, the lender only has access to collateral which is limited to the amount of the loan and accrued interest repayment.[4] Moreover, Eq. (5.4) can be rewritten as

---

[3] The value of the collateral requirement charged may be lower than the contractual repayment. However, if the lender can provide several different zero-profit loan contracts with different combinations of d_{ij} and c_{ij}, he/she may only offer the one with a value equal to the collateral and contractual payment to avoid any associated risk. Therefore, the equality setting dominates that of inequality.

[4] Throughout the analysis, we assume that the collateralization costs are paid by the lender, not by the borrower, so that collateralization costs are not explicitly incorporated into the borrower's default-nondefault decision. If the collateralization costs were incorporated, the equilibrium value of collateral assets required by the lender would be larger than the accrued payment, which is not economically or empirically admissible. However, note also that the collateralization costs are already implicitly reflected in the equilibrium interest factor and additional collateral charged by the lender ex ante through the break-even Eq. (5.4). Thus, this setting is consistent with the definition of institutional limitation.

$$\int_0^{\delta_{ij}-c_{ij}} [y_i + c_{ij}] f(y_i|\underline{w}_i)\,dy_i + \int_{\delta_{ij}-c_{ij}}^{Y} \delta_{ij} f(y_i|\underline{w}_i)\,dy_i$$
$$- \int_0^{\delta_{ij}-c_{ij}} \Phi_{ij}(C_{ij}) f(y_i|\underline{w}_i)\,dy_i - \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \Phi_{ij}(\delta_{ij}) f(y_i|\underline{w}_i)\,dy_i$$
$$= d_{ij}L_i(1+\rho_{ij}) \qquad (5.5)$$

This equation specifies the structural characteristics of the lender's problem in a competitive credit market. Because there are two unknown variables in one equation, numerous optimal interest factors are generated, each of which accompanies an optimal collateral requirement in a manner that satisfies Eq. (5.5). The multiple solutions of Eq.(5.5), or the multiple optimum values of d_{ij} and c_{ij}, provide the multiple simultaneous solutions to the lender's optimization problem. Consequently, there are numerous loan contracts with different combinations of loan-approval ratios, interest factors, collateral requirements, and collateralization costs. Each of these loan contracts generates zero profits for the lender. Specifically, Eq. (5.5) shows that the optimal d_{ij} and c_{ij} are parameterized by $[L_i, \rho_{ij}, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), R_{ij}(\cdot)]$. At the same time, the optimum interest factor to request, $R_{ij}(\cdot)$, and the optimum collateralization costs to employ, $\Phi_{ij}(\cdot)$, by lender j are also simultaneouly determined and parameterized by $[L_i, \rho_{ij}, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), R_{ij}(\cdot)]$. Therefore, the implicit solutions to Eq. (5.5) provide the loan supply curve of lender j and also generate different optimal zero-profit loan contracts with various combinations of (d_{ij}, c_{ij}) parameterized by $[L_i, \rho_{ij}, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), R_{ij}(\cdot)]$.

In order to simplify the analysis and exposition, we assume $\Phi_{ij}(y_i + c_{ij}) = \phi_{ij}(y_i + c_{ij})$, where $\phi_{ij} \geq 0$, and therefore $\Phi'_{ij}(y_i + c_{ij}) = \phi_{ij}$. The collateralization factor, or marginal collateralization cost, ϕ_{ij}, is treated as a nonstochastic parameter measuring the collateralization cost per dollar of collateral pledged. Accordingly, Eq. (5.5) can be simplified as

$$\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{Y} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i$$
$$- \phi_{ij}\left[\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i\right]$$
$$= (1-\phi_{ij})\left[\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i\right] + \int_{\delta_{ij}}^{Y} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i$$
$$= d_{ij} L_i (1+\rho_{ij}) \tag{5.6}$$

The solutions to Eq. (5.6) determine multiple optimal zero-profit loan contracts, where d_{ij} and c_{ij} are parameterized by $[L_i, \rho_{ij}, \phi_{ij}, f(y_i|\underline{w}_i), R_{ij}(\cdot)]$, in this simplified case. Equation (5.6) may be further explained as follows.

If $\phi_{ij} = 1$ and $d_{ij} \neq 0$, the optimal values of d_{ij} for which expected profits are zero satisfies

$$R_{ij}(d_{ij}L_i|\underline{w}_i) \int_{\delta_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i = (1+\rho_{ij}) \tag{5.7.1}$$

Namely, if the collateralization factor is equal to one, that is, the total collateralization costs are equivalent to the value of collateral, the optimal loan contract will be extended until the product of the corresponding interest factor and the probability of nondefault is equal to one plus the costs of funds. Accordingly, the optimal interest rate charged by the lender is higher than his/her costs of funds, $R_{ij} > 1 + \rho_{ij}$, because the probability of nondefault is less than one. The intuition is that if collateral plays no role in benefiting the lender against default owing to higher collateralization costs, the lender will take advantage of the interest rate instrument to avoid any losses.

If $\phi_{ij} > 1$ and $d_{ij} \neq 0$, then we obtain

$$R_{ij}(d_{ij}L_i|\underline{w}_i) \int_{\delta_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i > (1+\rho_{ij}) \tag{5.7.2}$$

Thus, the interest rate charged to the borrower is significantly larger than the lender's costs of funds in order to compensate for losses originating from liquidation of collateral.

If $\phi_{ij} < 1$ and $d_{ij} \neq 0$, the multiple optimal d_{ij} and R_{ij} offered by the lender satisfy Eq. (5.6), still with $R_{ij} > 1 + \rho_{ij}$, due to the existence of collateralization costs. In sum, the interest rate charged on the borrower is universally higher than the costs of funds to the lender due to collateralization costs.

The marginal rate of substitution between d_{ij} and c_{ij} for optimal loan contracts offered by lender j to borrower i is given by

$$\frac{d\,d_{ij}}{d\,c_{ij}} = \frac{(1-\phi_{ij})\int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)\,dy_i}{\lambda\,[\phi_{ij}\delta_{ij}\,f(\delta_{ij}|\underline{w}_i)+\phi_{ij}\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)\,dy_i - \int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i]+ L_i(1+\rho_{ij})} \tag{5.8}$$

where $\lambda \equiv R_{ij}L_i + \frac{\partial R_{ij}}{\partial d_{ij}L_i} d_{ij}L_i^2 > 0$. The value of λ represents the marginal effect of d_{ij} on the contractual repayment δ_{ij}. This substitution rate will vary with the values of d_{ij} and c_{ij}.

The sign of dd_{ij}/dc_{ij} is ambiguous. If ϕ_{ij} $<$, $=$, and $>$ 1, then the numerator is positive, zero, and negative, respectively. If $\lambda\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i$ is less (greater) than the sum of the other terms of the denominator, then the denominator is positive (negative). In other words, if the probability of the lender obtaining adequate repayment is less (greater) than the sum of the expected interest payment weighted by the collateralization factor, where the expected collateralization factor when the loan is nonperforming but adequate to pay the contractual payment and total costs of funds divided by the marginal effect of d_{ij} on δ_{ij}, then the denominator is positive (negative). In the case when $\phi_{ij} < 1$ and the denominator is positive, dd_{ij}/dc_{ij} is positive. The positive sign implies that a higher collateral requirement accompanies a larger loan size. In other words, an increase in the

loan size extended will cause a lender to charge a higher collateral requirement. Moreover, a higher collateralization factor may result in a lower positive substitution rate between d_{ij} and c_{ij}, and may even cause a negative marginal rate of substitution between d_{ij} and c_{ij} if $\phi_{ij} > 1$. The effects of different characteristics of traditional and nontraditional lenders derived from Eq. (5.6) are further analyzed and discussed in the following paragraphs.

The marginal effect of the collateralization factor on the loan-approval ratio

Consider the impact on d_{ij} of a change in ϕ_{ij}, holding L_i, ρ_{ij}, c_{ij}, and parameters of $R_{ij}(\cdot)$ fixed. Implicit differentiation of Eq. (5.6) yields

$$\frac{d\,d_{ij}}{d\,\phi_{ij}} = \frac{\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i}{\lambda\left[\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i - \phi_{ij}\delta_{ij}\, f(\delta_{ij}|\underline{w}_i) - \phi_{ij}\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)\, dy_i\right] - L_i(1+\rho_{ij})} \tag{5.9.1}$$

Since the numerator is positive, as long as $\lambda \int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i$ is less than the sum of other terms of the denominator, the sign of $d d_{ij}/d\phi_{ij}$ is negative, that is, d_{ij} decreases with ϕ_{ij}. This fact indicates that an increase in the collateralization factor will cause a lender to grant a smaller percentage of requested loans, which results in a lower interest rate charged. If $\lambda \int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i$ is larger than the sum of the other terms of the denominator, the positive $d d_{ij}/d\phi_{ij}$ implies that a larger loan will be granted to compensate for higher collateralization costs.

On the other hand, a nontraditional lender usually is more capable of disposing of specialized collateral through existing facilities and expertise than is a traditional lender. Holding other variables fixed, a higher ϕ_{iT} may cause d_{iT} to be less than d_{iN} if the sign of $d d_{ij}/d\phi_{ij}$ is negative. Namely, a nontraditional lender could extend a larger loan to the

same type of borrower than could a traditional lender due to the nontraditional lender's lower collateralization factor. Or, a traditional lender could offer less credit (i.e., $d_{iN} > d_{iT}$) and charge a corresponding lower interest factor based on a smaller loan size extended and a higher collateralization factor.

Furthermore,

$$\frac{d\underline{w}_i}{d\phi_{ij}} = \frac{\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij}) f(y_i|\underline{w}_i) dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} f(y_i|\underline{w}_i) dy}{[1-\phi_{ij}][\int_0^{\delta_{ij}-c_{ij}} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i}(y_i + c_{ij}) dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i} dy_i] + \int_{\delta_{ij}}^{Y} \delta_{ij} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i} dy_i} \quad (5.9.2)$$

The numerator is positive. If $\phi_{ij} < 1$, then the denominator is positive because, first, the sum of the decreased probability of default when $\underline{w}_i$ increases equals the increased probability of performance, and, second, repayment when the loan defaults is less than or equal to repayment when the loan performs. Therefore, $d\underline{w}_i / d\phi_{ij}$ is positive, implying that lenders with higher collateralization costs are likely to lend to less-risky borrowers. Moreover, if $d_{iT} = d_{hN}$, $\rho_{iT} = \rho_{hN}$, $R_{iT} = R_{hN}$, and the parameters of $R_{iT}(\cdot)$ equal those of $R_{hN}(\cdot)$ but $\underline{w}_i \neq \underline{w}_h$, a nontraditional lender with a lower collateralization factor could lend to a more risky borrower h compared with a less risky borrower i compared with a traditional lender (i.e., $\underline{w}_i > \underline{w}_h$). In other words, if two types of lenders offer identical terms of loan contract, a nontraditional lender should be able to reach a high-risk borrower because of the nontraditional lender's lower collateralization factor. Or, say, a less risky borrower is more likely to finance operating funds from a nontraditional lender than is a traditional lender if other terms of contract offered by the two types of lenders are identical, such as services and monitoring criteria. If the sign of $dd_{ij} / d\phi_{ij}$ is positive, the opposite conclusion could be drawn. That is, nontraditional lenders are only able to extend

a smaller loan, charge a lower interest rate, and reach a less risky borrower than are traditional lenders.

The marginal effect of the collateralization factor on the collateral requirement

To examine the effect of a change of ϕ_{ij} on c_{ij}, taking the derivative of Eq. (5.6) with respect to c_{ij} and ϕ_{ij} generates

$$\frac{d\,c_{ij}}{d\,\phi_{ij}} = \frac{\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} f(y_i|\underline{w}_i)\, dy_i}{(1-\phi_{ij}) \int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)\, dy_i} \tag{5.9.3}$$

$$\frac{d^2 c_{ij}}{d\,\phi_{ij}^{\,2}} = \frac{\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij})\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} f(y_i|\underline{w}_i)\, dy_i}{(1-\phi_{ij})^2 \int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)\, dy_i} > 0 \tag{5.9.4}$$

The sign of $dc_{ij}/d\phi_{ij}$ is positive (negative) if ϕ_{ij} is less (greater) than 1 and $d^2c_{ij}/d\phi_{ij}^{\,2} > 0$. So, the impact of an increase of ϕ_{ij} on c_{ij} is significantly influenced by collateralization costs. Specifically, if the collateralization factor is less than 1, c_{ij} increases with ϕ_{ij}, and the marginal rate is increasing. This statement implies that higher collateralization costs will push up the collateral requirement charged by the lender. The larger the collateralization factor, the larger the collateral requirement requested. Furthermore, the marginal rate between c_{ij} and ϕ_{ij} is increasing as ϕ_{ij} increases. However, if the collateralization factor is greater than 1, the collateral requested by the lender will decrease with collateralization costs. This relationship shows that if the value of collateral is not sufficient to pay the collateralization costs, the lender will reduce the collateral requested as collateralization costs are higher. The negative marginal rate is increasing as ϕ_{ij} increases.

In the case that $\phi_{ij} < 1$, a nontraditional lender with lower collateralization costs is able to charge a lower collateral requirement on the same type of borrowers than is a

traditional lender, holding other variables fixed. In other words, a traditional lender may need to request a higher collateral requirement due to his/her higher collateralization costs.

The marginal effect of costs of funds on the loan-approval ratio We now examine the effect on d_{ij} of a change in ρ_{ij}, holding other variables and parameters of $R_{ij}(\cdot)$ fixed. Differentiating Eq. (5.6) with respect to d_{ij} and ρ_{ij} results in the condition

$$\frac{d\,d_{ij}}{d\,\rho_{ij}} = \frac{d_{ij}L_i}{\lambda[\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i - \phi_{ij}\delta_{ij}\,f(\delta_{ij}|\underline{w}_i) - \phi_{ij}\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)\,dy_i] - L_i(1+\rho_{ij})} \tag{5.10.1}$$

$$\frac{d^2\,d_{ij}}{d\,\rho_{ij}^{\,2}} = \frac{d_{ij}L_i^{\,2}}{\{\lambda[\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i - \phi_{ij}\delta_{ij}\,f(\delta_{ij}|\underline{w}_i) - \phi_{ij}\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)\,dy_i] - L_i(1+\rho_{ij})\}^2} \tag{5.10.2}$$

For Eq. (5.10.1), the numerator is positive and the denominator is ambiguous. If $\lambda\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i$ is less (greater) than the sum of the other terms of the denominator, the sign of $dd_{ij}/d\rho_{ij}$ is negative (positive). Obviously, $d^2d_{ij}/d\rho_{ij}^{\,2} > 0$. Thus, if ρ_{ij} is positively (negatively) correlated with d_{ij}, higher costs of funds could result in a larger (smaller) size of loan extended. The marginal rate of the effect of ρ_{ij} on d_{ij} is increasing, implying that the marginal effect of ρ_{ij} on d_{ij} increases as ρ_{ij} increases.

In fact, traditional lenders report lower average costs of funds than do nontraditional lenders, in part due to their ability to acquire low-rate insured deposits and to maintain more diversified loan portfolios (Remolona and Wulfekuhler, 1992). However, traditional lenders' advantages in borrowing costs may be offset by regulatory costs, such as the costs of required reserves, deposit insurance premiums, and a higher capital requirement. On the other hand, because some nontraditional lenders treat credit as

a marketing tool or promotional device to stimulate sales and profits, the manufacturing margin from sales of a product can be used to cross-subsidize the lending margin. Thus, after considering the effect of cross-subsidization, nontraditional lenders may have a substantial advantage in costs of funds even though their borrowing costs are higher than those of traditional lenders. Specifically, holding $\phi_{iT} = \phi_{iN}$, we find nontraditional lenders with lower costs of funds are capable of offering a larger loan, that is, $d_{iN} > d_{iT}$ if $dd_{ij}/d\rho_{ij}$ is negative. If the parameters of $R_{iT}(\cdot)$ equal those of $R_{iN}(\cdot)$, a stronger result, $R_{iN} > R_{iT}$, can be obtained.

Moreover,

$$\frac{d\,\underline{w}_i}{d\,\rho_{ij}} = \frac{d_{ij}L_i}{[1-\phi_{ij}][\int_0^{\delta_{ij}-c_{ij}} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i}(y_i + c_{ij})dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i} dy_i] + \int_{\delta_{ij}}^{Y} \delta_{ij} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i} dy_i} \tag{5.10.3}$$

The numerator is positive, and if $\phi_{ij} < 1$, then the denominator is positive. Therefore, $d\underline{w}_i/d\rho_{ij}$ is negative. Namely, if $d_{iT} = d_{hN}$, $\phi_{iT} = \phi_{hN}$, $R_{iT} = R_{hN}$, and the parameters of $R_{iT}(\cdot)$ equal those of $R_{hN}(\cdot)$ but $\underline{w}_i \neq \underline{w}_h$, we easily show that a nontraditional lender with lower costs of funds could more easily lend to high-risk borrowers compared with a traditional lender if both types of lenders offer identical loan contracts. In brief, the above analysis partly explains why nontraditional lenders without advantageous borrowing costs and a diversified loan portfolio may be able to reach high-risk borrowers. If $dd_{ij}/d\rho_{ij} > 0$, the opposite conclusion that nontraditional lenders may offer a smaller loan and reach lower-risky borrowers could be drawn.

The marginal effect of costs of funds on the loan-approval ratio Now, we consider the impact of ρ_{ij} on c_{ij}, that is, the effect of an increase in the costs of funds on the collateral charged. Taking a derivative of Eq. (5.6) with respect to ρ_{ij} and c_{ij} yields

$$\frac{d\,c_{ij}}{d\,\rho_{ij}} = \frac{d_{ij}L_i}{(1-\phi_{ij})\int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)\,dy_i} \tag{5.10.4}$$

The sign of $dc_{ij}/d\rho_{ij}$ depends on the value of ϕ_{ij}. If $\phi_{ij} < 1$, a lender with higher costs of funds will increase the collateral requested. If $\phi_{ij} > 1$, the collateral requirement decreases with ρ_{ij}. Similarly, under the general case that $\phi_{ij} < 1$, if a nontraditional lender has advantages in costs of funds due to the cross-subsidization effect, he/she may request a smaller collateral requirement than would a traditional lender.

The marginal effect of the creditworthiness index on the loan-approval ratio

Consider the impact on d_{ij} of a change in $\underline{w}_i$, holding L_i, c_{ij}, ρ_{ij}, ϕ_{ij}, and parameters of $R_{ij}(\cdot)$ fixed. Implicit differentiation of Eq. (5.6) yields

$$\frac{d\,d_{ij}}{d\,\underline{w}_i} = -\frac{[1-\phi_{ij}][\int_0^{\delta_{ij}-c_{ij}} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i}(y_i+c_{ij})dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i} dy_i] + \int_{\delta_{ij}}^{Y} \delta_{ij} \frac{\partial\, f(y_i|\underline{w}_i)}{\partial\, \underline{w}_i} dy_i}{\lambda[\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)dy_i - \phi_{ij}\delta_{ij} f(\delta_{ij}|\underline{w}_i) - \phi_{ij}\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)dy_i] - L_i(1+\rho_{ij})} \tag{5.11.1}$$

In the case that $\phi_{ij} < 1$ and the denominator is negative, $d\,d_{ij}/d\,\underline{w}_i$ is positive, which implies that a farmer-borrower with higher creditworthiness is likely to be granted a larger size of loan and a farmer-borrower with lower creditworthiness is likely to be granted a smaller size of loan.

The marginal effect of the creditworthiness index on the collateral requirement

Now, examine the impact on c_{ij} of a change in $\underline{w}_i$, holding L_i, d_{ij}, ρ_{ij}, ϕ_{ij}, and parameters of $R_{ij}(\cdot)$ fixed. Implicit differentiation of Eq. (5.6) yields

$$\frac{d c_{ij}}{d \underline{w}_i} = - \frac{[\int_0^{\delta_{ij}-c_{ij}} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i}(y_i + c_{ij})dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i} dy_i] + \int_{\delta_{ij}}^{Y} \delta_{ij} \frac{\partial f(y_i|\underline{w}_i)}{\partial \underline{w}_i} dy_i}{\int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)dy_i} \tag{5.11.2}$$

The numerator and denominator are positive, so $dc_{ij}/d\underline{w}_i$ is negative, which implies that the collateral requirement charged by the lender may decrease as the creditworthiness index increases. In other words, lower collateral is pledged by an observably less-risky farmer-borrower and higher collateral is pledged by an observably more-risky farmer-borrower, given certain conditions.

In sum, the above analyses show that an increase in collateralization factor or costs of funds results in a smaller loan extended by lenders. In addition, so long as $\phi_{ij} < 1$, an increase in collateralization factor or costs of funds leads to a higher collateral requirement. Moreover, a nontraditional lender may offer a larger size of loan, lend to high-risk borrowers, and require less collateral requirement if he/she has a competitive advantage in disposing of collateral pledged by borrowers or in taking advantage of the cross-subsidization effect. In addition, a higher creditworthiness index of a farmer-borrower may increase the size of a loan granted by the lender and decrease the collateral requirement requested by the lender if there is no asymmetric information.

Monitoring costs

In the above setting where $f(y_i|\underline{w}_i)$ is known by lenders a priori and lenders have perfect conditional expectations as to outcome y_i, the contracting problem is not influenced by the borrower's behavior or action after the transaction. However, if the outcome $f(y_i|\underline{w}_i)$ is not freely observed by lenders without some costs, it is likely that the borrower will change his/her behavior or action after contracting. Such behavior may result in a higher default rate and suboptimal loan contracts offered by lenders ex ante.

Therefore, if $f(y_i|\underline{w}_i)$ is not freely observed, the lender will have a commitment to monitor the borrower's action after contracting. Monitoring may include periodic reporting of business information or making farm visits to prevent slacking, changing behavior, changing the status and purpose of the loan, or other actions that might increase the probability of default. In other words, the purpose of monitoring after contracting is to ensure that the borrower's behavior and the purpose and status of the loan are consistent with the loan contract anticipated and charged by the lender ex ante. The monitoring actions would attempt to lower the ex post default rate or riskiness of the project to some anticipated level, but not to increase costs by attempting to improve the anticipated distribution (increase mean or reduce variance) of the project. Such action is unnecessary because the lender already charged the loan terms and monitoring costs ex ante based on the anticipated level of lending risk. Hence, the terms of a loan contract definitely should incorporate monitoring costs ex ante, and more importantly the lender could reduce his/her own risks and the likelihood of moral hazard by monitoring the borrower at the borrower's expense.

Let m_{ij} be lender j's monitoring criteria determined ex ante, for example, the frequency of periodic visits and the acquisition and analysis of financial statement and other information. Let M_{ij} be the corresponding monitoring costs for lender j in dollars.

which are dependent on the loan size extended and contingent on the borrower's attributes, ability, and financial status. Specifically, the total monitoring costs $M_{ij}(d_{ij}L_i|\underline{w}_i)$ equal the product of the monitoring criteria $m_{ij}(d_{ij}L_i|\underline{w}_i)$ and the average costs per criteria. By spending M_{ij} dollars, lender j is able to observe $f(y_i|\underline{w}_i)$, but other lenders can not automatically observe $f(y_i|\underline{w}_i)$. It is, therefore, efficient for lenders to include monitoring costs, M_{ij}, in their maximization problem before contracting. In general, as shown in the literature reviewed in the previous chapter, the periodic relationship in supply of input products conveys some private and updated information about the current operation and management status of a farmer-borrower, which helps to lower the monitoring costs of nontraditional lenders. Hence, if $d_{iN} = d_{iT}$, M_{iN} with high probability is less than M_{iT}. In other words, if two types of lenders offer the same size of loan, the monitoring costs of nontraditional lenders may be lower than those of traditional lenders.

Specifically, the optimal loan contract offered by lenders in the competitive credit market where $f(y_i|\underline{w}_i)$ is not freely observed still solves Eq. (5.5) except that the additional term $M_{ij}(d_{ij}L_i|\underline{w}_i)$ should be added to the right-hand side of Eq. (5.6). This change comes from the inclusion of additional monitoring costs in the lender's cost function. Therefore, the structural system in the competitive credit market turns out to be

$$(1-\phi_{ij})\left[\int_0^{\delta_{ij}-c_{ij}}(y_i+c_{ij})\,f(y_i|\underline{w}_i)\,dy_i+\int_{\delta_{ij}-c_{ij}}^{\delta_{ij}}\delta_{ij}\,f(y_i|\underline{w}_i)\,dy_i\right]+\int_{\delta_{ij}}^{Y}\delta_{ij}\,f(y_i|\underline{w}_i)\,dy_i$$
$$=d_{ij}L_i(1+\rho_{ij})+M_{ij}(d_{ij}L_i|\underline{w}_i) \qquad (5.12)$$

The implicit solutions to Eq. (5.12), or the multiple optimal zero-profit loan contracts (d_{ij}, c_{ij}), are parameterized by $[L_i, \rho_{ij}, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), R_{ij}(\cdot)]$ and $M_{ij}(\cdot)$. The simultaneous solutions to Eq. (5.12) determine various multidimensional loan contracts with different

combinations of optimal loan-approval ratios, interest factors, collateral requirements, collateralization costs, monitoring criteria, and monitoring costs when the outcome of the project is unobservable. Comparision of Eq. (5.6) and Eq. (5.12) reveals that the interest factor requested under the unobservable case is larger than that of the observable case.

In summary, two categories of lenders compete using their multidimensional optimal loan contracts, each of which is comprised of the loan-approval ratio, interest factor, collateral requirement, monitoring criteria, and services. Therefore, an optimal credit contract (d_{ij}, R_{ij}, c_{ij}, m_{ij}, S_{ij}) can be expressed as a vector that specifies a value for each of these variables, assuming the components of an optimal loan package or bundle can not be split and traded separately. In such a setting, it seems reasonable to expect that different compositions of loan terms will be offered by different lenders to different borrowers. Given various credit contracts, the borrower will choose one based on his/her own maximizing consideration. The detailed farmer-borrower decision-making process is specified in the following section.

The Borrower's Problem

In this section, the farmer-borrower's financing decision-making process is described. The representative borrower's problem is to choose the credit contract that maximizes his/her expected utility. Comparision of the maximum (indirect) utility of alternative multidimensional credit contracts determines an equilibrium loan contract which equals farm demand and supply for traditional or nontraditional credit. The first part of this section provides a theoretical model which explains how a representative farmer-borrower generates his/her indirect expected utility level under the conventional utility maximization framework. After the important factors affecting the borrower's utility formation are identified by using this framework, a discrete choice model is

developed that provides an empirical framework to examine why a farmer-borrower might choose one lender over another.

Accordingly, competition for loans by lenders implies that the borrower chooses among several credit contracts which yield zero profits to lenders. Assuming that borrower i always knows the interest factor requested by lender j, $R_{ij}(d_{ij}L_i|\underline{w}_i)$, after requesting a loan, and that the borrower has adequate funds with costs of using his/her internal cash, γ_i, to finance $1 - d_{ij}$ of the project. Using collateral also results in additional costs for the borrower. In general, regardless of default or not, the use of collateral always involves some opportunity costs for borrower i, $O_{ij}(y_i + c_{ij})$, where $O'_{ij} > 0$ and $O_{ij}(0) = 0$, which describes the costs for losing the right to use specific collateral assets to secure other transactions. However, in case of default, the lender will liquidate or entitle total collateral C_{ij} and the borrower not only sacrifices his/her possession of additional collateral, c_{ij}, but also loses the productivity generated from c_{ij}, which can be expressed as $(1+ \alpha_{ij})c_{ij}$ where α_{ij} denotes the costs of losing productivity for borrower i in percentage terms. In addition, if the loan is not performing, the cost of default may include reputation damages which may also affect the borrower's decision.

It is assumed that the difference between the contractural repayment and total collateral is a function of costs of default, $\theta_{ij}(\delta_{ij} - y_i - c_{ij})$, where $\theta'_{ij} > 0$ and $\theta_{ij}(0) = 0$. Transaction costs, T_{ij}, which is defined as the time and costs of credit acquisition from lender j should also be considered by borrower i. Owing to the nature of nontraditional lenders, "one-stop-shopping" for product and financial inputs in the local vicinity saves transaction costs and also provides convenience for borrowers. Therefore, T_{iT} is normally larger than T_{iN}, which indicates that customer convenience is another competitive advantage for nontraditional lenders. In addition, the value of services, S_{ij}, provided by lender j significantly affects borrower i's expected value of different contracts.

Consequently, a risk-neutral farmer-borrower i's problem is selecting an optimal loan contract offered by lender j out of a discrete set of loan contracts if the expected utility (return) level for loan contract j is a maximum. The expected utility of a choice alternative is defined as the indirect (maximum) rather than direct utility because only the best terms of a particular contract is worth being compared with those of another contract.

To solve this borrower problem, a discrete choice model including a two-stage analysis is presented. In the first stage, the indirect expected return level associated with different loan packages is specified, which is consistent with the conventional utility maximization framework. In the second stage, a rational farmer-borrower will compare the indirect utility of each contract and then select just one contract which generates highest expected return for the borrower.

The first-stage analysis

If the outcome of a borrower's project is freely observed without cost, the first-stage analysis involves deriving the *i*th borrower's indirect expected utility with respect to individual contract j, j = N, T, by solving the following expected-return-maximization problem subject to the *j*th lender's problem, which includes his/her breakeven constraint and institutional constraint:

$$\begin{aligned}
\underset{d_{ij},c_{ij}}{\text{MAX}}\ U_{ij} \equiv\ & E(y_i|\underline{w}_i) - \{\int_0^{\delta_{ij}-c_{ij}} [y_i + c_{ij}(1+\alpha_{ij}) + \theta_{ij}(\delta_{ij} - y_i - c_{ij})] f(y_i|\underline{w}_i)\, dy_i \\
& + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} (y_i + (\delta_{ij} - y_i)(1+\alpha_{ij})] f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}}^{Y} \delta_{ij} f(y_i|\underline{w}_i)\, dy_i \\
& + O_{ij}(y_i + c_{ij}) + T_{ij} + (1-d_{ij}) L_i(1+\gamma_i)\} + S_{ij} \\
\text{s.t.}\quad & [1-\phi_{ij}][\int_0^{\delta_{ij}-c_{ij}} (y_i + c_{ij}) f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij} f(y_i|\underline{w}_i)\, dy_i] \\
& + \int_{\delta_{ij}}^{Y} \delta_{ij} f(y_i|\underline{w}_i)\, dy_i \geq d_{ij} L_i(1+\rho_{ij})
\end{aligned}$$

The Kuhn-Tucker first-order conditions associated with the Lagrangian maximization with the Lagrangian multiplier ω_{ij} are

$$\frac{\partial L}{\partial d_{ij}} = \{R_{ij}L_i + \frac{\partial R_{ij}}{\partial d_{ij}L_i} d_{ij}L_i^2\}\{-\int_0^{\delta_{ij}-c_{ij}} \theta_{ij}'(\delta_{ij} - C_{ij})\, f(y_i|\underline{w}_i)\, dy_i$$
$$- \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} (1+\alpha_{ij})\, f(y_i|\underline{w}_i)\, dy_i - \int_{\delta_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i$$
$$+ \omega_{ij}\phi_{ij}[\delta_{ij}\, f(\delta_{ij}|\underline{w}_i) + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} f(y_i|\underline{w}_i)\, dy_i] - \omega_{ij}\int_{\delta_{ij}-c_{ij}}^{Y} f(y_i|\underline{w}_i)\, dy_i\}$$
$$+ L_i(1+\gamma_i) - \omega_{ij} L_i(1+\rho_{ij}) \le 0\,;\, \frac{\partial L}{\partial d_{ij}} d_{ij} = 0 \tag{5.13.1}$$

$$\frac{\partial L}{\partial c_{ij}} = \int_0^{\delta_{ij}-c_{ij}} [\theta_{ij}'(\delta_{ij} - C_{ij}) - (1+\alpha_{ij})]\, f(y_i|\underline{w}_i)\, dy_i - O_{ij}'(C_{ij})$$
$$+ \omega_{ij}(1-\phi_{ij})\int_0^{\delta_{ij}-c_{ij}} f(y_i|\underline{w}_i)\, dy_i \le 0\,;\, \frac{\partial L}{\partial c_{ij}} c_{ij} = 0 \tag{5.13.2}$$

$$\frac{\partial L}{\partial \omega_{ij}} = \int_0^{\delta_{ij}-c_{ij}} [y_i + c_{ij}]\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{Y} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i$$
$$- \phi_{ij}[\int_0^{\delta_{ij}-c_{ij}} [y_i + c_{ij}]\, f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}-c_{ij}}^{\delta_{ij}} \delta_{ij}\, f(y_i|\underline{w}_i)\, dy_i]$$
$$- d_{ij}L_i(1+\rho_{ij}) \ge 0\,;\, \frac{\partial L}{\partial \omega_{ij}} \omega_{ij} = 0 \tag{5.13.3}$$

For the interior solution, the first-order Eqs. (5.13.1) through (5.13.3) equal zero. The equality of Eq. (5.13.3) specifies the multiple optimal loan contracts offered by the *j*th lender. In other words, the equality of Eq. (5.13.3) is identical to Eq. (5.6), which characterizes the structural system of the lender's problem. Let d_{ij}^* and c_{ij}^* be defined as the borrower's loan terms choice variables, which reflect his/her willingness to accept a

best loan contract offered by lender j as one of the choices. The interior solutions of d_{ij}^* and c_{ij}^* are determined by the lender's and borrower's optimization problem, that is,

$$d_{ij}^* = d_{ij}^*(L_i, \alpha_{ij}, \rho_{ij}, \gamma_i, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), \Phi'_{ij}(\cdot), O'_{ij}(\cdot), \theta_{ij}(\cdot), \theta'_{ij}(\cdot), R_{ij}(\cdot), \partial R_{ij}/\partial d_{ij} L_i) \tag{5.14.1}$$

$$c_{ij}^* = c_{ij}^*(L_i, \alpha_{ij}, \rho_{ij}, \gamma_i, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), \Phi'_{ij}(\cdot), O'_{ij}(\cdot), \theta_{ij}(\cdot), \theta'_{ij}(\cdot), R_{ij}(\cdot), \partial R_{ij}/\partial d_{ij} L_i) \tag{5.14.2}$$

In addition, ω_{ij} is also characterized by $[L_i, \alpha_{ij}, \rho_{ij}, \gamma_i, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), \Phi'_{ij}(\cdot), O'_{ij}(\cdot), \theta_{ij}(\cdot), \theta'_{ij}(\cdot), R_{ij}(\cdot), \partial R_{ij}/\partial d_{ij} L_i]$. The indirect expected return, U_{ij}^*, is then found by substituting the profit-maximizing values of the choice variables, given by Eq. (5.14.1) and Eq. (5.14.2), into the objective function

$$\begin{aligned} U_{ij}^*(L_i, \rho_{ij}, \alpha_{ij}, \gamma_i, T_{ij}, S_{ij}, f(y_i|\underline{w}_i), \Phi_{ij}(\cdot), R_{ij}(\cdot), \theta_{ij}(\cdot), O_{ij}(\cdot), \partial R_{ij}/\partial d_{ij} L_i) \equiv \\ E(y_i|\underline{w}_i) + S_{ij} - \{\int_0^{\delta_{ij}^* - c_{ij}^*} (y_i + c_{ij}^*(1+\alpha_{ij}) + \theta_{ij}(\delta_{ij}^* - y_i - c_{ij}^*)) f(y_i|\underline{w}_i)\, dy_i \\ + \int_{\delta_{ij}^* - c_{ij}^*}^{\delta_{ij}^*} [y_i + (\delta_{ij}^* - y_i)(1+\alpha_{ij})] f(y_i|\underline{w}_i)\, dy_i + \int_{\delta_{ij}^*}^{Y} \delta_{ij}^* f(y_i|\underline{w}_i)\, dy_i \\ + O_{ij}(y_i + c_{ij}^*) + T_{ij} + (1 - d_{ij}^*) L_i(1+\gamma_i)\} \end{aligned} \tag{5.15}$$

The expected return $U_{ij}^*(\cdot)$ gives the maximum return for a best multidimensional contract offered by lender j. In other words, $U_{ij}^*(d_{ij}^*, c_{ij}^*) = \text{Max } U_{ij}$, j = N, T. Note that $U_{ij}^*(\cdot)$ not only reflects the components of the *j*th contract bundle and the characteristics of the *i*th borrower, but also the attributes of the *i*th borrower's objective function.

For a corner solution, the first-order Eqs. (5.13.1) and (5.13.2) are less than zero, and the first-order Eq. (5.13.3) is greater than or equal to zero. The three corner solution cases follow.

(1) $d_{ij}^* = 0$ and $c_{ij}^* = 0$, or $\partial L/\partial d_{ij} < 0$ and $\partial L/\partial c_{ij} < 0$.

In this case, $\partial L/\partial d_{ij} = L_i(1+\gamma_i) - \omega_{ij}L_i(1+\rho_{ij})$ needs to be < 0, and $\partial L/\partial c_{ij} = -O'_{ij}(y_i) < 0$; while $\partial L/\partial \omega_{ij} = 0$ when $d_{ij}^* = 0$ and $c_{ij}^* = 0$. This yields $\omega_{ij} > 0$. Therefore, this is a feasible solution only when $1+\gamma_i < \omega_{ij}(1+\rho_{ij})$, namely, if the borrower's costs of using internal equity are smaller than the lender's costs of funds times its shadow price, assuming the borrower has adequate funds to finance the project and the borrower can choose to reject this loan contract offer.

(2) $d_{ij}^* \neq 0$ and $c_{ij}^* = 0$, or $\partial L/\partial d_{ij} = 0$ and $\partial L/\partial c_{ij} < 0$.

While $c_{ij}^* = 0$ needs

$$\frac{\partial L}{\partial c_{ij}} = \int_0^{\delta_{ij}} [\theta'_{ij}(\delta_{ij} - y_i) - (1+\alpha_{ij})] f(y_i|\underline{w}_i)\,dy_i - O'_{ij}(y_i) + \omega_{ij}(1-\phi_{ij}) \int_0^{\delta_{ij}} f(y_i|\underline{w}_i)\,dy_i < 0,$$

and $d_{ij}^* \neq 0$ needs

$$\frac{\partial L}{\partial d_{ij}} = \{R_{ij}L_i + \frac{\partial R_{ij}}{\partial d_{ij}L_i} d_{ij}L_i^2\}\{-\int_0^{\delta_{ij}} \theta'_{ij}(\delta_{ij} - y_i) f(y_i|\underline{w}_i)\,dy_i - \int_{\delta_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i$$
$$+ \omega_{ij}\phi_{ij}\delta_{ij} f(\delta_{ij}|\underline{w}_i) - \omega_{ij} \int_{\delta_{ij}}^{Y} f(y_i|\underline{w}_i)\,dy_i\} + L_i(1+\gamma_i) - \omega_{ij} L_i(1+\rho_{ij}) < 0.$$

While in this case,

$$\frac{\partial L}{\partial \omega_{ij}} = \int_0^{\delta_{ij}} y_i f(y_i|\underline{w}_i)\,dy_i + \int_{\delta_{ij}}^{Y} \delta_{ij} f(y_i|\underline{w}_i)\,dy_i - \phi_{ij} \int_0^{\delta_{ij}} y_i f(y_i|\underline{w}_i)\,dy_i - d_{ij}L_i(1+\rho_{ij}) \geq 0$$

Thus, d_{ij}^* must simultaneouly solve these three first-order equations; otherwise, this is not a feasible solution for the loan to be granted without requiring additional collateral.

(3) $d_{ij}^* = 0$ and $c_{ij}^* \neq 0$, or $\partial L/\partial d_{ij} < 0$ and $\partial L/\partial c_{ij} = 0$.

$d_{ij}^* = 0$ results in

$\frac{\partial L}{\partial d_{ij}} = L_i(1+\gamma_i) - \omega_{ij} L_i(1+\rho_{ij})$, which needs to be less than zero, and $\partial L/\partial \omega_{ij} = 0$,

which implies that ω_{ij} is not equal to zero.

$c_{ij}^* \neq 0$ needs $\frac{\partial L}{\partial c_{ij}} = -O'_{ij}(C_{ij}) = 0$, which contradicts the definition that

$-O'_{ij} < 0$. Hence, this is clearly not a feasible solution. The lender would not require additional collateral and would not extend credit.

If the output of the borrower's project is not freely observed by the lender, the lender will announce the monitoring criteria, m_{ij}, in advance to reduce the moral hazard. However, monitoring of borrowers results in monitoring costs, $M_{ij}(d_{ij}L_i|\underline{w}_i)$, for lenders as well as for borrowers. Let N_{ij} be defined as borrower i's monitoring costs, resulting from the lender's monitoring requirement. In this case, $N_{ij}(m_{ij})$ should be added to the borrower's objective function to reflect the borrower's disutility if monitoring is frequent. Furthermore, $M_{ij}(d_{ij}L_i|\underline{w}_i)$ should be added to the right-hand side of the first constraint in the borrower's optimization problem to reflect the lender's costs. As a result, d_{ij}^* and c_{ij}^* are now characterized not only by L_i, ρ_{ij}, $f(y_i|\underline{w}_i)$, $\Phi_{ij}(\cdot)$, and $R_{ij}(\cdot)$, but also by $M_{ij}(\cdot)$. Namely, U_{ij}^* of the monitoring case is not only affected by the factors in the non-monitoring case, but also by m_{ij}, $N_{ij}(\cdot)$, and $M_{ij}(\cdot)$.

The second-stage analysis

Once the indirect expected utility (return) function, $U_{ij}^*(\cdot)$, is defined and obtained, borrower i will choose one contract maximizing his/her expected return. In other words, the loan contract participation decision of a farmer-borrower is modeled as a comparison of the indirect expected returns offered by the traditional and nontraditional lender, which should be viewed as a discrete choice problem. A probabilistic discrete and dichotomous

choice model in which the dependent variable is a discrete outcome, such as a "yes or no" decision, can be used to analyze the factors affecting the borrower's choice of alternative loan contracts (Lee, 1978; Heckman, 1979; Nakosteen and Zimmer, 1980; Chambers and Foster, 1983; Caswell and Zilberman, 1985; Konyar and Osborn, 1990).

A random utility model can be formulated by incorporating a random component (or disturbance), ε_{ij}, to the indirect expected utility function to account for all unmeasured or unobserved attributes and characteristics:

$$\tilde{U}_{ij}^* = U_{ij}^*(\cdot) + \varepsilon_{ij} \qquad i = 1, \ldots, Z, j = N, T \qquad (5.16.1)$$

where $\tilde{U}_{ij}^*$ is the stochastic expected return derived from loan choice j by borrower i, $U_{ij}^*(\cdot)$ is the real valued or nonstochastic expected return affected by the attributes of loan choice j, which are specific to borrower i, and the characteristics of borrower i, which are not varied between loan choices.

For the purpose of analysis, $U_{ij}^*(\cdot)$ is assumed to have the following linear functional form:

$$U_{ij}^*(\cdot) = \Gamma' x_{ij} + \xi_j' z_i \qquad i = 1, \ldots, Z, j = N, T \qquad (5.16.2)$$

where

1. x_{ij} is a column vector of attributes of loan contract j explaining borrower i's indirect expected return function, which includes d_{ij}^*, c_{ij}^*, R_{ij}^*, m_{ij}, S_{ij}, α_{ij}, T_{ij}, $O_{ij}(\cdot)$, and $\theta_{ij}(\cdot)$;
2. z_i is a column vector of the socioeconomic characteristics of the *i*th borrower, which includes $f(y_i | \underline{w}_i)$ and γ_i; and

3. Γ and ξ_j are column vectors of parameters reflecting the impact of changes in x_{ij} and z_i on borrower i's indirect expected return or vectors of implicit prices or hedonic prices for different characteristics. It is assumed that Γ and ξ_j are constant with respect to the levels of x_{ij} and z_i.

Hence, if the indirect expected return of contract N in a random utility model is greater than that of contract T, the farmer-borrower will choose the nontraditional lender's loan contract. Specifically, if $\tilde{U}_{iN}^* > \tilde{U}_{iT}^*$, or if the unobservable, or latent, random variable $\pi_i^* = \tilde{U}_{iN}^* - \tilde{U}_{iT}^* > 0$, borrower i will choose a nontraditional lender. As a result, the values of the observable dummy and dependent variable Y_i are determined as

$Y_i = 1$ if $\pi_i^* > 0$, or borrower i chooses a nontraditional lender

$Y_i = 0$ if $\pi_i^* < 0$, or borrower i chooses a traditional lender

π_i^* can be rearranged as

$$\begin{aligned}
\pi_i^* &= \tilde{U}_{iN}^* - \tilde{U}_{iT}^* \\
&= \Gamma' (x_{iN} - x_{iT}) + (\xi_N - \xi_T)' z_i + \varepsilon_{iN} - \varepsilon_{iT} \\
&= \left[\Gamma', (\xi_N - \xi_T)'\right] \begin{bmatrix} x_{iN} - x_{iT} \\ z_i \end{bmatrix} + u_i \\
&= \beta' x_i + u_i \qquad (5.17)
\end{aligned}$$

where β', x_i, and u_i are unknown parameters, explanatory variables, and random errors in the linear statistical model, respectively.

For borrower i, as long as u_i has a standard normal or logistic distribution, the probability of choosing the nontraditional lender's contract can be expressed as the binary probit or logit probability as follows:

For the probit model,

$$pr(Y_i = 1) = pr(\pi_i^* > 0) = pr(u_i > -\beta' x_i) = 1 - F(-\beta' x_i) = F(\beta' x_i) \tag{5.18}$$

where $F(\cdot)$ denotes the standard normal accumulative distribution function.

For the logit model,

$$pr(Y_i = 1) = pr(\pi_i^* > 0) = pr(u_i > -\beta' x_i)$$
$$= 1 - \frac{1}{1+e^{\beta' x_i}} = \frac{e^{\beta' x_i}}{1+e^{\beta' x_i}} = \Lambda(\beta' x_i) \tag{5.19}$$

where $\Lambda(\cdot)$ denotes the logistic cumulative distribution function. The logit or probit functions are applied to describe the borrower's choice of an offered loan contract in terms of the loan contract attributes and the borrower's socioeconomic characteristics. In addition, the estimated model predicts the likelihood of the borrower's decision, as well as the marginal effects of different attributes on the borrower's selection decision.

The theoretical model presented in this chapter describes the lender's optimization process in the determination of optimal terms of the loan contract offered, and the borrower's decision-making process in selecting the most appealing credit contract. The model suggests that the existing expertise, unique features, and special intermediary functions of nontraditional lenders may allow them to offer more attractive loan terms or

reach riskier borrowers compared with traditional lenders. Further, the model shows that the borrower's loan contract acceptance decision is significantly affected by the attributes of alternative loan contracts, and the borrower's socioeconomic characteristics. This theoretical framework provides the foundation for the corresponding econometric model introduced in the next chapter.

CHAPTER 6.

ESTIMATION PROCEDURE AND DATA ANALYSIS

In this chapter, an econometric model is specified and applied to the farmer-borrower's loan contract participation decision in a discrete choice model. In the previous chapter, the results of the analysis indicate that the observable dependent variable Y_i depends on the difference between two random indirect expected returns associated with loan contracts individually offered by a traditional and a nontraditional lender. However, each indirect expected return is affected by the attributes of the corresponding loan contract and the socioeconomic characteristics of the *i*th borrower. In other words, a farm-borrower's participation or selectivity decision is a function of the differences in expected returns between two contract packages and the characteristics of the *i*th borrower, as shown in Eq. (5.17). The econometric model specified in this chapter relates the borrower's choice of a loan contract to the endogenous variables, such as the terms of the loan contracts, and to other exogenous variables and information, such as borrower-specific characteristics. The model incorporates the borrower's dichotomous decision on self-selecting a loan contract and the lender's and borrower's decisions in determining the terms of the loan package.

The main purpose of this estimation is to utilize the sample observations to estimate the parameters and marginal effects of different attributes on the borrower's decision function in order to reveal the interrelationships between the terms of a loan and borrower-specific characteristics from the borrower's perspective. However, several econometric problems must first be addressed. One of the most serious is the bias associated with ordinary least squares (OLS) estimation of the endogenous terms of the loan contract. As a result, some adjustments are required in the estimation procedure.

The remainder of this chapter is organized as follows. The first section presents the specification of an econometric model. The second section describes the data utilized in this study. The third section provides the empirical definitions of the relevant variables. The econometric model and estimation procedure are presented in the final two sections.

Specification

In the previous chapter, it was shown that the *i*th borrower will choose a nontraditional lender if $\pi_i^* > 0$, that is,

$Y_i = 1$ if $\pi_i^* > 0$, or borrower i chooses a nontraditional lender

$Y_i = 0$ if $\pi_i^* < 0$, or borrower i chooses a traditional lender

where

$$\begin{aligned}\pi_i^* &= \tilde{U}_{iN}^* - \tilde{U}_{iT}^* \\ &= \Gamma' (x_{iN} - x_{iT}) + (\xi_N - \xi_T)' z_i + \varepsilon_{iN} - \varepsilon_{iT} \\ &= \left[\Gamma', (\xi_N - \xi_T)'\right] \begin{bmatrix} x_{iN} - x_{iT} \\ z_i \end{bmatrix} + u_i \\ &= \beta' x_i + u_i \qquad (6.1)\end{aligned}$$

where u_i is normally distributed with zero mean and variance σ_u.

The most important part of this estimation is the structural participation decision equation specified in Eq. (6.1). Rewriting the decision equation above, we obtain

$$\pi_i^* = \Gamma_0 + \Gamma^{D\prime}(x^D_{iN} - x^D_{iT}) + \Gamma^{E\prime}(x^E_{iN} - x^E_{iT}) + \xi' z_i + u_i \qquad (6.2)$$

where both the column vector of attributes of a loan contract, N and T, offered by a nontraditional and a traditional lender individually, x_{iN} and x_{iT}, can be decomposed into two categories of variables, endogenous loan term choice variables, x^D_{iN} and x^D_{iT}, and exogenous attributes variables of loan contract j, x^E_{iN} and x^E_{iT}, respectively, and z_i is a vector of the exogenous socioeconomic characteristics of borrower i. Therefore, the model is completed by specifying the endogenous loan term variables, x^D_{iN} and x^D_{iT}, for the nontraditional lender and the traditional lender by their reduced-form equations, respectively:

$$\begin{aligned} x^D_{iN} &= \eta_{0N} + \eta' h_{iN} + e_{iN} \\ x^D_{iT} &= \eta_{0T} + \eta' h_{iT} + e_{iT} \end{aligned} \tag{6.3}$$

where h_i is a column vector of attributes explaining the determination of endogenous loan term variables, η' is a row vector of unknown parameters, and e_{iN} and e_{iT} are disturbance terms assumed to be normally distributed with variance σ_N^2 and σ_T^2, respectively.

Equation (6.2) and equation set (6.3) comprise the structural form of the model with endogenous variables π_i^*, x^D_{iN}, and x^D_{iT}. In fact, π_i^* is not observable. Only the actual choice Y_i can be observed. Further, we observe only x^D_{iN} (or x^D_{iT}) if borrower i selects a nontraditional lender (or a traditional lender), but not both. In other words, those borrowers who select an alternative are not randomly drawn from the population as a whole. Hence, equation set (6.3) can only be estimated by part of the samples. The resulting bias in data causes biased estimates of the loan term equations, which is defined as selectivity bias.

Because the observed dependent variable is binary, the estimation approach we introduce in this analysis is the two-stage logit or probit estimation. The first stage

involves estimating the endogenous variables, x^D_{iN} and x^D_{iT}, by their reduced-form equations through OLS and then obtaining the predicted or fitted values of the endogenous variables. In the second stage, x^D_{iN} and x^D_{iT} are replaced by their predicted values and the model's coefficients, or the marginal effects of different attributes in the decision equation, are estimated using standard probit or logit techniques. However, the selectivity bias in the first-stage OLS estimation for x^D_{iN} and x^D_{iT} occurs because of truncated samples. As originally shown by Johnson and Kotz (1972), Lee (1978), and Heckman (1979), OLS is not appropriate for estimating x^D_{iN} and x^D_{iT} because it can not fully reflect the existence of discrete selection on contracting. This can be seen by examining the non-zero and non-constant conditional means of e_{iN} and e_{iT}:

$$E(e_{iN} | Y_i = 1) = \sigma_{Nu^*} [- f(\Psi_i) / F(\Psi_i)]$$
$$E(e_{iT} | Y_i = 0) = \sigma_{Tu^*} [f(\Psi_i) / 1 - F(\Psi_i)] \qquad (6.4)$$

where $f(\cdot)$ and $F(\cdot)$ are the standard normal density and distribution functions, respectively, σ_{Nu^*} (σ_{Tu^*}) is the covariance of e_{iN} (e_{iT}) and u_i^*, and Ψ_i and u_i^* are defined by the following procedure. First, substituting Eq. (6.3) into Eq. (6.2) results in the reduced-form decision equation

$$\pi_i^* = b_0 + b_1 (x_i^*) + b_2 (z_i^*) + u_i^* \qquad (6.5)$$

where the vectors x_i^* and z_i^* include all exogenous variables in the model and u_i^* is normally distributed with unit variance. Second, let Ψ_i be defined as

$$\Psi_i = b_0 + b_1 (x_i^*) + b_2 (z_i^*) \qquad (6.6)$$

After Ψ_i is derived, we modify equation set (6.3) by adding the selectivity variables and zero-mean error terms, ν, in order to avoid the selectivity bias problem in the first-stage OLS estimation. Two selectivity variables, V_{iN} and V_{iT}, are defined as

$$V_{iN} = - f(\Psi_i) / F(\Psi_i)$$
$$V_{iT} = \quad f(\Psi_i) / 1 - F(\Psi_i) \tag{6.7}$$

After the selectivity variables are incorporated in equation set (6.3), a conventional two-stage probit or logit estimation procedure can then be applied to the structural model to generate consistent estimates of the parameters. In the first stage, the corrected equations for x^D_{iN} and x^D_{iT} are constructed by adding the selectivity variables as follows:

$$x^D_{iN} = \eta_{0N} + \eta' [h_{iN} , V_{iN}] + \nu_{iN}$$
$$x^D_{iT} = \eta_{0T} + \eta' [h_{iT} , V_{iT}] + \nu_{iT} \tag{6.8}$$

where $E(\nu_{iN} | Y_i = 1) = 0$ and $E(\nu_{iT} | Y_i = 0) = 0$. Then, estimation of Eq. (6.8) by OLS generates consistent estimated parameters in this stage.

Using the above estimation procedure and incorporating the appropriate modification for selectivity variables will result in consistent coefficients in the OLS estimation. However, because V_{iN} and V_{iT} are unknown, one just can replace V_{iN} and V_{iT} with their predicted values, $\hat{V}_{iN}$ and $\hat{V}_{iT}$. The predicted values are generated by estimating Eq. (6.5) by the maximum likelihood probit or logit method, which yields the estimates of b_0, b_1, and b_2, and the predicted value of Ψ_i, $\hat{\Psi}_i$. Using the fitted values of V_{iN} and V_{iT} instead of their true values violates the standard error structure assumption for OLS, resulting in biased estimates of standard errors (Robinson and Tomes, 1982). Therefore,

the correct asymptotic variance-covariance matrix derived by Heckman in 1979 will be employed to develop appropriate standard errors and asymptotic t-statistics in the first-stage estimation, which can be used to test the significance of the variables affecting the terms of the loan.

The second stage involves substituting the consistent predicted x^{D}_{iN} and x^{D}_{iT} back into structural Eq. (6.2) and then estimating this structural decision equation by the maximum likelihood probit or logit method. Consequently, the probability that the *i*th borrower chooses a nontraditional lender can be expressed as

$$
\begin{aligned}
pr(Y_i = 1) &= pr(\pi_i^* > 0) \\
&= pr(\Gamma_0 + \Gamma^{D\prime}(\hat{x}^{D}_{iN} - \hat{x}^{D}_{iT}) + \Gamma^{E\prime}(x^{E}_{iN} - x^{E}_{iT}) + \xi' z_i + u_i > 0) \\
&= pr(u_i > -\beta' x_i) = pr(u_i/\sigma_u > -\beta' x_i/\sigma_u) = F(\beta' x_i/\sigma_u) \\
&= pr(\kappa_i > -\beta^{*\prime} x_i) = F(\beta^{*\prime} x_i) \qquad (6.9)
\end{aligned}
$$

where $F(\cdot)$ is the standard normal cumulative distribution function. The consistent estimated coefficients in the structural form of the participation equation indicate the significance of factors reflecting the borrower's selection criteria and decision-making process in choosing between nontraditional and traditional lenders.

Data Description

The primary data used in this study are from the 1993 Iowa Farm Finance Survey, which was conducted by Iowa State University in cooperation with Iowa Agricultural Statistics in April 1993. The objective of this survey, conducted since 1984, is to obtain information on the financial status of Iowa farm families and their lenders. Therefore, the

information reveals not only family and farm demographic characteristics, but also the profitability, liquidity, and solvency of Iowa farm businesses, along with the quality of the agricultural lenders' loan portfolios included in the sample.

The data were collected from a random sample of 3,500 Iowa farm operators through response to a questionnaire survey that was sent out on April 15, 1993. By May 15, 1993, 1,300 surveys had been returned, and 1,125 surveys were usable. For each farm operator, the data contain five categories of microeconomic information:

1. Farmer's personal characteristics—age, family status, farm size, education, experience, and status of operation,
2. Traditional credit availability—loan amount borrowed, average interest rate, average length of loan, and so on,
3. Risk management—frequency of using risk management strategies,
4. Merchant and dealer credit (nontraditional credit)—loan amount borrowed, loan length, interest rate, and the reason for using nontraditional credit, and
5. Farmer's income statement in 1992 and balance sheets in January of 1992 and 1993—where profitability, liquidity, and solvency status, as well as loan portfolios using real estate and non-real estate debt are released.

Therefore, this data set is appropriately used to estimate the coefficients of the econometric model. A general examination of the sample representation of this survey follows.

Generally speaking, the respondents to this survey were older and operated larger farms on average compared with the population of the 1987 Census of Agriculture (Jolly, 1993). Survey respondents with less than 50 acres and younger than 35 years of age tend to be undersampled, while respondents with more than 50 acres and older than 45 years of age are oversampled. Weather-related losses in 1992 significantly affected the farm businesses' financial performance in 1992 and 1993. Liquidity, solvency, and profitability

ratios deteriorated, and net worth or equity all eroded in 1992 and 1993. Therefore, in this survey, the farm businesses characterized as having a strong financial position, defined as a strong equity position along with good profitability and solvency, account for only 38 percent of the population. Forty percent of the farm businesses were categorized as having a stable financial position. This category of farms has adequate equity position but experiences moderate cash flow or liquidity problems. The remaining 22 percent of farm businesses experienced financial stress and were classified into the financial-at-risk category, which includes severe and weak categories individually. In 1986 and 1991, however, this category of farms only comprised 31 percent and 15 percent of the population, respectively. Overall, farm financial performance fell by the beginning of 1993.

Empirical Definitions

The variables used in the empirical estimation can be divided into three categories: borrower personal characteristics, financial measures, and contract margins. Borrower personal characteristics and financial measures are two sub-categories of a farmer's socioeconomic attributes, which are directly evaluated by lenders for determining a best multidimensional loan contract and influence the borrower's participation decision. Contract attribute variables are endogenous and dependent variables hypothesized to be significantly associated with the probability of participation. The detailed definition and explanation of the derivation of selected variables are summarized in Table 6.1 and discussed next.

Table 6.1. Variable definitions

Variable	Description
PARTICIP	1 = if use nontraditional credit 0 = if use traditional credit
Borrower Characteristics	
AGES	Age in years 1 = < 35 years; 2 = 35-44 years; 3 = 45-54 years; 4 = 55-64 years; 5 = > 65 years
EDH	Husband's education
EDW	Wife's education 1 = high school education; 2 = community college; 3 = college; 4 = post graduate
EXPER	Years of farming
DEPSUPP	Numbers of dependent to support
FLEXP	Family living expenses
SIZEA	Farm operation size 1 = <50 acres; 2 = 50-179 acres; 3 = 180-499 acres; 4 = 500-999 acres; 5 = >1,000 acres
Farm Type	
CASGRAF	>95% of gross farm income from crops
GRALVSF	50%-95% of gross farm income from crops
HOGF	>50% of gross farm income from hog
BEEFF	>50% of gross farm income from beef
DAIRYF	>50% of gross farm income from dairy
Risk Management Strategy	
MPCI	Frequency using multiple-peril insurance
HAILI	Frequency using hail insurance
GOVTI	Frequency using government program scale: 1-5, 1= never and 5= always

Table 6.1. (continued)

Variable	Description
Financial Measures	
ROA	Return on asset ratio = (Net farm income + interest expenses – family living expenses) / Total assets
LIQUIDIT	Current ratio = Current assets / Non-real estate debt
DTOA	Debt to asset ratio = Total debt / Total assets
INTCOV	Interest coverage ratio = (Net farm income + interest expenses – family living expenses) / Interest expenses
ASSETTO	Asset turnover ratio = Gross farm income / Total assets
MGTEFF	Managerial efficiency ratio = Operating expenses / Gross farm income
COD	Cost of debt = Interest expenses / Total debt
COLOSPRD	Cost of losing productivity = Net farm income / Total Assets
ROE	Return on equity = (Net farm income – family living expenses) / Net worth
PM	Profit margin = (Net farm income + interest expenses – family living expenses) / Total gross income
NCI	Net cash income = Net cash farm income + off-farm income
Contract Attributes	
DEBT	Size of loan
COLLATER	Collateral proxy = Non-real estate assets – non-real estate debt
INTEREST	Interest rate
MONTH	Length of loan

Type of credit user

The total sample size of the 1993 Iowa Farm Finance Survey consists of 1,125 usable observations. However, a number of observations were deleted. The data were deleted if the respondent (1) did not report either non-real estate nontraditional debt, including merchant and dealer credit, or non-real estate traditional debt, including bank credit and Farm Credit System credit; (2) did not provide sufficient financial information for estimation; or (3) provided obvious erroneous data. Note that respondents participating in either nontraditional or traditional non-real estate credit markets were included in the sample. Nonparticipants were excluded.

For this research, borrowers were categorized as nontraditional and traditional credit users. In general, if the respondents reported that they participated in nontraditional credit, they were categorized as nontraditional credit users. If they reported only participating in traditional credit, they were categorized as traditional credit users. However, measuring credit market participation is not straightforward. In this study, two definitions of participation are developed—the flow approach and the stock approach. The flow approach is based on the concept of the flow of funds or credit and emphasizes a borrower's additional credit usage and credit participation over a specific time period. This approach reflects the farmer-borrower's short-term choice of debt contract and the general pattern of borrowing and lending. In this study, the flow-based estimates reflect the farmer-borrowers' reported new borrowings in the given year of 1992. The stock approach, on the other hand, is based on the stock of funds, or the borrower's accumulated credit usage and credit participation at a given point in time. This approach reflects a farmer-borrower's long-term choice of credit contract, and possibly his/her loyalty or commitment to a specific type of lender. In the following analysis, the stock-based estimates reflect the farmer-borrowers' accumulated borrowings as reported on their 1993

balance sheets. The sample sizes of nontraditional and traditional credit users based on the two approaches are discussed next.

The flow approach The flow estimates were made as follows. Respondents were categorized as nontraditional credit users if they answered that they received non-real estate credit from nontraditional lenders in 1992 and provided the terms of their loan contracts. Respondents who reported additional new borrowing from traditional lenders in their balance sheets were categorized as traditional credit users. Using this definition, we identified 64 nontraditional credit users and 121 traditional credit users. The dependent variable, PARTICIP, was evaluated as 1 for nontraditional credit users and 0 for traditional credit users.

The stock approach Under this approach, if a farmer-borrower showed nontraditional debt in his/her 1993 balance sheet, then the value of 1 was assigned to PARTICIP. For the rest of the farmer-borrowers, if they showed traditional debt in their 1993 balance sheets, the value of 0 was assigned to PARTICIP. Using this definition, 282 observations resulted in 88 nontraditional credit users and 194 traditional credit users.

The sample means and standard deviations of the variables for farmer-borrowers classified as nontraditional and traditional credit users are presented in Table 6.2 through Table 6.9, by type of credit user.

Borrower personal characteristics

Several measures of borrower personal characteristics are directly available from the survey. These measures include age, education, number of family dependents, farm size, farm type, and frequency of use of selected risk management strategies. The grouping standard for each category variable is consistent with that of the 1993 Iowa Farm Finance Survey report. Brief descriptions of the variables used in this analysis follow.

Table 6.2. Summary of sample statistics, by type of credit user—the flow approach

	Nontraditional Credit User			Traditional Credit User		
Variable	N	Mean	Std Dev	N	Mean	Std Dev
Financial Measures						
ROA	62	-0.0140	0.23867	111	-0.0635	0.2486
LIQUIDIT	58	3.4499	4.2088	120	3.6887	4.7110
DTOA	54	0.3305	0.2659	82	0.3444	0.2354
INTCOV	60	2.7313	20.1024	106	-4.3200	27.9654
ASSETTO	63	0.3858	0.2462	114	0.3418	0.3335
MGTEFF	63	0.7130	0.3263	117	0.7597	0.9977
COD	54	0.0856	0.0587	84	0.0906	0.0783
COLOSPRD	62	0.0714	0.0918	111	0.0429	0.1708
ROE	54	-0.0700	0.2643	85	-0.1435	0.5101
PM	62	-0.0653	1.0280	109	-0.4427	1.3551
NCI	63	58439.83	61781.24	118	47098.58	61538.57
Borrower Characteristics						
AGES	64	2.7187	1.0461	121	2.8512	1.0928
EDH	63	1.7777	0.9745	120	2.0166	1.0369
EDW	58	1.9655	1.0590	113	1.9292	1.0750
EXPER	64	22.9687	10.6532	121	23.6694	11.2237
DEPSUPP	64	3.2500	1.4692	121	3.2066	1.4196
FLEXP	64	25455.52	6369.89	121	25787.05	5810.87
SIZEA	64	3.2968	1.0028	121	3.2066	0.9212
CASGRAF	64	0.1718	0.3802	121	0.2479	0.4336
GRALVSF	64	0.4687	0.5029	121	0.4297	0.4971
HOGF	64	0.0937	0.2937	121	0.0991	0.3001
BEEFF	64	0.0781	0.2705	121	0.0743	0.2634
DAIRYF	64	0.0781	0.2705	121	0.0247	0.1561
MPCI	59	3.1864	1.6965	117	3.3504	1.7035
HAILI	60	3.7500	1.7036	117	3.2393	1.7203
GOVTI	63	4.4444	1.0438	120	4.4583	0.9949
Contract Attributes						
DEBT	64	26381.53	24036.03	40	21927.74	36171.38
COLLATER	61	174154.54	138916.08	120	126741.42	142822.43
INTEREST	60	6.9954	3.8951	40	9.1118	1.2457
MONTH	60	31.3555	19.9875	40	47.1000	39.7890
Sample Size		64			121	

Table 6.3. Frequency in age group, by type of credit user—the flow approach

Age Group (AGES)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nontraditional credit users				
less than 35 years	6	9.4	6	9.4
35 to 44 years	24	37.5	30	46.9
45 to 54 years	20	31.3	50	78.1
55 to 64 years	10	15.6	60	93.8
over 65 years	4	6.3	64	100.0
Traditional credit users				
less than 35 years	11	9.1	11	9.1
35 to 44 years	41	33.9	52	43.0
45 to 54 years	32	26.4	84	69.4
55 to 64 years	29	24.0	113	93.4
over 65 years	8	6.6	121	100.0

Table 6.4. Frequency in farm size group, by type of credit user—the flow approach

Farm Size Group (SIZEA)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nontraditional credit users				
less than 50 acres	4	6.3	4	6.3
50 to 179 acres	7	10.9	11	17.2
180 to 499 acres	25	39.1	36	56.3
500 to 999 acres	22	34.4	58	90.6
over 1000 acres	6	9.4	64	100.0
Traditional credit users				
less than 50 acres	6	5.0	6	5.0
50 to 179 acres	13	10.7	19	15.7
180 to 499 acres	62	51.2	81	66.9
500 to 999 acres	30	24.8	111	91.7
over 1000 acres	10	8.3	121	100.0

Table 6.5. Frequency in farm type, by type of credit user—the flow approach

Farm type	Frequency	Frequency
Nontraditional credit users	if farm type = 0	if farm type = 1
CASGRAF	53	11
GRALVSF	34	30
HOGF	58	6
BEEFF	59	5
DAIRYF	59	5
Traditional credit users	if farm type = 0	if farm type = 1
CASGRAF	91	30
GRALVSF	69	52
HOGF	109	12
BEEFF	112	9
DAIRYF	118	3

Table 6.6. Summary of sample statistics, by type of credit user—the stock approach

	Nontraditional Credit User			Traditional Credit User		
Variable	N	Mean	Std Dev	N	Mean	Std Dev
Financial Measures						
ROA	73	0.0213	0.1791	183	-0.0757	0.2399
LIQUIDIT	87	3.3756	4.2995	193	3.7859	6.1341
DTOA	65	0.3376	0.2320	147	0.3533	0.2889
INTCOV	70	1.9273	14.8299	176	-3.8672	27.0953
ASSETTO	73	0.3674	0.2256	187	0.3161	0.2901
MGTEFF	75	0.6764	0.1805	189	0.8191	1.0813
COD	56	0.0835	0.0563	149	0.0953	0.0751
COLOSPRD	73	0.0873	0.1435	183	0.0321	0.1443
ROE	57	-0.0188	0.2445	147	-0.1602	0.5534
PM	73	0.0626	0.4734	181	-0.5878	1.7169
NCI	75	64596.08	65437.58	190	54798.67	89211.58
Borrower Characteristics						
AGES	88	2.7613	1.0170	194	2.9175	1.1259
EDH	85	1.9764	1.0115	193	1.9015	1.0535
EDW	78	2.0256	1.0316	173	1.8786	1.0411
EXPER	88	23.9090	10.4448	192	23.9375	11.6756
DEPSUPP	88	3.4204	1.5663	194	3.0000	1.4031
FLEXP	88	25914.36	6055.03	194	25092.32	6136.74
SIZEA	88	3.5681	0.9918	194	3.1340	0.9005
CASGRAF	88	0.2272	0.4214	194	0.2061	0.4056
GRALVSF	88	0.4886	0.5027	194	0.3711	0.4846
HOGF	88	0.1022	0.3047	194	0.1391	0.3470
BEEFF	88	0.0681	0.2535	194	0.1030	0.3048
DAIRYF	88	0.0454	0.2094	194	0.0257	0.1588
MPCI	84	3.1547	1.6317	186	3.1720	1.7187
HAILI	84	3.6071	1.5524	185	3.2486	1.7824
GOVTI	86	4.4651	1.0255	194	4.3505	1.0534
Contract Attributes						
DEBT	88	22216.86	25314.97	194	41980.72	49602.32
COLLATER	87	214069.24	214785.59	193	141039.97	181444.11
INTEREST	40	6.5637	3.4296	69	9.0607	1.1226
MONTH	40	40.1250	16.6324	69	38.8405	26.1430
Sample Size		88			194	

Table 6.7. Frequency in age group, by type of credit user—the stock approach

Age Group (AGES)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nontraditional credit users				
less than 35 years	8	9.1	8	9.1
35 to 44 years	31	35.2	39	44.3
45 to 54 years	26	29.5	65	73.9
55 to 64 years	20	22.7	85	96.6
over 65 years	3	3.4	88	100.0
Traditional credit users				
less than 35 years	18	9.3	18	9.3
35 to 44 years	60	30.9	78	40.2
45 to 54 years	53	27.3	131	67.5
55 to 64 years	46	23.7	177	91.2
over 65 years	17	8.8	194	100.0

Table 6.8. Frequency in farm size group, by type of credit user—the stock approach

Farm Size Group (SIZEA)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Nontraditional credit users				
less than 50 acres	3	3.4	3	3.4
50 to 179 acres	7	8.0	10	11.4
180 to 499 acres	31	35.2	41	46.6
500 to 999 acres	31	35.2	72	81.8
over 1000 acres	16	18.2	88	100.0
Traditional credit users				
less than 50 acres	8	4.1	8	4.1
50 to 179 acres	33	17.0	41	21.1
180 to 499 acres	88	45.4	129	66.5
500 to 999 acres	55	28.4	184	94.8
over 1000 acres	10	5.2	194	100.0

Table 6.9. Frequency in farm type, by type of credit user—the stock approach

Farm type	Frequency	Frequency
Nontraditional credit users	if farm type = 0	if farm type = 1
CASGRAF	68	20
GRALVSF	45	43
HOGF	79	9
BEEFF	82	6
DAIRYF	84	4
Traditional credit users	if farm type = 0	if farm type = 1
CASGRAF	154	40
GRALVSF	122	72
HOGF	167	27
BEEFF	174	20
DAIRYF	189	5

Age AGES is a category variable which equals 1 if the borrower's age is less than 35 years old, 2 if 35 to 44, 3 if 45 to 54, 4 if 55 to 64, and 5 if greater than 65 years old.

Education and experience EDH and EDW represent the level of the husband's and wife's educations, respectively. EDH and EDW are 1 if he/she has a high school education, 2 for community college, 3 for college, and 4 for post graduate education. EXPER represents years of farming. Since experience is a linear combination of age and education, we include the age and education variables but exclude the experience variable in the regression. However, for a better understanding of the borrowers' characteristics, the sample mean and standard deviation for the experience variable are included in Tables 6.2 and 6.6.

Family dependents and expenditures DEPSUPP refers to the number of dependents the farm family supports, and FLEXP refers to the family living expenditures. Based on the report of 1992 Family Living Expenditures of Iowa Farm Families, family living expenses are equal to $11,242 if the family has one dependent, $22,483 if two, $30,042 if three, and $29,885 if four. If the family has more than four dependents, then family living expenses are equal to the product of $5,523 and the number of family dependents.

Farm size The total acreage operated by the farm business is represented by the variable SIZEA, which equals 1 if operating acres are less than 50 acres, 2 if 50 to 179 acres, 3 if 180 to 499 acres, 4 if 500 to 999 acres, and 5 if greater than 1,000 acres.

Farm type In order to investigate the effects of different farm types on the borrower's participation and the lender's assessment decision, specialized farm operations facing unique risks are defined separately. Five dummy variables are utilized for classifying farm type: cash grain farm (CASGRAF) with more than 95 percent of gross

farm income from crops, grain-livestock farm (GRALVSF) with 50 percent to 95 percent of gross farm income from crops, and hog farm (HOGF), beef farm (BEEFF), and dairy farm (DAIRYF) with more than 50 percent of gross farm income from hog, beef, and dairy enterprises, respectively.

Risk management strategy Three measures of a farm's risk management strategies are important variables in identifying borrower quality, especially from the lender's viewpoint, because farmers are often required to assign to lenders the proceeds of insurance as a part of the security position. Therefore, MPCI, HAILI, and GOVTI are used to reflect the frequency with which farmer-borrowers use multiple-peril crop insurance, hail insurance, and government programs, respectively, to avoid production risks. For each variable, the scale ranges from 1 to 5, with 1 indicating the respondent never used insurance tools and 5 indicating the respondant always used insurance tools.

Financial measures

Financial factors or ratios have been widely recognized as important explanatory variables in agricultural credit assessment or credit scoring. Lenders not only use these measures to assess the creditworthiness of credit applicants, but also to price the bundle of loan terms. Although no financial measure has consistently been identified as significant, liquidity, repayment ability, and solvency are the three measures most frequently applied to evaluate a borrower's quality in prior agricultural studies (Miller and LaDue, 1989). For this study, in addition to these three financial variables, measures of profitability, leverage, capital efficiency, and managerial efficiency are examined. Each of these ratios measures a particular aspect of a farm's position and performance. The definitions of these measures follow.

Profitability Profitability measures the farmer's potential ability to earn a satisfactory return on investment. The rate of return on owned assets (ROA) is an important indicator of profitability recommended by the Farm Finance Task Force. This ratio reflects pre-tax earnings per dollar of investment, which is independent of the way the farm business is financed and also excludes capital gains.

Liquidity Liquidity assesses the borrower's ability to meet his/her immediate financial obligations and to meet short-term unanticipated and adverse financial contingencies. Determining liquidity by measuring short-term solvency is often associated with net working capital, or the difference between current assets and current liabilities (Ross and Westerfield, 1988, 43). The most widely used measure of accounting liquidity is the current ratio. In this study, the LIQUIDIT variable is measured by the current ratio, which relates current assets to current liabilities. Since current liabilities (short-term debt) were not reported in the survey, a broader proxy measure based on total non-real estate liability (short- and intermediate-term debt) is appropriately used.

Leverage Debt is an important financial tool due to its tax advantages; however, too much debt is likely to lead to a higher probability of financial distress. Leverage indicates the extent to which a farm business relies on debt financing when compared with equity. The debt-to-asset ratio (DTOA) provides a simple measure of leverage. It measures the indebtedness of the farm in percentage terms.

Repayment capacity Repayment capacity emphasizes the ability of a farm business to generate sufficient income to meet its interest obligations. One of the most widely used measures of repayment capacity is the interest coverage ratio (INTCOV), which is computed by dividing capital earnings before interest and taxes by interest expenses. This ratio measures the relationship between capital earnings and interest paid on debt.

Capital efficiency Capital efficiency reflects the farmer's financial management skills in effectively managing assets invested in the business (Miller and Ladue, 1989). In this study, the asset turnover ratio (ASSETTO), determined by dividing total gross income by total assets, is used to measure the borrower's capital efficiency. This ratio is an index of the efficiency of utilization of capital stock.

Managerial efficiency Managerial efficiency, signaling how well the farm business produces a product or service at low costs by controlling its operating expenses, is often included in the evaluating the borrower's riskiness. The MGTEFF variable, which is the ratio of operating expenses to gross income, is exploited to measure management efficiency. This ratio expresses operating expenses as a percentage of gross income.

Cost of debt and cost of losing productivity In the previous chapter, the variable cost of debt (COD) and cost of losing productivity (COLOSPRD) were identified as influential factors affecting a borrower's selection decision between traditional and nontraditional lenders, but not in a lender's determination of loan terms. As a result, COD and COLOSPRD are incorporated only in the structural equation to reflect their impacts on the borrower's participation decision.

COD is derived by dividing interest expense by total liability, which reflects the average (weighted) interest rate on the debt of a borrower. The weights are based on total outstanding loan balances. COLOSPRD, which reflects a borrower's production losses if he/she loses possession of productive assets in case of default, is generated by dividing net farm income by total assets. Whether borrowers with higher COD or COLOSPRD are more inclined to borrow from nontraditional lenders or not will be discovered by examining their coefficients in the structural equation.

Several financial variables that were not selected as explanatory variables in the regression but are certainly helpful in describing a borrower's financial status are presented

in Tables 6.1, 6.2, and 6.3. Return on equity (ROE), reflecting the farm business's pre-tax earnings on equity and its financial structure, is a critical income measure. Profit margin (PM), determined by estimating pre-tax return before financing per dollar of sales, is another index of profitability. Net cash income (NCI), the sum of net cash farm income and off-farm income, indicates the status of the operator household's cash flow.

Contract attributes

In Chapter 5, it is shown that a farmer's choice of a loan contract is affected both by the borrower's socioeconomic characteristics and by attributes of the corresponding loan contract. Accordingly, the endogenous attributes of the loan contract are simultaneously determined by other exogenous variables in the lender's utility maximization process, given the farmer-borrower's socioeconomic characteristics. The equilibrium terms of the loan contract offered by the lender and accepted by the borrower are described as follows.

Loan size DEBT refers to the size of the loan, which is the actual amount borrowed, in dollars. In the flow approach, DEBT represents the total amount of new loans extended by nontraditional or traditional lenders in 1992. In the stock approach, DEBT equals the accumulated outstanding amount of loans extended until 1993 as shown in the farmer's balance sheet.

Collateral Because data on the amount of collateral requested by the lender were not available, collateral is represented by the proxy variable COLLATER, which equals the difference between non-real estate assets and non-real estate liabilities. This proxy variable reflects the amount of non-real estate assets that have not been committed to meet short- and intermediate-term pending obligations and that can be pledged as collateral.

Interest rate and loan length INTEREST is defined as the average interest rate paid by the borrower (in percentage terms) when using traditional credit or nontraditional credit. MONTH represents the average length of the loans extended, measured in months.

Data analysis

The summaries of the sample statistics listed in Tables 6.2 through 6.8 indicate the difference in financial and personal attributes of the two types of credit users with respect to two data sets—flow (1992) data and stock (1993) data.

Financial measures Both Table 6.2 and Table 6.6 show that, on average, nontraditional credit users have better profitability, leverage ratios, repayment ability, financial and managerial efficiency, and cash flow in both data sets. In other words, traditional credit users have overall inferior financial performance with the exception of liquidity management, which is slightly superior to that of nontraditional credit users. As might be expected, nontraditional credit users have a much lower cost of debt and a much higher cost of losing pledged productive assets or productivity in case of default for whole businesses relative to traditional credit users. In addition, the negative ROA, ROE, and PM reveal the poor financial condition of most Iowa farm businesses in 1992 and 1993, regardless of whether they use nontraditional or traditional credit.

In summary, these findings suggest that nontraditional credit users have less financial risk, are on average able to finance lower costs of funds, and are not likely to default due to the higher costs of losing productivity in case of default. Overall, nontraditional credit users have lower financial risk than do traditional credit users.

Borrower characteristics Tables 6.3, 6.4, 6.6, and 6.7 indicate that nontraditional credit users generally are younger, have less experience, and operate slightly larger farms relative to traditional credit users in both the flow and stock approaches.

Tables 6.2 and 6.6 also show that, except for the husband's education in the flow approach, nontraditional credit borrowers are more educated (both husband and wife) compared with traditional credit borrowers. In particular, the wife is more educated for nontraditional credit users, whereas the husband is more educated for traditional credit users. Tables 6.5 and 6.8 indicate that the distribution of farm type is similar for the two types of credit users in two cases, but the dairy farm is slightly undersampled for traditional credit users. In addition, Table 6.2 shows that nontraditional credit users use hail insurance more frequently, whereas traditional credit users make greater use of multiple-peril crop insurance. Both types of credit users participate in government programs at about the same frequency.

Contract attributes The additional loan size obtained and the collateral assets that could be pledged by nontraditional credit users in the year 1992 are, on average, much larger than those of traditional credit users. In contrast, the average interest rate charged and the average loan length extended by nontraditional lenders are much smaller than those of traditional lenders. On the other hand, in the stock measure of participation, the average loan size extended by traditional lenders is almost double that of nontraditional lenders, while the pledgeable collateral of traditional credit users does not proportionally increase compared with that of nontraditional credit users. Note that the average interest rate paid by nontraditional credit users is still much lower than that of traditional credit users, but the loan length of nontraditional credit users is slightly longer than that of traditional credit users.

The above results, however, suggest that nontraditional credit users are generally less risky and have a much lower average interest rate compared with traditional credit users. Besides, the additional loan size obtained by nontraditional credit users in the year 1992 is much larger than that of traditional credit users. In Chapter 5, the theory states

that nontraditional lenders are able to extend a larger loan than are traditional lenders due to the cross-subsidization effect, lower collateralization costs, and lower monitoring costs. Although the theory indicates that nontraditional lenders could reach more riskier borrowers and charge a higher interest rate, the empirical results suggest that they reach less risky borrowers and charge a significantly lower interest rate. This lower interest rate may reflect not only borrowers' lower interest premiums due to lower risk, but also the nontraditional lenders' cross-subsidization effect, or lower collateralization and monitoring costs. In general, these descriptive statistics are consistent with the theory.

Econometric Model

The econometric model basically consists of eight equilibrium loan term equations for two types of credit users individually, and one farmer-borrower participation equation. The flow and stock specifications use the same econometric model but employ different data sets. The empirical specification of the whole model is presented below.

The four equilibrium loan term equations for nontraditional and traditional credit users are:

$$\begin{aligned} DEBT_{ij} = {} & \eta^{D}_{0j} + \eta^{D}_{1j} DEPSUPP_i + \eta^{D}_{2j} AGES_i + \eta^{D}_{3j} EDH_i + \eta^{D}_{4j} EDW_i \\ & + \eta^{D}_{5j} SIZEA_i + \eta^{D}_{6j} CASGRAF_i + \eta^{D}_{7j} GRALVSF_i + \eta^{D}_{8j} HOGF_i \\ & + \eta^{D}_{9j} BEEFF_i + \eta^{D}_{10j} DAIRYF_i + \eta^{D}_{11j} MPCI_i + \eta^{D}_{12j} HAILI_i \\ & + \eta^{D}_{13j} GOVTI_i + \eta^{D}_{14j} ROA_i + \eta^{D}_{15j} LIQUIDIT_i + \eta^{D}_{16j} DTOA_i \\ & + \eta^{D}_{17j} INTCOV_i + \eta^{D}_{18j} ASSETTO_i + \eta^{D}_{19j} MGTEFF_i + \eta^{D}_{20j} V_{ij} \\ & + \nu^{D}_{ij}, \qquad i = 1, \ldots, n, \; j = N, T. \end{aligned} \tag{6.10}$$

$$\begin{aligned} COLLATER_{ij} = {} & \eta^{C}_{0j} + \eta^{C}_{1j} DEPSUPP_i + \eta^{C}_{2j} AGES_i + \eta^{C}_{3j} EDH_i + \eta^{C}_{4j} EDW_i \\ & + \eta^{C}_{5j} SIZEA_i + \eta^{C}_{6j} CASGRAF_i + \eta^{C}_{7j} GRALVSF_i \\ & + \eta^{C}_{8j} HOGF_i + \eta^{C}_{9j} BEEFF_i + \eta^{C}_{10j} DAIRYF_i + \eta^{C}_{11j} MPCI_i \\ & + \eta^{C}_{12j} HAILI_i + \eta^{C}_{13j} GOVTI_i + \eta^{C}_{14j} ROA_i + \eta^{C}_{15j} LIQUIDIT_i \\ & + \eta^{C}_{16j} DTOA_i + \eta^{C}_{17j} INTCOV_i + \eta^{C}_{18j} ASSETTO_i \end{aligned}$$

$$+ \eta^{c}_{19j} MGTEFF_i + \eta^{c}_{20j} V_{ij} + \nu^{c}_{ij}\,, \qquad i = 1, \ldots, n,\ j = N, T. \tag{6.11}$$

$$\begin{aligned} INTEREST_{ij} = {} & \eta^{I}_{0j} + \eta^{I}_{1j} DEPSUPP_i + \eta^{I}_{2j} AGES_i + \eta^{I}_{3j} EDH_i + \eta^{I}_{4j} EDW_i \\ & + \eta^{I}_{5j} SIZEA_i + \eta^{I}_{6j} CASGRAF_i + \eta^{I}_{7j} GRALVSF_i \\ & + \eta^{I}_{8j} HOGF_i + \eta^{I}_{9j} BEEFF_i + \eta^{I}_{10j} DAIRYF_i + \eta^{I}_{11j} MPCI_i \\ & + \eta^{I}_{12j} HAILI_i + \eta^{I}_{13j} GOVTI_i + \eta^{I}_{14j} ROA_i + \eta^{I}_{15j} LIQUIDIT_i \\ & + \eta^{I}_{16j} DTOA_i + \eta^{I}_{17j} INTCOV_i + \eta^{I}_{18j} ASSETTO_i \\ & + \eta^{I}_{19j} MGTEFF_i + \eta^{I}_{20j} V_{ij} + \nu^{I}_{ij}\,, \qquad i = 1, \ldots, n,\ j = N, T. \end{aligned} \tag{6.12}$$

$$\begin{aligned} MONTH_{ij} = {} & \eta^{M}_{0j} + \eta^{M}_{1j} DEPSUPP_i + \eta^{M}_{2j} AGES_i + \eta^{M}_{3j} EDH_i + \eta^{M}_{4j} EDW_i \\ & + \eta^{M}_{5j} SIZEA_i + \eta^{M}_{6j} CASGRAF_i + \eta^{M}_{7j} GRALVSF_i \\ & + \eta^{M}_{8j} HOGF_i + \eta^{M}_{9j} BEEFF_i + \eta^{M}_{10j} DAIRYF_i + \eta^{M}_{11j} MPCI_i \\ & + \eta^{M}_{12j} HAILI_i + \eta^{M}_{13j} GOVTI_i + \eta^{M}_{14j} ROA_i + \eta^{M}_{15j} LIQUIDIT_i \\ & + \eta^{M}_{16j} DTOA_i + \eta^{M}_{17j} INTCOV_i + \eta^{M}_{18j} ASSETTO_i \\ & + \eta^{M}_{19j} MGTEFF_i + \eta^{M}_{20j} V_{ij} + \nu^{M}_{ij}\,, \qquad i = 1, \ldots, n,\ j = N, T. \end{aligned} \tag{6.13}$$

These optimal loan term equations, simultaneously determined for borrower i, are expressed as a function of his/her personal characteristics, including dependents supported, age, education, farm size, farm type, insurance program participation, and six major financial performance measures associated with the health of the farm business. The variables included in this specification are those found to be important in the theoretical model and in the literature. Since the data used are not panel data and representative only of Iowa farm businesses which have similar local economic and production conditions, time trends and regional (county) variables are omitted. In addition, due to the nature of ex-post data, only the equilibrium terms of the contract package offered by the lender and accepted by the borrower are examined. Hence, the coefficients of these equations indicate the competitive equilibrium behavior or relationship of both the traditional or

nontraditional lenders and a farmer-borrower, rather than the ex-ante maximum loan supply, actual loan demand, or disequilibrium loan contracts. In other words, what are observed are the formal multidimensional loan contracts accepted by both parties.

As mentioned earlier, sample selectivity bias is a potential problem in this analysis because the approach entails the estimation of separate optimal loan term equations for nontraditional and traditional credit users, where these optimal loan term equations are fitted to a nonrandom subset of the population. Therefore, the selectivity variable, V_{ij}, must be included to be included to derive a disturbance term with a zero mean and a normal distribution.

The empirical specification of the probability of the *i*th borrower selecting nontraditional lenders or participating in nontraditional credit programs is

$$\begin{aligned} Pr(\,\mathrm{PARTICIP}_i = 1) = \Phi[\,&\Gamma_0 + \Gamma_1(\mathrm{DEBT}_{iN} - \mathrm{DEBT}_{iT}) + \Gamma_2(\mathrm{COLLATER}_{iN} - \\ &\mathrm{COLLATER}_{iT}) + \Gamma_3(\mathrm{INTEREST}_{iN} - \mathrm{INTEREST}_{iT}) \\ &+ \Gamma_4(\mathrm{MONTH}_{iN} - \mathrm{MONTH}_{iT}) + \Gamma_5\,\mathrm{COD}_i \\ &+ \Gamma_6\,\mathrm{COLOSPRD}_i + \Gamma_7\,\mathrm{FLEXP}_i + \Gamma_8\,\mathrm{AGES}_i + \Gamma_9\,\mathrm{EDH}_i \\ &+ \Gamma_{10}\,\mathrm{EDW}_i + \Gamma_{11}\,\mathrm{SIZEA}_i + \Gamma_{12}\,\mathrm{CASGRAF}_i \\ &+ \Gamma_{13}\,\mathrm{GRALVSF}_i + \Gamma_{14}\,\mathrm{HOGF}_i + \Gamma_{15}\,\mathrm{BEEFF}_i \\ &+ \Gamma_{16}\,\mathrm{DAIRYF}_i + \Gamma_{17}\,\mathrm{ROA}_i + \Gamma_{18}\,\mathrm{LIQUIDIT}_i \\ &+ \Gamma_{19}\,\mathrm{DTOA}_i + \Gamma_{20}\,\mathrm{INTCOV}_i + \Gamma_{21}\,\mathrm{ASSETTO}_i \\ &+ \Gamma_{23}\,\mathrm{MGTEFF}_i\,], \qquad i = 1, \ldots, n. \end{aligned} \tag{6.14}$$

where $\Phi(\cdot)$ is the cumulative normal distribution function. This probability is represented as a function of several variables, including the participant-nonparticipant loan term differentials, the farm business's cost of debt, the cost of losing productivity, family living expenses, financial measures, and borrower personal characteristics excluding risk management variables.

As illustrated in the theoretical model in Chapter 5, a farmer-borrower will self-select the nontraditional loan contract when the total indirect utility generated from this contract bundle exceeds that of a traditional contract bundle. Accordingly, the differentials in loan size, collateral security, interest rate, and loan length are needed in order to directly estimate the probability of participation. In addition, borrowers with different financial costs, financial ratios, and personal demographics are hypothesized to behave differently. However, the importance of different financial measures on the probability of participation of the flow and the stock approach may be different. Thus, the financial measures incorporated in the flow or the stock participation equation will be different. The financial measures indicating a borrower's financial profitability and stability, including ROA, LIQUIDIT, DTOA, and MGTEFF, are assumed to affect his/her additional or short-term borrowings. However, the financial measures reflecting a borrower's capital stability, including DTOA, INTCOV, and ASSETTO are assumed to affect accumulated or long-term borrowings.

Estimation Steps

The detailed two-stage estimation procedure can be divided into the five steps described next.

First step:

The first step of the procedure involves the estimation of the reduced-form decision equation by the probit method. The reduced-form decision equation includes all the exogenous variables shown in Eqs. (6.10) through (6.14). The coefficients from the reduced-form probit equation explain the total effects of the exogenous variables on the probability of participating in a nontraditional lender's credit program, both through the

contract term differentials for participating versus nonparticipating and through the farmer-borrower's socioeconomic attributes.

Second step:

In this step, the fitted value from the reduced-form probit result is used to generate two selectivity variables for participants and nonparticipants, respectively. The derivation of selectivity variables follows the expression in equation set (6.7), but replaces Ψ_i with $\hat{\Psi}_i$, the estimated Ψ_i.

Third step:

After deriving the estimated selectivity variables, the corresponding corrected loan term equations can be formed by adding in the estimated selectivity variables. Then, the corrected loan term Eqs. (6.10) through (6.13), which are specified to incorporate the variables identified to be important in determining loan terms, may be estimated by OLS, which produces unbiased coefficients. This first-stage estimation procedure is completed by deriving the corresponding asymptotic t-statistics for each equation based on the correct asymptotic variance-covariance matrix developed by Heckman in 1979.

Fourth step:

The fourth step entails calculating the predicted values of loan size, collateral requirement, interest rate, and length of loan from the estimated coefficients. The consistent estimated coefficients from the loan term equations permit the prediction of loan terms for each individual in both participation and nonparticipation status. Afterwards, the predicted loan term differences can be applied to estimate the probability that the borrower will choose the nontraditional lender.

Fifth step:

The final step of the procedure involves the second-stage probit estimation of the decision or participation equation expressed as Eq. (6.14). In addition to the loan term differentials obtained in the fourth step, other appropriate exogenous variables hypothesized to influence the borrower's participation decision are incorporated in the structural decision equation. In particular, because the loan term equations and decision equation do not have all the same exogenous variables, that is, more than one exogenous explanatory variable do not appear in both equations, there is no identification problem in estimating the coefficients of the structural decision equation.

CHAPTER 7.
EMPIRICAL RESULTS AND ANALYSIS

This chapter presents the results of the econometric estimation. According to the analytical models in the previous two chapters, the financial and personal attributes of a borrower are theoretically recognized as important factors in establishing optimal terms of loan contracts offered by lenders. In addition to these two categories of variables, the terms of the loan contract are theoretically identified as being critical in the farmer-borrower's participation decision. Therefore, the empirical results, presented in the following three parts, give a clearer picture about which factors are empirically crucial in affecting the lender's formation of a loan contract package and the borrower's participation decision.

The results are presented in the following three sections. The first section reports the estimation results after implementing step one as specified in the previous chapter. These results indicate the combined effect of all the variables used in estimating the probability of participation. The second section presents the estimation results after implementing step three. These results include sixteen corrected equilibrium loan term equations—eight for the flow approach for nontraditional and traditional borrowers and eight for the stock approach. Selectivity variables are included in each equation to generate unbiased coefficients. These results reveal how the equilibrium terms of a loan contract are established by lenders and borrowers. In addition, as discussed in the previous chapter, the significance of the selectivity variables indicates the borrowers' self-selection phenomenon in the loan contract participation decision. The third section reports the estimates of the structural-form decision equation after implementing the fifth step, which explains the incentives for the farmer-borrower's selection decision and the

magnitudes of these incentives on the borrower's participation probability. The corresponding empirical implications of these findings are discussed at the end of this chapter.

Estimates of the Reduced-Form Probability Equation

Maximum likelihood probit estimates of the reduced-form participation equation for the flow and stock approaches are reported in Table 7.1 and Table 7.2, respectively. The reduced-form participation equation includes all the exogenous variables shown in Eqs. (6.10) through (6.13). Therefore, the estimates capture the "combined" effects of those variables on the probability of participation, both via their indirect effects through loan term differential variables and via their direct effects on the probability equation. The direct effects of the variables on the probability equation after incorporating the predicted loan term differential variables are discussed in the third section of this chapter.

The flow approach

Table 7.1 shows that for flow lending activity in 1992, among the 22 variables considered, only the borrower's cost of debt, husband's education, use of hail insurance, and asset turnover ratio have strongly significant effects on the static reduced-form probability equation. The coefficient of the COD variable is significantly positive, indicating that farmer-borrowers with higher financing costs for operating farm businesses are more inclined to select nontraditional lenders. Another significant financial variable is ASSETTO. The significantly negative coefficient reveals that the likelihood that a farmer-borrower chooses nontraditional lenders is expected to decrease with a higher ASSETTO ratio in the reduced-form model. The remaining financial measures do not have significant combined effects.

Table 7.1. Probit estimates of the reduced-form probability equation for the flow approach

Regressor	Coefficient	Chi Square
INTERCEPT	-0.04735	0.00248
COD	5.10476***	7.38957
COLOSPRD	-0.61449	0.22982
FLEXP	0.00002	0.62407
DEPSUPP	-0.07682	0.32718
AGES	0.06776	0.31226
EDH	0.28778**	4.53006
EDW	-0.08342	0.45516
SIZEA	-0.13275	0.92473
CASGRAF	0.14239	0.13924
GRALVSF	-0.01772	0.00252
HOGF	0.05877	0.01681
BEEFF	-0.41766	0.71664
DAIRYF	-0.42252	0.56054
MPCI	0.07382	1.08571
HAILI	-0.20976***	8.05785
GOVTI	0.08925	0.51911
ROA	0.44382	0.31889
LIQUIDIT	0.00197	0.00601
DTOA	0.00771	0.00028
INTCOV	-0.00797	1.90265
ASSETTO	-1.05836*	2.71011
MGTEFF	0.02716	0.03876
Log Likelihood	-106.2014	
L.R. Chi-square		212.4029***

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.

Table 7.2. Probit estimates of the reduced-form probability equation for the stock approach

Regressor	Coefficient	Chi Square
INTERCEPT	1.32311	2.86549
COD	2.92750*	2.98640
COLOSPRD	0.42151	0.10915
FLEXP	0.00002	0.96658
DEPSUPP	-0.20140*	3.19962
AGES	0.01493	0.02357
EDH	-0.01235	0.01399
EDW	-0.00542	0.00280
SIZEA	-0.20660*	3.21991
CASGRAF	-0.49085	2.19533
GRALVSF	-0.50911*	2.85828
HOGF	-0.25858	0.49505
BEEFF	-0.16237	0.15829
DAIRYF	-0.69624	1.75101
MPCI	0.02153	0.14365
HAILI	-0.11665**	4.40319
GOVTI	0.07673	0.58614
ROA	-1.63017*	2.95129
LIQUIDIT	0.00741	0.18333
DTOA	0.12525	0.09500
INTCOV	0.00198	0.19247
ASSETTO	-0.57012	0.95269
MGTEFF	0.05919	0.26364
Log Likelihood	-154.5534	
L.R. Chi-square		309.1069**

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.

Except for the education of the husband and use of hail insurance, the personal characteristics of farmer-borrowers appear to have insignificant combined effects on the reduced-form decision equation. The significantly positive coefficient of EDH implies that a more educated husband is more likely to participate in a nontraditional lender's credit program after considering the EDH variable's direct and indirect effects. The HAILI variable is highly significant and exhibits a strong negative relationship with participation in the reduced-form model. In other words, farmers who use hail insurance very often are less inclined to select nontraditional lenders' programs. Examination of the farm type coefficients suggests that the probability of participation will be similar among operators of different types of farm businesses after incorporating the total effects of the exogenous farm type variables. The 1 percent significance of the likelihood ratio test shows that the null hypothesis that all the coefficients are jointly equal to zero is rejected, which implies that these exogenous variables capture explanatory power in explaining the participation equation of the flow approach.

The stock approach

Table 7.2 reveals that the significance of the probit estimates of the reduced-form probability equation for the stock approach is different from that of the flow approach. Results in Table 7.2 indicate that the variables of cost of debt, dependents supported, farm size, grain-livestock farm, hail insurance use, and return on assets seem to have statistically significant effects on the reduced-form probability equation. The positive coefficient of COD implies that farm businesses are more likely to finance from nontraditional lenders as their cost of debt is higher, which is consistent with the result of the flow analysis. The variable DEPSUPP has significant combined effects on the reduced-form probability equation, which suggests that farm borrowers with more

dependents to support would be less likely to finance credit from nontraditional lenders. The significantly negative sign of SIZEA demonstrates that operators of larger farms are more inclined to borrow operating funds from traditional lenders than from nontraditional lenders. The signs of the insignificant variables FLEXP, AGES, and EDW are the same as those for the flow approach. The coefficient of EDH strikingly changes from significantly positive in the flow approach to insignificantly negative in the stock approach, and the coefficient of COLOSPRD also changes from negative to positive.

With the exception of operators of grain-livestock farms, which appear less likely to finance from nontraditional lenders, operators of other types of farms have no significant preference to participate in nontraditional lenders' programs. HAILI is the only risk management variable with a significant effect on participation probability, which is consistent with the result for the flow approach. Of the six financial measures, return on assets, ROA, is the only measure with a significant combined effect for the stock approach. The coefficient on ROA indicates that farmer-borrowers with higher ROA are inclined to reduce their participation in nontraditional lenders' programs. The null hypothesis that the coefficients of these variables are jointly equal to zero is rejected at the 5 percent (or 1 percent) significance level of likelihood ratio test. Therefore, these variables have statistically significant power in explaining the reduced-form participation equation in the stock approach.

Estimates of the Equilibrium Loan Term Equations

The estimates of the 16 equilibrium loan term equations for the flow and stock approaches are presented in Table 7.3 through Table 7.10. These equations are fitted by ordinary least squares (OLS) with an instrumental variable included in each equation to control for selectivity bias. In particular, the t-statistics reported in these tables are

Table 7.3. Estimated coefficients of the corrected loan size equation for the flow approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA†††	-15862.00	-0.713	223826.00***	5.975
LIQUIDIT††	- 1702.64***	-3.135	277.19	0.484
DTOA	17094.00	1.036	2214.74	0.084
INTCOV	315.11	1.058	- 109.99	-0.579
ASSETTO	- 996.08	-0.049	- 20222.00	-1.072
MGTEFF†††	- 1481.93	-0.186	31089.00***	5.052
Borrower Characteristics				
DEPSUPP	1120.54	0.356	2614.10	0.870
AGES	2891.87	0.719	- 3332.74	-0.581
EDH	- 3180.37	-0.680	- 456.01	-0.087
EDW	789.32	0.181	- 5791.67	-1.271
SIZEA	4360.00	1.048	- 3726.45	-0.642
CASGRAF†	23105.00***	5.801	- 9447.26	-0.664
GRALVSF	13518.00	1.247	- 5931.93	-0.470
HOGF††	12703.00	0.801	- 59248.00**	-2.088
BEEFF	11574.00	0.749	- 24189.00	-1.460
DAIRYF	- 8149.33	-0.708	- 12245.00	-0.589
MPCI	- 537.70	-0.234	924.93	0.363
HAILI	1183.46	0.431	- 687.76	-0.203
GOVTI†	99.94	0.035	- 15027.00*	-1.738
SELECTIVITY	- 3196.65	-0.148	5982.74	0.255
R^2		0.280		0.307
F- value		0.837		2.210***

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
† Two coefficients are significantly different at 10 percent level.
†† Two coefficients are significantly different at 5 percent level.
††† Two coefficients are significantly different at 1 percent level.

Table 7.4. Estimated coefficients of the corrected collateral equation for the flow approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA	- 84402.00	-0.988	- 33169.00	-0.705
LIQUIDIT	6867.38***	2.703	6428.45***	3.300
DTOA	-130860.00**	-2.397	-153997.00***	-3.903
INTCOV	698.52	0.807	- 420.04	-0.884
ASSETTO[†]	-140107.00*	-1.789	19108.00	0.846
MGTEFF	- 36323.00	-0.852	- 5031.97	-1.030
Borrower Characteristics				
DEPSUPP	- 12814.00	-1.173	- 14024.00	-1.449
AGES	- 10513.00	-0.636	4707.98	0.470
EDH	20488.00	1.025	1336.98	0.107
EDW	8820.23	0.508	1971.58	0.176
SIZEA	74682.00***	3.613	97942.00***	5.842
CASGRAF	- 20089.00	-0.463	- 78403.00***	-3.282
GRALVSF	12885.00	0.297	- 53550.00***	-2.864
HOGF[††]	146989.00**	2.236	- 8892.78	-0.299
BEEFF	99159.00	1.323	- 20675.00	-0.407
DAIRYF	41111.00	0.768	- 2938.52	-0.106
MPCI[††]	- 26054.00**	-2.395	- 2302.39	-0.448
HAILI	7422.52	0.664	- 5539.25	-0.640
GOVTI	16160.00	1.317	- 837.02	-0.070
SELECTIVITY	- 40535.00	-0.470	- 39998.00	-0.698
R^2		0.654		0.518
F- value		3.640***		5.324***

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
[†] Two coefficients are significantly different at 10 percent level.
[††] Two coefficients are significantly different at 5 percent level.

Table 7.5. Estimated coefficients of the corrected interest rate equation for the flow approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA	-0.4686	-0.162	1.7323**	2.548
LIQUIDIT	0.0438	0.517	0.0253	0.891
DTOA	0.0640	0.028	-0.9845	-0.878
INTCOV	0.0241	0.552	-0.0006	-0.120
ASSETTO	7.0224**	2.158	1.4943**	2.579
MGTEFF†	-3.2017	-1.630	0.3067**	2.477
Borrower Characteristics				
DEPSUPP	0.2853	0.842	-0.2934	-1.608
AGES	0.7046	0.987	-0.2310	-0.926
EDH	-0.1777	-0.286	0.3922**	2.202
EDW	-0.5928	-0.915	-0.1194	-0.568
SIZEA	-1.1294	-1.401	-0.2049	-1.453
CASGRAF	1.9899	0.845	-0.8363	-1.250
GRALVSF	-0.2321	-0.108	-0.7731	-1.519
HOGF†	-2.2034	-1.019	2.3312**	2.487
BEEFF	2.1038	0.901	-0.3975	-0.679
DAIRYF	0.7877	0.238	1.3392	1.383
MPCI	0.2663	0.664	0.0656	0.702
HAILI	0.7547	1.599	0.2868**	2.437
GOVTI	0.1073	0.224	-0.5469***	-2.742
SELECTIVITY	2.3904	0.749	1.0328	1.432
R^2		0.353		0.658
F- value		1.063		1.828*

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
† Two coefficients are significantly different at 10 percent level.

Table 7.6. Estimated coefficients of corrected loan length equation for the flow approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA[††]	20.908	1.414	-64.105**	-2.121
LIQUIDIT	0.761*	1.918	- 0.153	-0.138
DTOA	- 7.309	-0.860	-84.414	-1.493
INTCOV	- 0.376***	-2.681	- 0.002	-0.008
ASSETTO[†]	- 7.789	-0.534	49.250	1.589
MGTEFF	1.418	0.122	-10.764	-1.348
Borrower Characteristics				
DEPSUPP[†]	- 1.667	-0.685	9.152*	1.713
AGES	- 4.879*	-1.638	- 0.967	-0.133
EDH	- 2.703	-0.817	- 0.399	-0.054
EDW	6.703**	2.090	- 2.243	-0.337
SIZEA	5.316	1.340	5.105	0.533
CASGRAF[††]	20.786**	2.219	- 0.836	-1.287
GRALVSF	8.687	0.960	- 0.773	-1.293
HOGF	27.373**	2.497	2.332	0.100
BEEFF	16.478*	1.699	- 0.397	-0.431
DAIRYF	4.695	0.503	1.339	1.417
MPCI	- 0.767	-0.507	5.869	1.303
HAILI	3.204*	1.728	8.528	0.949
GOVTI	- 0.756	-0.344	4.616	0.426
SELECTIVITY[†††]	-10.610	-0.707	36.456	0.825
R^2		0.434		0.414
F- value		1.495		0.672

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
[†] Two coefficients are significantly different at 10 percent level.
[††] Two coefficients are significantly different at 5 percent level.
[†††] Two coefficients are significantly different at 1 percent level.

Table 7.7. Estimated coefficients of the corrected loan size equation for the stock approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA††	- 9674.78	-0.439	56031.00**	2.243
LIQUIDIT†††	- 609.91	-1.617	- 2266.08***	-4.910
DTOA†††	-27663.00**	-2.519	17978.00*	1.982
INTCOV††	336.57	1.599	- 189.50**	-2.002
ASSETTO	6459.28	0.657	- 3978.65	-0.331
MGTEFF	- 8175.68	-0.531	- 860.46	-0.336
Borrower Characteristics				
DEPSUPP†	- 2939.82	-0.826	6133.64**	2.153
AGES††	- 4861.74**	-2.093	2373.31	0.821
EDH	3840.36	1.009	6366.18*	1.971
EDW†	708.18	0.273	- 6458.71*	-1.935
SIZEA††	10277.00***	3.161	27482.00***	4.741
CASGRAF	9435.03	0.950	7572.57	0.822
GRALVSF	- 2533.85	-0.307	10755.00	1.114
HOGF	9904.02	1.081	22775.00**	2.186
BEEFF	1174.83	0.134	30016.00*	1.802
DAIRYF	- 5471.48	-0.516	38808.00	0.994
MPCI	- 488.65	-0.228	- 914.95	-0.656
HAILI	- 325.65	-0.125	3301.72	1.579
GOVTI	- 735.76	-0.218	- 1437.17	-0.455
SELECTIVITY	1607.26	0.059	18484.00	1.217
R^2		0.407		0.330
F- value		2.295***		4.269***

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
† Two coefficients are significantly different at 10 percent level.
†† Two coefficients are significantly different at 5 percent level.
††† Two coefficients are significantly different at 1 percent level.

Table 7.8. Estimated coefficients of the corrected collateral equation for the stock approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA	-329308.00**	-2.435	-153061.00	-1.152
LIQUIDIT	6839.54*	1.789	11115.00*	1.999
DTOA[†]	-214316.00***	-3.273	- 86217.00**	-2.223
INTCOV	357.39	0.317	520.23	1.130
ASSETTO	- 70479.00	-1.383	- 9700.43	-0.313
MGTEFF[†]	150540.00	1.496	4083.72	0.872
Borrower Characteristics				
DEPSUPP	- 51434.00***	-2.796	- 21398.00**	-2.244
AGES	1276.40	0.072	293.76	0.036
EDH	3339.29	0.150	- 7511.18	-0.599
EDW	22221.00	1.362	- 7097.24	-0.435
SIZEA	109833.00***	4.566	69444.00***	4.237
CASGRAF	- 96545.00	-1.396	- 85953.00***	-2.507
GRALVSF	-169524.00**	-2.479	- 94104.00***	-2.683
HOGF	22338.00	0.250	1117.79	0.032
BEEFF	- 19328.00	-0.225	19674.00	0.532
DAIRYF	- 21610.00	-0.216	- 90119.00*	-1.913
MPCI	- 21916.00*	-1.756	- 9167.61*	-1.777
HAILI	- 25665.00	-1.388	- 9807.18	-1.209
GOVTI	34388.00**	1.983	18077.00**	2.031
SELECTIVITY[†]	-357549.00**	-2.020	- 99570.00	-1.473
R^2		0.580		0.446
F- value		4.547***		6.920***

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
[†] Two coefficients are significantly different at 10 percent level.

Table 7.9. Estimated coefficients of the corrected interest rate equation for the stock approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA	-1.4298	-0.202	1.9208*	1.732
LIQUIDIT	0.0800	1.490	-0.0217	-1.208
DTOA	5.6232*	1.664	1.8877**	2.509
INTCOV	-0.0476	-1.395	0.0025	0.805
ASSETTO[††]	7.5778**	2.097	-0.6063	-0.930
MGTEFF	-4.1280	-1.140	0.2603	1.147
Borrower Characteristics				
DEPSUPP[†]	0.8332**	2.057	0.0993	1.227
AGES	0.4381	0.518	0.2132*	1.743
EDH	0.1437	0.211	0.2093	1.322
EDW	0.1997	0.402	-0.0552	-0.137
SIZEA	0.6930	1.465	-0.3016	-1.457
CASGRAF	-0.3109	-0.206	-0.6364	-1.388
GRALVSF	-2.1507*	-1.680	-0.5239	-1.035
HOGF	-5.2388**	-2.119	-1.1434**	-2.031
BEEFF	-2.4965	-0.823	-1.2635***	-2.801
DAIRYF[†]	-3.3806*	-1.913	1.1747	1.471
MPCI	-0.1728	-0.598	0.0199	0.268
HAILI[†††]	1.1035**	2.598	-0.0212	-0.268
GOVTI	-1.3157**	-2.238	-0.3371***	-2.491
SELECTIVITY[††]	9.9869***	2.932	0.4849	0.691
R^2		0.620		0.467
F- value		1.550		2.102**

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
[†] Two coefficients are significantly different at 10 percent level.
[††] Two coefficients are significantly different at 5 percent level.
[†††] Two coefficients are significantly different at 1 percent level.

Table 7.10. Estimated coefficients of the corrected loan length equation for the stock approach

	Nontraditional Credit User		Traditional Credit User	
Variable	Coefficient	Asymptotic *t*	Coefficient	Asymptotic *t*
Financial Measures				
ROA	22.801	0.835	-41.434	-1.275
LIQUIDIT	0.571*	1.816	0.190	0.411
DTOA	6.951	0.505	-22.372	-1.560
INTCOV	- 0.202	-1.624	- 0.111**	-2.081
ASSETTO[†]	- 8.877	-0.578	28.283**	2.149
MGTEFF	-31.573	-1.469	3.128	0.638
Borrower Characteristics				
DEPSUPP	2.555*	1.694	3.904**	2.440
AGES[††]	-10.579***	-2.911	- 0.040	-0.017
EDH	-10.678***	-3.680	- 2.647	-0.611
EDW	5.296**	2.816	- 0.443	-0.125
SIZEA	- 3.476	-1.279	5.706	0.995
CASGRAF	11.284	1.528	- 0.910	-0.077
GRALVSF	- 1.873	-0.257	-18.983	-1.492
HOGF	23.985**	2.342	5.205	0.376
BEEFF	1.282	0.113	5.271	0.407
DAIRYF[†]	-11.886	-1.293	18.245	1.369
MPCI	3.943***	2.783	5.263***	2.888
HAILI[††]	- 2.455	-1.211	3.681**	2.237
GOVTI	3.911	1.322	5.645**	2.139
SELECTIVITY	-22.553	-1.520	- 6.716	-0.364
R^2		0.653		0.462
F- value		1.790*		2.060**

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.
[†] Two coefficients are significantly different at 10 percent level.
[††] Two coefficients are significantly different at 5 percent level.

asymptotic t-statistics derived from the correct asymptotic variance-covariance matrix. As mentioned previously, the loan size, collateral, interest rate, and loan length equations are simultaneously determined, and include only those variables hypothesized to influence these four terms of the contract package simultaneously.

The flow approach

Table 7.3 contains the estimates of the equilibrium loan size equations by type of credit user using the flow form of the participation variable. The significant financial variable for determining nontraditional credit users' loan size is LIQUIDIT, while those for traditional credit users are ROA and MGTEFF. The results indicate that as the nontraditional credit user's liquidity becomes higher, the equilibrium size of the loan declines. In addition, as the traditional credit user's profitability increases and managerial efficiency decreases, the loan size extended by traditional lenders increases. Examination of the borrower characteristic variables reveals that nontraditional credit users categorized as operators of cash-grain farms accept larger loans from nontraditional lenders compared with other types of nontraditional borrowers. However, traditional credit users categorized as operators of hog farms accept smaller loans from traditional lenders compared with other types of traditional credit users. Traditional credit users who are more likely to participate in government programs are also found to borrow less from traditional lenders. In general, the most significant factors affecting the nontraditional and traditional equilibrium loan sizes extended by lenders and accepted by borrowers are different; furthermore, the estimated signs for these two equations are not consistent. ROA, LIQUIDIT, MGTEFF, CASGRAF, HOGF, and GOVTI have significantly different effects on the determination of the equilibrium loan size by two types of lenders.

Table 7.4 shows the estimated coefficients of two collateral equations for nontraditional and traditional borrowers. The sign and significance of the financial variables between these two groups in the collateral equation are more consistent than those in the loan size equation. The significantly positive and negative coefficients of the variables LIQUIDIT and DTOA in Table 7.4 reveal that farmer-borrowers with higher liquidity or lower leverage pledge more collateral. However, the significantly negative coefficient of ASSETTO in the second column of Table 7.4 indicates that the pledgeable collateral assets sought by nontraditional lenders are lower if the borrower's capital efficiency is higher. Nontraditional credit users with larger farms or hog enterprises have a higher value of collateral assets. Farms frequently using multiple-peril crops insurance have lower values of collateral assets. Among traditional credit users, larger farms have more collateral assets and cash-grain farms have significantly less collateral assets. ASSETTO, HOGF, and MPCI play significantly different roles in determining the collateral pledged by two types of credit users. The significance of the F-value and R^2 indicates that these variables capture overall explanatory power of the reduced collateral equations.

Table 7.5 lists the OLS estimates of two interest rate equations for static credit extension in 1992. The most significant factor determining the nontraditional interest rate charged is ASSETTO, meaning that a higher capital efficiency will increase the interest rate asked by nontraditional lenders. The most significant factors for traditional lenders are ASSETTO, MGTEFF, EDH, HOGF, HAILI, and GOVTI. This result implies that for a traditional borrower, higher profitability and financial efficiency may increase the interest rate paid. However, higher managerial efficiency may lower the interest rate charged. Furthermore, traditional credit users with a more educated husband, greater frequency of using hail insurance, or categorized as operating hog farms are charged a

higher interest rate. The more frequent a borrower's participation in government programs, the lower the interest rate charged by traditional lenders. In general, the financial and characteristic variables have same effects on the nontraditional and traditional interest rate equations, with the exception of MGTEFF and HOGF, which are differently used by two types of lenders.

The estimated coefficients for the corrected loan length equations for the flow approach are given in Table 7.6. For nontraditional credit users, the equilibrium loan length increases as liquidity increases, but significantly decreases as repayment ability increases. EDW, CASGRAF, HOGF, BEEFF, and HAILI all have a significantly positive relationship with the equilibrium loan length, with the exception of AGES, which is negatively associated with loan length. For traditional credit users, the significant factors affecting the equilibrium loan length are ROA and DEPSUPP, which are negatively and positively associated with loan length, respectively. This result implies that traditional credit users with higher returns on assets have shorter operating loans, and those with more dependents to support are offered longer loan lengths. ROA, ASSETTO, DEPSUPP, CASGRAF, and SELECTIVITY play significantly different roles in determining the nontraditional and traditional loan length equations.

Of particular interest are the estimated coefficients of the selectivity variables. However, under the data limitations, especially the relatively small number of loan terms, none of the coefficients of the eight selectivity variables in the eight equilibrium loan term equations by type of credit users is significantly different from zero. This evidence, therefore, can only be interpreted that the self-selection phenomenon was not so important in financing operating credit in 1992 based on limited observations; however, whether self-selection has a marked effect on the estimated responses of farmer-borrowers to loan

term differentials based on whole samples will be carefully examined in the third section of this chapter, which discusses the structural-form participation equation.

The stock approach

Table 7.7 gives the estimates of two loan size equations based on the 1993 data set, where the accumulated debt reported in the farmers' 1993 balance sheets is used as the participation measure. The results show that financial factors significantly affecting the traditional and nontraditional equilibrium loan size equations for the stock approach are different in sign and significance, except for the liquidity variable, which has consistent significantly negative effects across credit users, implying that higher liquidity generally reduces the size of the loan offered. For nontraditional credit users, an increase in the leverage ratio or the farmer's age results in a significantly smaller size of loan extended. Farm size is most responsive to the equilibrium loan size, meaning that operators of larger farms tend to borrow significantly more than do operators of smaller farms. Accordingly, except that liquidity has a significantly negative effect on the equilibrium loan size in both the flow and stock approaches, leverage ratio, age and farm size become more crucial in determining loan size in the stock approach.

For traditional credit users, ROA, LIQUIDIT, DTOA, and INTCOV play significant roles in affecting the size of the loan granted. Only ROA has positive effects on loan size for both the flow and stock approaches. In contrast to that for nontraditional credit users, the leverage ratio for traditional credit users appears to have a significantly positive relationship with the equilibrium loan size, indicating that traditional credit users with higher leverage ratios are likely to be granted more money from traditional lenders. The significant negative sign of INTCOV implies that an increase in repayment ability will reduce the size of the loan extended. In addition, more dependents, a more educated

husband, and a less educated wife in the traditional credit user's family tend to increase the equilibrium loan size. Loan size is most responsive to farm size, as shown in the nontraditional credit users group. Regarding farm type, operators of hog and beef farms are found to borrow more than are operators of other types of farms.

ROA, LIQUIDIT, DTOA, INTCOV, DEPSUPP, AGES, EDW, and SIZEA are significantly differently used by two types of lenders when offer their optimal loan size. It is clear that the variables in the stock approach have more significantly different effects between nontraditional and traditional loan size equations than those of the flow approach. The test statistics listed at the bottom of Table 7.7 indicate that both the nontraditional and traditional credit user's loan size equations are jointly statistically significant at the 1 percent significance level. Comparing the flow and stock regression results for corrected loan size in Table 7.3 and Table 7.7, it is obvious that the financial measures and borrower characteristics have more significant effects on determining the equilibrium loan size in the stock approach than in the flow approach, especially for the traditional credit users group. That is, the socioeconomic characteristics appear to have a more significant influence on accumulated borrowings or dynamic lending activity than on new borrowings or static lending activity.

The parameter estimates of the corrected collateral equations are presented in Table 7.8. Among the six financial measures, LIQUIDIT and DTOA appear to have significantly positive and negative effects upon collateral across the two types of credit users, respectively. This result coincides with the findings for the flow approach discussed in the previous section. ROA also is a crucial factor and displays a negative relationship with collateral across borrowers, especially for nontraditional credit users. This result might be due to the fact that credit users with higher ROA have less collateral assets to pledge. In addition, DEPSUPP, GRALVSF, and MPCI have significantly negative

relationships, but SIZE and GOVTI have significantly positive relationships with collateral across farmer-borrowers. These findings imply that borrowers with more dependents, smaller farms, greater frequency of using MPCI, less frequency of using government programs, and categorized as grain-livestock farms operators have less pledgeable collateral assets across farm borrowers. For traditional credit users, in addition to the significant influences of the above variables, operators of cash grain farms and dairy farms are shown to have less collateral assets.

In general, most of the socioeconomic variables are similarly valued by two types of lenders, except that DTOA, MGTEFF, and SELECTIVITY, which are significantly differently used by two types of lenders. The significance of the selectivity variable in the nontraditional credit user's collateral equation also provides evidence of the importance of accounting for selectivity bias in estimating the collateral equation. A test of the null hypothesis that the coefficients of the collateral equation are jointly equal to zero is rejected for both nontraditional and traditional credit users at the 1 percent significance level. This result is consistent with the test result for the flow approach. The borrower's socioeconomic characteristics more significantly affect the stock collateral equation than the flow collateral equation.

The OLS estimates of the interest rate equations by type of credit user are reported in Table 7.9. There is an opposite sign pattern in the coefficients of the financial variables across the two types of borrowers, except for that of DTOA. DTOA has a significantly positive relationship with the equilibrium interest rate across credit users, meaning that a higher leverage ratio will significantly increase the interest rate paid, regardless of whether the lender is nontraditional or traditional. For nontraditional lenders, ASSETTO appears to have a significantly positive effect in determining the equilibrium interest rate. In other words, a higher asset turnover ratio unexpectedly increases the equilibrium interest rate.

Further, note that DEPSUPP and HAILI have a significantly positive relationship, while GRALVSF, HOGF, DAIRYF, and GOVTI have a significantly negative relationship with the equilibrium interest rate paid by nontraditional credit users. This result suggests that farm businesses with more dependents and that make greater use of hail insurance tend to pay a higher interest rate. Those businesses categorized as grain-livestock farms, hog farms, and dairy farms, or those that participate more frequently in government programs tend to pay a lower interest rate. For traditional credit users, the significantly positive effect of ROA implies that a higher return on assets increases the interest rate paid by traditional credit users. In addition, the positive effect of AGES and the negative effects of HOGF, BEEFF, and GOVTI are shown to be significant. These results suggest that traditional lenders are inclined to charge higher interest rates to older traditional credit users, but to charge lower rates to those traditional credit users who are classified as operators of hog farms or beef farms and who more often participate in government programs. In general, increased participation in government programs will significantly reduce the interest rate paid across the two types of borrowers.

ASSETTO, DEPSUPP, DAIRYF, HAILI, and SELECTIVITY have significantly different effects on determining the interest rates offered by the nontraditional and traditional lenders, respectively. The selectivity variable is positively associated with the nontraditional credit user's interest rate, revealing that self-selection is statistically important in estimating the interest rate equation. The sign and significance of ASSETTO of nontraditional credit users and those of ROA and GOVTI of traditional credit users are consistent in both the flow and stock interest rate equations. Furthermore, socioeconomic attributes more significantly affect the interest rate equation in the stock approach than that in the flow approach, especially for the nontraditional credit users group.

The empirical results in estimating the corrected loan length equations using the stock data set are presented in Table 7.10. The coefficient of LIQUIDIT is significantly different from zero at the 10 percent level in the loan length equation of nontraditional credit users, but not significant in that of traditional credit users. In addition, an increase in INTCOV decreases the loan length extended across credit users. This effect is significantly different from zero at the 11 percent and 5 percent levels for nontraditional and traditional credit users, respectively. The significantly positive relationship between ASSETTO and loan length extended to traditional credit users does not apply to nontraditional credit users.

With respect to the effects of borrower characteristics, DEPSUPP and MPCI are significantly positively associated with loan length across the two types of borrowers, indicating that an increase in dependents or in the frequency of using multiple-peril crop insurance increases the length of loans extended across all credit users. In addition, for nontraditional credit users, the estimates of AGES and EDH are significantly negative, whereas those of EDW and HOGF are significantly positive. These outcomes indicate that nontraditional credit borrowers of older ages and with higher education of the husband are extended shorter contract lengths, while those with higher education of the wife and classified as operating hog farms inversely are extended longer loan lengths. These relationships are not significant for traditional credit users. For the traditional credit users group, in addition to the significant effects of DEPSUPP and MPCI explained above, HAILI and GOVTI have a significantly positive association with loan length, which is weak for nontraditional credit users. As the frequency of hail insurance usage or government program participation by traditional credit users increases, the equilibrium length of the loan contract extended also increases. This relationship is insignificant for nontraditional credit users.

ASSETTO, AGES, DAIRYF, and HAILI play significantly different roles in affecting the nontraditional and traditional loan length equations. Namely, the two types of lenders differently use these variables when determine their optimal loan length. The effect of the selectivity variable in the loan length equation of the nontraditional credit users group is not statistically significant at the 10 percent level, but it is significant at the 13 percent level, which suggests that the self-selectivity variable should be taken into account in estimating the loan length equation. The significant sample value of the F-statistics supports that a test of the null hypothesis that all coefficients are jointly equal to zero is rejected at the 10 percent and 5 percent significance levels for nontraditional and traditional credit users, respectively. Comparison of the effects of socioeconomic characteristics on the flow and stock loan length equations obviously indicates that the stock loan length equation are more strongly affected by socioeconomic attributes, in particular for the traditional credit users group.

Taken together, financial measures and borrower characteristics have more significant impacts on stock lending activities than on flow lending activities. In other words, socioeconomic characteristics offer more power in explaining lending activity based on total accumulated borrowings but less power in explaining that of new additional borrowings.

Estimates of the Structural-Form Participation Equation

The bivariate probit estimates of the structural decision equation, explaining the farmer-borrower's probability of participating in nontraditional lenders' credit programs based on the specification of Eq. (6.14), are reported in Tables 7.11 and 7.12 for the flow and stock approach, respectively. These two tables include the maximum likelihood estimated coefficients, likelihood ratio statistics, chi square ratios, and marginal effects of

Table 7.11. Estimated coefficients of the probit structural decision equation for the flow approach

Regressor	Coefficient	Chi Square	Marginal Effect
INTERCEPT	1.018045	1.071371	
DEBTHAT	0.000023*	3.456589	0.0000077
COLLATERHAT	-0.000005**	3.585884	-0.0000019
INTERESTHAT	-0.528431**	4.439794	-0.2098706
MONTHHAT	-0.015468	0.937567	-0.0059648
COD	4.532132***	6.074481	1.7472573
COLOSPRD	-0.944957	0.583521	-0.3765142
FLEXP	0.000040*	2.532039	0.0000094
AGES	0.263413	2.230846	0.0799770
EDH	0.104478	0.237725	0.0408384
EDW	-0.313518*	3.495823	-0.1043812
SIZEA	-0.920707***	6.372919	-0.0043177
CASGRAF	2.034973	1.998314	0.7333344
GRALVSF	0.731532	1.051572	0.2768940
HOGF	-2.831753**	3.882264	-1.0876326
BEEFF	1.122183	1.254099	0.4460750
DAIRYF	-1.278383	1.885094	-0.5092263
ROA	5.777198**	3.606904	2.2233182
LIQUIDIT	0.711691*	2.863889	0.0126433
DTOA	1.604576	1.063643	0.5667418
MGTEFF	-1.045343*	3.555872	-0.3082893
Log Likelihood	-107.3343		
L.R. Chi-square		213.3909***	

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.

Table 7.12. Estimated coefficients of the probit structural decision equation for the stock approach

Regressor	Coefficient	Chi Square	Marginal Effect
INTERCEPT	-1.2874072	0.635799	
DEBTHAT	0.0000227***	6.773959	0.0000089
COLLATERHAT	-0.0000003	0.013138	-0.0000001
INTERESTHAT	-0.0438338	0.505039	-0.0171442
MONTHHAT	-0.0022965	0.138764	-0.0009141
COD	2.8611403*	2.909762	1.1310794
COLOSPRD	0.2279085	0.043035	0.0909174
FLEXP	0.0000296*	2.501383	0.0000089
AGES	0.1574484*	2.479747	0.0567213
EDH	0.0298083	0.074988	0.0118722
EDW	-0.1348007	0.844476	-0.0520113
SIZEA	0.2133109	0.774724	0.0667273
CASGRAF	-0.4900201	2.168698	-0.1944302
GRALVSF	-0.2475966	0.409527	-0.0982745
HOGF	-0.0839764	0.035767	-0.0334998
BEEFF	0.4279893	0.837097	0.1706101
DAIRYF	0.0516290	0.006649	0.0205969
DTOA	1.3493156***	5.457752	0.4842765
INTCOV	-0.0125899*	2.650119	-0.0050201
ASSETTO	-0.5113421	0.445797	-0.2012746
Log Likelihood	-154.6148		
L.R. Chi-square		310.4421**	

Note: * Significant at 10 percent level.
** Significant at 5 percent level.
*** Significant at 1 percent level.

the regressors on the probability of decision equation evaluated at the sample means. In order to examine the relative contributions to the probability of participation, it is helpful to calculate the marginal effect on the likelihood of participation for each explanatory variable. Specifically, the marginal effect of the *j*th variable associated with the borrower i's participation probability is

$$\partial\, pr(Y_i = 1) \,/\, \partial\, x_i^{\,j} = \partial\, F(\beta^{*\prime}\, x_i) \,/\, \partial\, x_i^{\,j} = f(\beta^{*\prime}\, x_i)\, \beta_j^{*} \qquad (7.1)$$

Obviously, the relative impact will vary with the values of x_i. In interpreting the estimated model, it will be helpful to calculate the marginal effects at the means of the regressors. Accordingly, given a one unit change in a particular independent regressor, the corresponding estimated percentage change in the overall probability of participation at the sample mean, holding everything else constant, is listed in the fourth column of Tables 7.11 and 7.12.

The flow approach

The estimates presented in Table 7.11 indicate the most significant factors determining a farmer-borrower's decision in choosing between two types of lenders using a flow measure of participation. Examination of the nontraditional and traditional lenders' loan term differential coefficients reveals that, except for the loan length differential, the terms of a loan contract, such as loan size, collateral, and interest rate differentials, are statistically significant determinants of loan contract selection. In other words, a farmer-borrower's participation decision strongly depends on the potential loan term gains or differentials, except for that of loan length. Specifically, the loan size differential has a significantly positive effect at the 10 percent level, but collateral and interest rate

differentials have significantly negative effects at the 5 percent level on the probability of participation in nontraditional lenders' loan contracts. These findings imply that a larger loan size, less collateral assets, or a lower interest rate may provide a strong incentive for farmer-borrowers to participate in nontraditional lenders' credit programs. Furthermore, the marginal effect of a 1 percent interest rate differential on the probability of participation is much stronger than that of $1,000 in the loan size differential or that of $1,000 in the collateral differential at the mean level. This result reveals that the empirical magnitude of the impact of a unit increase in the interest rate differential on the participation probability is larger compared with the other loan term variables, even though they have similar statistical significances. The insignificant coefficient of the loan length differential demonstrates that the probability of participation will not be significantly different for loan contracts of different lengths. In sum, these results indicate that, after considering the selectivity variable, farmer-borrowers are very sensitive to the loan term differentials when seeking new operating funds, especially to the interest rate differential.

Another variable substantially influencing the participation decision is cost of debt, which has a significantly positive association with the probability of participation. The higher the cost of debt already borne by the farmer, the higher the probability of participation in nontraditional lenders' programs. The marginal effect indicates that a 1 percent increase in the cost of debt will result in an approximately 1.8 percent greater likelihood of participation. This result is consistent with those of the reduced-form equation presented in Table 7.1. Examination of the variable COLOSPRD reveals that the cost of losing productivity is not a statistically significant determinant, but its marginal impact is empirically considerable, with a 0.58 percent change in probability corresponding to a 1 percent change in COLOSPRD. SIZEA also markedly affects the likelihood of participation at the 1 percent level. Its significantly negative coefficient

suggests that operators of larger farms are less inclined to borrow operating funds from nontraditional lenders. In other words, other things being equal, operators of smaller farms are significantly more likely to finance operating credit from nontraditional lenders.

The negative coefficient of the farm type variable HOGF indicates that operators of hog farms are less likely to select nontraditional lenders' credit programs than are operators of other types of farms. Note that the other farm type variables were not significant. The positive coefficient of ROA reveals that the farmer-borrower with higher profitability is more willing to finance from nontraditional lenders. Specifically, a 1 percent rise in ROA causes the probability of participation to rise by 2.2 percent.

The FLEXP variable exhibits a significantly positive association with participation at the 10 percent level, meaning that farm businesses with higher family living expenditures are more inclined to participate. Analytically, a $1,000 increase in living expenditures will increase the probability of participation by 0.94 percent. Also, EDW has a significant effect on the participation decision at the 10 percent level. Its significantly negative coefficient shows that the more educated the wife is in a farm business, the lower the probability is of the business choosing a nontraditional lender's contract. This relationship is weak for EDH. The variable EDH is insignificant and has a positive sign, suggesting that the husband's education has little positive effect on participation in nontraditional lenders' loan packages.

Two financial measures with significant effects at the 10 percent level on the flow decision equation are LIQUIDIT and MGTEFF. The significantly positive coefficient of liquidity reflects that a farm business with higher liquidity is more inclined to choose a nontraditional lender. For example, at the sample mean, a 1 percent increase in the liquidity ratio increases the probability of participation by 0.012 percent. In other words, a 100 percent (1.0 unit) rise in the ratio of current assets over non-real estate liabilities

increases the participation likelihood by 1.2 percent. The significantly negative coefficient of MGTEFF indicates that the farm business with higher managerial efficiency tends to finance from traditional lenders. The marginal effect of MGTEFF implies that a one unit rise in MGTEFF may result in a 0.3 percent decrease in the likelihood of participation.

In summary, the estimated results presented in Table 7.11 reveal that the farmer-borrower's probability of selecting a nontraditional lender decreases with collateral, interest rate, wife's education, farm size, hog farm category, and managerial efficiency, but increases with loan size, cost of debt, family living expenditures, return on assets, and liquidity. The significance of likelihood ratio test rejects the null hypothesis that all coefficients are jointly equal to zero at the 1 percent significance level. In other words, these variables capture overall explanatory power of the participation equation in the flow approach.

The stock approach

The estimated coefficients of the structural decision equation using a stock-based measure of participation are reported in Table 7.12. It is clear that the significance of explanatory variables for the stock equation is substantially decreasing compared with that for the flow equation. Most of their signs are remarkably consistent across the two tables. These findings show that these explanatory variables have the same direction of effects, but have different significances for the two participation equations. Specifically, the loan term variables and socioeconomic variables have more significant influences when the flow measures are used than when stock measures are employed.

The only loan term differential variable that appears to substantially affect the stock decision equation is the loan size differential, which is highly significant at the 1 percent level and exhibits a strong positive relationship with participation. An increase in the loan

size differential of $1,000 is associated with an increase in the probability of selecting nontraditional lenders' programs of 0.89 percent at the sample mean. This evidence implies that the loan size differential serves as a significant determinant of a farmer-borrower's participation decision, which is in line with the results of the flow approach reported in Table 7.11. As to the other loan term differentials, although the estimated coefficients are not significant, their relative size indicates that they may be of considerable importance in explaining the participation decision in the stock approach. Their signs are generally consistent with the flow approach as well. These findings also suggest that collateral and interest rate differentials do not significantly contribute to the borrower's participation probability in the stock participation equation but do contribute in the flow participation equation. In general, the loan term differentials are found to have identical signs in the two models, but differ in their statistical significance.

The most significant financial measure affecting the borrower's accumulated borrowings is the debt-to-asset ratio. The positive and statistically significant effect of DTOA on the likelihood of participation implies that a higher leverage ratio may substantially motivate participation in nontraditional lenders' loan contracts. Evaluated at the mean, a 1 percent increase in the leverage ratio increases the probability of participation by 0.48 percent.

Other variables significant at the 10 percent level include COD, FLEXP, AGES, and INTCOV, which all have signs consistent with those estimated in the flow model. The positive coefficients of the first three variables indicate that farmer-borrowers with higher costs of debt, higher living expenditures, and older ages are more likely to finance operating funds from nontraditional lenders. Therefore, a 1 percent increase in the cost of debt and a $1,000 increase in living expenses will cause a 1.13 percent and a 0.89 percent increase in the probability of participation, respectively. The large marginal effect of the

cost of debt reveals its empirical significance in the decision equation of both approaches. The interest coverage ratio is also significant at the 10 percent level but with a negative sign, meaning that the higher the repayment ability of the farmer, the lower the probability of participation. Its marginal effect is just 0.5 percent with a 100 percent, or 1.0 unit, increase in INTCOV.

On the other hand, although both EDH and EDW are insignificant in the stock decision equation, they have identical signs to those in flow model. The coefficient of SIZEA obviously changes from significantly negative to insignificantly positive in the stock participation equation, implying a diminishing role of farm size on the borrowing decision. The farm type variables in this equation are all insignificant. Taking these variables together, the husband's education, wife's education, farm size, and farm type are found to have no significant impacts on the decision-making process of dynamic borrowing activity.

The test statistics reported at the bottom of Table 7.12 indicate that the null hypothesis that the coefficients are jointly equal to zero is rejected at the 1 percent significance level, which supports the explanatory power of these loan term variables and socioeconomic variables on the participation decision equation.

Empirical Implications

The estimation results presented in Tables 7.11 and 7.12 provide a number of insights into the relative importance of various factors on the likelihood of loan contract participation, and also help create a better understanding of the marketing strategies that lenders could use to enhance borrowers' willingness to participate. The empirical implications for the flow and stock approaches are analyzed below.

The flow approach

Table 7.11 shows that the interest rate differential significantly outweighs other factors, even other loan term differentials, in influencing the borrower's participation decision. As shown previously, a 1 percent decrease in the percentage interest rate charged results in a 21 percent increase in the probability of participation based on the flow approach. A $1,000 increase in loan size or a $1,000 decrease in collateral cause approximately a 0.2 percent and a 0.7 percent increase, respectively, in the probability of acceptance of a nontraditional lender's loan contract. This finding implies that the incentive effects of a 1 percent decrease in interest rate are stronger than those of a $1,000 decrease in the collateral requirement or those of a $1,000 increase in loan size extended. To achieve the equivalent effect of a 1 percent decrease in interest rate on the participation probability, loan size and collateral need to increase by approximately $30,000 and decrease by approximately $105,000, respectively.

Based on the standard deviations of the contract attributes presented in Table 6.2, the variability of nontraditional lenders' interest rates is larger than that of traditional lenders, but the variabilities of loan size and collateral of both types of lenders are similar. This result seems to imply that for nontraditional credit users, the interest rate incentive probably has stronger effects than do loan size and collateral incentives because a 1 percent increase in interest rate is more likely than a $30,000 decrease in loan size and a $105,000 increase in collateral. For traditional credit users, this relationship is weak, which implies that all three incentives are likely to have similarly critical effects on motivating participation. Therefore, this evidence implies that for nontraditional credit users, the interest rate incentive may be more useful in encouraging participation in nontraditional lenders' credit programs. Or, increasing (decreasing) the interest rate charged appears to be the most efficient way to decrease (increase) a borrower's willingness to borrow

additional funds. For nontraditional lenders, the implementation strategy for short-term participation should focus on creating and offering a more competitive interest rate. Collateral and loan size incentives should be viewed as substitute tools for motivating participation if nontraditional lenders are able to easily reduce the interest rate charged. For traditional credit users, the interest rate, loan size, and collateral incentives may be equivalently helpful in motivating lending activity.

In sum, using the flow measure of participation, borrower acceptance could be increased if lenders concentrated more on reducing the interest rate charged rather than offering relatively larger loans or reducing the collateral requirement. Interest rate competition between nontraditional and traditional lenders appears to be a major factor that will influence market share in the agricultural credit market.

The stock approach

When participation is viewed from a stock perspective, a different set of inferences can be drawn. Table 7.12 indicates that the loan size differential is the only loan attribute with a statistically significant effect on the farmer-borrower's participation decision across borrowers. Although the interest rate differential is found to be statistically insignificant, the size of the estimated coefficient may have an important effect on a borrower's participation. According to the results of the previous section, if loan size and collateral each increases by $1,000, the probability of participation increases by 0.89 percent and decreases by 0.01 percent, respectively. A 1 percent increase in the interest rate, on the other hand, will increase the probability of participation by 1.7 percent, evaluated at the mean. In other words, to achieve the same effect as a 1 percent increase in interest rate, loan size must decrease by $2,000 and collateral must increase by $170,000.

The standard deviation statistics of contract attributes presented in Table 6.6 show that a $2,000 increase in loan size is much more likely than a 1 percent increase in the interest rate and a $170,000 increase in the collateral requirement, respectively. This evidence suggests that, across borrowers, the loan size incentive has more influence on a borrower's willingness to select one lender over another than does the interest rate or collateral incentive. From the farmer-borrower's perspective, the offered loan size differential substantially affects the choice of a loan contract. The offered interest rate and collateral differentials are also important in stimulating borrowers' participation, but relatively less effective than the loan size incentive. Therefore, an implementation strategy for accumulated or long-term participation might emphasize offering relatively larger loans. The role of the interest rate incentive appears to be less important based on the stock equation of credit.

In sum, both the flow and stock models indicate the importance of loan attributes in promoting farmer-borrowers' selection of nontraditional lenders' credit programs, especially interest rate and loan size. For the purpose of encouraging participation with limited credit sources compared with traditional lenders, nontraditional lenders should take advantage of the cross-subsidization effect to reduce the interest rate charged, and concentrate resources on the activities that could directly and indirectly reduce operational and financial costs and the interest rate charged. For traditional lenders without a cross-subsidization advantage but with diversified portfolios, lower funding costs, and broad credit sources, it is more advantageous to emphasize offering larger loans rather than lower interest rates when competing with nontraditional lenders. In one word, the issue of how to offer a competitive interest rate and a larger loan certainly determines a lender's position in the short- and intermediate-term credit market.

CHAPTER 8.
SUMMARY AND CONCLUSIONS

The purpose of this thesis was to investigate the farmer-borrower's decision-making process in choosing between traditional and nontraditional lenders when financing short- and intermediate-term credit. In this study, the theoretical and econometric models were derived to explain contract formation based on differential features of the two types of lenders, and contract selection based on differential characteristics of a borrower and loan contracts. The empirical analysis examined the impacts and incentives of various factors identified in the theoretical models on the farmer-borrower's choice of a lender or a loan contract. The corresponding implications of the empirical results provide a better understanding of the incentive strategies that lenders could use to motivate borrowers' willingness to participate.

This study is significantly different from current and previous studies in several ways. First, most current studies about agricultural lenders focus only on the lending activities of traditional lenders, whereas this study addresses the emergence and importance of nontraditional lenders, especially in the agricultural non-real estate credit market. Second, the existing literature emphasizing nontraditional lenders' activities is limited to the supply side analysis of loan contracts, whereas this analysis primarily focuses on the farmer-borrower's perspective of credit, or demand side analysis, of the loan market. Third, unlike other papers, which discuss how lenders efficiently design a loan contract, this study examines why farmer-borrowers accept loan contracts offered by either nontraditional lenders or traditional lenders. The major insights gained from the theoretical models and empirical analyses are summarized as follows.

1. The theoretical model identifies collateralization costs, costs of funds, monitoring costs, and borrowers' creditworthiness as important characteristics in the determination of contract terms. Nontraditional lenders may possess unique economic and managerial features and business strategies that directly lower these costs and provide potential advantages to either charge a lower interest rate or reach riskier borrowers than can traditional lenders. The empirical results indicate that nontraditional credit users are less risky and are charged much lower interest rates than are traditional credit users. The significantly lower interest rates charged to nontraditional credit users could be attributed to their lower financial and operation risk and to nontraditional lenders' cross-subsidization advantages, lower collateralization costs, and lower monitoring costs, which is in line with the theory.

2. Based on the utility maximization and discrete choice frameworks, the attributes of alternative loan contract packages and the socioeconomic characteristics of a farmer-borrower are theoretically identified in the conceptual model as significantly contributing to the probability of participation. In the first-stage analysis of the conceptual model, the importance of these factors affecting the borrower's utility formation are identified. In the second-stage analysis, a discrete choice model is developed to examine a farmer-borrower's selection of a loan contract.

3. The estimation procedure used in this study is a two-stage probit estimation. The first stage involves estimating the loan term variables, and the second involves estimating the participation or decision equation. Empirically, however, the self-selection process may cause biased estimates of the terms of loan contracts due to the truncated sample. Therefore, the selectivity variables should be taken into account in the estimation of loan term equations. Based on this limited data, the self-selection phenomenon was

found to have an insignificant effect on the loan term equations in the flow approach, but to have a significant effect on some of equations in the stock approach.

4. The empirical results support the conclusion that loan term differentials, financial measures, and borrower characteristics have significant impacts on the farmer-borrower's participation decision in choosing between two types of lenders in both the flow and stock approaches. Although the levels of significance of these variables in explaining incremental and accumulated borrowing activities are different, most of the estimated signs are consistent. Specifically, the farmer-borrower's probability of choosing nontraditional lenders in the flow approach is found to significantly decrease with collateral, interest rate, wife's education, farm size, hog farm category, and managerial efficiency, but to increase with loan size, cost of debt, family living expenditures, return on assets, and liquidity. For the stock specification, loan size, cost of debt, family living expenditures, age, and leverage ratio are significantly positively related, but the interest coverage ratio is significantly negatively related to the probability of participation.

5. Based on the empirical results, it appears that interest rate, loan size, and collateral incentives are efficient tools to increase a borrower's willingness to participate. Specifically, the flow approach indicates that, for nontraditional lenders, interest rate incentives may have a stronger effect on the probability of participation than do loan size and collateral incentives. For traditional lenders, all three incentives are equivalently influential. The stock approach, however, suggests that, regardless of the type of borrower, loan size incentive is the most useful instrument to motivate participation. Therefore, the financial loan terms play crucial roles in stimulating a farmer-borrower's use of nontraditional credit.

6. Financial loan terms appear to outweigh other socioeconomic factors in determining contract acceptance. This conclusion provides not only some strategic insights

for lenders, but also some implications for policymakers. A regulation or policy should avoid creating unfair competitive advantages for different commercial lenders, particularly relating to the interest rate and loan size incentives due to their vital roles in commercial lenders' competition and credit activities, which further affects borrower participation in the short- and intermediate-term credit market.

7. Given the shortcomings of the survey data, several variables, such as a borrower's collateral pledged, transaction costs, monitoring criteria and costs, reputation costs, and services provided by lenders, are not available to incorporate in the estimation process. In the absence of these variables, some insights can not be examined through the above empirical results. In addition, the farmer-borrower's dynamic borrowing behavior and intertemporal decision can not be well examined in this study because no panel data are available. The completeness of the microdata set certainly affects the success of future studies. Obtaining a microdata set that includes panel data, complete loan contract information, and the corresponding costs used for each loan contract may help in analyzing a farmer-borrower's decision-making process when financing operating credit.

8. Further study could extend to analysis of a farmer-borrower's intertemporal behavior over time in theoretical and empirical studies. Under a multiperoid framework, the effects of a farmer-borrower's preferences, criteria, and intertemporal decisions on his/her choice of a credit supplier could be better understood. Specifically, the importance of the quality of the business and social relationship, reputation effect, and past credit history on a farmer-borrower's determination of a loan contract and the relationship between borrowers and lenders could be examined.

BIBLIOGRAPHY

Akerlof, George, "The Market for Lemons: Qualitative Uncertainty and the Market Mechanism," *Quarterly Journal of Economics*, 84, August 1970, 488-500.

Anderson, Simon P., Andre de Palma, and Jacques-Francois Thisse, *Discrete Choice Theory of Product Differentiation*, Cambridge, Mass., The MIT Press, 1992.

Barkema, Alan and Mark Drabenstott, *The Realignment in Farm Lending: Strategic Issues for the 1990s*, Kansas City, Federal Reserve Bank of Kansas City, July 1991, RWP 91-01.

Barro, Robert J., "The Loan Market, Collateral, and Rates of Interest," *Journal of Money, Credit and Banking*, 8, August 1976, 439-57.

Bell, Carolin D., Roland K. Roberts, Burton C. English, and William M. Park, "A Logit Analysis of Participation in Tennessee's Stewardship," *Journal of Agricultural and Applied Economics*, 26, December 1994, 463-72.

Berger, Allen N. and Gregory F. Udell, "Collateral, Loan Quality, and Bank Risk," *Journal of Monetary Economics*, 25, 1990, 21-42.

Besanko, David and Anjan Thakor, "Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets," *International Economic Review*, 28, 1987, 671-84.

_____, "Competitive Equilibrium in the Credit Market under Asymmetric Information," *Journal of Economic Theory*, 42, 1987, 167-82.

Bester, Helmut, "Screening vs Rationing in Credit Markets with Imperfect Information," *American Economic Review*, 75, 1985, 850-55.

Boot, A., A. Thakor, and Gregory F. Udell, "Secured Lending and Default Risk: Equilibrium Analysis and Monetary Policy Implications," Working Paper, New York University, New York, July 1988.

Brennan, Michael J., Vojislav Maksimovic, and Josef Zechner, "Vendor Financing," *Journal of Finance*, 43, December 1988, 1127-41.

Calem, Paul S. and John A. Rizzo, "Banks as Information Specialist: The Case of Hospital Lending," *Journal of Banking and Finance*, 16, 1992, 1123-41.

Campbell, Tim S., *Money and Capital Markets*, Glenview, Illinois: Scott, Foresman and Companies, 1988.

Caswell, Margriet and David Zilberman, "The Choices of Irrigation Technologies in California," *American Journal of Agricultural Economics*, 67, May 1985, 225-34.

Chambers, Robert G. and William E. Foster, "Participation in the Farmer-Owned Reserve Program: A Discrete Choice Model," *American Journal of Agricultural Economics*, 65, 1983, 120-24.

Chan, Yuk-Shee and George Kanatas, "Asymmetric Valuations and the Role of Collateral in Loan Agreement," *Journal of Money, Credit and Banking*, 17, February 1985, 84-95.

Chan, Yuk-Shee and Anjan Thakor, "Collateral and Competitive Equilibrium with Moral Hazard and Private Information," *Journal of Finance*, 42, June 1987, 345-63.

Collendender, Robert, Richard Nehring, and Agapi Somwaru, *Profit Efficiency of the Farm Credit System Association*, Washington, D.C., USDA, Economic Research Service, 1991, Report No. 9155.

Covey, Ted, Paul Sundell, and James Ryan, "Measuring Farm Sector Interest Rates," *Agricultural Income and Finance*, AIS-52, February 1994, 38-42.

Daugherty, Katherine Louise Busby, "An Analysis of the Farmer Decision Making Process When Selecting Short-Term Operating Credit through Standard Survey Research Methods and Conjoint Analysis," Thesis, University of Illinois at Urbana-Champaign, 1993.

Diamond, Douglas W., "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies*, 51, 1984, 393-414.

_____, "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt," *Journal of Political Economy*, 89, August 1991, 689-707.

Dietrich, Michael, *Transaction Cost Economics and Beyond Towards a New Economics of the Firm*, New York: Routledge Company, 1994.

Dodson, Charles B., "Analysis of Lender-Borrower Choice and Implications for Federal Farm Credit Policy," Paper presented at NC-207 Annual Meeting, Kansas City, Missouri, 1995.

Dowd, Kevin, "Optimal Financial Contracts," *Oxford Economic Papers*, 44, 1992, 672-93.

Duncan, Marvin, "Structural Change for Farm Lenders in the 1980s, Comments," In *Financing Agriculture in the 1990s: Structural Change and Public Policy*, Washington, D.C.: Board of Governors of the Federal Reserve System, 1991, 29-31.

Frey, Thomas C. and Robert H. Behrens, *Lending to Agricultural Enterprises*, Boston: Bankers Publishing Co., 1981.

Gale, William G., "Collateral, Rationing and Government Intervention in Credit Market," In *Asymmetric Information, Corporate Finance, and Investment*, 43-61, Chicago: The University of Chicago Press, 1990.

Gardner, Mona J. and Dixie L. Mills, *Managing Financial Institutions: An Asset/ Liability Approach*, Orlando, Florida: The Dryden Press, 1991.

Green, William H., *Econometrics Analysis*, New York: Macmillan Publishing Co., 1990.

Greenwood, Michael J., "Human Migration: Theory, Models and Empirical Studies," *Journal of Regional Science*, 25, 1985, 521-44.

Gustafson, Cole R., Ronald J. Beyer, and David M. Saxowsky, "Credit Evaluation: Investigating the Decision Processes of Agricultural Loan Officers," *Agricultural Finance Review*, 49, 1991, 55-64.

Heckman, James J., "Sample Selection Bias as a Specification Error," *Econometrica*, 47, 1979, 153-61.

Hensher, David A. and Lester W. Johnson, *Applied Discrete-Choice Modeling*, New York: John Wiley and Sons Inc., 1981.

Hoshi, Takeo, Anil Kashyap, and David Scharfsein, "Bank Monitoring and Investment: Evidence from the Changing Structure of Japanese Corporate Banking Relationships," In *Asymmetric Information, Corporate Finance, and Investment*, 105-32, Chicago: The University of Chicago Press, 1990.

Hubbard, R. Glenn, *Asymmetric Information, Corporate Finance, and Investment*, Chicago: The University of Chicago Press, 1990.

Jaffee, Dwight M. and Thomas Russell, "Imperfect Information, Uncertainty, and Credit Rationing," *Quarterly Journal of Economics*, 90, 1976, 651-65.

Johnson, N. L. and S. Kotz, *Distributions in Statistics: Continuous Multivariate Distributions*, New York: John Wiley and Sons, Inc., 1972.

Jolly, Robert W., *1993 Iowa Farm Finance Survey*, FM 1843, Iowa State University, Ames, Iowa, 1993.

Judge, George G, R. Carter Hill, William E. Griffiths, Helmut Lutkepohl, and Tsoung-Chao Lee, *Introduction to the Theory and Practice of Econometrics*, New York: John Wiley and Sons Inc., 1988.

Koch, Timothy W., *Bank Management*, 2nd ed, Orlando, Florida, The Dryden Press, 1992.

Konyar, Kazim and C. Tim Osborn, "A National-Level Economic Analysis of Conservation Reserve Program Participation: A Discrete Choice Application," *Journal of Agricultural Economics Research*, 42, 1990, 5-19.

Lee, Boehlje and Murray Nelson, *Agricultural Finance*, 8th Edition, Ames, Iowa: Iowa State University Press, 1988.

Lee, Lung-Fei, "Unionism and Wage Rates: A Simultaneous Equations Model with Qualitative and Limited Dependent Variables," *International Economic Review*, 19, 1978, 415-33.

Lubben, Robert W. and Bruce J. Sherrick, "Economic Motivations for Vendor Financing: Theory and Evidence," Paper presented at NC-207 Annual Meeting, Chicago, 1993.

Maddala, G. S., *Limited-Dependent and Qualitative Variables in Econometrics*, New York: Cambridge University Press, 1983.

Mankiw, N. Gregory, "The Allocation of Credit and Financial Collapse," *Quarterly Journal of Economics*, 35, May 1980, 455-70.

Martin, Robert E. and David J. Smyth, "Adverse Selection and Moral Hazard Effects in the Mortgage Market: An Empirical Analysis," *Southern Economic Journal*, 57, April 1991, 1071-84.

Maurice, Joy O., *Introduction to Financial Management*, Homewood, Illinois: Richard D. Irwin, Inc., 1983.

Mester, Loretta J., "Traditional and Nontraditional Banking: An Information-Theoretical Approach," *Journal of Banking and Finance*, 16, 1992, 545-66.

Melnik, Arie and Steven Plaut, "Loan Commitment Contracts, Terms of Lending, and Credit Allocation," *Journal of Finance*, 41, June 1986, 425-35.

Miller, Lynn H. and Eddy L. LaDue, "Credit Assessment Models for Farm Borrowers: A Logit Analysis," *Agricultural Finance Review*, 49, 1989, 22-36.

Mishkin, Frederic S., *The Economics of Money, Banking and Financial Market*, 3rd ed, New York: Mishkin Economics, Inc., 1992.

Monke, James D., "Non-traditional Suppliers of Agricultural Credit," *Agribusiness*, 9, 1993, 29-33.

Monke, James D., Bruce J. Sherrick, and Steven T. Sonka, "An Examination of Non-Traditional Suppliers of Agricultural Credit," University of Illinois, Urbana-Champaign, April 1992, Working Paper, 92 E-474.

Nakosteen, Robert A. and Michael Zimmer, "Migration and Income: The Question of Self-Selection," *Southern Economic Journal*, 46, July 1980, 840-51.

Osberg, Lars, Daniel Gordon, and Zhengxi Lin, "Interregional Migration and Interindustry Labor Mobility in Canada: A Simultaneous Approach," *Canadian Journal of Economics*, 27, 1994, 58-80.

Pagano, Marco and Tullio Jappelli, "Information Sharing in Credit Markets," *Journal of finance*, 48, December 1993, 1693-1718.

Penson, John B., *Agricultural Finance: An Introduction to Micro and Macro Concepts*, Englewood Cliffs, New Jersey: Prentice-Hall Co., 1988.

Peoples, Kenneth L., David Freshwater, Gregory D. Hanson, Paul T. Prentice, and Eric P. Thor, *Anatomy of An American Agricultural Credit Crisis—Farm Debt in the 1980s*, Lanham, Maryland: Rowman and Littlefield, 1992.

Phillips, Richard A. and James H. Vanderhoff, "Adjustable Rate Mortgages and Housing Demand: The Impact of Initial Rate Discounts," *Journal of Real Estate Finance and Economics*, 5, 1992, 269-79.

Rao, Ananth, Glenn D. Pederson, and Michael D. Boehlje, "Farm Lender Asset and Funding Decisions: A Micro-Model Application," *Review of Agricultural Economics*, 16, July 1994, 399-412.

Remolona, Eli M. and Kurt C. Wulfekuhler, "Finance Companies, Bank Competition, and Niche Markets," *Federal Reserve Bank of New York Quarterly Review*, Summer 1992, 25-38.

Robinson, Chris and Nigel Tomes, "Self-Selection and Interprovincial Migration in Canada," *Canadian Journal of Economics*. August 1982, 15, 474-502.

Romero, Carlos and Tahir Rehman, *Multiple Criteria Analysis for Agricultural Decision*, Amsterdam, New York: Elsevier Science Publishers Company, Inc., 1989.

Ross, Stephen A. and Randolph Westerfield, *Corporate Finance*. St. Louis, Missouri: Times Mirror/Mosby College Publishing, 1988.

Ryan, James and Kenneth Erickson, "Outlook for Changes in Farm Financial Performance," Paper presented at the Agriculture outlook Conference, Washington, D.C., 1994.

Sherrick, Bruce J. and Robert W. Lubben, "Economic Motivations for Vendor Financing: Theory andEvidence," Paper presented at the NC-207 Annual Meeting, Chicago, 1993.

Sherrick, Bruce J., Steven T. Sonka, and James D. Monke, "Nontraditional Lenders in the Agricultural Credit Markets," *Agribusiness*, 10, 1994, 341-57.

Siles, Marcelo, Steven D. Hanson, and Lindon J. Robison, "Socio-Economics and the Probability of Loan Approval," *Review of Agricultural Economics*, 16, 1994, 363-72.

Splett, Nathan S., Peter J. Barry, Bruce L. Dixon, and Paul N. Ellinger, "A Joint Experience and Statistical Approach to Credit Scoring," *Agricultural Finance Review*, 54, 1994, 39-54.

Staten, Michael E., Otis W. Gilley, and John Umbeck, "Information Costs and the Organization of Credit Markets: A Theory of Indirect Lending," *Economic Inquiry*, 28, July 1990, 508-29.

Stiglitz, Joseph E. and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, 71, June, 1981, 393-410.

_____, "Asymmetric Information in Credit Markets and its Implications for Macro-Economics," 44, *Oxford Economic Papers*, 1992, 694-724.

Stover, Roger D., R. Kenneth Teas, and Roy J. Gardner, "Agricultural Lending Decision: A Multiattribute Analysis," *American Journal of Agricultural Economics*, 67, August 1985, 513-20.

Sullivan, Gene D., "Structural Change for Farm Lenders in the 1980s," In *Financing Agriculture in the 1990s: Structural Change and Public Policy*, Washington, D.C.: Board of Governors of the Federal Reserve System, 1991, 19-32.

Sundell, Paul A., "Determinants of Short-Term Agricultural Loan Rates at Commercial Banks," *Agricultural Income and Finance*, 47, December 1991, 42-45.

Thompson, Mary, "New Capital Sources for Ag Credit," *Agri Finance*, December 1987, 33-38.

Tokle, J. G. and Wallace E. Huffman, "Local Economic Conditions and Wage Labor Decisions of Farm and Rural Nonfarm Couples," *American Journal of Agricultural Economics*, 73, August 1991, 652-70.

Truong, Truong P. and David A. Hensher, "Measurement of Travel Time Values and Opportunity Cost From A Discrete-Choice Model," *The Economic Journal*, 95, June 1985, 438-445.

Turvey, Calum Greig, "Credit Scoring for Agricultural Loans: A Review with Applications," *Agricultural Finance Review*, 51, 1991, 43-54.

Turvey, Calum Greig and Alfons Weeresink, "The Demand for Agricultural Loans and the Lender-Borrower Relationship," Paper presented at NC-207 Agricultural Finance Conference, Chicago, 1993.

U.S. Department of Agriculture, Economic Research Service, *Agricultural Finance Outlook and Situation Report*, Washington, D.C.: U.S. Department of Agriculture, 1993.

_____, Economic Research Service, *Agricultural Income and Finance Report*, Washington, D.C.: U.S. Department of Agriculture, 1993 and 1995.

U.S. Department of Agriculture, NC-207 Regional Research Committee, "Regulatory, Efficiency, and Management Issues Affecting Rural Financial Markets," *NC-207 Project Description*, Washington, D.C.: U.S. Department of Agriculture, 1991.

Vickers, Douglas, *The Theory of the Firm: Production, Capital and Finance*, New York: McGraw-Hill, Inc., 1974.

Vijverberg, Wim P. M., "Labor Market Performance As a Determinant of Migration," *Economica*, 60, 1993, 143-60.

_____, "Dual Selection Criteria with Multiple Alternatives: Migration, Work Status, and Wages," *International Economic Review*, 36, 1995, 159-85.

Walraven, Nicholas, "Structural Change for Farm Borrowers in the 1980s," In *Financing Agriculture in the 1990s: Structural Change and Public Policy*, Washington, D.C.: Board of Governors of the Federal Reserve System, 1991, 7-17.

Wilson, Paul N. and David L. Barkley, "Commercial Bank Market Shares: Structural Factors Influencing Their Decline in the Agricultural Sector," *Agricultural Finance Review*, 48, 1988, 49-59.

APPENDIX A.

DETAILED DATA

Table A.1. Total farm debt outstanding, 1976-94 (million dollars)

Year	Real Estate	Non-real Estate	Total
1976	50,495	46,504	96,999
1978	66,707	65,339	132,046
1979	79,703	75,561	155,264
1980	89,692	80,968	170,660
1981	98,788	90,481	189,269
1982	101,809	102,200	204,009
1983	103,182	98,464	201,646
1984	106,697	95,519	202,216
1985	100,077	95,121	195,198
1986	90,408	85,753	176,161
1987	82,398	77,132	159,530
1988	77,634	70,636	148,270
1989	76,351	67,105	143,456
1990	74,138	67,606	141,744
1991	74,597	67,853	142,450
1992	75,639	68,402	144,041
1993	76,015	69,339	145,354
1994	77,236	74,819	152,055

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Table A.2. Real estate farm debt, by type of lender, 1976-94, (million dollars)

Year	CB	FCS	CFSA	LIC	I&O	CCC	TOTAL
1976	6,075	16,881	3,311	6,826	17,258	144	50,495
1997	6,994	19,640	3,613	8,150	19,556	492	58,445
1978	7,717	22,686	3,746	9,698	21,712	1,148	66707
1979	7,798	27,322	6,254	11,278	25,660	1,391	79,703
1980	7,765	33,225	7,435	11,998	27,813	1,456	89,692
1981	7,584	40,298	8,096	12,150	29,318	1,342	98,788
1982	7,568	43,661	8,298	11,829	29,326	1,127	101,809
1983	8,347	44,318	8,573	11,668	29,388	888	103,182
1984	9,626	46,596	9,523	11,891	28,438	623	106,697
1985	10,732	42,169	9,821	11,273	25,775	307	100,077
1986	11,942	35,593	9,713	10,377	22,660	123	90,408
1987	13,541	30,646	9,430	9,355	19,380	46	82,398
1988	14,397	28,372	8,953	9,018	16,873	21	77,634
1989	15,551	26,674	9,130	9,045	15,939	12	76,351
1990	16,158	25,719	7,576	9,631	15,047	7	74,138
1991	17,315	25,160	7,001	9,494	15,623	4	74,597
1992	18,659	25,271	6,361	8,718	16,628	2	7,563
1993	19,539	25,007	5,831	8,521	17,116	1	76,015
1994	21,038	24,627	5,391	9,010	17,170	0	77,236

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, LIC: Life Insurance Companies,
I&O: Individuals and Others, and CCC: Commodity Credit Corporation.

Table A.3. Market shares of real estate farm credit market, by type of lender, 1976-94

Year	CB	FCS	CFSA	LIC	I&O	CCC	TOTAL
				Percent			
1976	12.03	33.43	6.56	13.52	34.18	0.29	100.00
1977	11.97	33.60	6.18	13.94	33.46	0.84	100.00
1978	11.57	34.01	5.62	14.54	32.55	1.72	100.00
1979	9.78	34.28	7.85	14.15	32.19	1.75	100.00
1980	8.66	37.04	8.29	13.38	31.01	1.62	100.00
1981	7.68	40.79	8.20	12.30	29.68	1.36	100.00
1982	7.43	42.89	8.15	11.62	28.80	1.11	100.00
1983	8.09	42.95	8.31	11.31	28.48	0.86	100.00
1984	9.02	43.67	8.93	11.14	26.65	0.58	100.00
1985	10.72	42.14	9.81	11.26	25.76	0.31	100.00
1986	13.21	39.37	10.74	11.48	25.06	0.14	100.00
1987	16.43	37.19	11.44	11.35	23.52	0.06	100.00
1988	18.54	36.55	11.53	11.62	21.73	0.03	100.00
1989	20.37	34.94	11.96	11.85	20.88	0.02	100.00
1990	21.79	34.69	10.22	12.99	20.30	0.01	100.00
1991	23.21	33.73	9.39	12.73	20.94	0.01	100.00
1992	24.67	33.41	8.41	11.53	21.98	0.00	100.00
1993	25.70	32.90	7.67	11.21	22.52	0.00	100.00
1994	27.20	31.90	7.10	11.70	22.20	0.00	100.00

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, LIC: Life Insurance Companies,
I&O: Individuals and Others, and CCC: Commodity Credit Corporation.

Table A.4. Non-real estate farm debt, by type of lender, 1976-94 (million dollars)

Year	CB	FCS	CFSA	I&O	CCC	TOTAL	TOT+CCC
1976	22,002	12,127	1,652	9,787	936	45,568	46,504
1977	24,295	13,352	2,764	11,999	4,146	52,410	56,556
1978	26,718	14,878	5,086	14,011	4,646	60,693	65,339
1979	29,327	18,054	8,188	16,278	3,714	71,847	75,561
1980	29,986	19,750	10,029	17,367	3,836	77,132	80,968
1981	31,215	21,268	12,706	18,404	6,888	83,593	90,481
1982	34,322	20,558	12,977	19,139	15,204	86,996	102,200
1983	37,075	19,392	12,855	18,566	10,576	87,888	98,464
1984	37,619	18,092	13,740	17,640	8,428	87,091	95,519
1985	33,738	14,001	14,714	15,070	17,598	77,523	95,121
1986	29,678	10,317	14,425	12,143	19,190	66,563	85,753
1987	27,589	9,384	14,123	10,916	15,120	62,012	77,132
1988	28,309	8,766	12,899	11,760	8,902	61,734	70,636
1989	29,243	9,544	10,843	12,256	5,225	61,880	67,105
1990	31,267	9,848	9,374	12,740	4,377	63,229	67,606
1991	32,854	10,222	8,213	12,985	3,579	64,274	67,853
1992	32,912	10,346	7,143	13,230	4,771	63,631	68,402
1993	34,200	10,549	6,380	14,210	4,000	65,339	69,339
1994	38,237	11,712	5,680	15,190	4,000	70,819	74,819

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, I&O: Individuals and Others, and
CCC: Commodity Credit Corporation.

Table A.5. Market shares of non-real estate farm credit market, by type of lender, 1976-94

Year	CB	FCS	CFSA	I&O	CCC	TOTAL
			Percent			
1976	47.31	26.08	3.55	21.05	2.01	100.00
1977	42.96	23.61	4.89	21.22	7.33	100.00
1978	40.89	22.77	7.78	21.44	7.11	100.00
1979	38.81	23.89	10.84	21.54	4.92	100.00
1980	37.03	24.39	12.39	21.45	4.74	100.00
1981	34.50	23.51	14.04	20.34	7.61	100.00
1982	33.58	20.12	12.70	18.73	14.88	100.00
1983	37.65	19.69	13.06	18.86	10.74	100.00
1984	39.38	18.94	14.38	18.47	8.82	100.00
1985	35.47	14.72	15.47	15.84	18.50	100.00
1986	34.61	12.03	16.82	14.16	22.38	100.00
1987	35.77	12.17	18.31	14.15	19.60	100.00
1988	40.08	12.41	18.26	16.65	12.60	100.00
1989	43.58	14.22	16.16	18.25	7.79	100.00
1990	46.25	14.57	13.87	18.84	6.47	100.00
1991	48.42	15.06	12.10	19.14	5.27	100.00
1992	48.12	15.13	10.44	19.34	6.97	100.00
1993	49.32	15.21	9.20	20.49	5.77	100.00
1994	51.10	15.65	7.59	20.30	5.34	100.00

Source: U.S. Department of Agriculture, *Agricultural Income and Finance Report*, 1995.

Note: CB: Commercial Banks, FCS: Farm Credit System,
CFSA: Consolidated Farm Service Agency, I&O: Individuals and Others, and
CCC: Commodity Credit Corporation.

APPENDIX. B

SURVEY INSTRUMENT

1993 Farm Finance Survey

Information About You and Your Farm

1. In what county is most of your farming operation located? Q1
2. What is your age? Q2
3. How many dependents are you supporting (including yourself)? Q3
4. How many of these dependents are under age 18? Q4
5. Please enter the number that corresponds with the highest level of education that you and your spouse have completed.

   Wife: 1. high school 2. comm. college 3. college 4. post graduate Q5W

   Husband: 1. high school 2. comm. college 3. college 4. post graduate Q5H
6. How many years have you been farming? Q6
7. During the 1992 crop year, how many acres did you:

   a. Own Q7A
   b. Rent from others Q7B
   c. Rent to others Q7C
8. How do you describe your farming operation? (Please check one)

   a. Family or individual operation (do not include partnership and corporation) Q8A

   b. Partnership operation (include family partnerships) Q8B

   c. Corporation Q8C
9. Number of households or families involved in the farming operation Q9
10. Approximately what percent of your 1992 gross farm sales came from each of these sources?

    a. Crops Q10A %

    b. Beef Q10B %

    c. Pork Q10C %

    d. Dairy Q10D %

    e. Other farm enterprises Q10E %

    TOTAL = 100%

Credit Available for Expansion

Despite the availability of loanable funds at banks and farm credit institutions, some farmers have expressed concern about the willingness of these lenders to extend credit for expansion or modernization of farm businesses. In this section, we ask a few questions about the availability of credit for expansion of your farm business. Expansion includes new purchases of land, facilities and intermediate assets such as machinery or breeding stock.

11. Over the past two years, since January 1991, have you ever requested financing from a credit institution to expand your farm business?

1. Yes _____
2. No _____ (skip to 15) Q11

12. Was your farm business expansion request? (check one)

1. Completely approved _____
2. Partially approved _____ Q12
3. Was not approved _____ (skip to 14)

13. If your financing request was approved (completely or partially), please indicate the total amount borrowed and the average terms of your loan(s).

Use of Borrowed Funds	Amount Borrowed Since Jan. 1991 ($) (MNT)	Average Interest Rate (%) (RT)	Average Length of Loan (years) (YR)
Machinery, equipment (EQ)	Q13EQMNT	Q13EQRT	Q13EQYR
Breeding livestock (BR)	Q13BRMNT	Q13BRRT	Q13BRYR
Livestock facilities (LV)	Q13LVMNT	Q13LVRT	Q13LVYR
Other agricultural buildings (AG)	Q13AGMNT	Q13AGRT	Q13AGYR
Land (LN)	Q13LNMNT	Q13LNRT	Q13LNYR
Other (OT)	Q13OTMNT	Q13OTRT	Q13OTYR

14. If your loan for the expansion was not approved, check all reasons that apply.

a. Income from expansion was too variable Q14A
b. Insufficient documentation (budget or cash flow) Q14B
c. Previous loss experience Q14C
d. Insufficient cash flow Q14D
e. Insufficient collateral Q14E
f. Current debt levels were too high Q14F
g. Not a profitable expansion Q14G
h. Lack of experience with this enterprise Q14H
i. Loan was wrong purpose for this lender Q14I
j. Other (please indicate) _____ Q14J

15. Has inadequate financing limited the profitability or growth of your farm business?

1. Yes _____ Q 15
2. No _____

16. Would you be willing to take on additional debt for expansion if your lender offered to make credit available?

1. Yes _____ Q 16
2. No _____

17. Please indicate the reasons why you have chosen to limit borrowing levels. (check all that apply)

a. Interest rates are too high Q 17 A

b. I want to maintain cash reserves Q 17 B

c. I want to maintain a credit reserve Q 17 C

d. Profit margins are insufficient Q 17 D

e. My lender is unwilling to offer additional credit Q 17 E

g. Other (Explain) Q 17 G

Risk Management

18. Which risk management strategies do you use? Indicate the frequency with which you use these tools (please circle)

		Frequency of Use				
		Never	Seldom	Half of Time	Most of Time	Always
Q 18 A	a. Multiple peril crop insurance	1	2	3	4	5
Q 18 B	b. Hail insurance	1	2	3	4	5
Q 18 C	c. Hedging	1	2	3	4	5
Q 18 D	d. Forward contracting	1	2	3	4	5
Q 18 E	e. Commodity options	1	2	3	4	5
Q 18 F	f. Crop share leases	1	2	3	4	5
Q 18 G	g. Participate in government programs	1	2	3	4	5

19. Please describe your crop production and insurance program for corn and soybeans produced in 1992.

Crop	Planted (acres) (PL)	Insured (MU) Multiple peril (acres)	Insured (HL) Crop-Hail (acres)
Corn (CRN)	Q19CRNPL	Q19CRNMU	Q19CRNHL
Soybeans (SOY)	Q19SOYPL	Q19SOYMU	Q19SOYHL

20. Please describe your typical multiple peril crop insurance (MPCI) program

Crop	Average APH* Yield (Y) bu./ac.	Coverage level (L) (35,50,65,75%)	Elected Price (P) ($/bu.)	Premium ($/ac.)(PM)
Corn (CRN)	Q20CRNY	Q20CRNL	Q20CRNP	Q20CRNPM
Soybeans (SOY)	Q20SOYY	Q20SOYL	Q20SOYP	Q20SOYPM

* APH is actual production history

Merchant and Dealer Credit

Some farmers are turning to institutions other than banks or the Farm Credit System for non-real estate financing. In this section we ask a few questions about your use of nontraditional credit suppliers such as your local coop, a farm supply firm, an equipment manufacturer or a machinery dealer.

21. Since January 1, 1992 have you received non-real estate credit from a commercial source other than a bank or the Farm Credit System?

1. Yes _____
2. No _____ (skip to 24) Q21

If you answered yes, please complete the following:

Use of Credit	Amount Borrowed $ (MNT)	Loan Term (months) (MO)	Interest Rate % (RT)
Seed, fertilizer (SF)	Q21SFMNT	Q21SFMO	Q21SFRT
Feed (FD)	Q21FDMNT	Q21FDMO	Q21FDRT
Feeder livestock (FL)	Q21FLMNT	Q21FLMO	Q21FLRT
Machinery, equipment (ME)	Q21MEMNT	Q21MEMO	Q21MERT
Grain storage (GS)	Q21GSMNT	Q21GSMO	Q21GSRT
Livestock facilities (LF)	Q21LFMNT	Q21LFMO	Q21LFRT
Other (OT)	Q21OTMNT	Q21OTMO	Q21OTRT

22. Please indicate the importance of the following reasons for using these "nontraditional" credit suppliers. Rate each item on the five-point scale with a "1" being not important and "5" being very important.

		Not Important				Very Important
Q22A	a. Easy to obtain credit (limited paperwork, quick approval)	1	2	3	4	5
Q22B	b. Competitive interest rates	1	2	3	4	5
Q22C	c. Can't obtain credit elsewhere	1	2	3	4	5
Q22D	d. Loan size restricted by bank's legal lending limits	1	2	3	4	5
Q22E	e. Other _____	1	2	3	4	5

23. Which nontraditional credit suppliers did you use during this period? (check all that apply)

Q23LOC - Local coop _____
Q23REG - Regional coop _____
Q23PRI - Private farm supply firm _____
Q23MAC - Machinery dealer _____
Q23LIV - Livestock contracting firm (Q23LIV) _____
Q23OTH - Other: _____

Farm Income And Balance Sheet

24. From your 1992 tax records (Form 1040, 1040F, 1040E, and Form 4797) or your farm account book, please list the following information: Round to the nearest whole dollar. If you have a partnership or a family farm corporation, please provide information for the entire business (the consolidated statement).

1040 Form

Q24A a. Total income, (line 23) _____
Q24B b. Wages and salaries, (line 7) _____
Q24C c. Interest and dividends, (line 8a + 8b + 9) _____
Q24D d. Capital gains or losses (lines 13 + 14 + 15) _____

1040F Form

Q24E e. Gross income, (line 11) _____
Q24F f. Interest expense, (Lines 23a + 23b) _____
Q24G g. Depreciation (line 16) _____
Q24H h. Total expenses, (line 35) _____

1040E Form

Q24I i. Net cash and share rental income received from farm property _____

4797 Form

Q24J j. Gain from sales of farm property excluding land (Parts I, II and III) _____

25. What was the approximate market value of farm and financial assets you have owned the past two years? (please use financial statements if available) Round to the nearest whole dollar.

	Jan. 1992	Jan. 1993
a. Cash in checking, savings accounts	Q25A92	Q25A93
b. Financial investments (CDs, mutual funds)	Q25B92	Q25B93
c. Crops and livestock for sale (including CCC crops under loan)	Q25C92	Q25C93
d. Machinery, equipment, breeding stock	Q25D92	Q25D93
e. Land and buildings	Q25E92	Q25E93
f. Total assets	Q25F92	Q25F93

26. Please list your outstanding loan balances for farm real estate and farm non-real estate debt by type of lender on January 1, 1992 and 1993.

	Non-Real Estate Debt		Real Estate Debt	
	(N92) Jan. 1992	(N93) Jan. 1993	(R92) Jan. 1992	(R93) Jan. 1993
Bank (BK)	Q26BKN92	Q26BKN93	Q26BKR92	Q26BKR93
Farm Credit System (CS)	Q26CSN92	Q26CSN93	Q26CSR92	Q26CSR93
FmHA (FH)	Q26FHN92	Q26FHN93	Q26FHR92	Q26FHR93
Insurance Company IC	Q26ICN92	Q26ICN93	Q26ICR92	Q26ICR93
Individual (IN)	Q26INN92	Q26INN93	Q26INR92	Q26INR93
Merchant or dealer (MR)	Q26MRN92	Q26MRN93	Q26MRR92	Q26MRR93
Other loans (incl. CCC) (OL)	Q26OLN92	Q26OLN93	Q26OLR92	Q26OLR93
Total debt (TD)	Q26TDN92	Q26TDN93	Q26TDR92	Q26TDR93

Comments: _____

_____

_____

Note: If you have a question that requires an answer from the ISU Economics Department, please complete the following:

I authorize Iowa Agricultural Statistics to forward my name and address to Dr. Robert Jolly, ISU, Economics Department, for response to my questions.

Name: _____

Address: _____ Iowa _____ Date _____
(Town) (Zip)