EMPIRICIAL STUDIES ON LENDING VOLUME DECISIOINS, THE NUMBER OF
LENDING APPROVALS, AND LENDING RATES ATTITUDES: ESTIMATION BASED
ON HOUSEHOLD DATA FROM RURAL SHANDONG, CHINA

Dissertation
to obtain the Ph. D. degree
in the International Ph. D. Program for Agricultural Sciences in Goettingen (IPAG)
at the Faculty of Agricultural Sciences,
Georg-August-University Göttingen, Germany

presented by

TAO LI.

born in Yangling, Shaanxi Province, P.R.China

Göttingen, December 2012

D7

ABSTRACT

EMPRICIAL STUDIES ON LENDING VOLUME DECISOINS, THE NUMBER OF LENDING APPROVALS, AND LENDING RATES ATTITUDES: ESTIMATION BASED ON HOUSEHOLD DATA FROM RURAL SHANDONG, CHINA

By

Tao LI

This study uses household level data collected in Shandong Province of China to study rural formal financial institutions' lending volume decisions, the number of lending approvals, and respondents' attitude towards interest rates on formal loan in China's rural setting. The main body of the dissertation consists of three separate chapters.

The first chapter of the main body in the dissertation examines how rural households' characteristics affect one important dimension of lending decision-making practices of financial institutions. This is the decision of how much to lend to a borrower (the volume decision). This paper relaxes the restrictive joint decision assumptions of the Tobit model and consider the volume decision of the loans given by financial institutions conditional on, rather than jointly with, the decision whether to lend to a borrower in the first place. This paper estimates this model using a two-step econometric method and field survey data from the province of Shandong in China. Findings show that households' characteristics which affect loan approval differ from those which affect decision regarding loan volume. These findings thus broaden and deepen the extant studies on formal lending decisions in rural settings.

The second chapter of the main body in the dissertation attempts to identify significant household characteristics that formal lender apply when they classify formal loan lending over a period of years, this study interprets all loan rejection(s) as a zero number and treats at least one time loan approval as a positive integral (≥ 1). Thus, binary outcomes are estimated related to lending numbers over a five-year period using a complementary log-log binomial model and field survey data from the province of Shandong, China. Findings imply that the Chinese government should strive to improve education in rural areas and protect land rights of all farm families with the aim of increasing farmers' chances for access to formal loans. These policy implications thus broaden and deepen the extant studies on formal lending

decisions in rural settings.

Finally, the third chapter of main body in the dissertation identifies the determinants which affect whether potential borrowers feel that interest rates on formal loans are too high by examining their attitudes towards interest rates on formal loans. The analysis is based on a sample of 290 respondents from rural Shandong in China; 22 percent of the respondents feel that interest rates on formal loans are too high. A corrective method for sample selectivity, which builds on the work of van de Ven and van Praag (1981), has been applied in probit analysis. Empirical analysis indicates that respondents' gender and main cash income source have important influences on their attitudes towards high interest rates recognition. Empirical analysis indicates that respondent's gender, main cash income source, and family's total asset value have important influences on their attitude towards high interest rates recognition on formal loan. Empirical findings imply that financial institutions should pay more attention on borrowers who is female and whose main cash income source is farm work, and the government should change the monopolization of RCCs by promoting better competition in rural financial market.

This Dissertation is dedicated to My Parents Youqun LI & Xihui TANG, who remained a source of Love, Support and Encouragement throughout!

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

RCCs   - Rural Credit Cooperatives

ABC   - Agricultural Bank of China

ADBC   - Agricultural Development Bank of China

RPS   - Rural Postal Savings

GDP   - Gross Domestic Product

RMB   - Renminbi (Chinese money, Yuan)

CBRC   - Chinese Banking Regulation Commission

PBOC   - People's Bank of China

PSBC   - Postal Savings Bank of China

AME   - Average Marginal Effect

LR   - Log Likelihood

MLE   - Maximum Likelihood Estimation

SD   - Standard Deviation

OBS   - Amounts of Observations

CHAPTER ONE

INTRODUCTION

Developing finance in rural areas of many developing countries has the potential to expand users' opportunities for "more efficient technology adoption and resource allocation" (World Bank, 2008). In China, a land that represents about a quarter of the global population, many people in rural areas also suffer from inadequate liquidity supplies or financial services. If rural residents lack access to formal credit, then their ability to actively participate in and benefit from the development process would be limited (Li et al., 2011).

As a response to China's current rural financing situation, it is necessary to understand formal financial institutions' lending decisions and lending numbers from specific perspectives, such as loan volume and the number of loan approvals. Also, it is necessary to identify and target those who feel that interest rates on formal loans are too high and discover how to set them up with proper financial services.

Against this background, the current study uses household level data collected in rural Shandong, China. The study has three broad objectives, each of which constitutes a core chapter topic. The first objective is to study lending volume decisions of formal financial institutions in rural Shandong, China with a view to understand the lending volume process, namely, whether lending volume decisions are made jointly with, or conditional on, lending approval decisions. The second objective is to investigate the number of lending approvals by formal financial institutions in rural Shandong, China with a view to identify significant household characteristics that formal lenders apply when they classify formal loan lending over a period of years. And third, the study explores rural residents' attitudes towards interest rates on formal loan (lending rates of formal loans), with the purpose of looking for those who feel that interest rates on formal loan are too high.

The Chapter Two indicates that households' characteristics which affect loan approval differ from those which affect decision regarding loan volume using a two-step econometric method. The Chapter Three implies that the Chinese government should strive to improve education in rural areas and protect land rights of all farm families with the aim of increasing

farmers' chances for access to formal loans using a complementary log-log binomial model. The Chapter Four shows that respondent's gender, main cash income source, and family's total asset value have important influences on their attitude towards high interest rates recognition on formal loans using a corrective method for sample selectivity.

These three core chapters related to studying formal loans, to some extent, complement each other. Lending volume decisions are comprised of deciding whether to lend in stage one, and the decision of how much to lend (i.e., volume) in stage two. Hence, studying the number of lending approvals is helpful to understand lending volume, namely, what are the factors affecting the decision of lending approval? Correspondingly, studying lending volume decisions is helpful to understand the importance of lending approval on the entire process. Studying lending rates also indirectly helps to understand why financial institutions give zero lending approval and zero lending volume to all rural farmers on the basis of their censoring work. This is possibly because high lending rates make lenders suspect the borrower's capability of punctual loan repayment. Correspondingly, the study of lending volume and the number of lending approvals indirectly shows that the lending rate is an important determinant on lending practice.

Note, however, that the data used in the study needs to be viewed and acknowledged in light of its limitations. First, all respondent rural household characteristics were gathered after the five-year period in which loans were granted, but the initial decision to approve the first loan was made on the basis of the rural households' characteristics at the beginning of the five-year period. Clearly, there is a potential endogeneity problem associated with explaining past loan on the basis of current characteristics. For example, a household's current asset situation is presumably a function of how many loans that household has received in the past, and the volumes of these loans. In other words, a household's assets will tend to be higher if a household has received a loan. Hence, a covariate *asset* used in the third chapter, is suspected of endogeneity, which could make the findings in this article biased and inconsistent.

Second, data limitations also limits the number of household characteristics that I can employ as covariates in my various estimation, and thus, some valuable findings might be omitted. There are many variables that were collected in the survey that I would like to use because they are clearly related to loans, such as the number of laborers for farm production

and the number of laborers for non-farm production in survey period, but that I cannot use because of the endogeneity problem.

References:

World Bank (2008). *World Development Report 2008: Agriculture for Development.* The World Bank.   http://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf

Li, X., C. Gan, B. Hu (2011). "Accessibility to Microcredit by Chinese Rural Households". *Journal of Asian Economics*. 22(3):235-246.

CHAPTER TWO

HOW DO RURAL HOUSEHOLD CHARACTERISTICS AFFECT FORMAL LOAN LENDING DECISIONS? TWO-STEP ECONOMETRIC ESTIMATION BASED ON HOUSEHOLD DATA FROM RURAL CHINA

2.1. Introduction

Formal loans from financial institutions are an important element which serve agricultural production and improve the living standards of rural households in extensive rural areas of developing countries. In China, a land which has been undergoing a series of reforms of all segments and areas since 1979, enormous changes have taken place in the rural financial market. In particular, differences in regional economic structures have led to changes in rural finance demand in different regions of the country (Xie et al., 2005). For example, in Shandong Province, which is one of the developed coastal areas of China, rural households' demand for formal loans for nonfarm activities is soaring. Many rural households, which are mainly smallholders, not only need liquidity for seasonal production and current consumption but also to finance non-farm investments, construction and ceremonial social events (e.g., weddings). To meet these different kinds of capital demand for both farm and nonfarm needs, China's rural financial institutions, which are managed by the People's Bank of China (Central Bank of China), channel large volumes of financial capital to the country's agricultural sector and rural areas as part of a comprehensive policy aimed at boosting the incomes and welfares of rural households. Since formal lending in rural areas has changed over the last several decades from a demand perspective, studies on formal loan lending practices deserved more attention in China and other developing countries.

Previous literature mainly sheds light on agricultural lending because most formal loans were granted for agricultural production in rural areas[1]. Past research has mainly focused on

---

[1] In fact, loans from formal financial institutions for farm and non-farm purposes in rural areas are often subsumed under "agricultural lending" in China. I discuss this in more detail later. To emphasize the source of loans, I use "formal loan" instead of "agricultural lending" in this article.

five aspects of agricultural lending. The first aspect addresses the agricultural lending decision process. Stover et al. (1985), Featherstone et al. (2007) and Olagunju (2010) examine the agricultural loan decision process and analyze the factors from the perspective of the individual loan officer or financial institution. The second aspect deals with the testing of credit scoring or risk models of the lending decision. Hardy and Weed (1980), Barry et al. (1981), Thomas (2000), Zech and Pederson (2004), and Katchova and Barry (2005) examine such models which are used to estimate loan requirements and potential risks for lenders and help them decide whether or not to grant a loan to applicants. The third aspect addresses how internal and external characteristics of financial institutions themselves affect agricultural lending, Studies such as Mazzocco (1991), Bard et al. (2000), and Ahrendsen (2003) are representative of this branch of the literature. The fourth aspect explores the relationship between the informal and formal lending sectors in developing countries. For example, Turvey and Kong (2010), Guirkinger (2006), and Ghate (1992) examine the relationship between informal and formal lending in China, Peru, and Asian countries, respectively. The fifth aspect models the role of the informal and formal credit sectors (lenders) in developing countries. Boucher and Guirkinger (2007) and Boucher et al. (2008) show that asymmetric information between lenders and borrowers can oblige formal lenders to rely on collateral to solve the moral hazard and adverse selection problems inherent in credit transactions.

While the literature provides many insights into formal lending, one important aspect of lending decision-making practices has received very little attention to date: Is the lending volume decision conditional on or taken jointly with the lending approval decision? In this article, I attempt to answer the question so as to broaden and deepen the previous research on the lending decisions.

The lending process generally consist of the following stages: 1) Examination and approval of a loan application. At this stage the lender carefully examines a loan applicant's qualification so as to determine whether to lend to this applicant or not. 2) Loan contracting and distribution. At this stage the lender determines the volume of an approved loan and distributes it to the applicant. Accordingly, the lending decisions are made up of the decision of whether to lend (i.e., the approval decision in stage 1) and the decision of how much to lend (i.e., the volume decision in stage 2).

These two lending decisions are modeled jointly in most previous analyses using single equation methods, such as the Tobit model, based on one-step empirical estimation (see, for example, Featherstone et al. (2007) and Olagunju (2010)). This assumes that the lender decides whether and how much to lend simultaneously, and that both decisions are influenced by the same factors and in the same direction (Lin and Schmidt 1984). In other words, a covariate that increases the probability of loan approval also increases the loan volume.

This hypothesis may be restrictive. For example, women are often viewed as more risk-averse than men in regards to economic activities (see, for example, Fletschner and Kenney, 2011; Gockel, 2009; etc.). For this reason, the desired loan volume of female-headed households is possibly less than male-headed. In practice, each lending institution has its own benchmark yield, which is the lowest profit from lending and is determined by the loan's interest proceeds and lending costs. Under the premise of securing loan repayment capacity, the loan's interest proceeds depend on the volume of loan, the level of interest rate, and the terms of the loan. Obviously, if the volume of a loan that has been applied for is too small, it might be difficult for the financial institution to reach the benchmark yield and it might therefore decide not to approve the loan. Therefore, if faced with loan applications from both female-headed and male-headed households with otherwise identical repayment capacities, interest rates, loan terms, and lending costs, but with different desired loan volumes, a lender will be more likely to lend to a male-headed household. In other words, all other things being equal, it may be more difficult for female-headed households to obtain loan approval from a financial institution even if their creditworthiness is good. However, if a loan application by a female-headed household is approved, the lending institution might be more likely to decide to provide the loan volume that she has applied for than in the case of a male-headed household. This is because empirical research has shown that women play a more active role regarding loan usages, which has a positive effect on loan repayment (see, for example, Pitt and Khandker, 1998; D'Espallier et al., 2011; etc.). Hence, it is possible that female-headed households will be less likely to receive loans, but more likely to borrow larger volumes if their loan applications are approved. If true, the covariate 'female-headed household' (i.e., the gender of household head) will affect loan approval and loan volume in different directions.

My contribution to the literature, therefore, is that I model approval and volume

decisions separately. I test the null hypothesis of joint versus independent approval and volume decisions to determine which hypothesis is suitable for my dataset and econometric analysis.

To sum up, the primary goal of this article is to propose a two-step econometric model to model how households' characteristics affect lenders' decisions to approve loan applications, and determine the volumes of these loans. I test this model using field survey data from the Province of Shandong in China. A two-step econometric model captures the characteristics which influence lenders' decisions to approve loans to rural households using a binary sub-model and, conditional on the loan approval, the characteristics that influence their decisions on loan volume using a conditional truncated sub-model.

The rest of this paper is structured as follows. In the following section 2 I briefly introduce some background information of formal loans in rural China. In section 3 I develop a theoretical framework, which builds on the work of Katchova and Miranda (2004), to illustrate decisions of formal loan lending. In section 4 I present and estimate the one-step and the proposed two-step models for the loan approval and volume decisions, and compare these two models. In section 5 I describe the data. I present and discuss the results in section 6, and conclude in section 7.

2.2. Background

2.2.1. A Brief Introduction to China's Agricultural Lending Development

China's formal financial system in rural areas can trace its origins back to the 1950s[2]. At that time, Rural Credit Cooperatives (RCCs), located in nearly every township (of which there were over 30,000), were set up by the government to serve the credit needs of producers. In the centrally planned economic era (before 1978), these RCCs were "designed to channel

---

[2] Officially, rural financial institutions in China do not include informal financial institutions, as these institutions are neither regulated nor supervised by the People's Bank of China (PBC, Central Bank of China) and the deposits with most of these institutions are not protected by the state (Shen and Cheng, 2004). Therefore, in this paper, rural financial institutions refer to formal rural financial institutions only. I do not consider those semi-formal rural financial institutions, such as credit-only microcredit companies, which are purely private financial institutions that fall in between formal and informal financial institutions.

necessary credit to the agricultural sector so that it could provide cheaper grain and other raw inputs to support the development of the capital-intensive industrial sector" (Shen and Cheng, 2004).

In 1984, accompanied by economic reforms initiated in the late 1970s, the Chinese government started to reform its banking system. However, the reform process was very slow, especially as concerns the rural financial system. A comprehensive financial sector was not established until the mid-1990s. Then the formal financial sector in rural China was made up of the Agricultural Bank of China (ABC), the ADBC, RCCs and Rural Postal Savings (RPS), where ABC lent to agricultural enterprises, rural cooperatives, and village organizations, but usually not to individual rural households, and RPS were the only depository financial institutions.

Moreover, during the mid-1990s, two main changes in agricultural lending were observed (Shen and Rozelle, 2004). First, banks began to depend more on collateral to secure loans. Second, there was a sharp shift in the lending preferences of banks in favor of private firms including almost all rural enterprises and many privatized small and medium state-owned enterprises. During this period, formal institutions (RCCs and banks) were reluctant to lend to small farmers due to the high administrative costs and risks of such loans and a low ceiling on interest rates set by the central bank (Cheng and Xu, 2003).

Beginning in 2001, China initiated "a campaign to increase RCC lending to small farmers, and lending accelerated further following the issuance of a "Number 1 Document" in 2004 stating the government's intent to raise rural incomes and boost grain production" (Gale and Collender, 2006). Currently, RCCs "play an overriding role in the rural financial system in China" (Guo and Jia, 2009), and "more than 80 percent of formal agricultural loans in China are made by the country's 30,000-plus Rural Credit Cooperatives (RCCs)"(Gale and Collender, 2006). In addition, loans which are classified as 'agricultural' are increasingly used for nonagricultural purposes such as house construction, school fees, health care costs or nonfarm business expenses, etc. According to the People's Bank of Chinas' guidelines, micro loans may be used for agricultural production, purchase of small farming machinery; services before, during or after agricultural production; or housing, medical service, education and consumption (Peoples Bank of China, 2001).

To sum up, in recent decades the Chinese financial system has built up a plentiful supply of capital for agricultural lending. Chinese policymakers are increasingly channeling lending to smallholder farmers and agribusiness.

2.2.2. Trends in Agricultural Lending in Recent Decades

Figures 1 and 2 below respectively show the balance of agricultural loans for the whole country and the Shandong Province of China from 1979 to 2009.

As shown in the Figures, the balance of agricultural loans in the whole country and the Province of Shandong increased very slowly and gently during the first 16 years from 1979-1995. The relative shares of agricultural loans as a proportion of total loans fluctuated within a relatively broad brand and displays a rough downtrend as agriculture's share of total GDP declined. However, the balance of agricultural loans for the whole country and the Province of Shandong increased during the 1996-2009 period. The agricultural loan balance of the whole country and the Shandong Province respectively reached the equivalent of 21,623 billion Yuan (RMB)[3] and 296 billion Yuan in 2009, up 19,704 billion Yuan and 271 billion Yuan since 1996, respectively. In 2009, the agricultural share of all loans for the entire country and the Province of Shandong respectively was 5% and 11%, a 2 and 4 percentage-point increase from 1996, respectively. Since Shandong Province is one of China's most prosperous agricultural regions, it is not unusual that the agricultural share of all loans is higher than the average level of the whole country since the mid-1990s, when the reform of the banking system started to commercialize and modernize (see Figures 1 and 2). Hence, Shandong province provides an interesting setting for studying formal loan lending practices in rural China.

---

[3] 1 Yuan is roughly equivalent to 0.15 $ USD.
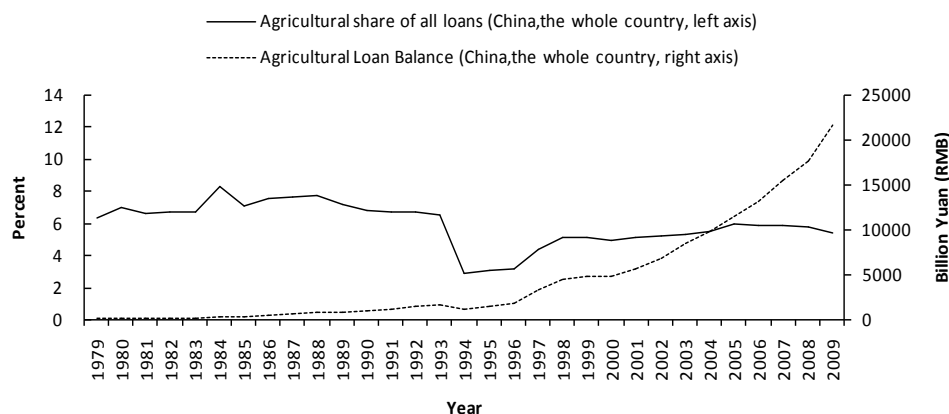
Fig.1. Agricultural Loan Balance, the Whole Country of China, Yearly, 1979-2009
Source: China Statistical Yearbook (Various Issues)
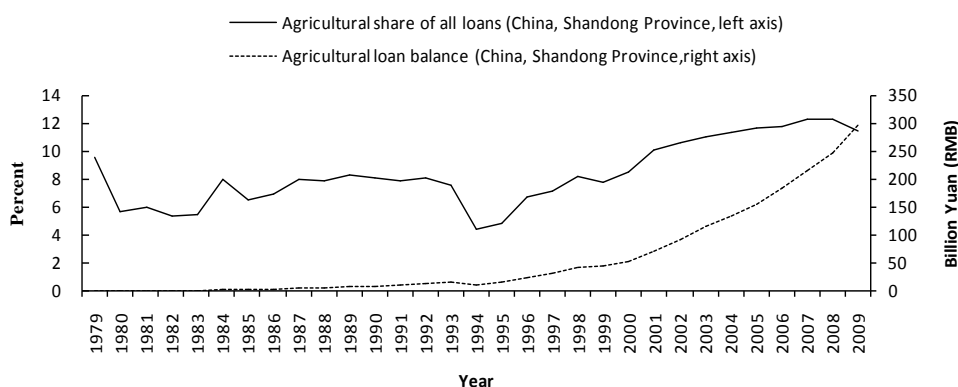
Fig.2. Agricultural Loan Balance, Shandong Province of China, Yearly,1979-2009
Source: Shandong Province Statistical Yearbook, China (Various Issues)

2.3. Theoretical Framework

Information and enforcement problems cause credit market imperfections and even the complete failure of these markets (Guirkinger and Boucher, 2008). Such loan constraints are especially likely to arise under the conditions prevailing in developing countries (see, for example, Conning and Udry, 2005). I consider three lending decisions for any loan application: full approval, part approval, and rejection. A household experiences full approval if its desired loan is approved in full by the lending institution. If its desired loan is completely refused, the household suffered from loan constraints. In between these two situations, I refer to partial approval if it's desired loan is partially approved.

In Figure 3 I assume that financial institutions employ an underlying indicator to judge

11

each formal loan applicant (rural household), and there is a distribution of these indicators across all applicants. I call this indicator the applicant's "liquidity condition", which is based on his or her qualitative and quantitative characteristics. The financial institutions have to measure their expected gains and losses by carefully assessing each applicant's liquidity condition. Above an upper liquidity condition threshold, the financial institution's expected utility from complete full loan approval exceeds that from partial loan approval or rejection. Below a lower liquidity condition threshold, rejection takes place. In between these thresholds, the financial institution's utility from partial loan approval exceeds that from either full approval or rejection.
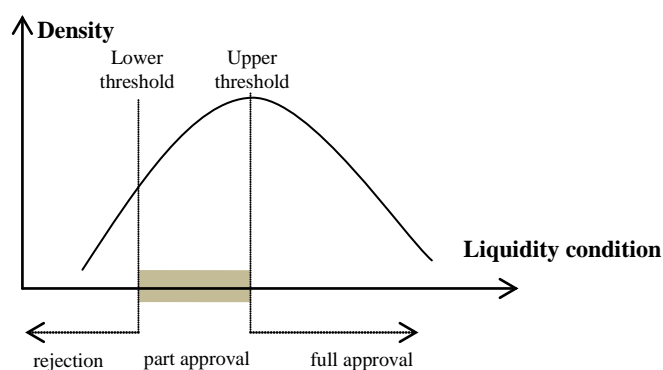
Fig.3. Decisions of Formal Loan Lending

I propose a two-step theoretical model of formal lending decisions which builds on Katchova and Miranda (2004). Consider a financial institution, indexed by i, that provides a formal loan to a rural household j. If the rural household submits one loan application, the financial institutions has to decide whether to approve this application, and how much of the desired loan to approve α_i.

In this article, I consider two estimation models: a conventional one-step model, which assumes that the loan approval and lending volume are decided simultaneously, and a two-step model, which assumes that the lending volume process is made conditional on the process of loan approval.

3.3.1. One-Step Model

Assume a financial institution i chooses α_i to maximize expected utility of profits for one lending decision:

$$\underset{\alpha_i \geq 0}{Max} \quad EU(\alpha_i R_i T_i - b_i^v - b_i^f) \qquad (1)$$

where α_i is the volume of granted loan, R_i is interest rate for the granted loan, T_i is the term of the granted loan, $\alpha_i R_i T_i$ are the total expected proceeds for the lending decision, b_i^v is the possible expenditure or loss for loan lending such as the costs of screening a loan application, b_i^f is the necessary cost for loan lending such as the salary of loan officers[4].

Maximization of expected financial institution utility yields expressions related to the loan applicant's (j) household characteristics, which can embody the potential ability of creating gains for using loans and guaranteeing loan repayment at a due date. Therefore, α_i is related to $\mathbf{x_j}$, a set of observable rural household's characteristics such as the education level of the household head, land size, number of laborers, etc. Formally, $\alpha_i = g_\alpha(\beta_\alpha' x_j, \varepsilon_{\alpha_i})$, where β_α' is a vector of parameters, and ε_{α_i} captures unmeasured factors related to formal loan lending (Katchova and Miranda, 2004).

In the one-step model, the financial institution's decision to lend or not is equivalent to a solution in which at least one of the lower bounds is binding: $\alpha_i = 0$. The approval decision is modeled jointly with the volume decision (α_i) in the sense that the same covariates ($\mathbf{x_j}$) and the same coefficients (β_α) affect both decisions (Katchova and Miranda, 2004).

---

[4] In practice, for the collateral which is used for a loan application, the market value of pledged asset P usually equals or exceeds the loan amount and its interest profits, i.e., $P \geq \alpha + \alpha RT$. However, for simplicity, I assume that $P = \alpha + \alpha RT$ so that function (1) is feasible. In addition, for parsimony, I omit the proceeds from the fees that all applicants must pay because such proceeds are usually very small.

3.3.2. Two-Step Model

In the two-step model, the volume decision is conditional on the loan approval decision. The financial institution first decides whether to approve a loan to applicant j, and if approval is chosen ($c_i = 1$), then the optimal volume in the lending practice (a_i) is chosen according to:

$$\underset{c_i=0,1}{Max} \ EU\left[(1-c_i)(-b_i^y - b_i^f) + c_i \underset{\alpha_i>0}{Max}(\alpha_i R_i T_i - b_i^y - b_i^f) \right] \tag{2}$$

In the two-step estimation model, $c_i = 0$ indicates loan rejection and is associated with the first term in the discrete maximization operation, and $c_i = 1$ indicates a lending approval decision and is associated with the second term in the discrete maximization operation. There is a trade-off between obtaining expected proceeds and covering the costs associated with the lending approval.

As in the one-step model, maximization of the expected utility of proceeds in (2) yields expressions that relate the lender's volume decision (α_i) to $\mathbf{x_j}$, a set of observable rural household's characteristics. However, maximization of expected utility of proceeds also yields expressions that relate the lender's approval decision (c_i) to a possibly different set of observable rural household's characteristics $\mathbf{z_j}$ in the two-step model. Formally, $c_i = h(\gamma' z_j, \varepsilon_{c_i})$, where γ is a vector of parameters and ε_{ci} represents unmeasured factors related to the decision of lending approval (Katchova and Miranda, 2004).

If the same covariates ($\mathbf{z_j}$ and $\mathbf{x_j}$) and the same coefficients ($\gamma \ and \ \beta_\alpha$) determine the loan decision (c_i), and the volume decisions (α_i), then the one-step and two-step models are identical. The two-step model allows the same covariate to affect lending approval and the volume decisions in different ways (via different coefficients) and different covariates to affect the two decisions (Katchova and Miranda, 2004).

2.4. Econometric Methods

Before addressing estimation and functional form issues I address the problem of data truncation due to a large percentage zero lending volumes (i.e., households whose applications are rejected). This truncation problem differs from the "sample selection—incidental truncation" problem that is usually corrected using Heckman's two-step procedure (Greene, 2000; Katchova and Miranda, 2004). Heckman's two-step model is not suitable here because the loan volumes for rural households whose applications are rejected are equal to zero rather than being unobserved (Lin and Schmidt, 1984).

Hence, following the theoretical framework, I outline the empirical models used to determine the households' characteristics which influence lenders' approval and volume decisions. The approval variable c_i is a discrete two-choice variable, the volume of granted loan α_i is a nonnegative variable. This leads to different econometric models for c_i and α_i. The loan approval decision c_i is modeled with a probit model. The granted loan volume decision α_i is modeled jointly with the approval decision using Tobit model. The granted loan volume decision is modeled conditional on the loan approval decision using a truncated regression.

I assume that the disturbances in the econometric models of the decision of lending approval, c_i and the lending volume α_i are independent. This assumption has been implicitly maintained in the literature when separate models are estimated with any two variables (c_i, α_i) as a dependent variable (Katchova and Miranda, 2004).

If a lender (formal financial institution) decides not to grant a loan to an applicant (rural household) ($c_i = 0$) then automatically $\alpha_i = 0$, whereas if a lender decides to grant a loan ($c_i = 1$) then $\alpha_i > 0$. Let Y_i equal α_i. For a lender with $c_i = 0$, the likelihood contribution is $P(c_i = 0)$, whereas for a lender with $c_i = 1$, the likelihood contribution is $P(c_i = 1) \cdot f(Y_i \mid c_i = 1) = P(c_i = 1) \cdot f(Y_i \mid Y_i > 0)$, where $P(\cdot)$ is the probability and $f(\cdot)$ is the

probability density function (Katchova and Miranda, 2004). Given the independence of α_i (conditional on $c_i = 1$), the joint density $f(Y_i \mid Y_i > 0)$ factors into $f(\alpha_i \mid \alpha_i > 0)$ (Katchova and Miranda, 2004).

2.4.1. Probit Model for the Loan Approval Decision

The discrete choice of whether to approve or to reject a loan application (c_i) can be estimated with a probit model or a logit model. Following Katchova and Miranda (2004), I employ the following probit model:

$$P(c_i = 1) = \Phi(\gamma' z_i) \qquad (3)$$

where $\Phi(\cdot)$ is the standard normal cumulative probability distribution (cdf), $\mathbf{z_i}$ is an $R \times 1$ vector of household's characteristics for rural household j, and γ is a vector of coefficients.

2.4.2. Tobit and Truncated Regression Models for the Lending Volume Decision

The discrete decision of whether to approve a loan and the continuous decision of the volume to lend is estimated using a Tobit model (see, for example, Featherstone et al. (2007)). The Tobit model assumes that a latent variable α_i^* is generated by:

$$\alpha_i^* = \beta_\alpha' x_i + \varepsilon_{\alpha_i} \qquad (4)$$

where $\mathbf{x_i}$ is an $S \times 1$ vector of rural households' characteristics for lender i, β_α is vector of coefficients, and ε_{α_i} are independently and normally distributed with mean zero and variance σ^2 (Katchova and Miranda, 2004). If α_i^* is negative, the observed volume of lending, α_i, is

zero. When α_i^* is positive, $\alpha_i = \alpha_i^*$.

The probability that the volume of lending is zero is:

$$P(\alpha_i = 0) = \Phi(-\frac{\beta_\alpha' x_i}{\sigma}) \qquad (5)$$

and the density for the positive values of α_i is:

$$f(\alpha_i \mid \alpha_i > 0) = \frac{f(\alpha_i)}{P(\alpha_i > 0)} = \frac{\frac{1}{\sigma}\phi(\frac{\alpha_i - \beta_\alpha' x_i}{\sigma})}{\Phi(\frac{\beta_\alpha' x_i}{\sigma})} \qquad (6)$$

where $\phi(\cdot)$ is the standard normal probability density function (pdf) (Katchova and Miranda, 2004). Equation (5) represents the lending approval decision, and is a valid probit model if considered separately from equation (6). Equation (6) represents a truncated regression for the positive values of the continuous loan volume decision ($\alpha_i > 0$). The Tobit model arises when the approval decision in equation (5) and the loan volume decision in equation (6) have the same variables $\mathbf{x_j}$ and the same parameter vector β_α (Katchova and Miranda, 2004). In the Tobit model, a variable that increases the probability of approval will also increase the mean of volume granted (Lin and Schmidt, 1984).

As shown in Katchova and Miranda (2004), the log-likelihood for the Tobit model consists of the probabilities for non-approval and a classical regression for the positive values of α_i:

$$InL = \sum_{\alpha_i = 0} In\Phi(-\frac{X_i\beta_\alpha'}{\sigma}) + \sum_{\alpha_i > 0} In\left[\frac{1}{\sigma}\phi\left(\frac{\alpha_i - X_i\beta_\alpha'}{\sigma}\right)\right] \qquad (7)$$

Cragg (1971) relaxed the assumption that the same covariates and the same parameter vector affect both the loan approval decision and the loan volume decision. Following Cragg, I

17

consider a hurdle model in which a lender makes a two-step decision. In the first step, a probit model represents a lender's choice of whether to approve a loan (c_i):

$$P(c_i = 0) = \Phi(-\gamma' z_i) \tag{8}$$

If this hurdle is crossed and $c_i = 1$, a truncated regression (equation (6)) describes the choice of how much loan to lend ($\alpha_i > 0$). The log-likelihood in Cragg's model is thus a sum of the log-likelihood of the probit model (the first two terms) and the log-likelihood of the truncated regression model (the second two terms) (Katchova and Miranda, 2004):

$$InL = \sum_{c_i = 0} In\Phi(-\gamma' z_i) + \sum_{\alpha_i > 0} \left\{ In\Phi(\gamma' z_i) + In[\frac{1}{\sigma} \phi(\frac{\alpha_i - \beta'_\alpha x_i}{\sigma}) - In\Phi[\frac{\beta'_\alpha x_i}{\sigma}]] \right\} \tag{9}$$

2.4.3. Choice of Econometric Models

A choice between the Tobit specification and Cragg alternative is a test of the restriction $\mathbf{z_j} = \mathbf{x_j}$ and $\gamma = \beta_\alpha / \sigma$ in equation (9) (Lin and Schmidt, 1984; Green, 2000; Katchova and Miranda, 2004). Given $\mathbf{z_j} = \mathbf{x_j}$ as the first condition, the second condition $\gamma = \beta_\alpha / \sigma$ is a testable restriction. Thus, testing the Tobit model against the more general Cragg model involves the following hypotheses:

$\mathbf{H_0}$: Tobit, with the likelihood function in equation (7)

$\mathbf{H_1}$: Cragg model (probit and a truncated regression estimated separately), with the likelihood function in equation (9).

Furthermore, the Tobit model can be tested against the Cragg model by estimating a probit, a truncated regression, and a Tobit model with the same covariates ($\mathbf{x_j}$), and by computing the following likelihood ratio statistic:

$$\lambda = 2(InL_{probit} + InL_{truncated\ regression} - InL_{Tobit}) \qquad (10)$$

where λ is chi-square distributed under the null hypothesis with degrees of freedom equal to the number of covariates including a constant (Green, 2000；Katchova and Miranda, 2004).

2.5. Data

The data used in this paper were collected in Shandong Province (China) in July 2010 by face-to-face interviews. 394 rural households were randomly selected from 5 villages in one town (Man Zhuang) and one county (Ning Yang). The survey collected detailed information on households' formal borrowing activities over the last 5 years (i.e., from July 2006 to July 2010) as well as households' basic characteristics.

During the survey, respondents identified whether their loan applications had been approved by financial institutions in the past five years, and the loan volume they was last granted. The survey information gathered also includes more general quantitative and qualitative rural households' characteristics which are considered important determinants of formal loan lending. Overall, 204 households were eliminated because they did not participate in my survey or did not apply for a formal loan during the past five years. This left 190 households that had applied for at least one formal loan. Of these, a further 22 households had to be removed since the information they provided was incomplete. Of the remaining 168 households that had applied for a formal loan in the past five years, 85 were approved by financial institutions to receive a loan.

Among the 85 households with approved loans, 60% applied for a farm loan, for example for commercial greenhouse vegetable production or purchasing a tractor, etc. The other 40% of these households applied for non-farm loans, such as for nonfarm business activities, medical care, children's education, house or car purchases, etc. This shows that formal loan lending in the rural areas of Shandong Province of China is not confined to agricultural lending. The average volume of the disbursed loan volume for the 85 households

is 32.18 thousands Yuan.

Since the period span related to the formal loan survey was five years, a loan for an individual respondent household might be disbursed by a financial institution to outside of the period studied. For the purpose of achieving accurate information, the survey collected current respondent household information within the survey period, namely, a retrospective survey related to respondent's historical household information was not conducted because many of those randomized respondents, especially when they are not household heads, rarely know the full households' information history. For the sake of developing the empirical analysis, however, it is thus very important to pick appropriate covariates from the collected information. A few of the covariates, which not only represent socioeconomic characteristics of rural households but also are exogenous, are hypothesized to be relevant in the loan approval and loan volume decisions. These include zero-one indicators for whether the household head is female, and has non-farm production skills. Also, in China, non-farm skill does not always refer to those professional skills that need professional training and study, some simple physical labor jobs, such as sanitation worker, are viewed as non-farm skill as well. Some respondents might say that the head of his or her household has no non-farm skill, the plausible reason is either that the household head is born with a physical disability or that the household head is too old for farm work (aged over 65 years old). Not many household heads in rural China absolutely did not have non-farm skill, of course. Therefore, these two zero-one indicators are appropriate for the study and are exogenous for the number of lending approvals analysis.

The average age of a household head over a period of years reflects that household's structure. Household structures was divided into four main types on the basis of age: (1) young household, defined as a household head's age between 18 and 35 years old; (2)middle-aged household, defined as a household head' age between 36 and 50 years old; (3)elderly household, defined as a household head's age between 51 and 65 years old; and (4)very elderly household, defined as a household head aged 66 years old or over. Hence, every responding household can be easily determined on the basis of the division of household structure for the empirical analysis.

In China, farmland is still owned and controlled by the state and leased to farmers.

Farmers can't sell it, and they can't use it for collateral on a loan. In 1997, rural households were allowed to sign a long-term lease of 30 years for the right to work a plot, which was allocated according to shares in village populations. Hence, it is reasonable to believe that the amount of farm land of every respondent household could not change from 2006 to 2010 due to undated signed leases in the survey area. Therefore, the covariate *land* is exogenous and introduced into the analysis.

The household head's education level was also considered exogenous because almost no household heads in rural China underwent education-change over the study period, hence, it can also be introduced into the empirical analysis. Additionally, the covariate *number*, which is total number of loan approval except the last one in the five-year period, is also used in the analysis. Overall, all dependent variables and covariates are listed and described in Table 1 below.

Table 1:

Descriptive statistics of dependent variables and covariates

Variables	Definition	Mean	Std.Dev.	Obs.
Dependent Variables				
Approval	Whether to approve to grant a loan to an applicant over the last five years	0.51	0.50	168
Volume	The loan volume they were last granted over the last five years in Yuan (thousands)	16.28	25.44	168
	Zero loan volume	0	0	83
	Positive loan volume	32.18	27.73	85
Covariates				
Gender	Whether the household head is female (female=1, male=0)	0.05	0.21	168
YongHH	1 if household head's age is between 18 and 35 years old; otherwise=0	0.08	0.27	168
MiddleHH	1 if household head's age is between 36 and 50 years old; otherwise=0	0.57	0.50	168
ElderHH	1 if household head's age is between 51 and 65 years old; otherwise=0	0.32	0.47	168
Education	Household head's education level in years	8.93	3.17	168
Nonfarmskill	Whether household head has non-farm skill (yes=1, non=0)	0.19	0.39	168
Land	Amount of farm land in Mu (1 Mu≈0.16 Acre)	3.05	3.59	168
Number	The total number of lending except the last one over the last five years	0.25	0.65	168

2.6. Results and Discussion

All of the alternative model specifications outlined above were estimated using maximum likelihood methods. Initially, considering that some rural households might apply and be granted a loan only once over the last five years, hence, the covariate *Number* is used on disbursed loan volume decision rather than lending approval decision analysis. Overall, the same set of covariates was used in all cases excepting the aforementioned exception.

The Tobit model is first tested against the more general Cragg specification of a separate probit model and a truncated regression model using the test statistic in equation (10). The likelihood ratio test statistics of 49.94 leads us to reject the Tobit model in favor of the Cragg model. Hence, the same household characteristics do not influence both the lending approval decision and the disbursed loan volume decision in the same way via the restricted coefficients in the Tobit model. I therefore focus on the signs and marginal effects of the covariates in the Cragg model in the following.

Results of the probit model for the loan approval decision, and the truncated regression and Tobit models for the loan volume decision, are given in Table 2. Both parameter estimates and average marginal effects (AMEs) are reported. In addition, the Cragg model can also be obtained with the *craggit* command in Stata, described in Burk (2009). The process of *craggit* command incorporates a probit model in the first tier and a truncated regression model in the second tier, hence, the empirical results are same with the result from the probit and truncated models. I report the values of "Wald chi-square", "Sigma", and "Log Likelihood" from *craggit* command, which indicates Cragg's model fits my data as a whole, for empirical results' complement at the row bottom of Table 2.

Table 2:

Probit, truncated regression, and Tobit model results for the loan approval and loan volume decisions

	Parameter Estimates			Average Marginal Effects (AMEs)	
	Cragg Model		**Tobit Model**	**Cragg Model**	
	Probit (loan approval)	Truncated Regression (loan volume)	(loan approval and volume)	Probit (loan approval)	Truncated Regression (loan volume)
	N=168	*N*=85	*N*=168	*N*=168	*N*=85
Covariates					
Gender	-0.17	30.20	-5.41	-0.03	30.20
	(0.98)	(85.86)	(21.27)	(0.18)	(85.86)
YoungHH	0.71	88.13	28.01	0.13	88.13
	(0.81)	(104.95)	(20.15)	(0.15)	(104.95)
MiddleHH	-0.28	60.55	6.83	-0.05	60.55
	(0.69)	(101.13)	(18.12)	(0.13)	(101.13)
ElderHH	-0.21	85.95	12.36	-0.04	85.95
	(0.72)	(103.52)	(18.67)	(0.13)	(103.52)
Education	0.14***	10.01**	5.69***	0.03***	10.01**
	(0.01)	(4.72)	(1.20)	(0.01)	(4.72)
Nonfarmskill	0.82**	41.98*	28.59***	0.15**	41.98*
	(0.35)	(22.05)	(7.06)	(0.06)	(22.05)
Land	0.41***	-0.39	4.35***	0.08***	-0.39
	(0.05)	(2.85)	(0.96)	(0.004)	(2.85)
Number		4.84	3.41		4.84
		(11.69)	(4.54)		(11.69)
Constant	-2.44***	-201.21	-83.11***		-201.21
	(0.84)	(137.50)	(22.35)		(137.50)
Sigma		44.82***	32.33		
		(10.34)	(2.63)		
Wald chi^2(8)		6.81			
LR chi^2(7)	123.02***				
LR chi^2(8)			89.76***		
Pseudo R^2	0.5283		0.09		
Log Likelihood	-54.9256	-371.7904	-451.6935		
Model Pearson Test	Chi2(91)= 110.08*				
% correct predictions	59				
Craggit:					

Sigma=44.82***(10.34)

Wald chi^2(7)=71.15***

Log Likelihood=-426.7160

Note: *, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively; standard errors in parentheses. coefficients, AME values, and their corresponding standard error obtained by *margins* command in Stata.

2.6.1. Parameter Estimates of Probit Model

The results of the probit model indicate that households with a head who has a higher education level and non-farm labor skills are more likely to be approved for a loan. Higher education increases productivity so that more value can be created, and having non-farm labor skill means more income sources. Thus, these two characteristics have strong positive effects (i.e., significance at 1% and 5% levels, respectively) on the probability of loan approval.

In addition, as can be seen in column 2 of Table 2, the covariate *land* has a statistically significant positive effect (significance at 1% level) on the loan approval decision. More land means that loan applicants' potential productivity or rent proceeds can be increased; hence, it is one indicator of repayment capacity.

2.6.2. Parameter Estimates of Truncated Regression Model

The parameter estimates for the truncated regression model for the loan volume decision show that the household head's education level and whether or not he/she has non-farm production skills have significant positive effects (significance at 5% and 10% levels, respectively) on the loan volume. Hence, having a household head with a higher education and non-farm production skills increases the probability of loan approval and the volume of the approved loan.

Note that the coefficients of the Tobit model in Table 2 usually display about the basically same sign and significance as the coefficients in the probit model. This indicates that the joint decision of loan approval and loan volume in the Tobit model is heavily influenced by the lending approval decision. These results highlight the important advantage of the Cragg model that it allows (possibly different) covariates to have different effects on the loan approval and loan volume decisions.

In addition, column 5 and 6 of Table 2 are the average marginal effects (AMEs) of the probability of loan approval and loan volume decisions, respectively. An average marginal effect is an estimate of a population-averaged marginal effect. When comparing the truncated regression with the probit models, not only does the significance of a few covariates' AMEs in

the truncated regression model disappear, but there are only two covariates influence the decision of loan volume in a same way from the decision of loan approval. Hence, these findings reconfirm the advantage of the Cragg model which has already been established above, and such advantage is what was expected a priori and supports the idea that the assumption of joint decisions on loan approval and loan volume might be restrictive.

2.7. Summary, Conclusions, and Limitations

In this article I have examined how rural households' characteristics affect lending decisions. I develop and estimate an econometric model in which a lender's decision about the volume of a loan is conditional on the decision to approve this loan. Field survey data collected in the Province of Shandong in China is used as an example.

Modeling the volume decision conditional on, rather than jointly with, the lending approval decision leads to very different results and implications and thus complements and extends previous research. My main empirical findings are as follows. First, I find that rural household's characteristics mainly affect the loan approval decision rather than lending volume decision. Second, I find that rural household's characteristics that increase the probability of loan approval do not necessarily increase the volume of approved loan or have any effect on the loan volume (see, for example, the covariate *land* in both decisions). If only the coefficients which have statistical significance on both the loan approval and loan volume decisions are considered, my empirical results show that those characteristics that increase the probability of loan approval often increase the volume. For example, a rural household with a well educated household head, which is one of the two covariates which have statistically significant effects in all models, is not only beneficial for gaining loan approval but also beneficial for meeting the necessities of loan requirements (i.e., without suffering from loan constraints).

Two clear policy implications that emerge from the results are that education and land are highly significant in the model estimates. Firstly, the government at all levels in China should strive to improve education in rural areas with the aim of increasing farmers' chances for access to formal loans which can lead them to higher productivity and household welfare.

Although the education importance has been discussed frequently in the past, it is absolutely necessary to emphasize again because of the poor state of education currently existing in rural China. In fact, there is an increasingly wide gap of education development between urban and rural China due to both objective and subjective factors, such as management, urban-rural dualistic economic structure, multi-channel financing policies and development concepts behind these. The unbalanced development of education seriously threatens efforts to give all people equal development opportunity in China, and the inequity leads to one of the important reasons that an undereducated farmer hardly has access to formal loans. Hence, all efforts for improving rural education are really deserved.

Secondly, the central and local governments of China should also protect land rights of all farm families with the aim of increasing farmers' chances for access to formal loans, which is beneficial to promote farmers to make long-term investments on farm production. These investments substantially boost farm household incomes and will be key to closing the income gap between Chinese cities and rural areas. What is more, secure land rights and long-term investments toward farm production can guarantee China's grain security. In fact, for the purpose of feeding its 1.4 billion people, the Chinese government should protect land rights so as to ensure sufficient arable land, and also to prevent these lands from being converted to nonagricultural uses simultaneously.

Note, however, that the data used in the study needs to be viewed and acknowledged in light of its limitations. All respondent rural household characteristics were gathered after the five-year period in which loans were granted, but the initial decision to approve the first loan was made on the basis of the rural households' characteristics at the beginning of the five-year period. The fact that a rural household did or did not receive a loan likely affected the development of at least some of the rural household's characteristics. There are many variables that were collected in the survey that I would like to use because they are clearly related to loans, such as the number of laborers for farm production and the number of laborers for non-farm production in survey period, but that I cannot use because they are endogenous for my partial studies. Data limitations caused a lack of enough independent variables to use in the study, and thus, some valuable findings might be omitted.

References

Ahrendsen, B.L., B.L. Dixon, and B. Luo (2003), "The Effects of Bank Mergers on Commercial Bank Agricultural Lending", Paper presented at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003.

Bard, S.K., P.J.Barry, and P.N.Ellinger (2000). "Effects of Commercial Bank Structure on Agricultural Lending." *Agricultural Finance Review*. 60: 17-31.

Barry, P.J., C. B. Baker, and L. R. Sanint (1981). "Farmers' Credit Risks and Liquidity Management." *American Journal of Agricultural Economics.* 63(2): 216-227.

Boucher, S.R., and C. Guirkinger (2007). "Risk, Wealth, and Sectoral Choice in Rural Credit Markets". *American Journal of Agricultural Economics*. 89(4): 991-1004.

Boucher, S.R., M.R. Carter, and C. Guirkinger (2008). "Risk Rationing and Wealth Effects in Credit Markets: Theory and Implications for Agricultural Development". *American Journal of Agricultural Economics*. 90(2): 409-423.

Burke, W.J. (2009). Fitting and Interpretting Cragg's Tobit Alternative Using Stata. *Stata Journal* 9(4): 584-592

Cheng, E., and Z. Xu (2003). "Rates of Interest, Credit Supply and China's Rural Development, Victoria University of Technology." *CSES Working Paper*. No. 20, May 2003.

China National Bureau of Statistics. *China Statistical Yearbook*. Beijing: China Statistics Press, various years.

Conning, J., and C. Udry. 2005. "Rural Financial Markets in Developing Countries. In: Evenson R., Pingali P., Schultz T. (Eds.)." *The Handbook of Agricultural Economics*. 3. Elsevier, North-Holland.

Cragg, J.G.(1971). "Some Statistical Models for Limited Dependent Variables with Applications to the Demand for Durable Goods." *Econometrica*. 39:829-844.

D'Espallier, B., Guérin, I. & Mersland, R. (2011). Women and repayment in microfinance: a global analysis. World Development. 39(5), 758-772.

Featherstone, A.M., C.A.Wilson, T.L.Kastens, and J.D. Jones (2007), "Factors Affecting the Agricultural Loan Decision-making Process." *Agricultural Finance Review*. 67(1):13-33.

Fletschner, D., and L. Kenney (2011), "Rural Women's Access to Financial Services". *Working Paper*, No. 11-07. Agricultural Development Economics Division, The Food and Agriculture Organization of the United Nations. March, 2011

Friedman, M.(1957). A Theory of the Consumption Function. Princeton University Press, Princeton.

Gale, F., and R. Collender (2006). "New Directions in China's Agricultural Lending." *Working Paper*. WRS-06-01. Economic Research Service. United States Department of Agriculture. January, 2006.

Ghate, P. (1992). "Interaction between the Formal and Informal Financial Sectors: The Asian Experience." *World Development*. 20(6): 859-872.

Gockel, R.P. (2009), "Credit and Risk: Analyzing Determinants of Willingness to Borrow More Credit in Rural Vietnam." *Working Paper*, Henry M. Jackson School of International Student Degree Project, June 4, 2009.

Greene, W.H. *Econometric Analysis*, 4th ed. New Jersey: Prentice-Hall, 2000

Guirkinger, C. (2006). "Understanding the Coexistence of Formal and Informal Credit Markets in Piura, Peru". *Working Paper*. Center for Research in Economic Development. University of Namur. Belgium.

Guirkinger, C., S. R. Boucher (2008). "Credit Constraints and Productivity in Peruvian Agriculture". *Agriculture Economics.* 39:295-308.

Guo, P., and X. Jia (2009). "The Structure and Reform of Rural Finance in China". *China Agricultural Economic Review*. 1(2): 212-226.

Hardy, W.E., J.B. Weed (1980). "Objective Evaluation for Agricultural Lending." *Southern Journal of Agricultural Economics*. July: 159-164.

Katchova, A.L., and P.J. Barry (2005), "Credit Risk Models and Agricultural Lending." *American Journal of Agricultural Economics.* 87(1): 194-205.

Katchova, A.L., and Mario J. Miranda (2004). "Two-step econometric estimation of farm characteristics affecting marketing contract decisions." *American Journal of Agricultural Economics*. 86(1): 88-102

Lin, T.-F., and P. Schmidt (1984). "A test of the Tobit specification against an alternative suggested by Cragg." *Review of Economics and Statistics*. 66 (1): 174-177.

Mazzocco, M. (2004). "Savings, Risk Sharing and Preferences for Risk." *American Economic Review*. 94 (4): 1169–1182 (September).

Olagunju, F., and A Ajiboye (2010), "Agricultural Lending Decision: A Tobit Regression Analysis." *African Journal of Food Agricultural Nutrition and Development*. 10(5): 2515-2541.

Peoples Bank of China (2001). "Guidelines on Rural Household Micro-Credit by Rural Credit Cooperatives," *unpublished document*, December 10, 2001.

Pitt, M.M., and S.R. Khandker (1998). "The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter?" *Journal of Political Economy*. 106(5): 958-996.

Shandong Province Bureau of Statistics. *Shandong Province Statistical Yearbook*. Beijing: China Statistics Press, various years.

Shen, M., and Cheng E.(2004). "Restructuring China's Rural Financial System: Existing Approaches, Challenges and The Future of Microfinance." *Working Paper*. German Agency for Technical Cooperation (GTZ). December, 2004.

Shen, M., and S. Rozelle (2004). "Financial Intermediation and Transition in Rural China: An Evolutionary Approach." *Mimeo*, China Center for Economic Research, Peking University.

Stover, R.D., R.K. Teas, and R.J. Gardner (1985). "Agricultural Lending Decision: A Multivariate Analysis." *American Journal of Agricultural Economics*. 67(3): 513-520.

Thomas, L.C. (2000). "A Survey of Credit and Behavioral Scoring: Forecasting Financial Risk of Lending to Consumers." *International Journal of Forecasting*. 16: 149-172.

Turvey, C.G. and R. Kong (2010). "Informal Lending among Friends and Relatives: Can Microcredit Compete in Rural China?". *China Economic Review*. 21(4): 544-556.

Xie, P., Xu Z., Cheng E. and Shen M. (2005). "Establishing a Framework for Sustainable Rural Finance: Demand and Supply Analysis in Guizhou Province of the People's Republic of China." *Working Paper*. Asian Development Bank. April, 2005.

Zech, L., and G. Pederson (2004). "Application of Credit Risk Models to Agricultural Lending." *Agricultural Finance Review*. 64(2):91-106.

CHAPTER THREE

ECONOMETRIC ESTIMATION OF RURAL HOUSEHOLD CHARACTERISTICS AFFECTING THE NUMBER OF LENDING APPROVALS

3.1. Introduction

Formal loans from financial institutions continue to play an important role in approaches to serve increased agricultural production and improve the living standards of rural households around the developing world, both in policy, academic discussions, and in practice. However, with economic development and continuous efforts to improve rural financial markets in developing countries, especially in rural China, loan demand has become increasingly complex and in many cases involves more frequent borrowing. For example, in the data analyzed for this study, 32 percent of all households who were granted loans by financial institutions received two or more loans over the five-year period. What is more, the number of lending approvals over this period reflects cumulative results of individual lending decision (approval or non-approval) for every borrower. In China, a variety of formal financial institutions can share potential and current clients' credit information with each other due to the development of computers and digital data storage. If a borrower who has received a loan before wants a new formal loan, then a lender can easily check his/her credit record by using shareware data among a variety of lenders to determine whether to grant him/her a loan. If a borrower cannot repay his/her last loan, then no lender will approve his/her new application. Hence, for simplicity, the study does not discriminate among the variety types of lenders. Additionally, the lending number links a close relationship with the borrower's credit scoring because a new loan approval depends on the borrower's creditworthiness in the past. Considering how important household characteristics (i.e., main components of the borrowers' credit scoring) are for justifying lending approval, exploring which household characteristics affect the number of lending approvals over a period of years deserves more attention in China and other developing countries.

Past research has mainly focused on five aspects of agricultural lending. The first aspect deals with the testing of credit scoring or risk models of the lending decision. Bauer and Jordan(1971), Johnson and Hagan (1973), Dunn and Frey (1976), Hardy and Weed (1980), Barry et al. (1981), Thomas (2000), Zech and Pederson (2004), and Katchova and Barry (2005) devise and examine such models which are used to evaluate relative financial and personal characteristics of borrowers and estimate loan requirements and potential risks for lenders in order to help lenders decide whether or not to grant a loan to applicants. The second aspect addresses the agricultural lending decision process. Stover et al. (1985), Featherstone et al. (2007) and Olagunju (2010) examine the agricultural loan decision process and analyze the factors from the perspective of the individual loan officer or financial institution. The third aspect addresses how internal and external characteristics of financial institutions themselves affect agricultural lending, Studies such as Mazzocco (1991), Bard et al. (2000), and Ahrendsen (2003) are representative of this branch of the literature. The fourth aspect explores the relationship between the informal and formal lending sectors in developing countries. For example, Turvey and Kong (2010), Guirkinger (2006), and Ghate (1992) examine the relationship between informal and formal lending in China, Peru, and Asian countries, respectively. The fifth aspect models the role of the informal and formal credit sectors (lenders) in developing countries. Boucher and Guirkinger (2007) and Boucher et al. (2008) show that asymmetric information between lenders and borrowers can oblige formal lenders to rely on collateral to solve the moral hazard and adverse selection problems inherent in credit transactions.

While the past literature provides many insights into formal lending, one important aspect of lending decision-making practices has received very little attention to date: how do rural household characteristics affect the number of loans over a period of years? This article attempts to answer this question to broaden and deepen the previous research on lending decisions.

In theory, a borrower could apply for a loan an unlimited number of times over a period of years on the basis of protection laws for consumers' rights and interests. Correspondingly, a lender has to respond to every loan application to determine whether to lend to a borrower or not. Hence, the total number of loans a borrower receives from a lender over a period of years

can be calculated by adding up every lending decision related to whether a loan application was approved. For example, assume a borrower submits three loan applications to a lender over a period of years, if his/her applications are all rejected, then the number of his/her lending approval is a zero outcome over the period, while if he/she gets lending approval twice, then the outcome is two. Correspondingly, as far as all borrowers are concerned, the observed number of lending approvals from all borrowers can be divided into two categories as a whole: zero lending outcome and positive integral lending outcome ≥ 1). The zero outcomes are interpreted as a loan rejection which are all loan applications are rejected by (a) lender(s) and positive integral outcomes are treated as loan approval, even if there are partial loan applications approved during the specified period.

These binary response values of lending approval over a period of years cannot be modeled using logistic regression or probit analysis, but they can be modeled using complementary log-log binominal models. This study's contribution to the literature, therefore, is modeling the number of lending approvals that were sequentially made by lenders over a five-year period, and comparing specific borrowers' loan applications during the same period.

To sum up, the primary goal of this article is to use a complementary log-log binominal econometric model to investigate how household characteristics affect the number of lending approvals over a period of five years.

The rest of this paper is structured as follows. In the following section 2 I briefly introduce some background information of formal loan in rural China. In section 3 I develop a theoretical framework to illustrate decisions of formal loan lending over a period of years. In section 4 I present and estimate the complementary log-log binominal model. In section 5 I describe the data. I present and discuss the results in section 6, and conclude in section 7.

3.2. Background

3.2.1. A Brief Introduction of Rural Formal Finance in China

China's financial system has undergone a series of reforms since the mid-1990's with the aim of building a modern and commercial financial system. The current rural formal financial

system in China mainly consists of the Rural Credit Cooperative (RCC), the Agricultural Bank of China (ABC), the Agricultural Development Bank of China (ADBC) and the Postal Savings Bank of China (PSBC). The ABC generally loans to agricultural enterprises, rural cooperatives, and village organizations, but usually not to individual rural households. The PSBC is the only depository financial institution. Among these four main institutions, "more than 80 percent of formal agricultural loans in China are made by the country's 30,000-plus Rural Credit Cooperatives (RCCs)" (Gale and Collender, 2006). In other words, RCCs "currently play an overriding role in the rural financial system in China" (Guo and Jia, 2009). Additionally, the Chinese Banking Regulatory Commission (CBRC) and the People's Bank of China (PBOC) regulate all four of these financial institutions.

Nowadays, with the development of computer technology, all formal financial institutions have built a client credit history record network throughout all the institutions in the country. In other words, as long as any applicant starts his/her loan application, that information will be stored, traced, recorded, and retrieved any time by any formal financial institution. Hence, different lenders are able to exchange information about the creditworthiness of a borrower through such a network, and the same lender can learn about the borrower's performance over time and develop trust in the future.

3.2.2. Trends in Agricultural Lending in Recent Decades

Figures 1 and 2 below respectively show the balance of agricultural loans for the whole country and the Shandong Province of China from 1979 to 2009.

As shown in the Figures, the balance of agricultural loans in the whole country and the Province of Shandong increased very slowly and gently during the first 16 years from 1979-1995. The relative shares of agricultural loans as a proportion of total loans fluctuated within a relatively broad brand and displays a rough downtrend as agriculture's share of total GDP declined. However, the balance of agricultural loans for the whole country and the Province of Shandong increased during the 1996-2009 period. The agricultural loan balance of the whole country and the Shandong Province respectively reached the equivalent of 21,623 billion Yuan and 296 billion Yuan in 2009, up 19,704 billion Yuan and 271 billion

Yuan since 1996, respectively. In 2009, the agricultural share of all loans for the entire country and the Province of Shandong respectively was 5% and 11%, a 2 and 4 percentage-point increase from 1996, respectively. Since Shandong Province is one of China's most prosperous agricultural regions, it is not unusual that the agricultural share of all loans is higher than the average level of the whole country since the mid-1990s, when the reform of the banking system started to commercialize and modernize (see Figures 1 and 2). Hence, Shandong province provides an interesting setting for studying formal loan lending practices in rural China.

Fig.1. Agricultural Loan Balance, the Whole Country of China, Yearly, 1979-2009
Source: China Statistical Yearbook (Various Issues)
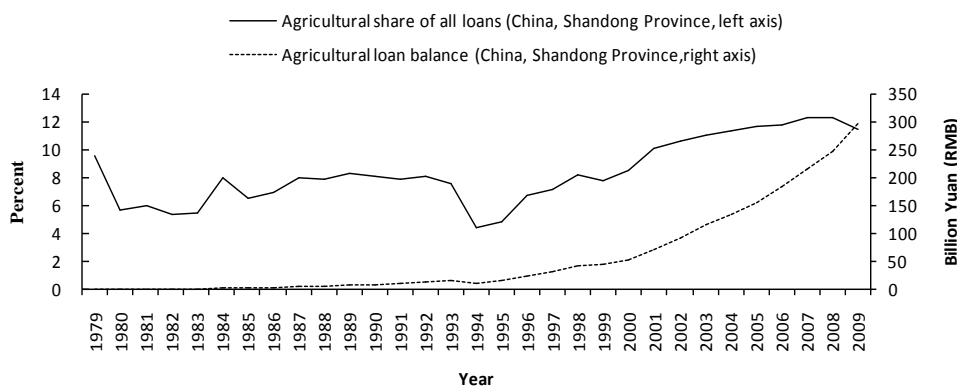
Fig.2. Agricultural Loan Balance, Shandong Province of China, Yearly,1979-2009
Source: Shandong Province Statistical Yearbook, China (Various Issues)

3.3. Theoretical Framework

Information and enforcement problems cause credit market imperfections and even the

complete failure of these markets (Guirkinger and Boucher, 2008). Such loan constraints are especially likely to arise under the conditions prevailing in developing countries (see, for example, Conning and Udry, 2005). I consider three situations for the number of lending approval(s) for all loan application(s) over a period of years: full approval, part approval, and rejection. A household experiences full approval if its desired number of loan application(s) over a period of years is/are approved in full by (a) lending institution(s). If its desired number of loan application(s) over a period of years is/are completely refused, the household suffered from loan constraints. In between these two situations, I refer to partial approval if it's desired number of loan application(s) over a period of years is/are partially approved.

In Figure 3 I assume that there are some underlying indicators which affect the number of lending approvals over a period of years as opposed to the number of loan applications in the same time, and there is a distribution of these indicators across all applicants. I call this indicator the applicant's "liquidity condition", which is based on his or her qualitative and quantitative characteristics. Each applicant's liquidity condition is main determinant to affect his or her final number of lending approval over a period of years. Above an upper liquidity condition threshold, the number of lending approval from complete full loan approval exceeds that from partial loan approval or rejection. Below a lower liquidity condition threshold, rejection takes place. In between these thresholds, the number of lending approval from partial loan approval exceeds that from either full approval or rejection.
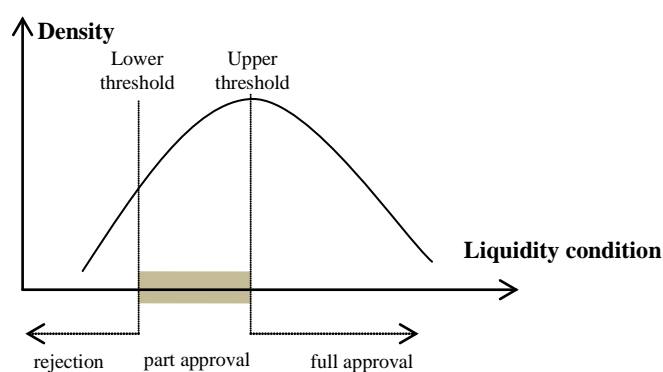
Fig.3. The Number of Lending Approvals

This study proposes a theoretical model for looking at formal lending approvals over a period of years. Consider a financial institution, indexed by i, that lends a formal loan to a

rural household j. If the rural household submits (a) loan application(s) K ($K = 1,2,\ldots N$, and N is a positive integer.) within a period of years, financial institutions have to decide whether to approve all application(s) or not, therefore K suffers either non-lending approval (all loan rejection) or lending approval (at least one time loan approval).

Assume a financial institution i maximizes the expected utility of profits during a period of years:

$$
\underset{C_{j_K}=0,1}{Max}\ EU\left\{\sum_{K=1}^{N}\left[\left(1-C_{j_K}\right)\left(-b_{j_K}^{v}-b_{j_K}^{f}\right)\right]+\sum_{K=1}^{N}\left[C_{j_K}\left(\alpha_{j_K}R_{j_K}T_{j_K}-b_{j_K}^{v}-b_{j_K}^{f}\right)\right]\right\} \tag{1}
$$

Where C_{j_K} is a lender i's lending decision for a borrower $j's$ Kth loan application. If approval is chosen, then $C_{j_K}=1$; otherwise $C_{j_K}=0$. When the Kth loan application is approved, then the optimal volume in the lending practice (α_{j_K}) is chosen, and the interest rate (R_{j_K}) and the term of loan (T_{j_K}) are also determined. $\alpha_{j_K}R_{j_K}T_{j_K}$ is the expected proceeds for the Kth loan approved by a lender, $b_{j_K}^{v}$ is the possible expenditures or losses for the Kth lending decision (non-lending approval or lending approval) such as the costs of screening a loan application, $b_{j_K}^{f}$ is the necessary cost of the lending decision (non-lending approval or lending approval) such as the salary of loan officers[1].

Although any borrower can submit unlimited loan applications, the decision of lending approval made by a lender is done sequentially, namely, if a borrower applies for a second loan, and if he/she performed well on the first loan, then the lender will be more likely to approve the second and additional loans. In other words, only after repaying past loan in due time will a borrower submit his/her new loan application and have high possibility or probability to get loan approval from the lender. Therefore, as far as a borrower (j) is

---

[1] In practice, for the collateral which is used for a loan application, the market value of pledged asset P usually equals or exceeds the loan amount and its interest profits, i.e., $P \geq \alpha + \alpha RT$. However, for simplicity, I assume that $P = \alpha + \alpha RT$ so that function (1) is feasible. In addition, for parsimony, I omit the possible proceeds from the fees of a loan application paid by applicants in all theoretical models because such proceeds are usually very small even if they actually exist in lending practice.

concerned, his/her total number of loan approvals' times H ($H = 0,1,2,\ldots K$) over a period of years does not always equal his/her total number of loan applications' times (K) over the same time, namely, $0 \leq H \leq K$. Since we can observe the total number of lending approval over a period of years for any borrower j, hence, as to all borrowers ($j_1, j_2 \cdots j_N$), we can interpret $H = 0$ as non-approval of lending if all applications of a borrower j_i ($i = 1,2,\cdots N$) over a period of years are not approved by lenders, and treat $H = 1,2,\ldots K$ as lending approval if all of j_i's applications are partially or fully approved by a lender in the specified period.

What is more, within a period of years, whether a lender has lent to a specific borrower (C_j), and if the lending approval is chosen at least once ($C_j = 1$, i.e., part or full loan application(s) is/are approved ($1 \leq H \leq K$)), then function (1) can be further described for a binary framework which views the intertemporal nature of the lending approval process as a whole and for the purpose of this empirical estimation as follows:

$$\underset{C_j = 0,1}{\text{Max}} \, EU \left\{ \left(1 - C_j\right)\left(-B_K^v - B_K^f\right) + C_j \underset{1 \leq H \leq K}{\text{Max}} \left[\sum_{H=1}^{K} \left(\alpha_{j_H} R_{j_H} T_{j_H}\right) - B_K^v - B_K^f \right] \right\} \qquad (2)$$

where $B_K^v = b_1^v + b_2^v \cdots b_K^v$ is the possible total expenditure or loss for all of a specific borrower's (j) loan applications' censoring work over a period of years, $B_K^f = b_1^f + b_2^f \cdots b_K^f$, which are the necessary total cost for all j's loan applications' censoring work over a period of years. $\alpha_{j_H} R_{j_H} T_{j_H}$ is the expected proceeds for the H th loan approved by a lender, herein, the proceeds from the loan application fees that all applicants must pay is omitted.

In function (2), $C_j = 0$ indicates non-lending approval (i.e., all of a borrower's loan applications are not approved by (a) lender(s) over a period of years) and is associated with the first term in the discrete maximization operation. $C_j = 1$ indicates lending approval (i.e., a borrower's part or full loan applications are approved by (a) lender(s)) and is associated with the second term in the discrete maximization operation. There is a trade-off between obtaining

expected proceeds and covering the costs associated with the lending approval.

Maximization of expected financial institution utility yields expressions related to the loan applicant's (j) household characteristics, which can embody the potential ability of creating gains for using loans and guaranteeing loan repayment at a due date. Therefore, H is related to $\mathbf{x}_j$, a set of observable rural household's characteristics such as the education level of the household head, land size, etc. Formally, $H = g_H(\beta'_H x_j, \varepsilon_H)$, where β'_H is a vector of parameters, and ε_H captures unmeasured factors related to formal loan lending.

3.4. Econometric Methods

In the empirical models of the binary outcome of lending approval over a period of years, the observed dependent variable, the total number of lending approval for every borrower during a time interval (e.g., five years), is a non-negative integer. Therefore, the total number of lending approval for every borrower as a whole takes on two values, zero or a positive integer. The value of zero denotes a non-lending approval ($C_j = 0$), and the value of positive integers denotes a lending approval (full or part) ($C_j = 1$). The model follows:

$$\Pr\big(C_j = 1/x_j\big) = 1 - e^{-\exp\big(\beta'_H x_j\big)} \tag{3}$$

Where the function (3) is called a complementary log-log model (Green, 2011). The log-likelihood in the complementary log-log model is thus given by:

$$InL = \sum_{c_j=1} InF(\beta'_H x_j) + \sum_{c_j=0} In\big[1 - F(\beta'_H x_j)\big] \tag{4}$$

where $F(z) = 1 - e^{-\exp(z)}$.

3.5. Data

The data used in this paper were collected in Shandong Province (China) in July 2010 by face-to-face interviews. 394 rural households were randomly selected from 5 villages in one town (Man Zhuang) and one county (Ning Yang). The survey collected detailed information on households' formal borrowing activities over the last 5 years (i.e., from July 2006 to July 2010) as well as households' basic characteristics.

During the survey, respondents identified whether loan applications were approved by financial institutions in a five-year period, and the number of loan granted by (a) lender(s). The survey information gathered also includes more general quantitative and qualitative rural household characteristics that are considered important determinants of formal loan lending. Overall, 204 households were eliminated because they did not participate in the survey or did not apply for a formal loan during the past five years. This left 190 households that had applied for at least one formal loan. Of these, a further 22 households had to be removed since the information they provided was incomplete. Of the remaining 168 households that had applied for a formal loan in the past five years, 85 were approved by financial institutions to receive a loan. On average, the number of formal loan granted by lenders for the 85 households over the last five years is 1.49 times.

Since the period span related to the formal loan survey was five years, a loan for an individual respondent household might be disbursed by a financial institution to outside of the period studied. For the purpose of achieving accurate information, the survey collected current respondent household information within the survey period, namely, a retrospective survey related to respondent's historical household information was not conducted because many of those randomized respondents, especially when they are not household heads, rarely know the full households' information history. For the sake of developing the empirical analysis, however, it is thus very important to pick appropriate covariates from the collected information. A few of the covariates, which not only represent socioeconomic characteristics of rural households but also are exogenous, are hypothesized to be relevant in the loan approval and loan volume decisions. These include zero-one indicators for whether the household head is female, and has non-farm production skills. Also, in China, non-farm skill

does not always refer to those professional skills that need professional training and study, some simple physical labor jobs, such as sanitation worker, are viewed as non-farm skill as well. Some respondents might say that the head of his or her household has no non-farm skill, the plausible reason is either that the household head is born with a physical disability or that the household head is too old for farm work (aged over 65 years old). Not many household heads in rural China absolutely did not have non-farm skill, of course. Therefore, these two zero-one indicators are appropriate for the study and are exogenous for the number of lending approvals analysis.

The average age of a household head over a period of years reflects that household's structure. Household structures was divided into four main types on the basis of age: (1) young household, defined as a household head's age between 18 and 35 years old; (2)middle-aged household, defined as a household head' age between 36 and 50 years old; (3)elderly household, defined as a household head's age between 51 and 65 years old; and (4)very elderly household, defined as a household head aged 66 years old or over. Hence, every responding household can be easily determined on the basis of the division of household structure for the empirical analysis.

In China, farmland is still owned and controlled by the state and leased to farmers. Farmers can't sell it, and they can't use it for collateral on a loan. In 1997, rural households were allowed to sign a long-term lease of 30 years for the right to work a plot, which was allocated according to shares in village populations. Hence, it is reasonable to believe that the amount of farm land of every respondent household could not change from 2006 to 2010 due to undated signed leases in the survey area. Therefore, the covariate *land* is exogenous and introduced into the analysis.

The household head's education level was also considered exogenous because almost no household heads in rural China underwent education-change over the study period, hence, it can also be introduced into the empirical analysis. Additionally, the covariate *asset*, which is household total asset value, is also used in the analysis. Overall, all dependent variables and covariates are listed and described in Table 1 below.

Table 1:

Descriptive statistics of variables

Variable	Definition	Mean	Std.Dev.	Obs.
Dependent Variable				
Number	Number of lending approvals' times over the last five years	0.76	0.96	168
	Zero: 0	0	0	83
	Positive Integer:	1.49	0.85	85
	1			58
	2			16
	3			8
	4			2
	5			1
Covariates				
Gender	Whether the household head is female (female=1, male=0)	0.05	0.21	168
YongHH	1 if household head's age is between 18 and 35 years old; otherwise=0	0.08	0.27	168
MiddleHH	1 if household head's age is between 36 and 50 years old; otherwise=0	0.57	0.50	168
ElderHH	1 if household head's age is between 51 and 65 years old; otherwise=0	0.32	0.47	168
Education	Household head's education level in years	8.93	3.17	168
Nonfarmskill	Whether household head has non-farm skill (yes=1, non=0)	0.19	0.39	168
Land	Amount of farm land in Mu (1 Mu≈0.16 Acre)	3.05	3.59	168
Asset	Household total asset value in Yuan (thousands)[2] including house, land, farm machine, etc.	199.74	180.65	168

3.6. Results and Discussion

The model specification outlined above was estimated using maximum likelihood methods. Results of the complementary log-log model for the number of lending approval over the five-year period are given in Table 2. Both parameter estimates and average marginal effects (AMEs) are reported.

---

[2] 1000 Yuan are roughly equivalent to 150$ USD.

Table 2:

Complementary log-log Binominal Model analysis results for the number of lending approval

Covariates	Parameter Estimates	Average Marginal Effects (AMEs)
	N=168	N=168
Gender	-0.15	-0.03
	(1.12)	(0.20)
YoungHH	0.60	0.11
	(0.93)	(0.16)
MiddleHH	-0.51	-0.09
	(0.82)	(0.15)
ElderHH	-0.40	-0.07
	(0.84)	(0.15)
Education	0.13**	0.02***
	(0.05)	(0.01)
Nonfarmskill	0.72**	0.13**
	(0.34)	(0.06)
Land	0.41***	0.07***
	(0.06)	(0.01)
Asset	0.001*	0.0002*
	(0.001)	(0.0001)
Constant	-2.95***	
	(1.01)	
LR chi^2(7)=113.40***		
Log Likelihood=-59.7346		

Note: *, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively; standard errors in parentheses. Coefficients, AME values, and their corresponding standard error obtained by *margins* command in Stata.

The results of the complementary log-log binominal model indicate that households with a head who has a higher education level and non-farm labor skills are more likely to be approved for a loan. Higher education increases productivity so that more value can be created, and having non-farm labor skill means more income sources. Thus, these two characteristics have strong positive effects on the probability of loan approval (5% significance level).

As can be seen in column 2 of Table 2, the covariate *land* has a statistically significant positive effect (1% significance level) on the loan approval decision as well. More land means that loan applicants' potential productivity or rent proceeds can be increased; hence, it is one indicator of repayment capacity for lenders.

A household's total asset value is often used by lenders to determine the initial and/or ongoing loan amount, and/or compliance with one or more debt covenants because they are often included in the borrowing base[3]. Household assets are often considered as collateral, so it is not surprising that they are associated with increased probability of lending approval. However, the significance level of variable *asset* is only 1%, and its coefficient is also very small.

In addition, column 3 of Table 2 show the average marginal effects (AMEs) of the probability of the number of lending approvals. An average marginal effect is an estimate of a population-averaged marginal effect. The AMEs' results of the complementary log-log model are unanimous to its counterpart coefficients with the same sign and statistical significance, hence, for parsimony, they are not discussed in the paper.

3.7. Conclusions, Limitations, and Future Research Direction

This article has examined how rural households' characteristics affect the number of lending approvals over a period of years. Field survey data collected in the Province of Shandong, China is used as the sample.

Modeling the number of lending approvals over a five-year period leads to a few interesting results and implications and thus complements and extends previous research. The main empirical findings are that household head's education level and non-farm production skills, the amount of farm land，and the household's total asset value have statistically significant effects in the model. These three factors are beneficial for borrowers to gain loan approval.

Two clear policy implications that emerge from the results are that *education* and *land* are highly significant in the model estimates. Firstly, the government at all levels in China should strive to improve education in rural areas with the aim of increasing farmers' chances for access to formal loans which can lead them to higher productivity and household welfare. Although the education importance has been discussed frequently in the past, it is absolutely

---

[3] The borrowing base is the value assigned to a collection of a borrower's assets, and its calculation is contractually specified in an agreement between the lender and borrower.

necessary to emphasize again because of the poor state of education currently existing in rural China. In fact, there is an increasingly wide gap of education development between urban and rural China due to both objective and subjective factors, such as management, urban-rural dualistic economic structure, multi-channel financing policies and development concepts behind these. The unbalanced development of education seriously threatens efforts to give all people equal development opportunity in China, and the inequity leads to one of the important reasons that an undereducated farmer hardly has access to formal loans. Hence, all efforts for improving rural education are really deserved.

Secondly, the central and local governments of China should also protect land rights of all farm families with the aim of increasing farmers' chances for access to formal loans, which is beneficial to promote farmers to make long-term investments on farm production. These investments substantially boost farm household incomes and will be key to closing the income gap between Chinese cities and rural areas. What is more, secure land rights and long-term investments toward farm production can guarantee China's grain security. In fact, for the purpose of feeding its 1.4 billion people, the Chinese government should protect land rights so as to ensure sufficient arable land, and also to prevent these lands from being converted to nonagricultural uses simultaneously.

Although some contributions from this study are particularly applicable to rural finance, the results of this study also need to be viewed and acknowledged in lights of its limitations. All respondent rural households' characteristics were asked after the five-year period in which loans were granted. But the initial decision to approve the first loan was made on the basis of the rural households' characteristics at the beginning of the five-year period. The fact that a rural household did or did not receive a loan likely has affected the development of that rural household's characteristics. As far as a covariate *asset* is concerned, a household's assets will tend to be higher if a household has been able to borrow. Hence, the covariate *asset* used in this article is suspected of endogeneity, and the findings in this article might be biased and inconsistent.

Considering the suspect covariate (i.e., *asset*), future research should first use a Hausman test to confirm whether the covariate is endogenous. If the test proves endogeneity, then a proper proxy for the variable or a appropriate instrumental variable to deal with endogeneity

problem is needed.

References

Ahrendsen, B.L., B.L. Dixon, and B. Luo (2003), "The Effects of Bank Mergers on Commercial Bank Agricultural Lending", Paper presented at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003.

ADBC (1994). "The Agricultural Development Bank of China Annual Report", published by ADBC, Beijing, China.

Bard, S.K., P.J.Barry, and P.N.Ellinger (2000). "Effects of Commercial Bank Structure on Agricultural Lending." *Agricultural Finance Review*. 60: 17-31.

Barry, P.J., C. B. Baker, and L. R. Sanint (1981). "Farmers' Credit Risks and Liquidity Management." *American Journal of Agricultural Economics.* 63(2): 216-227.

Bauer, Larry L. and John P. Jordan (1971). "A Statistical Technique for Classifying Loan Application." University of Tennessee Agr. Exp. Sta. Bull. 476.

Boucher, S.R., and C. Guirkinger (2007). "Risk, Wealth, and Sectoral Choice in Rural Credit Markets". *American Journal of Agricultural Economics*. 89(4): 991-1004.

Boucher, S.R., M.R. Carter, and C. Guirkinger (2008). "Risk Rationing and Wealth Effects in Credit Markets: Theory and Implications for Agricultural Development". *American Journal of Agricultural Economics*, 90(2): 409-423.

China National Bureau of Statistics. *China Statistical Yearbook*. Beijing: China Statistics Press, various years.

Conning, J., and C. Udry. 2005. "Rural Financial Markets in Developing Countries. In: Evenson R., Pingali P., Schultz T. (Eds.)." *The Handbook of Agricultural Economics*. 3. Elsevier, North-Holland.

Dunn, D. J. and T. L. Frey (1976). "Discriminant Analysis of Loans for Cash Grain Farms." *Agricultural Finance Review*. 36(April) .

Featherstone, A.M., C.A.Wilson, T.L.Kastens, and J.D. Jones (2007), "Factors Affecting the Agricultural Loan Decision-making Process." *Agricultural Finance Review*. 67(1):13-33.

Gale, F., and R. Collender (2006). "New Directions in China's Agricultural Lending." *Working Paper*. WRS-06-01. Economic Research Service. United States Department of Agriculture. January, 2006.

Ghate, P. (1992). "Interaction between the Formal and Informal Financial Sectors: The Asian Experience." *World Development*, 20(6): 859-872.

Greene, W.H. *Econometric Analysis*, 7th ed. New Jersey: Prentice-Hall, 2011

Guirkinger, C. (2006). "Understanding the Coexistence of Formal and Informal Credit Markets in Piura, Peru". *Working Paper*. Center for Research in Economic Development. University of Namur. Belgium.

Guirkinger, C., S. R. Boucher (2008). "Credit Constraints and Productivity in Peruvian Agriculture". *Agriculture Economics*. 39:295-308.

Guo, P., and X. Jia (2009). "The Structure and Reform of Rural Finance in China". *China Agricultural Economic Review*. 1(2): 212-226

Hardy, W.E., J.B. Weed (1980). "Objective Evaluation for Agricultural Lending." *Southern Journal of Agricultural Economics*. July: 159-164.

Johnson, R. B. and A. R. Hagan (1973). "Agricultural Loan Evaluation with Discriminant analysis." *Southern Journal of Agricultural Economics*. 5:57-62.

Katchova, A.L., and P.J. Barry (2005), "Credit Risk Models and Agricultural Lending." *American Journal of Agricultural Economics*. 87(1): 194-205.

Mazzocco, M. (2004). "Savings, Risk Sharing and Preferences for Risk." *American Economic Review*. 94 (4): 1169–1182 (September).

McDowell, A. (2003). "From the help desk: hurdle models." *Stata Journal*. 3(2): 178-184.

Shandong Province Bureau of Statistics. *Shandong Province Statistical Yearbook*. Beijing: China Statistics Press, various years.

Stover, R.D., R.K. Teas, and R.J. Gardner (1985). "Agricultural Lending Decision: A Multivariate Analysis." *American Journal of Agricultural Economics*. 67(3): 513-520.

Thomas, L.C. (2000). "A Survey of Credit and Behavioral Scoring: Forecasting Financial Risk of Lending to Consumers." *International Journal of Forecasting*. 16: 149-172.

Turvey, C.G. and R. Kong (2010). "Informal Lending Amongst Friends and Relatives: Can Microcredit Compete in Rural China?". *China Economic Review*. 21(4): 544-556.

Zech, L., and G. Pederson (2004). "Application of Credit Risk Models to Agricultural Lending." *Agricultural Finance Review*. 64(2):91-106.

CHAPTER FOUR

WHO FEELS THAT INTEREST RATES ON FORMAL LOANS ARE TOO HIGH IN RURAL FINANCIAL MARKETS? ESTIMATES FROM A SURVEY IN RURAL SHANDONG, CHINA

4.1. Introduction

The provision of formal loans to potential borrowers in the rural areas of developing countries is hampered by high transaction costs that stem from small loan sizes, lack of assets that are suitable as collateral, and covariate risks (Petrick and Latruffe, 2005). These factors increase the costs of formal lending and will, all other things being equal, result in increased interest rates. In China's rural financial market, where the Rural Credit Cooperatives (RCCs) dominate the markets for lending and deposit services (Guo and Jia, 2009), their monopoly position might further inflate interest rates. High interest rates will lead to partial or full exclusion of potential borrowers from formal financial systems, forcing them to rely on meager self-finances, interpersonal lending or illegal usury and thus limiting their ability to actively participate in and benefit from the economic development process (Li et al., 2011).

The determination and implications of interest rates have been studied from many different angles. Although most studies focus on macro finance (e.g. Duffee, 2002; Jarrow et al., 2007), some studies address farm loans and the field of micro finance. Featherstone et al. (1993) explore the relationship between interest rates in the national money market and interest rates on farm loans. Interest rate determination in underdeveloped rural areas has been studied by, for example, Bottomley (1975) and Petrick and Latruffe (2005). A large-scale field experiment carried out in South Africa by Karlan and Zinman (2008) in order to estimate interest rate elasticities of demand for credit, shows that the demand curves are downward sloping and steeper for interest rate increases relative to the lender's standard rates. Other related studies include Salazar et al. (2010), Attanasio et al. (2008), Dehejia et al. (2005), Alessie et al. (2005), Gross et al. (2002), etc. Castro and Teixeira (2006) study the effects of the Brazilian Interest Rate Equalization System (IRES) expenditures on Brazilian GDP, and

Mohane et al. (2002) analyze the effects of interest rate ceilings on the micro lending market in South Africa. Factors affecting the interest rate distribution for the Farm Credit System's direct lending associations in the US are studied by Dodson and Duncan (1998).

One aspect of interest rates in rural finance that has not received attention to date concerns the attitudes of potential formal loan clients towards interest rate levels. As we describe below, 22 percent of the respondents in the sample of Chinese farmers that we analyze believe that interest rates on formal loans are too high. If this share is representative of China as a whole, as many as 100 million rural farmers feel that interest rates on formal loans are too high and are therefore partially or fully excluded from formal finance.

What are the typical characteristics of these potential rural borrowers and what distinguishes them from borrowers who are satisfied with interest rate levels? Economic modeling, policy and practice suggest that interest rate levels are critically related to the functioning of loan markets (Karlan and Zinman, 2008). Understanding the attitude of potential formal borrowers in rural areas, on the level of lending rates can thus respond to help policymakers design optimal financial services, improve the rural financial structure, and thus to foster rural economic growth.

The objective of this article is therefore to determine what socio-economic characteristics influence some potential borrowers' attitudes towards high interest rates recognition on formal loans. To pursue the objective we analyze field survey data from Shandong Province in China using a method proposed by van de Ven and van Praag that allows us to correct for systematic non-response in a probit-type equation. The rest of this paper is structured as follows. In section 2 we provide some background information on formal financial institutions and interest rates in rural China. In section 3 we describe the data we employ. In sections 4 and 5, a conceptual framework and the proposed estimation technique, respectively, are presented. We present and discuss the results in section 6, and conclude in section 7.

4.2. Background

Although China's financial system has undergone a series of reforms since the mid-1990's with the aim of building a modern and commercial financial system, the basic structure of the

rural financial market of China is superficially similar to that of many developing countries. "Formal credit programs are highly centralized, private lending is strictly regulated and often considered illegal, and credit rationing is prevalent"(Cheng and Xu, 2004; Jia et al., 2007; Guo and Jia, 2009). China's rural finance consists of formal, semi-formal, and informal finances (Guo and Jia, 2009). Rural semi-formal finance refers to microcredit pilots and projects initiated by government agencies or NGOs which just operate in small regions of individual provinces in China. Rural informal finance refers to either interpersonal lending, which depends on personal relationship, or illegal usury, which usually charges borrowers exorbitant interest rates. Compared with these alternatives, rural formal finance in China operates with the advantages of ample loan supply and legal status in China's rural financial market. Hence, semi-formal finance and informal finance are poor substitutes for formal finance in rural China[1].

4.2.1. Formal Financial Institutions and Interest Rates in Rural China

The current rural formal financial system in China mainly consists of the Rural Credit Cooperative (RCC), the Agricultural Bank of China (ABC), the Agricultural Development Bank of China (ADBC) and the Postal Savings Bank of China (PSBC). All four of these institutions are regulated by the Chinese Banking Regulatory Commission and the People's Bank of China (PBOC). The ABC lends to agricultural enterprises, rural cooperatives, and village organizations, but only rarely to individual rural households. The PSBC is the deposit-only financial institution. Overall, "more than 80 percent of formal agricultural loans in China are made by the country's 30,000-plus Rural Credit Cooperatives (RCCs)"(Gale and Collender, 2006). Thus, RCCs play an dominant role in the loan disbursement and deposit systems in rural China (Guo and Jia, 2009), and most formal borrowers in rural areas deal exclusively with their local RCC.

Prior to the initiation of financial reforms in 1997, the Chinese government fixed interest rates for both formal financial institution deposits and loans. Following 1997, interest rates on

---

[1] As pointed out by Feder et al. (1990,pp:1152-1153), "…informal credit is not a good substitute for formal credit due to limited fungibility (otherwise every borrower would exhaust his or her informal credit first before going to the RCC)…".

loans were gradually liberalized and formal financial institutions were permitted to determine the interest rate for a particular loan within a given range of a benchmark interest rates set by the PBOC (Martin, 2012). Although the PBOC eliminated the ceiling on interest rates in the course of the reform process, it continued to set a benchmark interest rate. According to current Chinese law and regulation, "bank lending rates can be no less than 90% of the benchmark rate set by the PBOC, with no upward limit" (Martin, 2012). As a result, the formal financial institutions currently have considerable latitude to set interest rates on loans, and the PBOC benchmark rates and permissible bands have only a limited effect on interest rates. Therefore, it is not surprising that some potential formal borrowers in China's rural areas face interest rates that they feel are too high. In the data that we analyze below, those potential borrowers who stated that the current interest rate offered by formal institutions is too high also stated that the average maximum annual interest rate that they would accept was about 6 percent, while the average annual lending interest rate offered by formal institutions was about 7 percent.

4.2.2. Trends in Agricultural Lending in Recent Decades

Figures 1 and 2 show the annual cumulative loan disbursement and the share of agriculture in all formal lending for China as a whole and for Shandong Province, respectively, from 1979 to 2009. As shown in the Figures, the balance of agricultural loans in China and Shandong Province increased slowly during the first 16 years from 1979-1995. The relative shares of agricultural loans as a proportion of total loans fluctuated within a relatively broad brand and displayed a slight downtrend as agriculture's share of total GDP declined. However, the balance of agricultural loans increased strongly during the 1996-2009 period both in China as a whole and in Shandong province, reaching 21,623 billion Yuan (RMB) and 296 billion Yuan respectively in 2009[2]. In respectively, up 2 and 4 percentage points from 1996. Since Shandong Province is one of China's most prosperous agricultural regions, it is not unusual that the agricultural share of all loans is higher there than in China as a whole.

---

[2] 1000 Yuan are approximately equivalent to 150 US$.
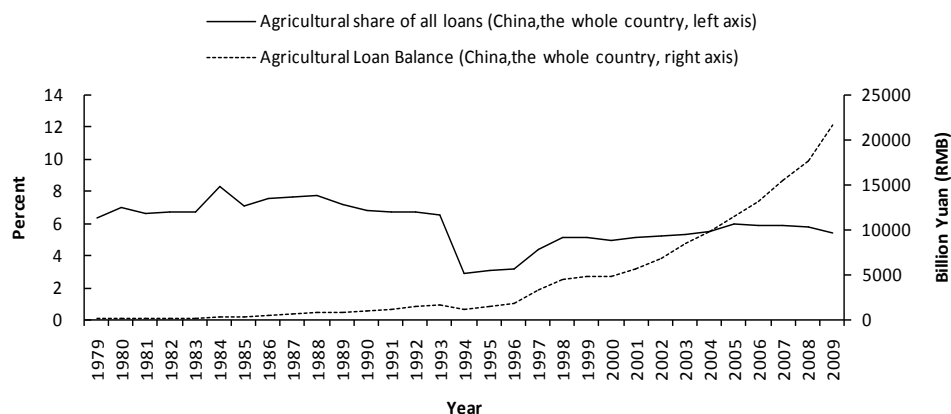
Fig.1. Agricultural Loan Balance, the Whole Country of China, Yearly, 1979-2009
Source: China Statistical Yearbook (Various Issues)

Fig.2. Agricultural Loan Balance, Shandong Province of China, Yearly,1979-2009
Source: Shandong Province Statistical Yearbook, China (Various Issues)

4.3. Data

The data used in this paper were collected in Shandong Province (China) in July 2010. 394 rural households were randomly selected from 5 villages in one town (Man Zhuang) and one county (Ning Yang), but 104 selected respondents did not wish to participate, leaving a sample size of 290. The survey collected detailed information on households' formal borrowing activities over the last 5 years (i.e., from July 2006 to July 2010) as well as households' basic demographic and economic characteristics.

For the purposes of this study, the core question in the survey questionnaire reads as follows[3]: "Given that you wish to borrow from a formal financial institution, and comparing

---

[3] Author's translation from Chinese. The questionnaire was designed in Chinese in accordance with Chinese reading habits and idiom.

the interest rate set by the formal institution with the maximum interest rate that you would accept, do you feel that the interest rate set by the formal institution is: A) too high; B) too low; C) fair?". After compiling the responses to this question, it was found that only 25 respondents who chose answer "B". Thus, the responses can be mainly divided into two categories: *too high* and *fair*. In the paper, we mainly shed light on those respondents who answered "A" because they most likely shy away from formal loan market because of interest rates on formal loan set by the lenders. Since other financing channels such as interpersonal lending are not good substitutions for formal financing under current situation of China' rural financial market and consequently, some potential borrowers most likely cannot meet their financial needs if they are also excluded from formal loan. One of research goals on rural finance in developing countries thus focuses on finding out socio-economic characteristics of some borrowers who suffer from formal loan constraints so as to design optimal policy to help them to access to formal loan. Moreover, some respondents who answered "B" and "C" most likely feel easy or free when they want to borrow from formal financial institutions so that we can pay little attention to them. In consequence, in the following we consider responses "B" and "C" together in a new category — *not too high*. Such a new division on respondents' attitudes towards interest rates on formal loan (i.e., *too high* or *not too high*) allows us to clearly and better concentrate our core research, namely, who feels that interest rates on formal loans are too high in rural financial markets?.

Although there was no way to know exactly why 104 respondents abstained from the survey, their non-participation resulted in non-responses of all survey questions related to rural finance and consequently, we miss those respondents' information so that they cannot be selected to be in our sample. These non-responses, which are called *unit* non-responses by Berinsky (2005), are random because these missing observations are random in the context of survey research. As a result, such distortions are inconsequential in the aggregate (Berinsky, 2005), and can be excluded from the survey population without leading to sample bias. Of the 290 respondents who participated, 184 respondents answered the core question. Of these, 64 respondents, or 22 percent of the complete sample of 290, stated that the formal interest rate is too high (response "A"). 106 respondents did not answer the core question, but did answer other related questions. Herein, those 106 respondents solely did not answer the core question

in entire survey. As to such non-responses, there might be a few reasons for explanation such as these respondents might lack sufficient information on interest rates on formal loan, however, whatever the reason may be, their non-responses are viewed as intentional. Hence, these non-responses, which are called *item* non-responses by Berinsky (2005), are not random. We cannot exclude these non-responses from the sample without incurring the risk of compositional biases in potential borrowers' attitudes towards interest rates on formal loans (Berinsky, 2005).

Other questions in the survey included the following: "Is your main cash income from farm work? A) Yes; B) No" "Who is your preferred lender when you want to borrow money? A) relatives or friends; B) formal financial institutions; C) usury"; and "Who did you mainly borrow from in the past? A) relatives or friends; B) formal financial institutions; C) usury". Only one respondent in our survey admitted that not only his preferred lender but also his past main source of loans was usury. One other respondent stated that usury was his preferred source of loans, but not his main source in the past. Usury rates will presumably be much higher than formal rates, so anyone accustomed to usury will presumably find formal rates to be "not too high". For brevity and convenience, we simply drop the two cases in which usury was stated, and leaving these two observations out of the study does not significantly alter the results. Hence, we finally leave the sample size of 288 for our analysis. In addition, the answers choices related to the questions of "Who is your preferred lender when you want to borrow money?" and "Who did you mainly borrow from in the past?" become two: A) relatives or friends and B) formal financial institutions.

Responses to the questions discussed above are coded into the following variables as follows: *attitude* equals 1 if the respondent states that interest rates on formal loans are too high, and 0 otherwise; *income* equals 1 if the respondent's cash income is mainly from farm work, and 0 otherwise; *prefer* equals 1 if the respondent's first borrowing source is "relatives or friends", and 0 otherwise; and *source* equals 1 if the respondent's main source of loans in the past was "relatives or friends", and 0 otherwise. In addition, the variable *response* equals 1 if the respondent answered the core question, and 0 otherwise. Personal characteristics such as *age* and *gender* are also included in our analysis, whereby *gender* equals zero for male respondents and one otherwise. Respondents' educational attainment are coded into seven

categories from "never went to school" (the lowest level) to "completed college or university" (the highest). To avoid multicollinearity in the empirical analysis, we use dummy variables for the first six of these attainment levels (*edu1* through *edu6*). The respondent's family's total assets (*assets*), the number of laborers (*labor*), and the number of household members under 12 years of age and aged 65 or over (*oldchild*) are also included. The definitions, means and standard deviations of the variables used in the empirical analysis are summarised in Table 1.

Table 1: Variable definition and sample statistics

Variable	Definition	Mean	Std.Dev.	Obs.
Dependent Variable				
response	Answering the core question (i.e., Given that you wish to borrow from a formal financial institution, and comparing the interest rate set by the formal institution with the maximum interest rate that you would accept, do you feel that the interest rate set by the formal institution?) =1; otherwise=0	0.63	0.48	288
attitude	Feel that interest rates on formal loans are too high=1; otherwise=0	0.35	0.48	182
Independent Variable				
age	Respondent's age in years	47.68	11.32	288
gender	Whether the respondent is female (male=0, female=1)	0.50	0.50	288
educational attainment	Set of dummy variables with the reference category "completed college or university"			288
edu1	1 if respondent never went to school; otherwise=0	0.05	0.21	288
edu2	1 if respondent attained some elementary school; otherwise=0	0.10	0.31	288
edu3	1 if respondent completed elementary school; otherwise=0	0.15	0.36	288
edu4	1 if respondent attained some high school; otherwise=0	0.14	0.35	288
edu5	1 if respondent completed high school; otherwise=0	0.42	0.49	288
edu6	1 if respondent attended some university or college; otherwise=0	0.13	0.33	288
labor	The number of family laborers	2.72	1.48	288
oldchild	The number of family members aged under 12 or over 65 years	1.41	1.31	288
income	1 if main cash income comes from farm work; otherwise=0	0.49	0.50	288
prefer	1 if preferred source of loans is relatives or friends; otherwise=0	0.85	0.35	288
source	1 if main source of loans in past was relatives or friends; otherwise=0	0.73	0.44	288
asset	Total asset value of household including house, farm machine, other fixed assets, etc. (in thousand Yuan)	151.49	153.96	288

4.4. Conceptual framework

Our rural finance survey was designed to assess potential formal loan borrowers' attitudes towards interest rates. Attitude is described or defined as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object"(Fishbein and Ajzen, 1975). Considering a truth that potential borrowers usually plan to use formal loans for a purpose of either production or consumption and consequently, it is a underlying idea that these potential borrowers each have a potential investment project in mind, and that the rates of return of these investments follow some distribution, with some rates of return being higher than the current interest rates, and others being lower or same, and these potential borrowers formulating their attitudes correspondingly (i.e. *not too high* or *too high*). Note, however, that consumption cannot directly create wealth, but potential borrowers who plan to borrow for consumption should also look for a proper investment project because they have to repay the loan. Therefore, according to law and loan contract, whatever the purpose of borrowing may be, potential borrowers each should consider a investment project in mind so as to repay loan in due time.

The use of rate of return of a investment project (R_i^{Invest}) as a way of relating to an attitude towards interest rates on formal loan ($R_i^{Interest}$) seems reasonable if potential formal loan borrowers who want to choose between two attitudes (i.e., either too high or not). Hence, in this paper a respondent's attitude towards the interest rate on formal loans is assumed to depend on his or her personal **rate difference** (R_i^{Dif}) between the interest rate on formal loan and the rate of return of a potential investment project from borrowing, namely, $R_i^{Dif} = R_i^{Interest} - R_i^{Invest}$. As far as a respondent's R_i^{Dif} is concerned, $R_i^{Interest}$ can be viewed as constant term because it is set by the financial institutions, hence, the respondent's **rate difference** is absolutely decided by R_i^{Invest}, which in turn is influenced by his or her socio-economic characteristics as outlined in the following equation:

$$
\begin{aligned}
R_i^{Dif} &= R_i^{Interest} - R_i^{Invest} \\
&= R_i^{Interest} - f(age_i, gender_i, education_i(edu1_i \cdots edu6_i), labor_i, oldchild_i, income_i, asset_i)
\end{aligned}
$$
$$
i = 1,2,\cdots,n \ respondents \qquad\qquad (1)
$$

further, considering the constant term $R_i^{Interest}$, equation (1) can be simplified below:

$$R_i^{Dif} = F(\ age_i, gender_i, education_i(\ edu1_i \cdots edu6_i\ ), labor_i, oldchild_i, income_i, asset_i\ )$$
$$i = 1,2, \cdots, n\ respondents \qquad\qquad\qquad (\ 2\ )$$

Therefore, the **rate difference** is influenced by the respondent's age, gender, and educational attainment, the number of laborers in his or her family, and the number of household members aged under 12 or over 65 years. Whether or not farming generates the respondent's main cash income, and his or her total family's asset level are also hypothesized to influence the **rate difference** and, by extension, attitude towards interest rates on formal loans.

4.5. Empirical Model

In order to estimate the **rate difference**, we specify the conceptual model in equation (2) as follows:

$$R_i^{Dif} = \alpha X_i + \varepsilon_{1i} \qquad\qquad\qquad (\ 3\ )$$

where once again R_i^{Dif} represents the **rate difference** to respondent i of coming to his or her attitude towards interest rates on formal loan, X_i is a vector of the covariates discussed above, and α is a vector of corresponding parameters. ε_{1i} is assumed to be normally distributed, namely, $\varepsilon_{1i} \sim \left(0, \sigma_1^2\right)$.

We cannot actually observe the **rate difference** R_i^{Dif}, but we do know whether or not the respondent states that the interest rate on formal loans is too high. Thus we have an indicator of whether or not $R_i^{Dif} \geq 0$ is true (van de Ven and van Praag, 1981). In other words, all we observe is the dichotomous variable *attitude*, which we label γ_i and which equals 1 if the respondent states that interest rates are too high, and 0 otherwise. Thus, γ_i is given by:

$$\gamma_i = 0 \quad if \quad R_i^{Dif} < 0 \quad (\ interest\ rates\ are\ not\ too\ high\ ),$$
$$\gamma_i = 1 \quad if \quad R_i^{Dif} \geq 0 \quad (\ interest\ rates\ are\ too\ high\ ). \qquad\qquad (\ 4\ )$$

As mentioned above, a considerable percentage of the respondents did not answer the

core question but did answer the other questions in the survey (i.e., *item* non-response). These observations, if they are excluded from sample, could not only result in a compositional biases (Berinsky, 2005), but also not be used to estimate the coefficients α in equation (3) (van de Ven and van Praag, 1981).

According to van de Ven and van Praag (1981), *item* non-response behavior can also be analyzed by a means of probit analysis. For each respondent we define the variable *response* $\delta_i = 1$ if all questions related to rural finance have been answered, and $\delta_i = 0$ if all questions except the core question were answered:

$$\delta_i = 0 \;\; if \;\; Y_i < 0,$$
$$\delta_i = 1 \;\; if \;\; Y_i \geq 0, \qquad\qquad (5a)$$
$$Y_i = \beta Z_i + \varepsilon_{2i} \qquad\qquad (5b)$$

where Y_i is an unobserved index of response propensity, β a vector of unknown parameters, Z a vector of exogenous variables, and ε_{2i} is also assumed to be normally distributed, namely, $\varepsilon_{2i} \sim \left(0, \sigma_2^2\right)$. Specifically, we can view *item* non-response as respondents' preferences for answering the core question. "It is assumed that preferences represent the formation of an individual's state of mental awareness that primarily reflects an individual's beliefs and perceptions about the objects, which are dynamic in nature and can change significantly over time"(Huang, 1996). Thus, it is hypothesized that a respondent's socio-economic characteristics, for example, the variables *age*, *gender*, *labor*, *oldchild*, *income*, *edu1,···,edu6*, *prefer*, *source*, and *asset* influence his or her preferences for answering the core question (i.e., Z=(*age, gender, labor, oldchild, edu1,···,edu6 ,income ,prefer, source, asset*, and constant term)).

To sum up, since we only observe attitudes towards interest rates on formal loan for those respondents willing to answer the core question first, equations (5a) and (5b) model whether the respondent answered the core question and consist of a probit model in the preference equation. Moreover, equations (3) and (4) are respondents' attitudes towards interest rates on formal loans and a probit model in the attitude equation. In addition, δ_i in equation (5a) is fully observed, but γ_i in equation (4) is observed only for those respondents

who chose to answer the core question. Although equations (3), (4), (5a), and (5b) can be estimated independently of the probit procedure, there will be a loss of efficiency unless the error terms of the two probit equations are independent (Meng and Schmidt, 1985). More importantly, observations for equations (3) and (4) represent a "choice-based" or censored sample which could be subjected to potential selectivity bias if estimated separately (Huang, 1996). Therefore, the appropriate procedure is the joint estimation of equations (3), (4), (5a) and (5b) (Meng and Schmidt, 1985).

Accordingly, following van de Ven and van Pragg (1981), we assume that ε_{1i} in equation (3) and ε_{2i} in equation (5b) are bivariate standard normally distributed[4] with correlation coefficient ρ, the cumulative bivariate normal distribution function Φ_2, and cumulative standard normal distribution function Φ. Then, the likelihood [based on eqs. (3), (4), (5a) and (5b)] is :

$$InL = \prod_{i=1}^{N_1} \Phi_2(\alpha X_i, \beta Z_i; \rho) \cdot \prod_{i=N_1+1}^{N} \Phi_2(-\alpha X_i, \beta Z_i; \rho) \cdot \prod_{i=N+1}^{M} \Phi(-\beta Z_i) \qquad (6)$$

where the first N_1 observations have $\gamma_i = \delta_i = 1$ (answered all questions and feel that interest rates on formal loans are too high), the following $N - N_1$ observations have $\gamma_i = 0$ and $\delta_i = 1$ (answered all questions and feel that interest rates on formal loans are not too high), and the last $M - N$ observations have $\delta_i = 0$ (answered all questions except the core question on attitudes towards interest rates) (van de Ven and van Praag, 1981).

4.6. Results and Discussion

The probit with sample selection model was estimated using the maximum likelihood method. The model specification outlined above was initially estimated using the complete set of explanatory variables presented in Table 1. Likelihood Ratio tests were then used to exclude

---

[4] Namely, $\sigma_1 = \sigma_2 = 1$. The assumption is based on the well-known probit-normalization in order to get by maximizing the nonlinear likelihood function (5) an asymptotically efficient estimate of α and β. See, e.g. Goldberger (1964).

explanatory variables which do not improve the fit of the model. In the following we report the results of the resulting parsimonious specifications, which just focus on the signs of statistically significant findings for each explanatory variable.

The maximum likelihood estimates of the model are presented in Table 2. The explanatory variables of different education attainment levels (i.e., *edu1*,…,*edu6*) were excluded from the outcome function with respect to the respondents' attitude towards high interest rates' recognition on formal loan because they did not improve the fit of the probit with sample selection model. A likelihood-ratio test indicates that the null hypothesis that the two error terms of probit model with sample selection are uncorrelated (i.e., $\rho = 0$) can be rejected at the 0.008 significance level, namely, the sum of the log likelihoods from the two separate probit models do not equal the log likelihood of the probit model with sample selection at the 0.008 significance level.

The results of the *response* equation (5a and 5b) (see δ_i in table 2) show that respondents whose family member have more people aged over 65 and more children under 12 years of age, are less likely to answer the core question. A plausible explanation is that more old and children people in a family usually means more consumption expenditure than wealth creation. Such families may be generally less likely to borrow and therefore will lack the information required to answer the core question. Respondents who have lower education attainment level (i.e., never went to school or only attained some elementary school) are also less likely to answer the core question. The strong negative influence of *edu1* and *edu2*, or this phenomenon, might partly be explained by the reduced capability of less educated people to fill in the questionnaire. However, since these same respondents did answer the other questions in the survey, it may also be an indication that those people rarely borrow money from formal financial institutions and were thus unable to answer core question. Interestingly, as opposed to some respondents who completed elementary school (i.e., variable *edu3*), respondents who attained some high school (variable *edu4*) are less likely to answer the core question. The negative influence of *edu4*, or this phenomenon, might partly be explained by increased capability of more educated people to mainly raise funds through other financing channels such as informal finance so that they might also have insufficient knowledge to

respond he core question.

As might be expected, those respondents whose past borrowing source is "relatives or friends" are less likely to answer the core question. Finally, the finding of a negative and significant coefficient associated with the variable *prefer* is interesting but makes sense because those respondents whose preferred source of loans is friends and relatives might never access a formal loan, so they cannot give their answer with respect to the core question due to relatively poor knowledge of interest rates on formal loans.

With respect to the *attitude* equation (3 and 4), the results (see γ_i in table 2) show that being female has a significant but negative effect on the likelihood that a respondent will state that interest rates on formal loans are too high. This finding might imply that female farmers are more confident of using formal loans than males. This phenomenon might be explained by the fact that females are more risk-averse than males (see, for example, Fletschner and Kenney, 2011; Gockel, 2009; etc.), so that they might efficiently use formal loans if they can access the loan. Moreover, results indicate that respondents whose main cash income is agriculture are less likely to state that interest rates on formal loans are too high. This finding might be explained by the popular large scale financial support for agricultural production brought about by agriculture loans with relatively lower using costs in China, for example, a well-known policy that government purchases grain without limitations at protective prices (i.e., a kind of price subsidy) not only compensates farmers' all production costs including loan costs but also guarantees them a steady increase income. In addition, as might be expected, the results suggest that total values about a family's total asset exert significant but opposite influence on the likelihood that a respondent will state that interest rates on formal loans are too high. A plausible explanation is that more total assets are beneficial for smoothing any possible loan risks and increasing the capability of loan payment, so more assets reduce the respondents' sensitivity to interest rates.

In order to get some ideas about the relative influence of the attitude towards interest rates on formal loans we respectively calculated the marginal effects of the probability $\Pr(\delta_i = 1)$, $\Pr(\gamma_i = 1)$, and $\Pr(\gamma_i = 1 | \delta_i = 1)$ with respect to explanatory variables at the average value in the sample (see Table 2). Considering that the former and middle marginal

effects of explanatory variables (columns 3 and 5 in Table 2) have the same sign and significance as their related coefficients in the equations (5a) and (3) (columns 2 and 4 in Table 2), for parsimony, we therefore just shed light on the latter marginal effect (column 6 in Table 2). Column 6 represents the marginal effects for the probability of an attitude towards high interest rates on formal loan given a response that a respondent answered the core question being observed (i.e., $\Pr(\gamma_i = 1 \mid \delta_i = 1)$).

From column 6 in Table 2, the variables *gender*, *income*, and *asset* have significant but negative influence on the likelihood that a respondent will state that interest rates on formal loan are too high, but the marginal effects with respect to respondent's family total asset values are negligibly due to very small effect. Therefore, the remaining two variables (respondents' gender and whether or not their main cash income is from agriculture) are important for setting a proper loan program for financial institutions. Also the level of significance of the coefficients of these two variables (statistical significance at 1% level) shows their importance. We may conclude that respondents who are female and whose main cash income is from agriculture might be top-priority lending objects of formal loans due to their opposite attitude with respect to the likelihood that a respondent state that interest rates on formal loan are too high. Since these two types of respondents simultaneously indicated responses of answering the core question and their attitude towards high interest rates on formal loan, thus, the rural formal financial institutions should pay more attention to their liquidity demands.

Moreover, the conditional marginal effects of variable *edu1*, *edu2*, *prefer*, and *source* have significant and positive influence on the likelihood that a respondent will state that interest rates are too high. The positive marginal effects from the variable *edu1* and *edu2* can be explained by the fact that relatively lower education attainment levels largely limit those respondents' capability of wealth creation so that they hold an opinion that interest rates on formal loans are too high. Combining this with the findings of the *response* function (column 2 and 3 in Table 2), it might be concluded those respondents with relatively lower education level most likely shied away the formal loan market because they cannot afford interest rates on formal loans, and thus it is not difficult to understand why they did not respond the core

question. The positive marginal effect from the variables *prefer* and *source* are as expected and can be explained by the fact that most loans with zero interest from relatives or friends[5] are more likely appealing so that respondents feel that interest rates on formal loans are too high. Combining this with the program with respect to how to attract more farmers into the formal loan market, we may conclude that popular agricultural loans are very difficult to attract those farmers who have cheap channels to raise funds, so the rural financial institutions may provide them other services, such as financial planning, so as to get service yields.

Table 2: Maximum likelihood estimates of the parameters and marginal effects of response for answering the core question (δ_i) and attitude towards interest rate on formal loan (γ_i) equations

Variable	Response (δ_i)		Attitude (γ_i)		Conditional Marginal Effects
	Coefficient	Marginal Effects	Coefficient	Marginal Effects	
age	0.01(0.01)	0.005(0.003)	-0.01(0.01)	-0.002(0.002)	-0.005 (0.003)
gender	0.02(0.19)	0.009(0.07)	-0.47*** (0.19)	-0.14*** (0.05)	-0.22*** (0.08)
labor	-0.01(0.06)	-0.005(0.02)	-0.01(0.06)	-0.002(0.02)	-0.0004(0.02)
oldchild	-0.17*** (0.07)	-0.06*** (0.03)	0.02(0.07)	-0.005(0.02)	0.04(0.03)
income	-0.20(0.18)	-0.08(0.07)	-0.53*** (0.19)	-0.15*** (0.05)	-0.20*** (0.07)
asset	0.0005(0.0006)	0.0002(0.0002)	-0.001* (0.001)	-0.0003* (0.0002)	-0.0006** (0.0002)
edu1	-1.40** (0.66)	-0.50*** (0.17)			0.69*** (0.04)
edu2	-1.55*** (0.60)	-0.55*** (0.15)			0.70*** (0.04)
edu3	-0.78(0.60)	-0.30(0.23)			0.24(0.29)
edu4	-1.01* (0.61)	-0.39* (0.21)			0.38(0.43)
edu5	-0.71(0.58)	-0.27(0.21)			0.15(0.15)
edu6	-0.77(0.60)	-0.30(0.23)			0.24(0.30)
prefer	-0.44* (0.26)	-0.15* (0.08)			0.07** (0.03)
source	-0.64*** (0.21)	-0.22*** (0.07)			0.10*** (0.03)
constant	1.78** (0.73)		0.13(0.48)		

Log Likelihood = -272.6067

LR test of indep. Eqns (ρ =0): $\chi^2_{1,0.008}$=7.13

Wald $\chi^2(6) = 13.39$**

Number of Observations = 288

Note: *,**,***, represents 10%, 5%, and 1% significant level, respectively; standard errors in parentheses. Marginal effects is at the same mean value. The appropriate marginal effect for a binary independent variable, say, *d*, would be calculated by taking the difference of estimated probabilities when *d* increases from 0 to 1, namely, Marginal Effect=Pr(*d*=1)-Pr(*d*=0) (Greene, 2011).

---

[5] Interest rates charged by relatives or friends are often zero or very low in the rural areas of China. Indeed, in our survey, 93% of the respondents, who answered the core question, confirmed that the interest rates charged by relatives or friends are zero.

4.7. Summary and Conclusion

In this article we studied respondents' attitudes towards interest rates on formal loan on the basis of their responses of answering all questions in the survey. For an estimation method we used a probit model with sample selection which was suggested by van de Ven and van Praag (1981). The maximum likelihood estimation that accounts for sample selectivity bias was used to analyze the survey data collected for this study.

Our main conclusion is that respondents' gender, their main cash income sources, and their family's total asset values have negative influence on the likelihood that a respondent will state that interest rates on formal loans are too high. The conditional marginal effects, which indicate respondents' attitudes towards high interest rates on formal loans on the basis of their response of answering all survey questions, suggest that respondents' gender, their main cash income sources, relatively lower education attainment levels, and past main borrowing source have important influence on the attitudes towards high interest rates on formal loans.

A clear implication is that female clients or clients whose main cash income is from farm work deserve to be paid more attention by formal loan lenders due to their negative attitudes towards high interest rates recognition on formal loans. If China's rural formal financial institutions can closely combine with the state's preferential policies which support agricultural production and rural economic growth, then they can develop proper loan services or programs which are aimed at these two types of clients in rural financial markets. In fact, from 2004 to 2009, each year's China's No. 1 documents released by the central government, elaborating on the biggest economic concern of the state, clearly announced many policies to promote agriculture and rural development. Many policies from these documents encourage development of rural finance and consequently, developing several policy-led financial products, for example, agricultural loan with appropriate discount of lending rate, can not only appeal to many potential clients but also promote formal loan's development.

In addition, from the results of this empirical investigation, we draw the following policy implication. Since 22 percent of the respondents felt that interest rates on formal loans were

too high, it brings evidence for the failure of rural formal loan markets to some extent. Considering population size in China's rural areas, we have enough reasons to believe that there should be many potential formal loan borrowers who are suffering loan constraints because they cannot afford interest rates on formal loans. As we mentioned above, one obvious reason for those respondents' predicaments is that RCCs currently have a monopoly in rural formal loan market so that borrowers almost have no multiple options and consequently, they might be forced to leave the formal loan market. In order to redress the partially failure rural financial system, the Chinese government and POBC should change the monopolization of RCCs by allowing more other financial institutions to enter rural financial market for a competitive environment. For example, the Chinese government and POBC should bend the rules for private or even foreign capital entering the rural financial market so as to enlarge the rural financial supply to some extent. Prior to 2005 and 2006, although China's central government has opened up its rural financial market to private or foreign microfinance institutions (MFI) (Guo and Jia, 2009; Turvey and Kong, 2010), these few licensed institutions with pilot character operate in pretty small regions so that they cannot shake RCCs' monopoly on formal loan disbursement at all. In consequence, if a large number of private or foreign financial companies are licensed by the government and POBC, then it should be beneficial to promote better competition in rural financial market.

Another possible reason for those respondents' predicaments is that the characteristics of rural financial demands are usually small, scattered and seasonal as compared to urban financial demands so that traditional commercial banks would not like to enter into the rural financial market due to high-transaction costs and limited collateral capacity. In China, for example, prior to 1995, "ABC withdrew from rural areas and focused primarily in urban areas" (Guo and Jia, 2009). And ABC's urbanization is also an important reason which leads to RCCs' current position of monopoly in China's rural formal loan market, of course. In consequence, the Chinese government and POBC should lay out preferential policies for agricultural or rural loan (e.g., exempting financial institutions' full sales tax and partial income tax if their loans disbursement are for agricultural production or rural development) so as to attract a great deal financial institutions to penetrate in rural areas. This is also a way to change the monopolization of existing rural financial institutions and redress financial market

failure.

Overall, as far as policymakers (i.e., the government and POBC) are concerned, the key point of future work is to change the monopolization of current rural financial institutions and allow more financial institutions or capital to enter rural financial market so as to promote competition among different institutional lenders and thus potentially improve the financial services.

References:

Alessie, Rob, S. Hochguertel, and G. Weber (2005). "Consumer Credit: Evidence from Italian Micro Data". *Journal of the European Economic Association*. 3(1): 144-178.

Attanasio, O. P., P. K. Goldberg, and E. Kryiazidou (2008). "Credit Constraints in the Market for Consumer Durables: Evidence from Micro Data on Car Loans". *International Economic Review*. 49(2): 401-436.

Berinsky, A. J. (2005). "Silent Voices: Public Opinion and Political Participation in American". Princeton University Press.

Bottomley, A. (1975). "Interest Rate Determination in Underdeveloped Rural Areas". *American Journal of Agricultural Economics*. 57(2): 279-291.

Castro, E.R., and E. C. Teixeira (2006). "Agricultural Credit Interest Rate Equalization Policy: A Growth Subsidy?" Selected Paper. IAAE Conference, Gold Coast, Australia, August 12-18.

Cheng, E. and Xu, Z. (2004). "Rates of Interest, Credit Supply and China's Rural Development". *Savings and Development Quarterly Review*. Vol (2): 131-156.

Dehejia, R., H. Montgomery, and J. Morduch (2005). "Do Interest Rates Matter? Credit Demand in the Dhaka Slums". ADB Institute Discussion Paper 37.

Dodson, C.B., and M.R. Duncan (1998). "The Determinants of Net Interest Rate Spreads for Farm Credit Direct Lending Associations." *Working Paper*. Proceedings: 1998 Regional Committee NC-221, October 5-6, 1998, Louisville, Kentucky.

Duffee, G.R. (2002). "Term Premia and Interest Rate Forecasts in Affine Models". *The Journal of Finance*. 57(1): 405-443.

Featherstone, A.M., B.K.Goddwin, and A. D. Barkema (1993). "Dynamics of Farm Interest Rates". *Working Paper*. Proceedings: 1993 Regional Committee NC-207, October 4-5, 1993, Chicago, Illinois

Feder, G., L.J. Lau, J.Y. Lin, and X. Luo. (1990). "The Relationship between Credit and Productivity in Chinese Agriculture: A Microeconomic Model of Disequilibrium". American *Journal of Agricultural Economics*. 72(5):1151-1157.

Fishbein, M. and Ajzen, I. (1975). Belief, Attitude, Intention, and Behavior: An Introduction

to Theory and Research. Reading, MA: Addison-Wesley.

Fletschner, D., and L. Kenney (2011), "Rural Women's Access to Financial Services". Working Paper, No. 11-07. Agricultural Development Economics Division, The Food and Agriculture Organization of the United Nations. March, 2011

Gale, F., and R. Collender (2006). "New Directions in China's Agricultural Lending." *Working Paper*. WRS-06-01. Economic Research Service. United States Department of Agriculture. January, 2006.

Gockel, R.P. (2009), "Credit and Risk: Analyzing Determinants of Willingness to Borrow More Credit in Rural Vietnam." *Working Paper*, Henry M. Jackson School of International Student Degree Project, June 4, 2009.

Goldberger, A.S. (1964). Econometric Theory. New York: John Wiley & Sons.

Greene, W. (2011). Econometric Analysis (7th edition). Prentice Hall.

Gross, D.B., and N.S. Souleles (2002). "Do Liquidity Constrints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data". *Quarterly Journal of Economics*, 117(1): 149-185.

Guo, P., and X. Jia (2009). "The Structure and Reform of Rural Finance in China". *China Agricultural Economic Review*. 1(2): 212-226.

Huang, C.L. (1996). "Consumer Preference and Attitudes towards Organically Grown Produce". *European Review of Agricultural Economics*. 23:331-342.

Jarrow, R., H. Li, and F. Zhao (2007). "Interest Rate Caps 'Smile' Too? But Can the LIBOR Market Models Capture the Smile?" *The Journal of Finance*. 62(1): 345-382.

Jia, X., Heidhues, F. and Zeller, M. (2007). "Taking the Bands off Rural Credit Market: an Evidence from China". IAMO Forum 2007: Sustainable Rural Development: What is the Role of the Agri-food Sector? Halle (Saale).

Karlan, D. S., and Joathan Zinman (2008). "Credit Elasticities in Less-Developed Economies: Implications for Microfinance", *American Economic Review*. 98(3): 1040-1068.

Li, X., C. Gan, and B. Hu (2011). "Accessibility to Microcredit by Chinese Rural Households". *Journal of Asian Economics*. 22(3): 235-246.

Martin, M.F. (2012). "China's Banking System: Issues for Congress". *CRS Report for Congress*, Congressional Research Service. 7-5700. R42380. February 20, 2012.

http://www.fas.org/sgp/crs/row/R42380.pdf

Meng, C. L., and Schmidt, P. (1985). "On the cost of Partial Observability in the Bivariate Probit Model". *International Economic Review*. 26(1): 71-85.

Mohane, H., G.K. Goetzee, and W. Grant (2002). "The Effects of the Interest Rates Ceilings on the Micro Lending Market in South Africa". *Working Paper:2002-02*. University of Pretoria, Pretoria. 0002. South Africa. http://ageconsearch.umn.edu/bitstream/18078/1/wp020008.pdf

Petrick, M., and L. Latruffe (2005). "The Determinants of Polish Farmers' Credit Interest Rates: Hedonic Price Analysis and Implications for Government Policy". XIth Insernational Congress of the EAAE. Copenhagen, Denmark. August 24-27, 2005.

Salazar, G., C. Turvey, V. Bogan, and L. Cubero (2010). "How high is too high? Soaring Interest Rates and the Elasticity of Demand for Microcredit". *Selected Paper*. AAEA, CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010.

Turvey, C.G., and R. Kong (2010). "Informal Lending amongst Friends and Relatives: Can Microcredit Compete in Rural China?" *China Economic Review*. 21(4): 544-556.

van de Ven, W.P.M.M., and B.M.S. van Praag (1981). "The Demand for Deductibles in Private Health Insurance: A Probit Model with Sample Selection". *Journal of Econometrics*. 17: 229-252

CHAPTER FIVE

SUMMARY AND OUTLOOK

This dissertation used randomized field survey data to estimate lending volume decisions of lenders, the number of lending approvals by lenders, and respondents' attitudes about lending rates of formal loans. The sample included rural residents collected from rural Shandong, China in July 2010.

This dissertation provided empirical evidence for lending volume decisions in Chapter Two, the number of lending approvals over a period of years in Chapter Three, and respondents' attitudes towards interest rates on formal loans in Chapter Four. The results mainly show that rural households' characteristics were the main affect on the approval decision, rather than the lending volume decision covered in Chapter Two. Chapter Three elaborates on the finding that households where the head of the house has a higher education level and has a large area of land were more likely to be granted a loan by lenders over a period of years. Additionally, Chapter Four has a discussion of the finding that respondents' gender and main cash income sources have important influences on the attitudes towards high interest rate recognition on formal loan.

These findings must be considered when drawing policy recommendations, as the potential roles of education and amount of land owned indicate not only increasing rural residents' welfare, but also the ability to allow borrowers to gain a more advantaged position in the financial market. Hence, the government at all levels in China should strive to improve education in rural areas and protect land rights of all farm families with the aim of increasing farmers' chances for access to formal loans. These findings also give a clear implication that female clients, or clients whose main cash income is from farm work, deserve to be paid more attention by formal loan lenders, in part because they generally have positive attitudes about current lending rates of formal loans.

The findings bring to light three possible disequilibrium situations between lending and borrowing practices, which can all be summed up to the fact that loan demand does not equal loan supply in the rural financial market. The first disequilibrium is a volume disequilibrium,

if a borrower's desired loan volume does not equal his/her disbursed loan volume. The second disequilibrium is a number disequilibrium, if a borrower receives a lower number of loan approvals' times than a number of loan applications' times. The third disequilibrium is a loan rate disequilibrium, if a borrower's expected interest rate on formal loan does not equal the actual interest rate set by the financial institutions. This leads to a question that cannot be answered in the study but needs to be answered in the future: how do the household's characteristics affect the disequilibrium between lending and borrowing practices?

In addition, given the results of this study, two additional questions require answers. First, how can the questionnaire design be improved to achieve higher quality data relating households' characteristics? The data should be genuine exogenous when I use them to be independent variables for my empirical analysis in the dissertation. If these data are genuine exogenous, they can effectively avoid endogeneity problems that arise in empirical analysis. Second, what extent do the results apply to other settings? China is a large country and suffers unbalanced development in various rural areas and the results may vary across settings. Therefore, further research needs to expand the survey area, which can include a number of completely different regions in China, to reach more general conclusions for the entire country.

APPENDIX

SAMPLE QUESTION
(ABRIDGED VERSION IN ENGLISH)

NOTE: Author's translation from Chinese. The questionnaire was designed in Chinese in accordance with Chinese reading habits and idiom.

1. Respondent's gender: ○ male; ○ female.   Household head' gender: ○ male; ○ female.

2. Responedent' age:_____; Household head's age:_____.

3. How many people do farm work in your family? _____

4. How many people do off-farm work in your family?_____

5. How many people are over 65 years old in your family?_____

6. How many people are under 12 years of age in your family?_____

7. What is the highest level of education you have attained? (Please indicate only the last level of education completed or the level at which you are currently studying)

   ①uneducated (never went to school); ②completed some elementary; ③completed elementary; ④completed some middle school; ⑤completed middle school; ⑥completed some college or university; ⑦completed college and university.

8. How many years of the household head do he/she have?_____

9. How many Mu of land have you farmed?_____ (Note: 1 Mu≈0.16 Acre).

10. Does the household head have skill(s) for working non-farm job? ○ Yes; ○ No.

11. What is the total worth of all assets (including house, land, fixed assets, etc.) in your family (in thousands)?_____thousand Yuan.

12. Given that you wish to borrow from a formal financial institution, and comparing the interest rate set by the formal institution with the maximum interest rate that you would accept, do you feel that the interest rate set by the formal institution is:

   A) too high; B) too low; C) fair

13. Is your main cash income from farm work? A) Yes; B) No

14. Who is your preferred lender when you want to borrow money?

A) relatives or friends; B) formal financial institutions; C) usury

15. Who did you mainly borrow from in the past?

A) relatives or friends; B) formal financial institutions; C) usury

16. Did you be granted loan(s) from formal financial institutions over the past five years?

A) Yes; B)No; C) Non-application

17. If you received formal loan (s), then how many times did you be granted by formal financial institution over the past five years? And how much of the last loan did you be granted by formal financial institution over the past years?

_____time(s); _____Yuan.