An Empirical Investigation of Credit Constraints

in the Rural Credit Market in Guizhou China

By Rongrong Weng

Department of Natural Resource Sciences McGill University, Montreal

February, 2008

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science in Agricultural Economics

> ©Rongrong Weng (February, 2008)

An Empirical Investigation of Credit Constraints in the Rural Credit Market in Guizhou China

Abstract

It is commonly held that rural households in China, especially poorer households, have been credit rationed by formal lenders. This study examined factors that determine a household's propensity to borrow using a formal loan and the likelihood of being credit rationed. The analysis is based on data from a survey of households in Guizhou province. The results suggest that the likelihood to borrow is mainly dependent on household resilience to income volatility, and the likelihood to be credit rationed mainly depends on the household's ability to repay the loan and creditworthiness. In addition, lower-middle-class farmers are the most constrained group. For those households taking formal loans, the purposes of agricultural production and consumption-smoothing are equivalently important in rural Guizhou.

Une recherche empirique sur des contraintes de crédit dans le marché de crédit rural à Guizhou en Chine

Résumé

En Chine, il est tenu commun que les ménages ruraux, particulièrement les plus pauvres, ont été crédités rationnement par les prêteurs formels. Cette étude examine les facteurs de la détermination de la propension d'un ménage d'être qualifié pour un prêt formel et de la probabilité d'être crédité rationnement. Cette analyse est basée sur des données d'une étude des ménages dans la province de Guizhou. Les résultats suggèrent que la probabilité à emprunter dépend principalement de la résilience du ménage à la volatilité du revenu et que la possibilité d'être crédité rationnement est dépendant primordialement de la capacité du ménage de rembourser le prêt, puis de son solvabilité. En outre, les fermiers de bas-moyen-classe sont les plus touchés par les contraintes de crédit. Pour les ménages qui prennent les prêts formels, ils ont le but d'établir une production d'agricole et une consommation régularisée qui sont équivalemment important dans le Guizhou rural.

Acknowledgements

I would like to give my deepest thanks to my supervisor, Dr. John Henning for his thoughtful guidance and enlightening instructions. With his wisdom and kindness, he helped me through in all the aspects of this thesis, from topic selection to data acquisition and from his training of my ability of critical thinking to his detailed correction of my writing. I am greatly indebted to his time and his help to my research.

Meanwhile, I am thankful to the Asian Development Bank (ADB) and Dr. Guangwen He at the China Agricultural University for making available the data for this study. I am also grateful to Dr. Ying Qian at the ADB for his whole-hearted support for my research.

I would also like to thank Ms. Marie Kubecki, the Graduate Student Coordinator, for her ready help, Mr. Aaron Chao and Mr. Charles Ngo for their English editing and French translation, and Miss Esther Chao, Miss Jean Chang and Miss Xiangxiang Ye for their caring and cherishing during my writing of the thesis.

To my parents

Abstract	. i
Résumé	ii
i Acknowledgementsi	ii
1. Introduction	1
1.1. Rural poverty in china	1
1.2. Credit access and poverty in rural China	2
1.3. Current credit situation in Guizhou	4
1.3.1. Rural poverty in Guizhou.	5
1.3.2. Credit supply in rural Guizhou	7
1.3.3. Credit demand in rural Guizhou	0
1.4. Problem statement and objectives	0
1.5. Structure of the thesis	1
2. Literature review	3
2.1. Introduction	3
2.2. Role of credit in development of rural areas	3
2.2.1. Finance and growth	3
2.2.2. The role of credit in development of rural areas	6
2.3. Defining credit rationing	8
2.4. Causes of credit rationing	0
2.4.1. The imperfect information paradigm	0
2.4.2. The contract enforcement problem	2
2.5. The Borrowing and lending decisions	2
2.5.1. Notional and effective demand	3
2.5.2. Sectoral interaction	6
2.6. Empirical studies on credit rationing	8
2.6.1. Productivity and demand for credit	9
2.6.2. Preemptive credit rationing	2
2.7. Summary	5
3. Methodology	6
3.1. The economic model	6
3.1.1. The borrower's decision	6
3.1.2. The lender's decision	9
3.2. The statistical model 4	0
3.3. Data	4
3.4. Model specification 4	-5
3.4.1. Demand equation 4	-5
3.4.2. Rationing equation 5	1
4. Results and discussion 5	7
4.1. Descriptive statistics 5	7
4.2. Estimation results	9
4.3. Discussion 6	3
5 Conclusions 6	8
5.1. Summary of findings	8
5.2 Policy implications 7	0
5.3. Limitations and future research 7	1
References	3

Appendix 1: Figures and tables	. 80
Appendix 2: Questionnaire to households	. 89

1. Introduction

1.1. Rural poverty in china

Since the implementation of market-oriented reforms in 1978, China has seen remarkable socio-economic progress, especially in its effort to combat poverty. From 1981-2001, the extent of absolute poverty, defined as the proportion of people living below the World Bank poverty line of less than one US dollar per day fell from 53 % to 8 %. There were over 400 million fewer people living in absolute poverty in 2001 than 20 years previously (Ravallion and Chen, 2004). Despite of the achievement in poverty alleviation, an estimated 26 million people continued to live in poverty in 2003 according to China's official poverty line of 637 RMB per year (0.2 USD per day). However, if the World Bank's poverty line is applied, the number of people living in absolute poverty would have been 200 million, the second largest after India (National Bureau of Statistics of China, 2004). Perhaps one of the valid generalizations about the poor is that they are disproportionately located in rural areas and that they are primarily engaged in agricultural and associated activities. Data from China supports this argument. In China, 90% of those living in poverty are located in rural areas where two-thirds of the population lives (Gwen Moore Children of China Fund, 2006). The part of the population living in poverty is geographically concentrated, with wide differences in income distribution existing among and within regions. Most of the poor resides in the west and northern-central hinterlands in China. Indeed, if the poverty line was defined as the farmers' net annual income per capita being 1500 RBM (190 USD) or less, then all the provinces that lie below the poverty line would be in the West. In 1992, the Aid-the-Poor Development Office of the State Council defined a "Poor County" to be one where the annual net income per capita was less than 400RMB (50.6USD). The proportion of Poor Counties per province is 40.1% in the West, 24.1% in Central China, and 12.9% in the East (China Development Gateway, 2006).

The issue of rural poverty is also reflected in regional and sectoral inequality. On the one hand, there are signs of regional divergence between the coastal provinces and much of inland China (Jian el al., 1996). For example, in 2004, annual income per capita in the East was 2.6 times that of West, 2.2 times that of Central and 1.4 times that of Northeast in 2004 (Yang, 2006). This is seen to have been (at least partly) the result of the government's policies, including the greater emphasis on industrial reform than on agricultural reform since the mid-1980's, and the practice of inter-provincial transfers (through differential tax treatment and public investment) that has favoured coastal areas (Ravallion and Jalan, 1999). On the other hand, urban-biased institutions and policies lead to the fact that urban workers' productivity and earnings far exceeded those of their rural counterparts (Putterman, 1993; Yang and Zhou, 1999 and Yang 1999). In 2004, per capita annual net income of rural households was 9422 RMB (National Bureau of Statistics of China, 2005)¹.

However, poverty defined as whether households or individuals have enough resources or abilities to meet their needs (World Bank, 2002), goes beyond the lack of income. Economically, the poor are not only deprived of income and resources, but of opportunities that include the lack of credit for income generation, and to stabilize consumption (Khandker, 2003). A great amount of literature (Khandker and Pitt, 2003, Khandker, 2005, Kurmanalieva et al, 2003 and Morduch and Haley, 2002) has been devoted to the examination of the impact of access to credit on poverty alleviation, most of which is focused on the impact of microfinance programs as an institutional innovation to meet the needs for credit by small and medium scale producers and business.

1.2. Credit access and poverty in rural China

According to Xie et al (2005), rural finance reforms since 1996 have failed to enhance competition in rural credit markets. Rural China is currently serviced by

¹ Note that per capita annual net income of urban households was not available from this source.

a limited number of alternatives when it comes to formal financial institutions. These include the Rural Credit Cooperatives (the RCCs), the Agricultural Bank of China (ABC), the Agricultural Development Bank of China (ADBC), and the Postal Savings System. The ADBC focuses only on commercial grain and cotton production. The ABC operates at least at the township level. However, following the financial reforms in 1996, the ABC has been retreating from providing financial services and has been closing down some of its business offices. Similar to the RCCs' extensive presence in rural China, the Postal Savings System has more than 30,000 branches at and below the township level, and absorbs large amounts of savings. However, the postal savings system had no lending and credit card business². One significant development in the 1990s was the rapid spread of various forms of semi-formal "Rural Cooperative Foundations" in many localities across the country and these took over large swathes of rural finance. However, they were requested be dissolved in March 1999 by the State Council (Holz, 2001). Thus, the RCCs represent the principal, if not only, formal financial institutions with a nationwide network of offices at and below the township level in rural China. Nevertheless, the RCCs' institutional structures had meant that a significant portion of its deposits from rural household had always been placed in the formal banking system and used for urban and non-agricultural investment. As a result of problems in ownership and management, a reform of the RCCs was initiated in 2003. Results of the RCC reform have been generally positive, however, there has been a lack of participation by farmer-owners in the reform process and the participation of farmer-owners in the restructured RCCs is decreasing (PlaNet Finance, 2005). Thus, there are still limited alternative forms of rural finance other than the RCCs, particularly those that serve the poor.

In light of the contribution of access to credit to alleviate poverty, policymakers are contemplating alternative forms of financing, primarily microfinance institutions (MFI). Microfinance involves small-scale transactions in credit and

² Since 1995, the China Banking Regulatory Commission tried to convert the Postal Savings System into a commercial bank. The China Postal Savings Bank was expected to open by the end of 2006 (Zhao, 2005). A pilot loan business has been started in 12 provinces and 1 municipality thus far. It is estimated that it will be the fifth biggest bank after the completion of its restructure.

savings designed to meet the needs of small and medium scale producers and business. The People's Bank of China (the Central Bank) staged a series of measures in January 2000 and December 2001 to encourage RCCs to implement microfinance programs. However, micro finance programs have been operated by NGOs for quite some time. Since the initial introduction of microfinance to China in 1994, more than 10 million poor families have received microfinance services in China, through nearly 20,000 microfinance programs, consisting of NGO pioneered programs, government-run programs and microfinance provided by Rural Credit Cooperatives, the major supplier of rural credit in the rural financial market. Although NGO programs seemed to achieve positive progress in raising participants' income and smoothing their consumption, their legal status remains unclear, which encumbers NGO programs from further expanding. China's financial laws and regulations forbid non-financial institutions, including NGOs, from supplying any type of financial service. As a consequence, the authorities and microfinance donors have to negotiate a temporary legal status for microfinance projects (Du, 2005). The government-run programs differ little from the failed subsidized loan program they replaced in that these microfinance programs do not target the poor effectively, do not effectively establish basic principles and achieve low repayment rates (Park and Ren, 2001). The outreach of the RCCs' pilot micro credit programs, especially those in the study region of Guizhou Province, will be discussed in the next section. Given that the RCCs' pilot micro credit programs were only initiated at the end of 2001, there is little empirical information regarding the sustainability of these programs.

1.3. Current credit situation in Guizhou

Among 34 provinces and municipalities, Guizhou is considered an interesting area for research on credit and poverty alleviation, given its high poverty rate and pilot micro credit programs that are currently taking place. This has been recognized by the Asian Development Bank and resulted in a survey conducted by He and Li (2005). They conducted a survey of rural households in Tongren Prefecture in Guizhou regarding the financial situation and the results have drawn attention to credit needs of these households.

1.3.1. Rural poverty in Guizhou

Guizhou Province is located in the upstream Yangtze River basin in southwestern China. The province covers an area of 176,100 square kilometers, with the average altitude of 1,100 meters. Most of the land lies between 1,000 meters and 1,400 meters above sea level. Mountains and hills make up 92.5% of the total provincial area, of which 61.9% is dominated by Karst landscapes (Guizhou People's Government, 2006). A Karst landform is shaped by the removal of bedrock in solution and by the development of underground drainage without the development of surface stream valleys (Encyclopædia, Britannica. 2007). The western part of the province covers 17,600 square kilometers of the Yunnan-Guizhou plateau (Gwen Moore Children of China Fund, 2006).

Guizhou boasts its rich mineral deposits, water resources, forest resources and wildlife. Its coal reserves rank the fifth largest in China and phosphorus reserves rank second, accounting for 32.6% of the national total (Guizhou People's Government, 2006a). With its warm weather and sufficient amount of precipitation, Guizhou is a mountainous area typical of the sub-tropical plateau zone. Most of the province averages an annual temperature of 15 °C, with an average temperature of 5.2 °C in January and 24.3 °C in July. It also enjoys plenty of rainfall; the average annual precipitation is between 1,000 and 1,400 millimetres.

Guizhou is mainly an agricultural province. 87% out of its 38 million people live in rural areas, undertaking production of food crops (rice, corn, potato, etc), cash crops (oil seeds, tobacco, etc), and vegetables. The arable land in Guizhou Province totals around 1.9 million hectares, three quarters of which is for grain production (China Population Information and Research Center, 1999). The warm and moist sub-tropical climate provides the farmers more than 270 frost-free days per year for agricultural production (Guizhou People's Government, 2006b).

However, agriculture faces tremendous challenges mainly arising from the large population and the mountainous and complex landscape. Due to the large population, the arable land per capita is only 0.05 hectare. With a high population density and scarcity of arable land, a significant amount of terraced fields on steep slopes have been cultivated, accounting for over 50% of total arable land. Cultivation of steep slopes has resulted in a decrease in forestry resources and land erosion. 42% of the land in Guizhou is suffering from erosion, which has caused a decrease in soil quality, desertification and deterioration of the ecological system (Guizhou Development and Reform Commission, 2006). In addition, infrastructure development, especially road and telecommunication development, still lags behind, and access to markets and information is fairly poor (UNICEF, 2000). These may be part of the reasons for the rural poverty in Guizhou as described below.

The per capita GDP of Guizhou residents in 2004 was 3568 RMB (470 USD), ranking it last among 34 provinces and municipalities (National Bureau of Statistics of China, 2005) and the net income of farmers was 1721.55 RMB (215 USD). The disparity of rural and urban sectors is even more severe in Guizhou, which can be shown by the difference in savings deposits between urban and rural residents. At the end of 2003, per capita savings deposits of urban residents in Tongren Prefecture was 10,116.3 RMB, a sharp contrast with 405 RMB for the rural counterparts, a difference of 25 times! (He and Li, 2005)

Guizhou is a cultural melting pot of ethnic groups. Ethnic minorities comprise a considerable proportion (34%) of the total population, with the Miao and Bouyei people representing a large share. 3.5 million Miao people, which is half of total population of the Miao in China, live in Guizhou, and there are about 2.5 million Bouyei people. The ethnic minority groups live in secluded mountainous areas

and are mainly engaged in agricultural production. With high illiteracy rates, they are more likely to be victims of rural poverty.

1.3.2. Credit supply in rural Guizhou

As stated before, since the commercialization of state-owned commercial banks in the mid 1990s, and the restructuring of their ownership in 2003, the formal rural financial market became more limited in terms of suppliers. In rural Guizhou, as other rural areas, the RCCs are dominant, and in some villages, the only, formal credit supplier. For instance, in Wanshan County, there exists only 3 financial institutions (the RCCs, the Postal Savings System and Industrial and Commercial Bank of China), of which only the RCCs provide a rural credit service (He, 2005). With 85 branches and around 2000 offices, the RCCs, therefore, enjoy the largest share in the loan market, whereas its share in deposit market is surprisingly low. Due to lack of data, the specific share of the RCCs in the deposit and loan market across Guizhou Province is inaccessible. However, He (2005) pointed out that, in Jiangkou County, the share of the RCCs in the loan market in 2004 was 72.6%, compared with a 36.4% share in the deposit market.

In Guizhou, the gap of shares between the loan and deposit markets, together with the high deposit-loan ratio in the RCCs, have given rise to concern regarding the outflow of rural funds and the insufficient circulation of funds in the rural financial system, for which the postal savings system is partly to blame. The gap between deposit and loan activities in the Agricultural Bank of China (the ABC) is not significant (Xie el al, 2005). Meanwhile, the RCCs in Guizhou have about 20 billion RMB in deposits and 18 billion RMB in outstanding loans. It is true that the postal savings system provides a nationwide remittance system, through which migrant workers can remit to their families remaining in rural areas, which is of significant importance to Guizhou, given its large proportion of migrant workers in the labour force of the province. However, the Postal Saving System has been absorbing deposits for two decades without providing credit in Guizhou³, which serves as a channel for the outflow of rural funds. With 548 branches across Guizhou, below the township level, rural households have easy access to its branches, and there was 2.7 billion RMB in deposits as of September 2004 (Xie et al, 2005). This can be regarded as a pure outflow of funds from rural Guizhou, and represents around one third of total rural loans issued by the RCCs in Guizhou in 2003.

Responding to its high incidence of poverty, Guizhou has been one of the provinces to undertake the RCCs' pilot program⁴ that focuses on micro credit programs. Microcredit is designed for agricultural production, student loans and consumption loans. Micro credit issued by the RCCs has two forms: group guarantee loans similar to the Grameen Bank and credit loans. Credit loans, or loans without collateral security, are targeted at creditworthy rural households who are in need of loans of small amounts but unable to provide collateral. Rural households are firstly credit rated by the RCCs according to their financial conditions, and then creditworthy farmers are granted a credit line, the maximum amount of loans that they can apply for. However, each time a farmer wishes to borrow against their line of credit, an application must be made to the RCC. The RCCs' group guarantee loans differ from the Grameen Model in China in terms of interest rates, female participation and repayment scheme. Firstly, although the reform of the RCCs increased the ceiling on interest charged on RCCs rural loans to 10.28%, doubling the base rate of 5.14% per annum, it is nevertheless insufficient to reach a cost-effective scale for the RCCs to operate. What is required is reported to be a conservative estimate of 20% annually, as in other successful NGO microfinance programs (Park and Ren, 2001). The Grameen Model charges interest rates between 15-20%. Secondly, the targets of RCCs

³ Please refer to footnote 2 for discussion regarding the reform of postal savings system. Guizhou is not among the 13 pilot provinces where postal saving banks started to issue loans in 2006.

⁴ Seven provinces and one municipality were selected as the first group for pilot testing the reform of the RCCs. They were Guizhou, Jiangsu, Jiangsi, Jilin, Shanxi, Shandong and Zhejiang provinces and Chongqing municipality.

microfinance programs are heads of households, who are mainly males in rural China. Contrarily, females are the focus of the Grameen Model. Finally, as for the repayment schedules, a RCC microcredit loan requires a lump-sum payment on the maturity date. However, the Grameen Model uses frequent instalments as one of the mechanisms to ensure its high repayment rate (Xie et al, 2005).

Given that the RCCs are the main provider of formal rural financial services, it is likely that the financial needs of rural households that are not covered by RCCs' service are, at least partly, met by informal financing mechanisms. These range from interest - free loans between friends and relatives, to sophisticated financing arrangements that circumvent national banking regulations in creative ways (Tsai, 2001). The People's Bank of China (PBC) 2004 survey of rural households in six counties of Guizhou⁵ cast much-needed light on the sources of credit among rural households across rural Guizhou. Interpersonal lending was listed as the most important credit source for rural households (64.1% in terms of frequency and 45.7% in terms of total value), while the RCCs were the second (31.2% in terms of frequency and 41.5% in terms of value). The importance of the informal financial market in rural Guizhou was confirmed by He's (2005a) case study in Jiangkou County. The informal financial market in Jiangkou is active with a magnitude of approximately 3 million RMB. Private rural sources of credit in Jiangkou consist of a quasi-formal institution (the Mutual Saving Association), interpersonal lending, professional brokers and money lenders. There are 57 Mutual Saving Associations in Jiangkou, in which 20% of the rural households participate. Most of the interpersonal loans are low in amount and short in period and they are mainly for consumption and emergency use instead of for agricultural production. Thus, it remains unclear to what extent the informal financial mechanism meets the needs of credit of rural households in Jiangkou and Guizhou as a whole (He, 2005).

⁵ These six counties were comprised by counties from prefectures which are well off (Zunyi), average (Qiandongnan Miao and Dong Autonomous Prefecture) and poorest (Bijie), respectively. Two counties were selected from each prefecture.

1.3.3. Credit demand in rural Guizhou

Not until a careful examination of rural households' demand for credit is carried out can we justify the widely believed assumption that rural household in developing countries are effectively constrained in the amount that they can borrow from formal financial market (Braverman and Stiglitz, 1989, Eswaran and Kotwal, 1989 and Fry, 1995). In He and Li's (2005) survey of 502 rural households in Tongren Prefecture of Guizhou, 88% of farmers had the desire to borrow, the majority of which were households with middle or low income. Meanwhile, 31% of farmers reported the inability to get a formal loan, of which 90% were farmers with middle and, especially, low-income. IFAD (2001) reached to a similar conclusion based on a survey of rural households in six poor counties across China conducted by the Chinese Academy of Agricultural Sciences in 1997. One of the counties was Weining in Guizhou, where residents were asked if they had an outstanding formal loan, if they were able to get an additional formal loan and if they desired a formal loan. IFAD (2001) found that the percentage of those reporting an inability to borrow was highest in the poorest group (63% could not get new loans, compared to 39% in the richest group and 50% for the whole sample).

Therefore, it should be understood that the ability of some to get a formal loan does not mean there are no credit constraints. Even when formal credit is available, the amount is limited, so farmers are being credit rationed. This can again be shown from He and Li's (2005) finding that 56% farmers, out of those who received loans, reported that the loans they obtained could not meet their needs.

1.4. Problem statement and objectives

The rural financial reform started in 1996 has literally made the RCCs the only formal financial service providers in some rural areas of Guizhou. The RCCs' pilot microcredit program has been aimed at raising the income of poor rural households. With its extensive presence at and below the township level across rural Guizhou, it would suggest that access to financial institutions is not an important obstacle to obtaining credit. However, the RCCs' coverage of credit demand by farmers in Guizhou with average or low-income is very low, although there are still funds available in the RCCs. The issue of the RCCs' outreach becomes more interesting when we take it into account that many poor households may ration themselves out of the micro credit market (Cheng, 2006) in fear of high transaction costs or being rejected in a loan application. The low participation rate of poor farmers in the formal credit market could also be due to constraints other than capital that reduce agricultural productivity, low-cost substitutes for formal credit (Kochar, 1997), or lack of profitable investment opportunities (Xie et al, 2005).

Thus, the research question is what explains whether or not rural households borrow in the formal financial market and how the formal lender allocates the credit to the borrowers. This involves investigating what household characteristics determine the propensity to borrow in a rapidly changing economic environment and especially to understand the behaviour of low-income rural households in with regard to their demand for credit. Since loans are the result of the interaction between farmers and lenders, this thesis will attempt to distinguish the demand for credit from the lender's decision so as to explore the extent of effective credit rationing in the province of Guizhou. Understanding the determinants of the demand for credit and supply procedures of lenders could help illuminate how the RCCs and other microfinance institutions could rearrange their lending mechanisms in order to further reach the rural poor.

1.5. Structure of the thesis

The second chapter reviews the body of economic literature that has explored the role of credit in promoting economic growth in general, and the development of rural areas and the causes of credit rationing. This includes a discussion of the

separate effects of imperfect information, and the problem of contract enforcement.

Chapter Three presents the methodology underlying the estimation of the determinants of the demand for credit, and the likelihood that a household will be credit rationed. First, based on previous studies, economic models for the borrower's and lender's decisions are developed and the logit statistical model for binary dependent variables is discussed. Second, data used to analyze borrowing and lending are described. These data come primarily from a recent survey described in He and Li (2005). Finally, model specifications for demand and rationing equations are presented.

Chapter Four presents and discusses the results of the empirical analysis. First, descriptive statistics are examined regarding sources of credit, magnitude of credit rationing and purposes of loans. Second, the results of the logit regression analysis are investigated. The analysis is focused on the effects of wealth, productivity, shareholding and credit rating, financial infrastructure, and other demographic variables on the demand for a formal loan and the determinants of rationing.

Chapter Five summarizes the main findings of this study. It also discusses the limitations of the analysis, policy implications and suggestions for further research.

2. Literature review

2.1. Introduction

Financial development, especially the provision of credit to the rural poor, has been shown to have a significant impact on economic growth and social improvement (Section 2.2). Nevertheless, credit rationing exists in varying degrees in developing countries. After discussing the definition and empirical measurement of credit rationing in Section 2.3, Section 2.4 gives the theoretical explanations for credit rationing. Adverse selection and moral hazard in the context of informational asymmetry, together with high monitoring and enforcement cost, give rise to the theoretical possibility of credit rationing. The causes of credit rationing are further analyzed by examining the participation decision of borrowers in Section 2.5 and the empirical studies regarding the characteristics of credit-rationed households in Section 2.6.

2.2. Role of credit in development of rural areas

The early literature of economic growth focused on the role of capital and labour resources and the use of technology as the sources of growth (Solow, 1956 and 1970). Nevertheless, a few influential economists began to draw attention to the role of the financial system in economic development (Goldsmith 1969 and McKinnon 1973). Due to the significant impact of financial development on economic growth, some developing countries, probably most well known Bangladesh, started to implement credit programs, particularly microcredit programs, as a means for rural development. Theses programs have shown significant impact on the economic and social progress of rural society.

2.2.1. Finance and growth

Schumpeter (1911) was among the first who studied the finance-growth link. He argued that financial intermediaries provide service in mobilizing savings, evaluating projects, managing risk, monitoring managers and facilitating

transactions, which are essential for technological innovation and economic development. In contrast, some influential economists expressed doubts about the finance-growth relationship. Robinson (1962) argued that economic development creates demands for particular types of financial arrangements, and the financial sector simply responds to these demands. Lucas (1988) suggested that the role of finance had been overemphasized.

Although conclusions concerning finance and growth should be reached hesitantly, a large body of theoretical reasoning and empirical evidence, especially since the early 1990s, implies a positive relationship between financial development and economic growth.

Theoretical analysis

Theoretical analysis includes Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991), which related services provided by financial intermediaries to steady-state growth. The Greenwood-Jovanovic model indicated the interaction between economic growth and financial development. Economic growth provides the necessary capital and institutional conditions for the development of financial structure, while financial structure in turn allows for higher growth, in that investment could be more efficiently undertaken. Three stages of development were identified in the Greenwood-Jovanovic model. In the stage of economic development, the exchange of goods and services is largely unorganized. In the second stage of economic take-off, the economy grows more rapidly and financial structure becomes more extensive. In the stage of maturity, the economy has a higher growth rate than previous stages and has a fully developed financial structure.

The Bencivenga-Smith model explained how the equilibrium behaviour of competitive intermediaries affects resource allocation. Bencivenga and Smith (1991) constructed two models in an economy consisting of three-periods, overlapping generations and two goods, a single consumption good and a single

capital good. The following assumptions apply and the difference in the two models lies in the assumption concerning saving behaviour.

Assumption 1: For both models, only young generations are endowed with labour. Initially, only old and middle-aged generations have an endowment of the capital good.

Assumption 2: In Model 1, all income earned by the young generation is saved. Thus, financial institutions have no effect on decisions about the proportion of savings out of income. This assumption was made to ensure that a higher growth rate can be achieved without increasing saving rates by financial intermediaries.

In Model 1, Bencivenga and Smith (1991) demonstrated that equilibrium growth rates in economies with financial intermediaries is higher that economies without a competitive financial system. In Model 2, Assumption 2 is relaxed and agents are allowed to choose the level of saving to maximize the total utility of saving and consumption. Model 2 reached the same conclusion as Model 1. Thus, Bencivenga and Smith (1991) concluded that financial intermediaries can result in higher equilibrium growth rates and that economic development does not depend on the increase in savings rates.

Empirical studies

Empirical work was initiated by Goldsmith (1969) who presented data and charts showing a upward drift in the financial interrelation ratio, the value of all financial instruments outstanding divided by the value of national wealth, for both developed and developing countries for the period from 1860 to 1963. Goldsmith (1969) stated, although not decisively, that financial intermediaries accelerate economic growth by facilitating the migration of funds to activities with highest social return.

Cross-country regression models have been used to analyze macroeconomic relationships between financial development and long-run growth, for instance,

Gelb (1989), Roubini and Sala-i-Martin (1992) and, probably most well known, King and Levin (1993). King and Levin (1993) presented cross-country evidence consistent with Schumpeter's view. They applied various measures of the level of financial development, and showed a strong association between these measures and real per capita GDP growth, the rate of physical capital accumulation, and economic efficiency improvements.

Although Arestis and Demetriades (1996) agreed with King and Levine (1993) that financial development and growth are robustly correlated, they were cautious about the validity of the cross-section framework that King and Levine (1993) used. Arestis and Demetriades (1996) argued that the cross-country regression approach can only refer to the average effect of a variable across countries. Arestis and Demetriades (1996) showed that once the contemporaneous correlation between the main financial indicator and economic growth is taken into account, there is no longer any evidence to suggest that finance development promotes economic growth. In order to analyze the causality between financial development and economic growth, Arestis and Demetriades (1996) used time series data and error-correction models. The results suggested that different institutional contexts and financial policies lead to systematic differences in causality patterns across countries. For instance, in the bank-based systems, such as Japan where a small number of banks are involved in the allocation of funds and ownership of financial assets, unidirectional causality running from finance to growth was found. Whereas in the capital-market-based systems, such as United Kingdom and United States where highly developed capital markets and banks have relatively low involvement in the allocation of funds and ownership of financial assets, the results suggested a bidirectional causality.

2.2.2. The role of credit in development of rural areas

Recently, the investigation of the effect of credit on the development of rural areas has been mainly carried out through the evaluation of microfinance programs in less developed countries. Microfinance has been extensively examined over the past 20 years, and the resulting literature is very large. Microfinance programs have been found to increase both individual and community income, contribute to poverty alleviation and have positive social impact. The impact of microcredit programs discussed here is mainly assessed by empirical studies of Grameen Banks or the Bangladesh Rural Advancement Committee (BRAC). The extensive coverage and long history of these programs provide a great amount of cross-sectional and panel data for impact assessment with sophisticated statistical methods.

First, credit is an important instrument for increasing income, consumption and expenditure at both the individual and the village level. At the individual level, a large body of literature has noted the positive income effect of microfinance programs (Hossain, 1988, Khandker, 1998 and 2005, Khandker and Pitt, 2003, Park and Ren, 2001). For example, based on a household survey in five project villages and two control villages in Bangladesh, Hossain (1988), found that Grameen Bank members had incomes about 43 percent higher than the target group in the control villages and about 28 percent higher than the target group non-participants in the project villages. Hossain (1988) argued that the increase in income was mainly from processing and manufacturing, trading, and transportation services financed by loans provided by Greenman Banks.

At the village level, Khandker (2005) showed the positive spillover effects of microfinance programs on nonparticipants and on the local economy as a whole. With the help of household-level panel data from surveys of microcredit programs in Bangladesh in 1991/1992 and 1998/1999, Khandker (2005) used a household-level fixed-effects model to control for village heterogeneity. He found that the village averages of women's current and past borrowing have significant positive impacts on per capita expenditure of an average household of a village. Therefore, he concluded that the microfinance programs have influenced the welfare of not only the participants but also the nonparticipants. Thus, the total effect of the program is a sum of the effects for participants and nonparticipants.

Second, credit also contributes to poverty alleviation through the reduction of vulnerability of rural households. Vulnerability refers to the inability of households to insure against idiosyncratic risks (Amin et al, 2003). Hashemi et al (1996), Montgomery et al (1996), Morduch (1998) have argued that microfinance programs could reduce the vulnerability of rural poor in the following ways: smoothing consumption in a context where incomes of rural households experience seasonal fluctuations, providing emergency assistance during natural disasters and building assets. In terms of seasonal fluctuation, Mustafa et al (1996) carried out two surveys of participants and nonparticipants of the Bangladesh Rural Advancement Committee (BRAC), one of the largest micro credit providers in Bangladesh, in October 1993 and February 1994 in order to capture the seasonal variations. They found that BRAC members had better coping capacity in pre-harvest lean seasons (October to November) and that these capacities increased with length of participation and amount of credit borrowed.

Finally, the existing evidence on the social impact of microcredit is mostly positive, such as the improvement of women's status and fertility. Regarding the improvement of women's status, Zaman (2000) used household survey data collected in Bangladesh in 1995 and found a positive effect of borrowing from BRAC, on female control for a range of factors, such as control over her assets, decision-making power, etc. Steele et al (2001) used panel data from rural Bangladesh to examine whether participation in microcredit programs leads to increased levels of contraceptive use. After adjusting for sample-selection bias, i.e. microcredit programs tend to attract women who are already using contraception, the estimated results of random-effects models nevertheless suggested a positive effect of microcredit programs on use of contraception.

2.3. Defining credit rationing

Despite the significant economic and social impacts of credit in the development of rural areas, a large body of literature has noted and discussed the fact that rural households, especially those with middle or low income, face credit rationing. For instance, Yadav et al. (1992) found that 70.5% of households surveyed in rural Nepal were excluded either partially or totally from the formal credit market. Similar results were found by Feder et al (1989) in their study of rural China and by Mushinski (1999) in his analysis of Guatemala. Indeed, the widespread use of microfinance arrangements in developing countries reflects the issue of credit rationing among the rural households, and these are actually institutional innovations trying to solve the credit-rationing problem (Mushinski, 1999)

Credit rationing is broadly defined as a situation in which there exists an excess demand for loans because quoted loan rates are below the Walrasian marketclearing level. Jaffee and Stiglitz (1990) classified occurrences of credit rationing into four categories, which are interest rate rationing, divergent views rationing, redlining and pure credit rationing. Jaffee and Stiglitz (1990) defined interest rate rationing as a situation where a borrower receives a loan of a smaller size than desired at a given interest rate. To obtain a larger loan, the borrower has to pay a higher rate. In the case of divergent views rationing, some individuals cannot borrow at the interest rate which they consider appropriate based on their perception of their probability of default. From this perspective, a borrower's perception of their risk is mainly relevant as a factor determining their demand for credit. Redlining occurs when a lender refuses to grant a loan to a borrower when the lender cannot obtain their required return at any interest rate. Pure credit rationing occurs when some individuals obtain loans, while apparently identical individuals do not, although they are willing to borrow at precisely the same terms. Pure credit rationing is the focus of Jaffee and Stiglitz's (1990) discussion.

The empirical measurement of rationing has brought to the fore the issue of the exact nature of rationing. Three types of rationing are identified in the empirical works: applicant rationing, quantity rationing and preemptive rationing. Some of these empirical works are briefly discussed here, for the purpose of illustration, and will be discussed in more detail in Section 2.6.

The first type of credit rationing is applicant rationing. This is the case when a loan application is completely rejected by the lender. Pure credit rationing in Jaffee and Stiglitz's (1990) discussion implicitly refers to applicant rationing. Jappelli (1990) applied the concept of applicant rationing to assess the proportion of credit-rationed households and their characteristics in the U.S. economy.

The second type of credit rationing is quantity rationing. Rationing might also occur when a household receives less than the loan amount it desires (Stiglitz and Weiss, 1981, 1983, Carter, 1988 and Besanko and Thakor, 1987). Baydas et al. (1994) analyzed micro-entrepreneurs in Ecuador, in which they divided the group of credit-rationed borrowers into those who were rejected and those who obtained a smaller amount of loan than demanded. In their analysis, non-applicants were treated as those who were not credit-rationed.

The third type of credit rationing is preemptive rationing. Non-applicants might fear rejection or face high transaction costs in the loan application, and, therefore, exclude themselves from credit markets (Feder et al., 1989). Thus, Zeller (1994) and Mushinski (1999) divided non-applicants into preemptively rationed and uninterested respondents. Preemptively rationed households may well have had some demand for credit that can not be realized, thus, they should also be considered as credit rationed.

2.4. Causes of credit rationing

So what are the microeconomic reasons behind the existence of credit rationing to households. The theoretical explanation of rationing in credit markets is now well established. Adverse selection and moral hazard, together with high monitoring and enforcement costs, give rise to the theoretical potential for credit rationing.

2.4.1. The imperfect information paradigm

Many lenders face problems of informational asymmetries when trying to identify the riskiness of lending to specific subsets of borrowers. First, the case is examined when credit rationing emerges because of adverse selection associated with imperfect information. The adverse selection theory of credit markets originates with the paper by Stiglitz and Weiss (1981) in which they explained why the interest rate could not equate supply to demand in the credit market with imperfect information. Their theory of adverse selection are of the cornerstones of the asymmetric information framework as applied to the credit market. The theory is based on two main assumptions. First, lenders cannot distinguish between borrowers of different degrees of risk. Some applicants are clearly more risk-averse than others, reflected in their project choices. Second, loan contracts are subject to limited liability. The presence of limited liability of borrowers imparts a preference for risk among borrowers, and a corresponding aversion to risk among lenders. Thus, higher interest rates increases the average riskiness of the applicant pool; it is precisely those borrowers with the least risky projects who will cease to borrow first. Profits may therefore decrease as interest rates increase beyond some point. A lender may thus be better off rationing access to credit at a lower interest rate rather than raising the interest rate further.

The Stiglitz-Weiss model (1981) has been criticized for its assumption that lenders are unaware of borrower characteristics (Siamwalla et al, 1990 and Ghosh et al, 1999). It is reasonable to assume that banks will not have as much information as their borrowers. However, the close-knit character of many traditional rural societies implies that informal moneylenders will more likely to possess information about the borrower's characteristics and ability to pay. Thus, Besley (1994) argued that informal moneylenders tend to solve the problem of adverse selection by restricting their business to a small group of borrowers with whom they have built up a long-term relationship.

Second, even if lenders live in close proximity with borrowers and solve the adverse selection problem, there is the problem of moral hazard (Ghosh et al., 1999). Moral hazard, a concept due to Arrow (1963), refers to the possibility that the redistribution of risk (such as insurance which transfers risk from the insured to the insurer) changes people's behaviour. The problem of moral hazard would

incur a trade-off between extraction of rents and the provision of incentives to induce a good harvest. Moral hazard can arise when lenders are unable to discern borrowers' actions that would affect the distribution of returns from an investment. The Stiglitz-Weiss model (1981) can be extended to explain the possibility of credit rationing arising from moral hazard. The underlying assumption is also the limited liability for the borrowers. If the project fails and the loan is not repaid, the lender bears the cost of the loan. This encourages the lender to increase the interest rate. However, Stiglitz and Weiss (1981) showed that an increase in interest rates would reduce borrowers' incentive to take the effort to avoid low yield states and the probability of loan repayment is thus reduced. As with adverse selection, lenders would restrict amount the loans in order to correct borrowers' incentives (Besley, 1994).

2.4.2. The contract enforcement problem

Mushinski (1999) argued that credit market imperfections in developing countries derive not only from informational asymmetries, but also from costly monitoring and enforcement, which give rise to the problem of contract enforcement. The contract enforcement problem is a situation in which the borrower is able but unwilling to repay (Besley, 1994). The difficulty in successfully enforcing the repayment might cause lenders to reduce the amount of loans. The main reason for the enforcement problem is the poor development of property rights in developing countries. In this situation, formal lenders may focus their loans on households who meet the collateral requirements and land is regarded as an ideal candidate for collateral. However, lack of land ownership leaves poor households with little probability of obtaining a loan from formal lenders.

2.5. The Borrowing and lending decisions

A careful examination of the interaction between borrowers and lenders would facilitate the analysis of characteristics of credit- rationed households. Mushinski (1999) modeled the loan transaction as a two-stage game. By distinguishing

notional demand for credit from effective demand for credit, Mushinski (1999) explained how households would be preemptively rationed. Kochar (1997) derived supply schedules in formal and informal sectors, by which he determined the theoretical probability of applicant and quantity rationing. First Mushinski's (1999) theoretical framework is examined and then Kochar's (1997) analysis is discussed.

2.5.1. Notional and effective demand

The two-stage game in Mushinski (1999)'s analysis involves a household's decision to apply for a loan and a lender's decision to offer a loan.

Borrower's decision

In the first stage of a loan application, the determination of demand probability is carried out by examining two scenarios, notional and effective. Notional demand for credit is the household's demand for credit when the applicant is certain of being offered a loan and the transaction cost for loan application is zero. Effective demand for credit is the household's demand for credit when there is a probability of being rejected and there is a transaction cost.

The following assumptions apply:

Assumption 1: The household's profit or utility function $U_1(R)$ is strictly concave, where *R* represents revenues.

Assumption2: The value of collateral (*C*) to lenders is less than the amount of the loan demanded (*L*). The lenders set the collateral requirement equal to the wealth of the household (*W*). So, L > W = C.

Assumption3: The function of disutility associated with loan application $U_2(K)$ is strictly convex, where $K(\bullet)$ is a function of the transaction cost. Assume that the

transaction cost is only a function of household characteristics X. Thus, $U_2(K)=U_2(K(X))$

Assumption4: All the households with positive demand would apply for loans.

Revenues that a loan applicant obtains depend on the household's characteristics X and the terms of the loan (L, r, C) where r is the interest rate. Thus,

$$U_1(R) = U_1(L, r, W, X)$$
(2.1)

The household's reservation utility is the utility when the borrower is self-financed, denoted as $U_1^0(W, X)$. Therefore, a household has positive notional demand if

$$U_1(L, r, W, X) > U_1^0(W, X)$$
(2.2)

Thus, if the loan would result in more utility than not borrowing, there is a notional demand.

As for effective demand for credit, the probability of being offered a loan $P(\bullet)$ is less than one and it is assumed that this is determined by the size of the loan, wealth, and household characteristics $P(\bullet) = P(L, W, X)$. Thus, the expected utility from applying a loan $U_1^*(R)$ will be

$$U_{1}^{*}(R) = P(L, W, X) \bullet U_{1}(L, r, W, X) + (1 - P(L, W, X)) \bullet U_{1}^{0}(W, X) + U_{2}(K(X))$$

$$(2.3)$$

Therefore, a household has positive effective demand if the expected utility from the loan application is greater than the reservation utility:

$$U_1^*(R) > U_1^0(W, X)$$
(2.4)

A comparison of equations (2.1) and (2.3) indicates that a household with positive notional demand could have no effective demand due to two reasons. First, $P(\bullet)$ in equation (2.3) is equal to 0, in other words, the application is rejected. This is actually pure credit rationing or applicant rationing as discussed by Jaffee and Stiglitz (1990) and Jappelli (1990). Second, a small $P(\bullet)$ in conjunction with large $U_2(K(X))$ might also result in zero effective demand. Non-applicants might fear rejection or face a high transaction cost of loan application, and, therefore, exclude themselves from credit markets. This explains the theoretical probability of preemptive credit rationing as examined by Feder et al. (1989), Zeller (1994) and Mushinski (1999).

Lender's decision

In the second stage, the lender's decision is considered, that is the probability that a lender issues a loan offer to an applicant. This decision can also be divided into two categories. First, the "notional- demand- offer- probability" is the likelihood that a lender would offer a loan to an applicant who has positive notional demand. It is notional in that it is not offered to borrowers. Second, the "effective- demandoffer- probability" measures the likelihood that a lender will offer a loan to an applicant who has positive effective demand.

Although the "effective-demand-offer- probability" is what can be directly found in the transaction records of banks, the notional- demand- offer- probability provides a better mechanism to unveil what are important characteristics of households to lenders when making an offer decision. The "effective-demandoffer- probability" measures the percent of effective loan recipients out of the total number of households with positive effective demand. However, the pool of effective loan applicants is very likely to exclude a number of households with positive national but zero effective demand. The characteristics of those preemptively credit-rationed households are neglected if we use effectivedemand-offer- probability for empirical analysis. To sum up, households decide to apply for a loan after the comparison of the utility of borrowing and the reservation utility of self-finance. However, the high transaction cost of a loan application and low probability of obtaining a loan reduce the utility of borrowing. It might well be the case that the household selects itself out of the credit market in the face of the disutility of transaction costs and the fear of rejection. Thus, the household is preemtively credit rationed.

2.5.2. Sectoral interaction

The framework of notional and effective demand by Mushinski (1999) clearly explains the decision-making mechanism of borrowers. However, in the second stage where the lender is making a decision, this model is simplistic, and fails to demonstrate the supply schedule, and is unable to explain why and how lenders select loan recipients out of the pool of applicants with positive demand, either notional or effective. As an alternative, Kochar (1997)'s introduced a broader view, by emphasizing supply schedules for both formal and informal lenders. It also explains the existence of quantity rationing due to an upward-sloping supply curve.

Supply schedules

The supply schedule defines the reservation or marginal cost MC at which the lender is willing to lend to the household. The focus of Kochar (1997)'s analysis is on the household's choice between formal and informal lending sectors. The key difference between formal informal sectors lies in the interest rate.

In the formal sector, interest rates are set by the government. While the interest rates vary by farm size and type of investment, they do not vary with loan amount. In other words, the interest in formal sectors r^F is fixed. The reservation cost in formal sector MC^F is given by expected marginal loss in income if the borrower defaults. Since the formal sector is constrained to lend at a fixed interest rate, MC^F only depicts the notional supply schedule, in that it is not offered to the

borrower. MC^F and r^F are not necessarily equal, hence the effective formal supply curve is horizontal at r^F , as long as $r^F > MC^F$.

On the other hand, informal lenders have the freedom to set the interest rate of informal loan arrangements. It is reasonable to assume that the reservation cost in informal sector MC^{I} is identical to the interest rates charged to households r^{I} . As the loan amount increases, the increase in lenders' opportunity cost is greater than the increase in expected income. Consequently, lenders will raise the interest rate when loan amount increases, which implies an upward sloping supply curve. The upward sloping supply curve also implies two types of credit rationing, both applicant rationing and quantity rationing. First, since the supply schedule shifts with borrower characteristics, the interest rate for risky households may be high enough to ration those households out of the credit market. Second, an upward sloping supply curve implies that households may not be able to borrow as much as they want at a given interest rate, reflecting the risk of default.

Participation decision

Kochar's (1997) analysis of whether a household applies for a loan is based on a comparison of the expected reservation or marginal utility $U'_1(R)$ and the relevant reservation or marginal cost r^i (i=formal, informal). The household would have positive demand in the informal sector, as long as the marginal revenue of borrowing is greater than marginal cost of the loan, i.e. $U'_1(R) > r^i$.

Since the interest rate in the informal sector $r^{I}(L, X)$ shifts with households' characteristics, $r^{I}(L, X)$ already reflects the informal lenders' selection for borrowers. If the household finds it profitable to borrow from the informal sector, i.e. $U'_{1}(R) > r^{I}$, it is able to obtain the credit. However, the decision in the formal sector is a consecutive process consisting of two stages. In stage 1, the household applies for formal credit if $U'_{1}(R) > r^{F}$. In stage 2, the bank decides to offer credit

if the marginal revenue of offering the loan exceeds the marginal cost of the bank, i.e. $r^F > MC^F$.

A household chooses between the formal and informal sectors based on the least cost source of credit at each loan amount. The marginal cost of borrowing for household *j* is determined as follows. If the household is denied by the formal sector, then the marginal cost for household *j* is the supply schedule of informal lenders. In other words, for $L_j^F = 0$, $MC_j(L) = r^I(L)$. If household *j* has access to both sectors, then it chooses the least cost source of loan. For $L_j^F > 0$, $MC_j(L) = \min(r^I(L), r^F)$. Households can be divided into three groups, those who borrow from the formal sector (J=1), those who borrow from the informal sector (J=2) and those who do not borrow from either sector (J=3). Figure 2.1 shows the decision tree for observed sectoral outcomes in the rural credit market.

Thus the sectoral outcomes can be summaries as follows:

Pr (borrows formal) = Pr $(U'_1(R) > r^F, r^F < r^I, r^F > MC^F)$

Pr (borrows informal) = Pr $(U_1(R) > r^F, r^F < r^I, r^F < MC^F, U_1(R) > r^I)$

+ Pr
$$(U'_{1}(R) > r^{I}, r^{I} < r^{F})$$

Pr (not borrowing) = Pr $(U'_{1}(R) > r^{F}, r^{F} < r^{I}, r^{F} < MC^{F}, U'_{1}(R) < r^{I})$

+Pr
$$(U'_{1}(R) < r^{I}, U'_{1}(R) < r^{F})$$

2.6. Empirical studies on credit rationing

The interaction between borrowers and lenders presented above is reflected in the modeling of empirical studies on credit rationing. All the studies discussed in this section, except for Yadav et al (1992), analyzed both the demand and supply sides. Some studies found that the observed low participation in loan market of certain

types of households is the result of their low demand for credit (Baydas et al, 1994 and Kochar, 1997). The possible explanation for the low demand is inefficiency in agricultural production (Kochar, 1997 and Yadav et al, 1992). However, others argued that the low participation in the rural credit market is due to the terms of loan contracts that might reduce the effective demand for credit by households who have positive notional demand for credit (Mushinski, 1999 and Zeller, 1994).

2.6.1. Productivity and demand for credit

Baydas et al's (1994) study evaluated the important factors which result in applicant rationing and quantity rationing. They found that a model with a single supply equation could result in a misleading interpretation, that lenders discriminate against a certain type of borrower. To avoid this problem, they simultaneously estimated demand and supply equations in their study of small-scale enterprises in Ecuador with a survey of 447 entrepreneurs. The demand and supply equations are as follows:

$$LD = \beta_1 X_1 + \alpha_1 r + \varepsilon_1 \tag{2.5}$$

$$LS = \beta_2 X_2 + \alpha_2 r + \varepsilon_2 \tag{2.6}$$

LD is the amount of credit demanded, LS is the maximum amount of credit that the lender is willing to offer, X is a vector of explanatory variables and r is the fixed interest rate charged.

Lenders select borrowers according to the following decision rule:

LR= LS, if LS \geq LD LR= 0, if LS < LD

LR is the observed loan granted. One of the specification problems here is data censoring when the dependent variable is the amount of credit granted. The data
are typically available for LD and LR, so LS is observed only when LS \geq LD. Therefore, OLS regression is subject to sample selection bias. Baydas et al (1992) asserted that maximum likelihood estimation would yield more efficient results for a simultaneous equation system, such as equations (5) and (6). The system allowed Baydas et al (1992) to compare the estimators of some of the same explanatory variables in the demand and supply equations. The supply equation indicated that lenders are more willing to offer credit to entrepreneurs with higher profitability and higher education. Therefore, one might state that lenders discriminate against less profitable enterprises and less-educated entrepreneurs. However, the demand equation revealed that entrepreneurs with less profitability or less education also have a smaller demand for credit. Baydas et al (1992) concluded that the smaller amount of loans reported in certain classes of entrepreneurs was not due to greater rationing by lenders, but rather because of their lack of demand.

As an alternative to solve the problem of data censoring, Yadav et al (1992) estimated a Tobit regression to adjust for sample selection bias in their study of credit rationing in rural Nepal. Okurut et al (2005) employed a Heckman two-step model in their analysis of credit rationing in the informal financial sector in Uganda. They separated the equation of selection (determining those who applied for credit) from the equation of interest (determining how much credit a household applied for).

Regarding the causes of low participation in rural credit market, Kochar (1997) reached the same conclusion that demand by households affects the credit outcome. This was based on data from a 1981-1982 Government of India household survey of 7053 rural households on credit transactions, indebtedness and household and farm investments. His results were based on the results from two empirical models.

Model I

First, Kochar (1997) estimated a univariate probit supply model, assuming (i) that all households demand formal credit at the existing interest rate and (ii) that the formal sector is the cheapest source for all households. The equation inferred from his study is as follows:

 $y = \alpha H + \beta V + \gamma D + \varepsilon$

H, V and D are vectors of variables at the household, village and district level, respectively. y=1, if the household was offered a loan; y=0, otherwise. Assumption (ii) implies that those who did not apply for a loan are also included in the category of y=0. Evaluating the probability of access to formal credit at the mean levels of the explanatory variables, 81% of rural households are estimated to be rationed out of the formal sector.

Model II

A bivariate probit model of demand and supply then allowed the probability of borrowing from the formal sector to be jointly determined by the lender's decision on offering credit as well as the household's demand for credit. The model relaxes the assumption that all households demand formal credit, but maintains the other assumption. Evaluated at the mean levels of the explanatory variables, both the probability of access to the formal loan and the probability of a household demanding formal loan are low at 26.06% and 38.93%, respectively. Given that a household demands a loan, the probability of obtaining the loan is, however, high at 60.42%. The estimated results show that non-borrowers include small farm households and farms with low level of productivity, as measured by the area of irrigated land households possess. Hence, Kochar (1997) argued that the extent of rationing is considerably less than what is conventionally assumed. The low demand for formal credit could be due to constraints other than capital which reduce agricultural productivity, or because of the availability of low-cost substitutes for formal credit.

As evidence of the effect of productivity on demand for credit, Yadav et al (1992) provided two interesting findings after analyzing statistical descriptions of certain variables. The data were from a survey of 190 farm households in Nepal in 1988. First, they found that cropping intensity and the proportion of land irrigated have significantly positive effects on credit obtained. This supports the hypothesis that modern rice technology raises the amount of loans by increasing input demand. Second, Yadav et al (1992) observed that the amount of formal loans per ha for large farms is less than that of smaller farms, although large farmers can provide land as collateral for formal loans, which is an obvious advantage in access to formal credit. A possible explanation for less borrowing might be the result of inefficiency, i.e. the lower yield, in the production of large farms. The higher cost of hiring and supervising labours for a large farm could also make the production less efficient.

In order to analyze the causes of less borrowing by large farms, Yadav et al (1992) tested the effects of farm size on productivity. Productivity was measured by rice yield per ha and cash cost per ha. Cash costs include costs of hired draft animals and tractors, costs of hired labour, and the other variable inputs. The estimated results showed that farm size had a significantly negative effect on rice yield per ha and positive effect on cash costs. Yadav et al (1992) therefore concluded that large farmers choose to borrow less per ha from the formal sector because of their lower production efficiency. Yadav et al's (1992) analysis demonstrated that large farmers simultaneously have two characteristics, which are less demand for formal credit and inefficiency in production, but they failed to show the causal effect of productivity on credit demand.

2.6.2. Preemptive credit rationing

In addition to productivity, the low demand discussed by Kochar (1997) and Yadav et al (1992) might also result from the terms of loan contracts. Mushinski (1999) identified the reasons for not borrowing in his survey of 761 households in Guatemala. The purpose of his study was to test differences between the outreach of banks and credit unions. The information on non-borrowers allows for a distinction to be made between preemptively rationed households and uninterested households. The definition of preemptively rationed households included those who do not borrow because of insufficient collateral, high transaction costs of loan application and fear of rejection. Two other groups of households were also included. The first group was the households who did not seek a loan because an application made prior to 1992 had been rejected. The second group was households who received loans from moneylenders at interest rates greater than 25 per cent, which is significantly higher than the interest rate charged by banks. The failure of such households to seek a bank loan indicated that they felt no possibility of obtaining a bank loan, even though they desired a loan. Thus, the concepts of notional and effective demand presented in section 2.5.1 are applied in the empirical study as follows. Households with positive effective demand are those who applied for loans. Households with positive notional demand are those with positive effective demand and those who are preemptively rationed. In each sector, i.e. banks and credit unions, the offer equation is estimated with data from two sub-samples, those with positive effective demand and those with positive notional demand. The offer equation is

$y = \alpha + \beta X + \varepsilon$

X is a vector of explanatory variables. For both of the sub-samples, y = 1 if the household is offered a loan. For the sub-sample of households with positive effective demand, y=0 if the application is rejected. For the sub-sample of households with positive notional demand, y=0 if the application is rejected or preemptively rationed.

For banks, the comparison between the two sub-samples revealed that banks lend primarily to households with large land wealth, who are typically engaged in large-scale agricultural activities. The sectoral comparison between banks and credit unions showed that credit unions serve markets unserved by formal lenders. Zeller (1994) also adjusted for preemptive rationing when measuring the extent of credit rationing in his study of informal lenders and formal credit groups in Madagascar. Zeller's (1994) purpose of was to examine the performance of group lending where members of community-based lending groups allocate group loans among themselves. In the survey of 189 households in agroecological regions of Madagascar, the reasons for not borrowing were asked in order to separate pre-emptively rationed households from uninterested ones. Univariate probit models were used to estimate both demand and supply equations for both informal credit markets or lending groups.

Demand equation for lending groups

 $y = \alpha + \beta X + \varepsilon$

X is a vector of explanatory variables. y=1 if the household applied for credit in the lending group. y=0, otherwise.

Supply equation for lending groups

 $y = \gamma + \delta Z + u$

Z is a vector of explanatory variables. y=1 if the household was granted a loan. y=0 if a household was rejected for a loan or preemptively rationed.

The same modelling was applied in the informal credit market. Zeller (1994) found that physical collateral did not play an important role in either lending groups or the informal credit market. In addition, group members are able to obtain and use local information about the applicant's creditworthiness in much the same way as informal lenders do. Therefore, Zeller concluded that community-based groups have an information advantage over distant formal banks.

2.7. Summary

In view of the research questions that guide this study, the most important results to retain from the literature review are the following.

- Adverse selection occurs when lenders cannot distinguish between borrowers of different degrees of risk. An increase in the interest rate will cause borrowers with less risky projects to withdraw from the credit market and therefore increase the average riskiness of the applicant pool. A lender may thus be better off rationing access to credit at a lower interest rate rather than raising the interest rate further.
- Moral hazard arises when lenders are unable to discern borrowers' actions that would affect the distribution of returns from an investment. An increase in interest rates could reduce borrowers' incentive to make the effort to avoid low yield states. Thus, lenders restrict the amount of loans in order to correct borrower's incentives.
- The poor development of property rights in developing countries makes it difficult to enforce the repayment of loans when borrowers are able but unwilling to repay. This again causes the lenders to reduce the amount of loans.
- Households decide to apply for a loan after the comparison of utility of borrowing and the reservation utility of self-finance. However, the high transaction cost of a loan application and low probability of obtaining a loan reduce the utility of borrowing. Thus, households might select himself out of the credit market in the face of the disutility of transaction costs and the fear of rejection.
- The observed low participation in formal credit markets might not be the result of rationing by lenders; rather it might the consequence of the low demand for credit by borrowers due to inefficiency in agricultural production or less costly credit being available in the informal credit market.

3. Methodology

This chapter describes the method used to analyze credit rationing in rural Guizhou. Even though informal lending is a substantial component in rural credit, this study restricts the analysis to the formal market due to the unavailability of other relevant data. The borrower's and formal lender's decision-making problems are discussed first, using the framework of random utility models and cost benefit analysis, respectively. Models with discrete dependent variables, mainly the probit and logit models, are then briefly discussed as econometric applications for these decision-making problems. The remaining part of the chapter describes the data and model specification. In this study, borrowing and rationing functions will be estimated by employing the logit regression method.

3.1. The economic model

A theoretical framework for the borrower's and formal lender's decision-making is developed in this section. An individual will apply for formal credit if the utility of the loan is greater than his reservation income, which is the utility of the best alternative to a formal loan. However, the approval of his application is dependent on the lender's marginal cost and revenue of the formal loan.

The actual extent of credit rationing is determined by both the borrower and lender. This is because analyzing the demand equation alone is not able to determine conclusively whether credit allocation patterns represents external rationing by the supply side or internal self-selection by the demand side (Baydas, 1994 and Zeller 1994). The decision-making problem of the borrower and the lender can be analyzed as follows.

3.1.1. The borrower's decision

This model is formalized below following the structure described in Greene (1997) for random utility models. An individual can choose to borrow from a formal

lender or self-finance, and it is assumed that the individual will opt for the alternative that provides the greater utility (Judge et al., 1980).

A discrete variable, D, is defined as:

$$D_i = \{1 \text{ if an individual i desires formal credit; } 0, \text{ otherwise}\}$$

The decision-making process can be expressed with the following equations.

$$D_{i} = f(U_{i}^{0}(R), U_{i}^{*}(B))$$

$$D_{i} = 1, \text{ if } U_{i}^{*}(B) > U_{i}^{0}(R)$$

$$D_{i} = 0, \text{ if } U_{i}^{*}(B) < U_{i}^{0}(R)$$
(3.1)

where $U_i^0(R)$ is the reservation utility of individual i and $U_i^*(B)$ is the utility of making a loan application.

Each individual has a reservation utility, simply the best alternative to a formal loan. The best alternative could be self-financing or an informal loan, and the better it is, the less likely an individual will use a formal loan. The utility that can be derived from an application for a formal loan can be expressed as follows (Mushinski, 1999 and Kochar, 1997).

$$U_{i}^{*}(B) = prob(L, W, X) \bullet U_{i}(L, P, W, X) - U_{i}(T) + (1 - prob(L, W, X)) \bullet U_{i}^{0}(R), \qquad (3.2)$$

where prob(L,W,X) is individual i's self-estimation of the probability of receiving a loan, L is a group of variables regarding the terms of a loan (including duration, interest rate, and personal commitments such as collateral and

guarantee), W is a group of wealth-related variables, X is a group of demographic variables, $U_i(L, P, W, X)$ is the utility if the formal loan is received, P is a group of variables related to the level of productivity and $U_i(T)$ is the disutility of transaction costs. Thus, for a person who makes an application for a loan, their utility is a weighted average of the utility of receiving the loan, and their reservation utility. The weights are the probability of receiving or not receiving the loan.

A loan may be motivated by consumption or production needs. The former could include children's tuition, medical expenses, weddings and funerals and house-building. The latter includes seeds, livestock, fertilizers, agricultural machinery and so on. Households with relatively low potential income or endowments are likely to have a higher utility of consumption loans, given that they are in a greater need for consumption-smoothing (Ghatak et al., 2001). In terms of production loans, one would expect that individuals with higher agricultural productivity have a greater utility from loans due to a higher return on investment (Feder, 1984).

The probability of receiving a loan is determined by the terms of the loan (L) (including duration, interest rate, and personal commitments such as collateral and other guarantees), the level of wealth (W), and household characteristics (X). Ceteris paribus, a farmer will consider himself more likely to be offered formal credit if the loan is small and for the purpose of production (Feder, 1984). In addition, poorer farmers will regard themselves to be less advantageous than richer farmers when applying for loans with the same terms (Avery, 1998).

Transaction costs are an important factor that discourages a farmer from applying for a formal loan (Rojas and Rojas, 1997, Adams and Nehman, 1979). Transaction costs in a rural formal financial market include: (i) loan charges collected by the lender beyond interest payments, such as application and service fees, bribes and forced purchase of other services from the lender and (ii) the borrower's time and travel expenses related to the loan transaction (Adams and Nehman, 1979). The opportunity costs of the borrower's time could be substantial, especially during planting and harvesting periods.

In sum, the reservation utility varies among individuals. The benefit the individual will receive from the loan is affected by the uncertainty of receiving the loan and the transaction cost of obtaining the loan. An individual will desire a formal loan if the net utility of the loan exceeds his reservation utility.

3.1.2. The lender's decision

A formal lender will decide to offer credit to an applicant if the marginal utility of the loan is greater than the marginal cost. Note that the problem of "amount rationing", where the borrower only partially receives what he applied for, is not included in the lenders' decision-making model because only information about whether or not an individual received a loan is available.

Similar to the borrower's decision-making problem, a discrete variable, S, is defined as:

$$S_i = \{1 \text{ if formal lender i offers credit to the borrower; 0, otherwise}\}$$

The framework of marginal revenue and cost based on Kochar (1997) is applied in the analysis of the lender's decision-making problem. The model is formalized following the discussion of cost benefit calculations in Greene (1997).

$$S_{i} = f(MR, MC(L, W, C, P, X))$$

$$S_{i} = 1, \text{ if } MR > MC(L, W, C, P, X)$$

$$S_{i} = 0, \text{ if } MR < MC(L, W, C, P, X)$$

$$(3.3)$$

where MR is the lender's marginal revenue, MC(W, C, P, X) is the marginal cost of offering a loan, C is a group of variables related to the borrower's credit history,

and W, P and X have been defined previously. For the formal lender, the marginal revenue of a loan is the exogenously fixed interest rate, because the interest rate is set by the government and is not allowed to vary with the amount of a loan (Adams, 1994 and Kochar, 1997).

Various types of costs are involved in the costs of lending. These include administrative costs (e.g. cost of screening and monitoring loan applicants, and costs of processing, delivering and administering loans) and default risk expenses (Saito and Villanueva, 1981). Larger loans and longer maturity will reduce administrative costs due to economies of scale, and thus the terms of a loan contract (L) will affect the marginal cost of loans. The risk of default is dependent on the borrower's credit history (C) and solvency which is indirectly influenced by household wealth (W) and the project to be invested in. The credit literature suggests a wealth bias in credit rationing by formal lenders (Cater 1988 and Swaminathan 1991) as formal lenders offer a greater proportion of loans to rich households than poorer ones. As for production loans, agricultural productivity (P) will play an important role in determining the level of return on credit and, consequently, the capacity of a household to repay the loan.

To sum up, the marginal cost of a loan is affected by administrative costs and the risk for default. A formal lender will decide to offer credit to an individual if the exogenously fixed interest rate is greater than the marginal cost of the loan.

3.2. The statistical model

Although the decision-making problems of borrowers and lenders are based on different economic models (i.e. the random utility model and cost benefit analysis), they have common statistical characteristics in that the dependent variables are both qualitative and constrained to fall below zero and one. Similar statistical models can be applied to both demand and supply analyses (Greene, 1997) and thus only the borrower's decision making problem will be discussed below.

A qualitative dependent variable will arise when there is a choice or outcome variable that depends on an underlying "latent" variable, that is assumed to be continuous (Greene, 1997). Latent variables (as opposed to observable variables), are variables that are not directly observed but are rather inferred from other variables that are observed and directly measured (Flores-Cerrilo and MacGregor, 2005). The latent variable in the borrower's decision making problem (d^*) represents how intensely an individual desires a formal loan. It is assumed that d^* is a linear function of a vector of independent variables X. That is,

$$d^* = X\beta + \varepsilon \tag{3.4}$$

where the set of parameters β reflect the impact of changes in X on the probability. However, it is only observed whether an individual applies for a formal loan or not. That is, we observe: $d_i = 1$ if $d_i^* > c$ and 0 otherwise, where d_i is the individual's decision of whether to borrow or not.

$$\Pr\left(d_{i}^{*} > c\right) = \Pr\left(\mathbf{x}_{i}^{'} \beta + \varepsilon_{i} > \mathbf{c}\right) = \Pr\left(\varepsilon_{i} > \mathbf{c} - \mathbf{x}_{i}^{'} \beta\right)$$
(3.5)

If the probability function $F(\cdot)$ is symmetric (as with normal and logistic distributions), then

$$\Pr\left(d_{i}^{*} > c\right) = \operatorname{F}\left(\mathbf{x}_{i}^{'} \boldsymbol{\beta}\right), \tag{3.6}$$

Various probability functions, $F(\cdot)$, might be employed to analyze these problems and commonly used functions are the normal cumulative distribution function $\Phi(\cdot)$, giving rise to the probit model and the logistic cumulative distribution function $\Lambda(\cdot)$, giving rise to the logit model. More specifically, for the probit model,

$$\Pr(d_i=1) = \Phi(\mathbf{x}_i^{'}\beta) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\mathbf{x}_i^{'}\beta} e^{-\frac{t^2}{2}} dt$$
(3.7)

and for the logit model,

$$\Pr\left(d_{i}=1\right) = \Lambda\left(\mathbf{x}_{i}^{'}\beta\right) = \frac{e^{\mathbf{x}_{i}^{'}\beta}}{1 + e^{\mathbf{x}_{i}^{'}\beta}}$$
(3.8)

Marginal effects

A marginal effect is defined as the change in probability associated with a marginal change in one of the independent variables. The marginal effect of a change in \mathbf{x}_i depends on the level of other variables. In general,

$$\frac{\partial P_i}{\partial \mathbf{x}_i} = \frac{\partial F(\mathbf{x}_i^{'} \boldsymbol{\beta})}{\partial \mathbf{x}_i} \boldsymbol{\beta} = f(\mathbf{x}_i^{'} \boldsymbol{\beta}) \boldsymbol{\beta}$$
(3.9)

where P_i is the probability that household i chooses to borrow $(d_i=1)$, and $f(\cdot)$ is the density function that corresponds to the cumulative distribution, $F(\cdot)$. For the probit model, this is

$$\frac{\partial P_i}{\partial \mathbf{x}_i} = \phi(\mathbf{x}'_i \boldsymbol{\beta}) \boldsymbol{\beta}$$
(3.10)

where $\phi(t)$ is the standard normal density. For the logit model,

$$\frac{d\Lambda(\mathbf{x}_{i}^{'}\beta)}{d(\mathbf{x}_{i}^{'}\beta)} = \frac{e^{\mathbf{x}_{i}\beta}}{(1+e^{\mathbf{x}_{i}\beta})^{2}} = \Lambda(\mathbf{x}_{i}^{'}\beta) \left[1 - \Lambda(\mathbf{x}_{i}^{'}\beta)\right], \quad (3.11)$$

and thus in the logit model,

$$\frac{\partial P_i}{\partial \mathbf{x}_i} = \Lambda(\mathbf{x}'_i \beta) \left[1 - \Lambda(\mathbf{x}'_i \beta) \right] \beta$$
(3.12)

Therefore, the interpretation of the marginal effect is different than for the usual linear statistical model. The value of the density function $f(\cdot)$ is always positive

and thus the signs of β show whether the dependent and independent variables are positively or negatively correlated. Moreover, the size of the marginal effect is dependent on the both the absolute value of β and the magnitude of $f(\cdot)$.

Both the probit and logit models have been widely used in econometric applications (Greene, 1997). This thesis will use the logit model, given that the logit analysis provides results which can be more easily interpreted in terms of odds and odds ratios which will be discussed below (Cramer, 2003, Long and Freese, 2003).

Odds ratio

Effects for the logit model can be interpreted in terms of changes in the odds. The discussion of odds and odds ratios follows Long and Freese (2003). For binary outcomes, the odds, Ω , is defined as the ratio of the probability of observing a positive outcome versus a negative one. In the demand equation, the odds of borrowing is the probability that a household has a demand for formal credit divided by the probability that the household does not have a demand for a formal loan.

$$\Omega = \frac{\Pr(d_i = 1)}{\Pr(d_i = 0)} = \frac{\Pr(d_i = 1)}{1 - \Pr(d_i = 1)}$$
(3.13)

In the logit model, the log odds, the natural log of the odds, is a linear combination of the x's and β 's:

$$\ln\left\{\frac{\Pr(d_i=1\mid \mathbf{x})}{1-\Pr(d_i=1\mid \mathbf{x})}\right\} = \ln \ \Omega(\mathbf{x}) = \beta_0 + \beta_1 x_1 + \dots + \beta_k x_k + \dots + \beta_n x_n \qquad (3.14)$$

An odds ratio (OR) is used to compare the odds when x_k changes by one unit. In the demand equation, the odds ratio for the dependent variable when x_k is changed by one unit is:

$$OR = \frac{\Omega(\mathbf{x}, x_{k}+1)}{\Omega(\mathbf{x}, x_{k})} = \frac{e^{\beta_{0}}e^{\beta_{1}x_{1}}e^{\beta_{2}x_{2}}\cdots e^{\beta_{k-1}x_{k-1}}e^{\beta_{x}x_{k}}e^{\beta_{k}}e^{\beta_{k+1}x_{k+1}}\cdots e^{\beta_{n}x_{n}}}{e^{\beta_{0}}e^{\beta_{1}x_{1}}e^{\beta_{2}x_{2}}\cdots e^{\beta_{k-1}x_{k-1}}e^{\beta_{x}x_{k}}e^{\beta_{k+1}x_{k+1}}\cdots e^{\beta_{n}x_{n}}} = e^{\beta_{k}}$$
(3.15)

Thus, the coefficients can be interpreted as indicating that for a unit change in x_k , the odds is expected to change by β_k , holding all other variables constant.

3.3. Data

Data used in this study come from two sources. Data regarding regional agricultural productivity are from the China Data Center at the University of Michigan -Ann Arbour. The remaining data comes from the survey of 502 rural households in Guizhou conducted by He and Li (2005).

He and Li's (2005) survey

The analysis in this study is based on data from their survey in July 2005 as part of the Technical Assistance Program of the Asian Development Bank. The survey questions gathered information relevant to explain the likelihood to borrow. The questionnaire (Appendix 2) was divided into four parts:

- Part 1: Household characteristics (demography; land; assets; wealth).
- Part 2: Deposit activity (choice of banks; reasons for saving; source of funds)
- Part 3: Credit (attitude toward formal and informal lenders; credit history; knowledge of RCCs' micro credit).
- Part 4: Insurance (attitude and history).

Data from the China Data Center

The literature suggests that agricultural productivity affects both the demand and supply of rural credit (Kochar, 1997 and Yadav et al, 1992). While the variation in agricultural productivity could be best accommodated by yield per hectare for each surveyed household, these data were not available in the survey conducted

by He and Li (2005). Fortunately, the China Data Center provided detailed online data concerning agricultural output and agricultural machinery power at the county level. The justification for the use of the county-level data will be discussed in the following section.

Sampling methods

He and Li (2005) selected villages by a combination of simple random sampling and multistage sampling. Four counties were randomly selected. They were Tongren, Jiangkou, Shiqian and Yuping. Multistage sampling was used to select the surveyed villages. Firstly, towns in each county were divided into three groups based on their level of economic development. One town was randomly selected out of each group. And three villages were randomly selected out of each town. Surveyed households were randomly selected in each village. Table3.1 shows the distribution of the survey data.

3.4. Model specification

3.4.1. Demand equation

The likelihood to borrow depends on the variables that reflect the household's demographic characteristics, the level of wealth and the regional development of agricultural productivity and financial infrastructure. The model to be tested is the following:

$$DEM = f (OUT, POW, AGE, AGE2, EDU, LAB, DPD, WEA,$$
$$DPS, EXP, E_W, FIN)$$
(3.12)

What follows is the definition of these variables and how the explanatory variables are expected to affect the dependent variable.

The dependent variable:

DEM –demand for formal credit. Households were asked if there was a time when they needed a loan from a bank or a RCC. It is equal to 1 if a household indicated a need for credit, and 0 otherwise.

Demographic variables:

AGE- age of the head of the household. Three factors are expected to influence the impact of AGE on the demand for credit by farmers. These are the concept effect, the wealth effect and the expenditure effect. First, the concept effect will be examined. The Confucian value of thrift may still be deeply rooted in Chinese culture, especially among older rural individuals (Huang, 2005 and China Daily 2000). Many older farmers still regard the practice of borrowing money to be risky and psychologically unacceptable, so they would rather reduce their consumption than apply for a loan (He, 2005). Thus, the relationship between DEM and AGE is downward sloping (Figure 3.1). Second, the amount of household property generally accumulates with age. However, since agricultural production in rural Guizhou is still labour-intensive (Wang, 2003), a farmer's productivity generally depreciates with age after the farmer reaches a certain age. Consequently, the level of wealth could decrease after a certain level of age (Madajewicz, 2003). In other words, at some point, there might be a decreasing effect of age on wealth and therefore an increasing effect of age on the demand for credit (wealth effect will be discussed later). Thus, the demand function should be a convex function of age if the wealth effect holds (Figure 3.1). Third, the expenditure effect is analyzed. Middle-aged farmers are expected to shoulder the highest burden of expenditures related to the household, including tuition and marriage expenses for their children, funeral expenses for their parents, housebuilding and so on. In other words, middle-aged farmers have the greatest need of credit for consumption-smoothing among the age groups. So, the demand function would be a concave function of age if the expenditure effect holds (Figure 3.1).

 AGE^2 , quadratic term of AGE, is thus introduced to account for the non-linear association between demand for credit and age due to the wealth and expenditure effects.

To sum up, it can not be predicted ex ante the exact nature of the relationship between the demand for credit and the individual's age. It is an empirical issue on which this study attempts to shed some light.

EDU- level of education of the head of household. It is defined by categories from 1 to 6, corresponding to whether the individual is illiterate, graduated from elementary school, junior high school, high school, technical school, or college (or above). The actual effect of the level of education on the demand for formal credit is ambiguous. On the one hand, highly educated individuals are more likely to discard the traditional concept of a loan as risky, and thus would have a higher probability to borrow from formal lenders. On the other hand, the positive link between education and income is well documented in economics, although the causal relationship between schooling and income is still under dispute (Ashenfelter and Rouse, 1999). If the causal relation between education and income holds, education would provide skills, or human capital, that raises an individual's productivity in agricultural production or agribusiness. It might also be possible that individual can obtain higher level of education simply because his family is wealthy enough to afford the heavy financial burden of tuition. Whichever argument holds, the positive relationship between education and income is evident. Since wealthier households are more resilient to income volatility, the level of education could be negatively correlated with the demand for credit. In brief, the net impact of education on demand for credit depends on the relative strength of the concept effect and the wealth effect. Therefore the sign of education can not be predicated.

LAB – the number of labourers over 16 years of age. Limited access to family labour places important constraints on the household's ability to generate agricultural output (Feder, 1984). Agricultural tasks, especially in cultivation, are

very labour intensive at certain periods of the year. An issue that could be raised here is that if farmers can hire labour during peak seasons, the impact of family labour might not be very significant. However, it is not a common practice in rural Guizhou. Moreover, there might be a scarcity of family labour, given that 57% of surveyed households have adults migrating to cities for jobs. Thus, it is expected that the more family labourers a household has, the less likely it is to have demand for credit.

DPD - the number of dependents in the family, defined as the total number in the household minus the number of adult labourers). A household with more dependents is expected to have greater needs for consumption. Thus, the number of dependents is expected to be positively correlated with demand for credit. Some studies have combined the effect of labour and dependents to generate a dependent ratio, the ratio of dependents to the number of family members or adult labourers (Zeller, 1994). However, this study separates these two variables in order to examine the individual effect of them on demand for credit.

Wealth variables:

WEA – self-estimation of the level of household property in the village. Property includes assets that the household can claim ownership of, such as the house, consumer durables, etc. This does not include land, because land is not owned by individuals, but by the State. Individuals can only claim the right of use of the land (State Council, 1999). It is defined by categories from 1 to 3, corresponding to whether the level of household property is lower, middle or upper compared to others in the village. Wealthier households are more capable to safeguard against volatility in agricultural production and household consumption, whereas poorer households are more likely to be in need of credit for consumption-smoothing. Thus, the level of property is expected to have a negative correlation with demand for credit.

DPS – the amount of household deposits in formal financial institutions at the end of 2004. The value of this variable is classified into five ascending categories (0= no deposit, 1= less than 1000 RMB, 2=1000 to 3000 RMB, 3=3000 to 5000 RMB, 4=5000 to 10000 RMB, and 5=more than 10000 RMB). This variable should be negatively correlated with demand for formal credit. The rationale is the same as for WEA.

EXP – the amount of total expenditure in 2004. This includes household expenditures such as food, clothing, tuition, house-building, etc, and expenditures for agricultural production. The variable takes the value of 1 to 4 as expenditure increases (1=less than 1000 RMB, 2=1000 to 5000 RMB, 3=5000 to 10000 RMB, and 4=more than 10000 RMB). This variable will reflect a gross effect of expenditure on the desire for formal credit which includes the need for production and consumption. Although household wealth and expenditure would probably be positively correlated, it might still be expected that, ceteris paribus, that an increase in household expenditure would lead to a higher demand for credit.

 E_W – it is an interaction effect, calculated as the product of EXP and WEA. The impact of expenditure on the demand for credit may be different across farmers in various wealth categories. As expenditure increases, the proportion of the expenditure to household wealth increases faster for poorer farmers than for richer farmers, hence, a potentially higher demand for credit by poorer farmers. However, in spite of greater need of credit, a higher proportion of loans to household wealth will probably discourage poorer farmers from applying for formal credit when they take into account their low probability of obtaining a loan. They might turn to informal lenders to satisfy their need for credit. Thus, the relationship between E W and DEM is ambiguous.

The effect of productivity:

Food crop output (tonnes) per unit of rural labour at the county level is used to measure agricultural productivity. Although agricultural productivity would be measured more precisely by data at the individual household level, data at the county level can still capture the regional development of agricultural productivity. Regional variation in agricultural productivity could also affect the individual demand for loans (Kochar, 1997). This may be due to the fact that farm production techniques can be transmitted in an agrarian society as Guizhou through indigenous communication by means of folk media, such as songs and story-telling and indigenous organization and social gatherings, such as village meetings and irrigation associations (Mundy and Compton, 1991).

Kochar (1997) found that in India, the demand for formal credit was positively correlated with regional agricultural productivity. However, there are two opposite means through which efficiency in agricultural production can affect the household's demand for formal credit. First, higher productivity indicates a higher return to capital from production loans and thus a higher capacity to service debt. Second, households with higher agricultural productivity are more likely to be wealthy farmers and thus they could have lower demand for consumption loans. Thus, the signs on production variables depend on the proportion of production and consumption loans in the total formal loans.

OUT – food crop yield (tonnes) per unit of rural labour at the county level. The rationale for choosing food crop yield is as follows. 76.1% of the surveyed households were engaged in crop production. Food crops, included rice, wheat, corn and potato, as the major crops.

POW – annual agricultural machinery power (10,000 kw) per unit of rural labour at the county level. Agricultural machinery includes machines used in crop production, for instance, machines for planting (e.g. seed-sowing machines and planter), irrigation (e.g. irrigation sprinkler and pump), fertilizer application (e.g. manure spreader) and harvest (e.g. reaper and thresher). It also includes machines used in livestock raising, for example, feed processor, electric incubator and so on. Differences in agricultural machinery power per unit of rural labour should reflect differences in the level of agricultural mechanization between the regions.

Financial infrastructure:

FIN- level of financial development of the village. It is measured by the average value of loans by the RCCs per rural household in the 36 surveyed villages. This dataset is published in He and Li (2005, p19). Data for 8 villages were directly found in He and Li (2005), whereas data regarding the remaining 28 villages were not disclosed. However, the value for the remaining 28 villages is assigned as the average value for the corresponding towns. The mean is a reasonable guess of the value for a randomly selected observation (Acock, 2005). As discussed in sampling methods, villages were randomly selected out of each town. Thus, the average value of the town is a rational substitute for the value of villages. Households in villages with more sophisticated financial development are likely to exhibit a higher propensity for borrowing among rural households. Thus FIN is expected to be positively correlated with the demand for formal credit.

3.4.2. Rationing equation

The likelihood to be credit rationed is a function of variables affecting the borrower's demographic characteristics, the level of wealth, creditworthiness and the regional development of agricultural productivity and financial infrastructure. The model to be tested is the following:

Most of the explanatory variables are defined similarly as those in (3.12).

RTN – whether or not the household is credit rationed (yes 1, no 0). Following the discussion of the empirical measurement of credit rationing in chapter 2, households in the following categories are credit rationed by formal lenders:

 Applicant rationing: rural households who applied for formal loans but were rejected;

- (2) Quantity rationing: rural households did not apply for formal loans because the credit ceiling assigned to them was insufficient to meet their financial need;
- (3) Preemptive rationing: rural households did not apply for formal credit due to the following reasons: (a) unable to provide any or sufficient collateral, (b) complicated procedures of application, (c) perceived little chance of obtaining the loan due to lack of personal connections.

Households were not credit rationed if they either received a formal loan or did not apply for a loan due to the following reasons: (d) did not need a loan, (e) convenient informal loans, (f) uninformed that formal loans are available to farmers, (g) fear of inability to repay the loan. Those in categories (d) and (e) are called uninterested households by Mushiski (1999).

Demographic variables:

AGE -age of head of household. The effect of age on credit access does not seem to be straightforward at first glance. There are four types of effects of age on the supply of credit, which are the education effect, the experience effect, the network effect and the wealth effect. First, the education effect and the experience effect will be examined. The effect of age contains a trade-off between level of education and the accumulation of experience. In rural China, older farmers on average received less schooling than younger individuals, since the national education system was backward in the past. Lack of education and accumulated experience have opposite impacts on agricultural productivity, which in turn affects household wealth (Figure 3.2). Second, an older individual may have developed personal connections in the community that would serve as social collateral for a loan application. Thus, the network effect implies a negative correlation between AGE and RTN (Figure 3.2). Finally, similar to the demand equation, there might be a decreasing effect of the farmer's age on the level of household wealth and thus an increasing effect of the farmer's age on the probability of being credit rationed. If this is the case, then the rationing function

should be a convex function of the farmer's age (Figure 3.2). Again, AGE^2 is used to capture the non-linear wealth effect.

In sum, the expected signed of both AGE and AGE 2 in the rationing equation will depend on relative strengths of these four effects of age on the supply for credit.

EDU- level of education of head of household. As explained previously, a more educated individual is likely to have higher level of income, whether due to causality or simultaneity between level of education and wealth. Wealthier households probably have less need of liquidity and might not apply for loans. Thus, they are more likely to fall into category (e) (those who do not need loans). For both reasons, higher education is expected to reduce the probability of credit rationing.

LAB- the number of family members who are more than16 years old. As discussed previously, the more adult family labourer, the higher the incomegenerating ability for the household. So, it is expected that the LAB would be positively correlated with access to formal credit.

DPD- the number of dependents in the family. Ceteris paribus, households with more dependents would have less income per capita, which is one of the indicators that formal lenders use to rate the creditworthiness of households. Thus, DPD is expected to have a positive effect on RTN.

Wealth variables:

All the wealth variables are supposed to have two contrary impacts on credit rationing. First, given the expenditure level, a wealthier household is more likely to be able to finance their expenditure without borrowing. In this sense, a wealthy household is more likely to be uninterested in formal loans, which reduces the chances of being credit rationed. Meanwhile, a higher level of wealth would increase the credit rating of rural households, which implies a higher probability of credit access if individuals apply for the loan. Given that the majority of rural households reported demand for formal loans (He, 2005 and IFAD, 2001), one might believe that the positive correlation between wealth and credit access would be the dominating factor in the interaction between rural households and formal lenders.

WEA– self estimation of the level of household property in the village. As explained previously, WEA should be negatively correlated with RTN. However, as discussed in proceeding section, households with middle-level wealth are most constrained in formal loans. To test this effect, the quadratic term of WEA is introduced in eq.3.13.

DPS– the amount of household deposits in formal financial institutions at the end of 2004. Monetary savings can be easily liquidated in order to repay a loan. Besides the general feature that DPS has as a wealth variable, deposits in the RCCs alone would raise the credit rating of rural households according to some local enforcement regulations of the RCCs micro credit program (The RCCs Beijing, 2002). For both reasons, a higher amount of savings in formal financial institutions is expected to increase the probability of credit access.

The effect of credit:

RAT – dummy variable of whether or not a farmer has been credit rated. Obtaining a credit rating is part of the procedure in the RCCs' micro credit programs. As described in the introduction, the RCCs' microcredit program targets rural households with middle or low income who are creditworthy, in need of small loans but unable to provide collateral. The procedure for these loans is more simplified, to a significant extent, compared with other loan applications. Controlling for wealth variables, it would be easier for households with a credit rating to obtain the loan that is below the credit ceiling granted, in contrast to unrated households. Thus, households with a credit rating would receive better access to formal credit.

Note that RAT is not included as an explanatory variable in the demand equation. The RCCs only evaluate those households who have submitted an application for a credit rating. It is very likely that only a household with demand for credit would apply for a credit appraisal. Thus, the fact that a household obtained a credit rating might simply be the consequence of demand for credit, rather than a factor that determines the household's demand. Therefore RAT was excluded from the demand equation.

SHA – dummy variable of whether or not the individual was a shareholder of the RCCs (yes 1, no 0). Shareholders of RCCs can be divided into voluntary and non-voluntary ones. Voluntary shareholders are those who took the initiative to join the RCCs. Non-voluntary shareholders are those who were forced to join the RCCs. Why is this so? It happens when some households apply for loans and a certain amount was deducted from their loan as equity capital (He, 2005). However, irrespective of whether or not a shareholder is voluntary or non-voluntary, shareholders are given preference in receiving the financial services of the RCCs (China Banking Regulatory Commission, 2005). This preferential treatment includes priority over non-shareholders in loan application and the issue of loans at a lower interest rate. Thus, being a shareholder would increase credit access, and therefore, SHA is expected to be negatively correlated with RTN.

Note that SHA is also not included in the demand equation because of the following reasons. For voluntary shareholders, it is likely that farmers applied to join the RCCs due to their need for formal credit, whereas non-voluntary shareholders already obtained loans from the RCCs. Therefore, regardless of whether voluntary or non-voluntary, being a shareholder is simply the result of farmers' need for formal credit.

The effect of productivity:

Households in counties with higher average agricultural productivity would be expected to have greater income-generating ability in general. Thus, households living in regions where average agricultural production is more efficient are more likely to have access to formal credit. Thus, both OUT and POW are expected to be negatively correlated with RTN.

Financial infrastructure:

FIN- level of financial development of the village. A greater amount of RCCs' loans per household implies that the RCCs in this village have better access to funding, probably due to more abundant deposits from rural households. In other words, the RCCs themselves are less credit constrained with a higher value of FIN. Other things being equal, an applicant is more likely to receive credit from the RCCs with better financial strength. On the other hand, a higher value of FIN may also reflect better relationship between the RCCs and borrowers. For both reasons, it is expected the level of financial development would be negatively correlated with credit rationing.

4. Results and discussion

This chapter describes the results found in descriptive statistics and the regression analysis. The household's borrowing propensity and credit availability are discussed first, followed by the analysis of factors affecting the likelihood of borrowing and being credit rationed.

4.1. Descriptive statistics

It is worth mentioning that most of the discussion of descriptive statistics in this section is based on He and Li (2005). There are four sources of credit in these four counties: formal institutions consisting of the RCCs and the Agricultural Bank of China, relatives and friends, professional money lenders and international organizations. It is clear that formal institutions, especially the RCCs, are the most important source of credit in all four counties. Based on the survey data, 628 loans were made between 2002 and 2004, among which 69.3% were from the RCCs (see Table 4.1). The importance of formal credit in the rural credit market of Guizhou is consistent with Yadav et al's (1992) finding in their study of Nepal. The substantial share of the RCCs in the rural financial market of Guizhou might be explained by the fact that the development of the RCCs' microcredit program facilitates access to formal credit. 48.9% of the households were voluntary members of the RCCs and 38.6% of the households had obtained a credit rating.

The role of formal institutions in the rural credit market is also shown by households' borrowing propensity. 444 households or 88% of the households indicated a need for loans from the RCCs or banks. An investigation of household property further shows that households with a lower property level had a higher desire for formal credit (see Table 4.2). 96.3% of the households with a low property level indicated their need for formal credit. This is significantly higher than the proportion in the middle or high property groups, as shown by the chi square test. The breakdown of households by level of deposits also shows that the low deposit group had a significantly higher proportion of households with

demand for formal credit (see Table 4.3). These results support that idea that formal loans have an important role in consumption-smoothing among less wealthy individuals (Swaminathan, 1991).

The analysis of individual's loan history shows that the majority of rural households had access to formal credit. Table 4.4 shows 70.6% of the households had received loans from the RCCs or banks. Whereas 29.4% of the households had not obtained formal loans, the actual extent of applicant rationing will be smaller when those who did not need formal loans are taken into account. Among 140 households who did not receive formal credit, 42 households had their loan application rejected (call them "applicant rationed"), 58 households were preemptively rationed, 35 households did not need credit and 5 households did not reveal the reason for non-application. To be conservative, these five households were in fact credit-constrained, either applicant rationed or preemptively rationed.

However, of all households who were applicant rationed, 95% of these were low or medium property households, and they represented 95% of households who were preemptively rationed (See Table 4.5 and 4.6). The information regarding the level of amount rationing is not directly available in the survey; nevertheless, the extent of amount rationing can be roughly examined by looking into the question of whether the credit ceilings granted by the RCCs were able to meet the households' need for formal credit. 58.4% of the credit-rated households indicated that the ceiling amount was not sufficient to meet their needs, among which 80.2% of households were those with low or middle levels of property (See Table 4.7). Therefore, the results of all three categories of credit rationing are consistent with the wealth bias that the credit literature suggests (Carter 1988 and Swaminathan 1991). Interestingly, middle property households were actually the most severely constrained group, having the highest proportion of households being credit rationed in all three respects, i.e. applicant, preemptive and amount rationing. Chi square tests were carried out to test if the relationship between rationing and property level is statistically significant. P-values in Table 4.5-4.7

show that the difference in credit accessibility across different property groups is statistically significant at the 1% level in cases of applicant rationing and preemptive rationing and at the 10% level in the case of amount rationing. Note that the numbers of observations in the three rationing categories are different because these three categories correspond to different questions and a different number of responses was gathered for each question. The apparently quadratic relationship between the level of property and the likelihood of being rationed will be further tested in the regression model.

He and Li's (2005) survey also shed light on the purposes of loans. (Table 4.8) The proportions of production and consumption loans were almost equivalent in the sample data. 51.7% of the formal loans were for income-generating purposes and 48.3% was for consumption. The percentage of production loans increases with the level of property and this trend is statistically significant at the 5% level. However, as Swaminathan (1991) argued in his study of agrarian credit markets in India, the stated purpose of a loan by a wealthier borrower needs to be analyzed with caution, due to the fungibility of credit. Knowing the requirements of the formal lender, it is easier for a wealthier farmer to present their demand as a production loan. For a poorer farmer, his consumption needs outweigh production needs and thus such a deception is not easy (Swaminathan, 1991).

In sum, the RCCs have become the major credit supplier in rural Guizhou, not only in terms of their market share in the rural financial market, but also households' propensity to borrow from the RCCs. It appears that the majority of rural households have access to formal credit, however poorer households are more likely to face credit constraints.

4.2. Estimation results

The data were first examined for evidence of collinearity. Multicollinearity is a data problem where the measured variables are too highly intercorrelated to allow precise analysis of their individual effects (Greene, 1997 and Gujarati, 2003). The

correlation matrix and auxiliary regressions were used to detect the existence of multicollinearity. Auxiliary regression is the regression of each X variable on the remaining X variables.

The results from the correlation matrix and auxiliary regressions both suggested multicollinearity among some of the regressors. One suggested rule of thumb to detect collinearity is that if the pair-wise correlation coefficient is in excess of 0.8, then collinearity is a serious problem (Greene, 1997). In the correlation matrix (see Table 4.9), the absolute value of the correlation coefficient between OUT and POW is greater than 0.8. In the auxiliary regressions, the critical F value at a 10% level of significance F_c is 2.3, and the F values of the auxiliary regressions of all the regressors except SHA are greater than F_c (See Table 4.10 and 4.11). This indicates that each explanatory variable, except SHA, is collinear with other explanatory variables. However, one should use caution when dropping variables from the model because the consequences of speciation bias may be more serious than insignificancy due to multicollinearity (Greene, 1997).

In view of this, only EDU and POW are dropped from the models due to the following reasons. The reason for leaving out EDU from the equations is that it is highly correlated with AGE (see Table 4.12) and because the level of education is not the direct causal effect on the demand or the supply of a formal loan. EDU was defined as a six category dummy variable, according to level of education. In the initial regression, it was not significant. As an alternative, it was transformed into a 0/1 dummy (higher versus lower level of education), but this did not yield any improvement. Thus EDU is dropped from the models. The justification for dropping POW is that it is highly correlated with OUT and FIN (see Table 4.12). Meanwhile, both EDU and OUT were not significant in initial regressions. Consequently, EDU and OUT were dropped from the equations.

It is interesting to note that OUT and POW are negatively correlated, which was unexpected. A possible explanation could be that the link between the level of food crop output and agricultural machinery power is not very straight forward at the county level. Thus it must be left to future research to obtain data and explore agricultural productivity at the individual level.

One might argue that the introduction of county dummies may capture the regional effect on the household likelihood of borrowing and being credit rationed other than the effect of regional financial infrastructure. In view of this, county dummies were estimated in both the demand and the rationing equations. However, the coefficients of county dummies in both equations were not significant. Thus, county dummies were not included in the models.

The results of maximum likelihood estimates for the demand and rationing equations are presented in Table 4.13. These two equations are used to analyze the factors that determine the likelihood of a demand for a formal loan and of being credit rationed by the formal lender. In the demand equation, the dependent variable (DEM) is equal to 1 if the household indicated a need for formal credit; 0 otherwise. In the rationing equation, the dependent variable (RNT) is equal to 1 if the household is credit-rationed by the formal lenders; 0 otherwise. Because the demand and rationing equations have different specifications, the numbers of observations are different. These two equations were estimated with the statistical software package STATA version 9.0 using the logit maximum likelihood procedure.

The significance of the set of regressors can be assessed using the p-value associated with the LR chi2 (.) statistic. P-values approximately equal to zero indicate that one can reject the null hypothesis that the coefficients are not jointly significant (Amemiya, 1981). In the demand and rationing equations, the null hypothesis is easily rejected.

Pseudo- R² reported in Table 4.13 is McFadden's Pseudo-R², defined as R²=1-ln (L_1/L_0) , where L_1 is the value of the likelihood function when all predictors are included in the model, and L_0 is the value of the same function when only the constant is included (McFadden, 1974). It is called "pseudo" R² because it is

similar to R^2 in the sense that it is measured on a similar scale, ranging from 0 to 1, with higher values indicating a better fit. However, Pseudo- R^2 does not mean what R^2 means in OLS regression, i.e. the proportion of total variability explained by the model (Long and Freese, 2003).

In the demand equation, the level of property (WEA), deposits (DPS) and the product of EXP and WEA (W_E) are statistically significant at the 1% level, as can be inferred from the z-statistic. The coefficients associated with WEA, DPS and EXP have the expected signs. Based on the discussion in Chapter 3, there was no a priori expectation regarding the sign of the coefficient of W_E, yet the estimated result shows that W_E has a positive impact on the likelihood of borrowing.

Among the variables with insignificant coefficients in the demand equation, the coefficients associated with the number of dependents in the family (DPD) and total expenditure (EXP) have the expected sign. However, the signs of the coefficients associated with the number of family members over 16 years of age (LAB) and the level of local financial development (FIN) were unexpected. Based on the discussion in Chapter 3, there was no a priori expectation regarding the effect on demand of age (AGE) and the variable related to agricultural productivity (OUT). Yet the results indicate a concave relationship between AGE and demand, a positive relationship between the level of agricultural productivity and demand.

In the rationing equation, DPS, SHA, RAT and OUT are statistically significant at the 10% level or better and have the expected signs. Among the variables with insignificant coefficients in the rationing equation, the coefficient associated with DPD has expected sign, however, the signs of the coefficients associated with LAB and FIN were unexpected. In addition, the effects on rationing of AGE and AGE² were not known a priori, yet the estimated results indicate a concave relationship between AGE and rationing.

The odds ratios for each regressor are also shown in Table 4.13. The inverses of the odds ratios for the variables that negatively affect the dependent variable are presented in the parentheses beside the original odd ratios in order to compare the magnitude between positive and negative effects. In the demand equation, WEA has a more important impact on demand than other variables because the magnitude of the odds ratio of WEA is greater than that of other variables. Being in an additional higher category of property level, the odds of having demand for a formal loan decreases by a factor of 0.131. Similarly, in the rationing equation OUT has the most important effect on credit rationing. The odds of being credit rationed decreases by a factor of 0.007 if the food crop output increases by one tonne.

4.3. Discussion

The majority of the results are consistent with expectations. For instance, the characteristics that define a household's ability to generate income are, without exception, negatively correlated with the likelihood to borrow and to be rationed by the formal lender. The discussing will start with wealth-related variables.

Wealth variables:

In the borrowing equation, as the level of property (WEA) and deposits (DPS) increase, there is a drop in the likelihood to borrow. This conforms to the expectation that a wealthier household is more capable to safeguard against volatility in agricultural production and household consumption.

However, contrary to expectation, the amount of household expenditure (EXP) has a negative relationship to the likelihood to borrow. A possible explanation is that an increase in household expenditure indicates not only a higher need for consumption credit but also a higher level of wealth of the household, since household expenditure and wealth are highly correlated. The simple OLS regression coefficient of WEA, with EXP as the dependent variable, is significant at the 1% level (t_{WEA} =10.62, P=0.000). This shows that household expenditure

grows in line with the level of wealth. The negative correlation between EXP and demand implies that a higher level of wealth reduces the need of a loan for consumption purposes.

The positive and statistically significant coefficient associated with the product of EXP and WEA (E_W) conforms to the expectation that impact of expenditure on demand for credit varies across property levels. Moreover, given the expenditure level, the poorer a household is, the less likely it is for him to borrow using formal credit. The result raises the possibility that a poorer farmer turns to the informal lender for credit. It can be argued that poorer households select themselves out of the formal credit market when in need of a loan. This hypothesis was empirically tested by Swaminathan (1991), and his results confirmed it.

In the rationing equation, an increase in the level of deposits (DPS), which is an indicator of repayment ability, decreases the probability of being credit rationed. In addition to this result, the relationship between WEA and RTN has an inverted U-shape. Although WEA² is significant only at the 15% level (the Z value associated with WEA² is -1.45), the descriptive statistics do indicate a concave relationship between WEA and RTN, in that households with middle level property are most severely credit constrained in terms of applicant rationing, amount rationing and preemptive rationing. The concave relationship between WEA and RTN means that the likelihood to be credit constrained actually increases with the level of property up to a certain point. Beyond a certain threshold, the relationship is reversed. While the analysis of the sample data shows that middle class farmers are credit constrained most severely, maximum likelihood regression provides a more precise estimation, showing that the lowermiddle-class farmers are the most constrained group. This result is different from the empirical finding of IFAD (2001) that the inability to borrow was highest in the poorest group. A possible explanation for the discrepancy results is that the IFAD results are based on a survey by the Chinese Academy of Agricultural Sciences in 1997, whereas the microcredit programs of the RCCs in Guizhou only started in 2003, and may have improved credit availability for the poorest group of farmers. Since the RCCs have clearly stated that their microcredit program is targeted at the poor households (People's Bank of China, 2000 and 2001), the RCCs might give preference, to a certain extent, to the poorest households in order to reallocate credit as a tool of government policy (Adams, 1979 and Swaminathan, 1990).

Overall, the results support the hypothesis that, in general, the more vulnerable a household is, in terms of the level of household property and deposits, the more likely it is to borrow and to be credit rationed by the formal lender. To be more precise, it is the lower-middle-class farmers who are the most constrained group. Moreover, it appears that, given the expenditure level, a poorer household, compared with a wealthier household, is likely to select itself out of the formal credit market when in need of a loan.

The effect of shareholding and credit rating:

In the rationing equation, the fact of being a shareholder of the RCCs (SHA) or receiving a credit rating by the RCCs (RAT) significantly reduces the likelihood of being credit rationed. This conforms to the expectation that higher creditworthiness significantly decreases the probability of being credit rationing (Chakravarty and Scott, 1999).

The effect of productivity:

In the demand equation, food crop output (tonnes) per unit of rural labour at the county level (OUT) is positively but insignificantly correlated with demand for formal credit. In other words, the level of agricultural productivity has no significant impact on household demand. The estimated results are inconsistent with Kochar's (1997) argument that higher productivity in agricultural production significantly increases the demand for formal credit. The different purposes of the loan might be a possible explanation for the inconsistency with Kochar's (1997) finding. Kochar's (1997) conclusion was based on the rationale that a higher return on capital, from a production loan, is associated with a higher level of
productivity, which increases the demand for a production loan. However, if the loan is used for the purpose of consumption-smoothing, the higher the level of productivity, the less likely it is for a household to borrow, since a farmer with higher agricultural productivity is more likely to be a wealthier farmer and thus has less need for a consumption loan. As discussed in the descriptive statistics, there is no significant difference between the proportions of production and consumption loans in the sample data, and the correlation between OUT and demand thus turns out to be insignificant.

In the rationing equation, the estimated coefficient of OUT is negative and statistically significant. The higher the level of productivity is, the less likely it is for a household to be credit constrained. Higher agricultural productivity is associated with greater income-generating ability. The results confirm the hypothesis that at least at the county level, a formal lender uses the income-generating ability as one of the criteria for credit rationing.

To sum up, agricultural productivity dose not seem to have a significant impact on the demand of formal credit, but formal lenders use this measure to ration credit. Meanwhile, the purposes of agricultural production and consumption-smoothing for borrowing activity are equivalently important in rural Guizhou.

Demographic variables and the effect financial infrastructure:

The coefficients of all the demographic variables and the variable related to local financial development are insignificant in both demand and rationing equations. This does not mean that none of these variables are important. Rather, it could be argued that they influence the likelihood of borrowing and credit rationing through an indirect influence on consumption and the level of wealth. Indeed, there is a strong correlation between EXP and the number of dependents in the family (DPD), as well as between WEA and the number of adult labourers (LAB). The simple OLS regression coefficient of DPD, with EXP as the dependent variable, is significant at the 1% level (t $_{DPD} = 2.64$, P=0.008). And the simple OLS

regression coefficient of LAB, with WEA as the dependent variable, is significant at the 10% level (t $_{LAB}$ =-1.75, P=0.081).

Regarding AGE, since this variable affects consumption and wealth in various, and even opposite, ways as discussed in Chapter 3, the overall effect thus appears to be not straightforward. The insignificant impact of age on the likelihood of borrowing and being credit rationed was also found in Baydas's (1994) study of small-scale enterprises in Ecuador and Jappelli's (1990) study of credit-constrained consumers in the U.S.

Summary

The regression results suggest that the likelihood to borrow is mainly dependent on household resilience to income volatility (WEA, DPS and EXP). And the likelihood to be credit rationed mainly depends on household ability to repay the loan (DPS, OUT) and creditworthiness (SHA and RAT). More precisely, lowermiddle-class farmers appear to be the most constrained group and the credit availability to the poorest farmers may have been improved after the implementation of the microcredit programs of the RCCs. Meanwhile, given the expenditure level, a poorer household, compared with a wealthier household, is likely to select itself out of the formal credit market when in need of a loan. And regarding the purpose of a formal loan, the purposes of agricultural production and consumption-smoothing are equivalently important in rural Guizhou.

5. Conclusions

5.1. Summary of findings

Despite of its achievements in poverty alleviation since the implementation of market-oriented reforms in 1978, China still has a large number of people living in absolute poverty (National Bureau of Statistics of China, 2004). The poor are disproportionately located in rural area and primarily engaged in agricultural and associated activities. Among the 34 provinces and municipalities in China, Guizhou is considered an interesting area for research on credit and poverty alleviation, given its high poverty rate and pilot micro credit programs that are currently taking place. Since the rural financial reform that started in 1996, the Rural Credit Cooperatives (the RCCs) have literally been the only formal financial service providers in some rural areas of Guizhou. It is commonly held that rural households, especially those with a lower level of wealth, have been credit rationed by formal lenders. At the end of 2001, the RCCs initiated a microcredit program in order to raise the income of poor rural households. However, little research has been done in terms of evaluating the results of their microcredit program. This study was thus motivated by the lack of empirical research on the credit constraints of rural households after the implementation of the RCCs' microcredit program. The issue of RCCs' outreach becomes more interesting when it is taken into account that many poor households may ration themselves out of the micro credit market (Cheng, 2006) in fear of high transaction costs of a formal loan. The low participation rate of poor farmers in the formal credit market could also be due to constraints other than capital that reduce agricultural productivity, low-cost substitutes for formal credit (Kochar, 1997), or lack of profitable investment opportunities (Xie et al, 2005). Thus, the objective of this study was to examine the determinants of the demand for and the supply of credit which underlie credit market outcomes.

The analysis is based on data from a survey of households in Guizhou province conducted by He and Li (2005) as part of a Technical Assistance Program of the Asian Development Bank. He and Li (2005) provided a comprehensive review of borrowing activities in Rural Guizhou and proposed models to investigate the demand for and the supply of credit. This thesis expands upon their research. First, in this thesis, the magnitude of credit rationing is measured more precisely by taking into account preemptive rationing (Mushinski, 1999 and Zeller, 1994). Second, the effect of productivity is examined in order to test the hypothesis that the borrowing decision is affected by constraints other than capital (Kochar, 1997). Finally, the spillover effect of the RCCs' microcredit program is investigated by including in the model the level of financial development of the village, which is measured by the average value of loans of the RCCs per rural household. The purpose is to test if the RCCs' micorcredit program would have a positive spillover effect on borrowing decisions and credit accessibility of nonparticipants of the program (Khandker, 2005). The determinants of demand and supply were explored using logit models in which the likelihood of a household borrowing and being credit rationed were related to a number of variables that characterized the circumstances of rural households.

The analysis of descriptive statistics confirms that the RCCs have become the major credit suppliers in rural Guizhou, not only in terms of their market share in the rural financial market, but also households' propensity to borrow from the RCCs. It appears that the majority of rural households have access to formal credit, however poorer households are more likely to face credit constraints.

The estimated results on the demand side show that the level of property and deposits have negative and significant impacts on the likelihood to borrow. This indicates that a wealthier household is more capable to safeguard against volatility in agricultural production and household consumption. The interaction term of property and expenditure is positively and significantly correlated with demand. This implies that, given the expenditure level, the poorer a household is, the less likely it will borrow using formal credit. The result raises the possibility that a poorer farmer turns to informal lenders for credit. Contrary to Kochar's (1997) findings in his study in India, food crop output, as a proxy for agricultural

productivity, has no significant impact on demand. The different purposes of the loan might be a possible explanation for the inconsistency with Kochar's (1997) finding. A higher level of productivity would increase the demand for a production loan due to a higher return on capital. However, a higher level of productivity could also decrease the demand for a consumption loan, since a farmer with higher agricultural productivity is more likely to be a wealthier farmer and thus has less need for a consumption loan. Thus, the fact that the proportions of production and consumption loans were almost equivalent in the sample data makes the impact of productivity on demand appeared insignificant.

On the supply side, the likelihood to be credit rationed mainly depends on household ability to repay a loan and creditworthiness. First, regarding creditworthiness, being a shareholder of a RCC or being credit rated by a RCC increases the probability of receiving a formal loan. Second, in terms of repayment ability, an increase in level of deposits or productivity decreases the probability of being credit rationed. The result for productivity shows that a formal lender uses income-generating ability as one of the criteria for credit rationing. The relationship between a household's level of property and rationing has an inverted U-shape, meaning that lower-middle-class farmers are the most constrained group. This also suggests that the credit accessibility of the poorest farmers may have been improved after the implementation of the RCCs' microcredit program.

5.2. Policy implications

The negative correlation between property and demand and the concave relationship between property and rationing suggest a credit gap faced by lower-middle-class farmers. Given the large proportion of lower-middle class farmers (IFAD, 2001), a clear policy implication is thus the need to improve the outreach of the RCCs' microcredit programs to this group of farmers. This may be achieved by providing more flexible loan durations and repayment frequency (Park and Ren, 2001). In their survey, He and Li (2005) found that the actual loan

durations being offered to the respondents were shorter than the optimal duration that these households desired. Most of the actual loan durations were less than one year, which is not suitable for a project with a profitability period greater than one year. Meanwhile, most micro credit in rural China is payable by instalments (Xie et al, 2005). Although an instalment basis reduces the pressure of having to make a lump-sum payment, it would increase the cost of raising funds when the cash flow of the household is not consistent with the repayment schedule. As stated previously, a large proportion of rural households in Guizhou, particularly poorer households, rely on remittances from migrant workers from the household. Migrant workers usually remit money once a year, so frequent instalments would increase the borrowing cost for these households. Thus, an effective credit delivery system, including flexible loan durations and repayment frequency, is necessary to ensure that the delivery system meets the diverse socio-economic development needs of the poor.

The results also show that the consumption-smoothing motive for formal loans is not less important than the income-generating motive, which is particularly the case for poorer farmers. This suggests that microcredit programs that disregard the insurance function provided by consumption credit will find limited success in Rural Guizhou, because consumption credit helps rural households to cope with potential income or consumption stress (Zeller and Sharma, 2000). The purpose of a loan should not be used as a criterion to ration credit, not only in the RCC's microcredit programs but also other microcredit programs aimed to reach the rural poor.

5.3. Limitations and future research

The credit literature suggests that access to informal credit plays in important role in the borrower's decision-making problem (Kochar, 1997). As discussed in Chapter 3, when making a borrowing decision, each individual has a reservation utility, which is the best alternative to a formal loan. The best alternative could be self-financing or an informal loan. Due to data unavailability, the analysis of a borrower's reservation utility does not take into account the utility of an informal loan. It only focuses on the utility of self-financing. Thus, the borrower's decision concerning an informal loan is an issue left for further research. Meanwhile, additional data on informal credit transactions would also help to further test the impact of expenditure requirements on the demand for credit across wealth levels. The results suggest that given the level of expenditure, when the financial need cannot be met in the formal credit market, a poorer household might be more likely to use an informal lender than a richer household. Thus, additional data on informal credit are necessary to conclusively test this hypothesis.

In addition, the conclusion regarding the effect of agricultural productivity on credit accessibility is drawn based on county-level data. Thus, it must be left to future research to obtain data and explore agricultural productivity at the individual level, and how this is related to borrowing activity.

Another interesting topic left for future research is the evaluation of the RCC's microcredit program from the institutional perspective, as opposed to the borrower's perspective in this study. Because the benefit to rural households must be weighed against program costs, when evaluating microcredit programs (Park and Ren, 2001), it would be useful to examine the sustainability of the RCC's microcredit program, e.g. revenue versus cost, repayment rate, etc.

References

Acock, Alan, 2005, "Working with Missing Values," *Journal of Marriage and Family*, Vol. 67 (November), pp1012-1028

Adams, Dale, and G.I. Nehman, 1979, "Borrowing Costs and the Demand for Rural Credit," *Journal of Development Studies*, Vol. 15, Issue2, pp.165-176

Adams, Dale, 1994, "Transaction Costs in Decentralized Rural Financial Markets," Studies in Rural Finance Occasional Paper No.2023. Columbus, OH: Ohio State University

Aleem, Irfan, 1990, "Imperfect Information, Screening and the Costs of Informal Lending: A Study of a Rural Credit Market in Pakistan," *The World Bank Economic Review*, Vol.4, No.3, pp.329-349

Amemiya, T. and Nold, F.C., 1975, "A modified logit model," the *Review of Economics and Statistics*, May 1975, pp 255-57.

Amemyia, T., 1981, "Qualitative response models: a survey," Journal of Economic Literature, Vol. XIX, pp 1483-1536.

Amin, Sajeda, Ashok S. Rai, and Giorgio Topa, 2003, "Does Microcredit Reach the Poor and Vulnerable? Evidence from Northern Bangladesh," *Journal of Development Economics*, Vol. 70, pp. 59-82

Arestis, Philip, and Panicos Demetriades, 1996, "Finance and Growth: Institutional Considerations and Causality," Paper presented at the Royal Economic Society Annual Conference, Swansea University, April

Arrow, Kenneth, 1963, "Uncertainty and the Welfare Economics of Medical Care," The American Economic Review, Vol. 53, No. 5, pp 941-973

Ashenfelter, Orley and Cecilia Rouse, 1999, "Schooling, Intelligence, and Income in America: Cracks in the Bell Curve," National Bureau of Economic Research (NBER) working paper series, Working Paper 6902, Cambridge, MA, accessed at <u>http://www.nber.org/papers/w6902</u>

Avery, Robert, Raphael Bostic, and Katherine Samolyk, 1998, "The Role of Personal Wealth in Small business Finance," *Journal of Banking and Finance*, vol.22, pp.1019-1061

Baydas, Mayada M., Richard L. Meyer and N. Aguilera-Alfred, 1994, "Credit Rationing in Small-Scale Enterprises: Special Microenterprise Programmes in Ecuador," *The Journal of Development Studies*, Vol. 31, No.2, pp. 279-209

Bell, Clive, 1998, "Credit Markets and Interlinked Transactions," in *Handbook of Development Economics*, H.chenery and T.N. Srinivasan (Ed.) Amsterdam, North-Holland

Bencivenga, Valerie, and Bruce Smith, 1991, "Financial Intermediation and Endogenous Growth," Review of Economic Studies, Vol 58, pp 195-209

Besanko, David and Anjan V. Thankor, 1987, "Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets," *International Economic Review*, Vol. 28, No. 3, pp. 671-689

Besley, Timothy, 1994, "How do Market Failure Justify Interventions in Rural Credit Market," *The World Bank Research Observer*, Vol.9, Issue 1, pp 27-49

Braverman, A, and J.E. Stiglitz, 1989, "Credit rationing, tenancy, productivity, and the dynamics of inequality," In *The Economic Theory of Agrarian Institutions*, Bardhan, P. (Ed.), Oxford University Press, New York.

Carter, Michael R., 1988, "Equilibrium Credit Rationing of Small Farm Agriculture," *Journal of Development Economics*, Vol. 28, No.1, pp. 83-103

Chakravarty, Sugato and James S. Scott, 1999, "Relationships and Rationing in Consumer Loans," The Journal of Business, Vol. 72, No.4, pp. 523-544

Cheng, Enjiang, 2006, The Demand for Micro-credit as a Determinant for Microfinance Outreach – Evidence from China, Paper presented at the Association for Chinese Economic Studies (Australia) (ACESA)2006 Emerging China: Internal Challenges and Global Implications, Melbourne.

China Banking Regulatory Commission, 2005, Guidance for Regulating Equity Participation in RuralCooperativeFinancialInstitutions(inChinese),accessedat http://www.xh358.com/main.php?pvar1=d2004062401

China Daily, 2000, Slow Development in Rural Consumption Credit, Accessed at <u>http://english.people.com.cn/english/200007/03/eng20000703_44553.html</u>

China Development Gateway, 2006, *Where is the poor located in China (in Chinese)*, access at <u>http://www.chinagate.com.cn/chinese/jp/44923.htm</u>

China Population Development and Research Center, 1999, *Basic Conditions of Family Planning Programme at the Provincial Level, Guizhou*, Beijing, Accessed at <u>http://www.cpirc.org.cn/en/30Province1999-guizhou.htm</u>

Coudouel, Aline, Jesko S. Hentschel, and Quentin T. Wodon, 2002, Poverty Measurement and Analysis, World Bank, Washington D.C., Accessed at <u>http://povlibrary.worldbank.org/files/5467_chap1.pdf</u>

China Daily, 2000, Slow Development in Rural Consumption Credit, Accessed at http://english.people.com.cn/english/200007/03/eng20000703_44553.html

Cramer, J.S., 2003, Ch9 "The Origins and Development of the Logit Model," in *Logit Models from Economics and Other Fields*, Cambridge University Press, pp.149-157

Du, Xiaoshan, 2005, "The Regulatory Environment for Microfinance in China," Essays on Regulation and Supervision, Microfinance Regulation and Supervision Resource Center, Washington D C

Encyclopædia Britannica, 2007, "cave," Encyclopædia Britannica Online. January 25, 2007, http://www.search.eb.com/eb/article-49697

Eswaran, M., Kotwal, A., 1989, Credit and agrarian class structure. In: Bardhan, P. (Ed.), The Economic Theory of Agrarian Institutions. Oxford Univ. Press, New York.

Feder, Gershon, 1984, "The Relation between Farm Size and Farm Productivity- the Role of Family Labour, Supervision and Credit Constraints," *Journal of Development Economics*, Vol. 18, pp. 297-313

Feder Gershon, L.J. Lau, J.Y.Lin, and X. Luo, 1989, "Agricultural Credit and Farm Performance in China," *Journal of Comparative Economics*, Vol. 13, pp. 508-526

Flores-Cerrillo, Jesus, and John MacGregor, 2005, "Latent Variable MPC for Trajectory Tracking in Batch Process," *Journal of Process Control*, Vol.15, pp.651-663

Fry, Maxwell, 1995, Money, Interest, and Banking in Economic Development, John Hopkins Press.

Ghatak, Maitreesh, Massimo Morelli and Tomas Sjostrom, 2001, "Credit Rationing, Wealth Inequality and Allocation of Talent," Applied Mathematics Working Paper Series, No.23/2001, International Centre for Economic Research (ICER), Turin, Italy

Gelb, A. H., 1989, "Financial Policies, Growth and Efficiency", Policy Planning and Research, Working Paper, No. 202, World Bank

Ghosh, Parikshit, Dilip Mookherjee, and Debraj Ray, 1999, "Credit Rationing in Developing Countries: An Overview of the Theory," In *A Reader in Development Economics*, Dilip Mookherjee and Debraj Ray (Eds.), London: Blackwell (2000)

Goldsmith, Raymond W., 1969, *Financial Structure and Development*, New Haven, Connecticut, Yale University Press

Greene, William, 1997, Ch9 "Data Problem," in Econometric Analysis, Prentice Hall, pp.418-449

Greene, William, 1997, Ch19 "Models with Discrete Dependent Variables," in *Econometric Analysis*, Upper Saddle River, New Jersey:Prentice Hall, pp.871-947

Greenwood, Jeremy and Boyan Jovanovic, 1990, "Financial Development, Growth, and the Distribution of Income," *The Journal of Political Economy*, Vol. 98, Issue 5, Part 1, pp. 1076-1107

Gwen Moore Children of China Fund, 2006, *A Glimpse at Guizhou Province*. New York, Accessed at http://www.suscom-maine.net/~gbmoore/help.html

Guizhou Government, 2006a, *A Brief Introduction to Guizhou*, Guiyang, Accessed at <u>http://www.gzgov.gov.cn/enggov/pages/gsjj.htm</u>

____, 2006b, *Guizhou Statistical Yearbook 2003(in Chinese)*, Guiyang, Accessed at <u>http://www.gzgov.gov.cn/2005pages/gznj/default.asp#</u>

Guizhou Development and Reform Commission, 2006, *Overview of Reforestation Project in Guizhou (in Chinese)*, Guiyang, Accessed at <u>http://www.guz.cei.gov.cn/xbkf/xbkfnr.asp?ID=46</u>

Gujarati, Damodar N., 2003, Ch10 "Multicollinearity: What Happens If the Regressors Are Correlated," in *Basic Econometrics*, New York: McGraw-Hill, pp341-386

Hashemi, S.M, S.R. Schuler and A.P.Riley, 1996, "Rural Credit Programs and Women's Empowerment in Bangladesh," World Development, Vol. 24 No. 4, pp 635-653

Hashemi, S.M. and L. Morshed, 1997, "Grameen Bank: A case Study," In *Who Needs Credit? Poverty and Finance in Bangladesh*, G.D. Wood and I. Sharif (Eds), University Press Limited, Dhaka, Bangladesh

Haurin, Donald, Patric Hendershott and Susan Wachter (1997), "Borrowing Constraints and the Tenure Choice of Young Households," *Journal of Housing Research*, Vol. 8, Issue2, pp. 137-154

He, Guangwen, 2005, People's Republic of China: Macroeconomics and Financial Development in Tongren Prefecture and Its Counties, Asian Development Bank. Reproduced with permission from the Asian Development Bank from the ADB website, www.asiandevbank.org/Documents/Reports/Consultant/35412-PRC/macroeconomics-tongren.pdf. For more information on development in Asia and the Pacific, see www.adb.org.

He, Guangwen and Lili Li, 2005, People's Republic of China: Financial Demand Study of Farm Households in Tongren/Guizhou of PRC, Asian Development Bank, Technical Assistance Consultant's Report. with permission from the Asian Development Reproduced Bank from the ADB website, www.adb.org/Documents/Reports/Consultant/35412-PRC/fds-tongren-guizhou.pdf. For more information on development in Asia and the Pacific, see www.adb.org.

Heidhues, Franz, 1994, "Consumption Credit in Rural Financial Market Development," In Financial Landscapes Reconstructed: the Fine Art of Mapping Development, F.J.A. Bouman, and O.Hospes (Eds), Westview Press, Boulder, pp.34-48

Holz, Carsten A., 2001, "China's Monetary Reform: the Counterrevolution from the Countryside," Journal of Contemporary China, 10 (27), pp 189-217

Hossain, M., 1988, "Credit for the Alleviation of Rural Poverty: The Grameen Bank in Bangladesh," Research Report No. 55, International Food Policy Research Institute (IFPRI), Washington DC

Huang, Nellie, 2005, China on Credit, Newsletter in Time May 2005, Accessed at http://www.time.com/time/magazine/article/0,9171,1059083,00.html

International Fund for Agricultural Development (IFAD), 2001, "Rural Financial Services in China: Thematic Study," Report No. 1147-CN Rev. 1, accessed at http://www.ifad.org/evaluation/public_html/eksyst/doc/thematic/pi/cn/China.pdf

Jaffee, D., and J. Stiglitz, 1990, "Credit Rationing," In Handbook of Monetary Economics, Friedman, B.M. and F.H. Hahn (Eds.), Vol. II, Elsevier, Amsterdam, pp. 838-888

Jappelli, Tullio, 1990, "Who is Credit Constrained in the U.S. Economy," The Quarterly Journal of Economics, Vol. 105, No 1, pp. 219-234

Judge, George et al, 1980, The Theory and Practice of Econometrics, New York: John Wiley & Sons

Kamal, A., 1996, "Poor and the NGO Process: Adjustments and Complicities," In 1987-1994: Dynamics of Rural Poverty in Bangladesh , G.D. Wood and I. Sharif (Eds.), University Press Limited, Dhaka and Zed Books, UK

Khan, Azizur, 1979, "The Comilla Model and the Integrated Rural Development Programme in Bangladesh: An Experiment in Cooperative Capitalism," World Development, Vol. (7), pp.397-422

Khandker, Shahidur R., 1998, *Fighting Poverty with Microcredit: Experience in Bangladesh*, Oxford University Press, New York.

_____, 2005, "Microfinance and Poverty: Evidence Using Panel Data from Bangladesh," *The World Bank Economic Review*, Vol. 19, No.2, pp.263-286

Khandker, Shahidur R., and Mark M. Pitt, 2003, "The Impact of Group-Based Credit on Poor Households: An Analysis of Panel Data from Bangladesh", World Bank, Washington, D.C.

King, Robert G. and Ross Levine, 1993 "Finance and Growth: Schumpeter Might be Right," The Quarterly Journal of Economics, Vol. 108, No. 3. pp 717-737

Kochar, Anjini, 1997, "An Empirical Investigation of Rationing Constraints in Rural Credit Markets in India," *Journal of Development Economics*, Vol. 53 (1997), pp 339-371

Kurmanalieva, Elvira, Heather Montgomery and John Weiss, 2003, "Micro-finance and Poverty Reduction in Asia: What Is the Evidence," Prepared for 2003 ADB Institute Annual Conference on 'Micro Finance and Poverty Reduction', Tokyo December 5th, 2003

Levine, Ross, 1991, "Stock Markets, Growth, and Tax Policy," Journal of Finance, Vol. 46, Issue 4, pp. 1445-1465

____, 1992, "Financial Intermediary Service and Growth," Journal of Japanese and International Economics, Vol. 1992, Issue 4, pp. 383-405

Long, J. Scott and Jeremy Freese, 2003, Ch4 "Models for Binary Outcomes," in *Regression Models for Categorical Dependent Variables Using Stata*, College Station: Stata Press, pp109-150

Lucas, Robert E., Jr., 1988, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, XXII, pp 3-42

Madajewicz, Malgosia, 2003, "Capital for the Poor: The Effect of Wealth on the Optimal Credit Contract," *Columbia University Working Paper*

McFadden, D., 1974, "Conditional logit analysis of qualitative choice behaviour", in *Frontiers in econometrics*, Ed. P. Zarembka. New York: Academic Press, p.105-142.

McKinnon, Ronald I., 1973, Money and Capital in Economic Development, Washington DC: Brookings Institution

Montgomery, R., D. Bhattacharya and D. Hulme, 1996, "Credit for the Poor in Bangladesh: the BRAC Rural Development Programme and the Government Thana Resource Development Programme," In D. Hulme and P Mosely *Finance against Poverty*, Vols 1 and 2, Routledge, London.

Morduch, Jonathan, 1998, "Does Microfinance Really Help the Poor: New Evidence from Flagship Programs in Bangladesh," Working Paper, Department of Economics and HIID, Harvard University and Hoover Institution, Stanford University

Morduch, Jonathan and Barbara Haley, 2002, "Analysis of the Effects of Microfinance on Poverty Reduction," June, Prepared for the Canadian International Development Agency

Mundy, Paul and J. Lin Compton, 1991, "Indigenous Communication and Indigenous Knowledge," Development Communication Report 74, 1991/3, Clearinghouse on Development Communication, Arlington, Virginia

Mushinski, David W., 1999, "An Analysis of Offer Functions of Banks and Credit Unions in Guatemala," The Journal of Development Studies, Vol.36, No.2, pp. 88-112

Mustafa, S.I. Ara, et al, 1996, "Beacon of Hope: An Impact Assessment of BRAC's Rural Development Programme," Bangladesh Rural Advancement Committee (BRAC), Dhaka, Bangladesh

National Bureau of Statistics of China, Rural Survey Organization, 2004, Poverty Statistics in China, Beijing

National Bureau of Statistics of China, 2006, China Statistical Yearbook 2005, Beijing

Okurut, F.N., A. Schoombee and S.Van Der Berg, 2005, "Credit Demand and Credit Rationing in the Informal Financial Sector in Uganda," South African Journal of Economics, Vol. 73, Issue 3, pp. 482-497

Park, Albert and Changqing Ren, 2001, "Microfinance with Chinese Characteristics," World Development, January, 29:1, pp39-62

PlaNet Finance, 2005, *Rural Credit Cooperatives in China: Background Information*, Paris, Accessed at <u>http://microfinancegateway.com/content/article/detail/28064/?PHPSESSID=3efe8382cfff911a7c8b4d7b3a 19a415</u>

People's Bank of China, 2000, "Guidance of Management on RCCs' Joint-guaranteed Loans (in Chinese)," <u>http://www.pbc.gov.cn/detail_frame.asp?col=100&id=66&keyword=&isFromDetail=1</u>

People's Bank of China, 2001, "Guidance of Management of RCCs' Microcredit Loans (in Chinese)," http://www.pbc.gov.cn/rhwg/012403f.htm

People's Bank of China, 2001, The Announcement of the People's Bank of China with Regard to the Regulation of RCCs (in Chinese), accessed at <u>http://www.law-lib.com/law/law_view.asp?id=120741</u>

Putterman, Louis, 1993, Continuity and Change in China's Rural Development: Collective and Reform eras in Perspective. New York: Oxford University Press.

Ravallion, Martin and Shaohua Chen, 2004, "Understanding China's (Uneven) Progress Against Poverty," *Finance & Development*, December 2004, pp 16-19

Ravallion, Martin and Jyotsna Jalan, 1999, "China's Lagging Poor Areas," *The American Economic Review*, Vol. 89, No. 2, pp 301-305

Robinson, Joan, 1952, "the Generalization of the General Theory," in *The Rate of Interest and Other Essays*, London: Macmillan

Rojas, Mariano and Luis Rojas, 1997, "Transaction Costs in Mexico's Preferential Credit," *Development Policy Review*, Vol. 15, pp.23-46

Roubini, N. and X. Sala-i-Martin, 1992, "Financial Repression and Economic Growth," *Journal of Development Econometrics*, Vol. 68, No. I, pp. 5-30

Saint-Paul, Gilles, 1992, "Technological Choice, Financial Markets and Economic Development," *European Economic Review*, Vol. 36, Issue 4, pp. 763-781

Saito, Katrine and Delano Villanueva, 1981, "Transaction Costs of Credit to the Small-Scale Sector in the Philippines," *Economic Development and Cultural Change*, Vol. 29, No.3, pp.631-640

Schuler, S.R. and S.M. Hashemi, 1994, "Credit Programmes Women's Empowerment and Contraceptive Use in Rural Bangladesh," *Studies in Family Planning*, Vol. 25, No.2

Schumpeter, Joseph A., 1911, The Theory of Economic Development, Cambridge, MA: Harvard University Press

Siamwalla, A. et al., 1990, "the Thai Rural Credit System and Elements of a Theory: Public Subsidies, Private Information, and Segmented Markets," *The World Bank Economic Review*, Vol. 4, Issue 3, 271-296

Solow, Robert M., 1956, "A Contribution to the Theory of Economic Growth," *The Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94

, 1970, "Growth Theory: An Exposition," The Economic Journal, Vol. 80, No.320, pp. 936-938

Steele, Fiona, Sajeda Amin, and ruchirat Naved, 2001, "Saving/Credit Group Formation and Change in Contraception," *Demography*, Vol. 38, No. 2, pp. 267-282

Stiglitz, Joseph E. and Andrew Weiss, 1981, "Credit Rationing in Markets with Imperfect Information," *The American Economic Review*, Vol. 71, No.3, pp.393-410

____, 1983, "Incentive Effects of Terminations: Application to the Credit and Labour markets," The American Economic Review, Vol. 73, No. 5, pp. 912-927

Swaminathan, Madhura, 1991, "Segmentation, Collateral Undervaluation, and the Rate of Interest in Agrarian Credit Markets: Some Evidence from Two Villages in South India," *Cambridge Journal of Economics*, Vol.15, pp. 161-178

The RCCs Beijing, 2002, Rules for Implementation of the Guidance of Management of the RCCs' Microcredit Loans (in Chinese), accessed at <u>http://nc.mofcom.gov.cn/news/P1P1111529907.html</u>

Todd, H., 1996, Women at the Center: Grameen Bank after One Decade, University Press Limited, Dhaka, Bangladesh

Tsai, Kellee S., 2001, "Beyond Banks: The Local Logic of Informal Finance and Private Sector Development in China," Paper prepared for the conference on Financial Sector Reform in China, co-sponsored by the China Public Policy Program at the Kennedy School of Government, Harvard Business School, and Massachusetts Institute of Technology, Cambridge, MA, September 11-13, 2001

Wang, Yongping, 2003, "Technological Supporting System and Institutional Arrangement for Guizhou Agricultural Sustainable Development (in Chinese)," *Guizhou Agricultural Science*, Vol.31, Issue2, pp.55-58

Wachtel, Paul,2003, "How Much Do We Really Know about Growth and Finance," *Economic Review*, First Quarter 2003, pp 33-47, Federal Reserve Bank of Atlanta, Atlanta, Georgia

Watson, Andrew, 1998, "Conflicts of Interest: Reform of the Rural Credit Cooperatives in China," *Economic Policy in Transitional Economics*, Vol 8, pp 23-40

Xie, Ping, Zhong Xu, Enjiang Cheng and Minggao Shen, 2005, Establishing a Framework for Sustainable Rural Finance: Demand and Supply Analysis in Guizhou Province of the People's Republic of China, Asian Development Bank, Phillipines

Yadav, S., K.Otsuka, and C.C. David, 1992, "Segmentation in Rural Financial Markets: the Case of Nepal," *World Development*, Vol. 20, No.3, pp. 423-436

Yang, Dennis Tao, 1999, "Urban-Biased Policies and Rising Income Inequality in China", The American Economic Review, Vol.89, No.2, pp306-310

Yang, Dennis Tao and Hao Zhou, 1999, "Rural-Urban Disparity and Sectoral Labor Allocation in China", *Journal of Development Studies*, February 1999, 35(3), pp 105-133.

Yang, Kaizhong, 2006, "How to Understand and Manage Regional Economic Inequality in China," (in Chinese) China Center for Urban and Regional Development Research, Peking University, Beijing, China. Accessed at <u>http://curdr.pku.edu.cn/article/list.asp?id=90</u>

Zaman, Hassan, 2000, "Assessing the Poverty and Vulnerability Impact of Micro-Credit in Bangladesh: A Case Study of BRAC", Word Bank, Accessed at www.worldbank.org/html/dec/Publications/Workpapers/wps2000series/wps2145/wps2145.pdf

Zeller, Manfred, 1994, "Determinants of Credit Rationing: A Study of Informal Lenders and Formal Credit Groups in Madagascar," *World Development*, Vol. 22, Issue 12, pp.1895-1907

Zeller, M. and Sharma, M., 2000, "Many borrow, more save, and all insure: implications for food and micro-finance policy," *Food Policy*, Vol.25, pp. 143–167.

Zhao, Renfeng, 2005, State Okays New Postal Savings Bank, Newsletter in China Daily July 29, 2005, Accessed at <u>http://www.chinadaily.com.cn/english/doc/2005-07/29/content_464463.htm</u>

Appendix 1: Figures and tables









Figure 3.2 The education, experience, network and wealth effect of age on rationing



County	Tongren	Jiangkou	Shiqian	Yuping	total
Towns	3	3	3	3	12
Villages	9	9	9	9	36
Households	143	120	119	120	502

Table 3.1: The distribution of survey sa	mple
--	------

Source: He and Li (2005)

Table 3.2:	Expected	effect	of	explanatory	variables	on	demand	for	and
rationing of	f formal cr	edit							

mand ? ? ? ? -+	credit rationing ? ? - - +
????-+	? ? - +
? ? - +	? ? - +
? ? - +	? - - +
? - +	- - +
- +	- +
+	+
-	-
-	-
+	
?	
	-
	-
	-
?	-
? ?	
? ?	
??	
	•

Note: the sign "?" denotes that effect of the explanatory variable on dependent variable is ambiguous.

Table 4.1: Sources of loans (2002-2004)

Source	Numbers of loans	Percentage
The RCCs	435	69.3
Friends and Relatives	176	28.0
The Agricultural Bank of China	8	1.3
Others	9	1.4
Total	628	100

Source: He and Li's (2005) survey

Table 4.2: Borrowing propensity by level of household property

	Demand		
	Yes	No	Total
Property	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)
Low	105 (96.3%)	4 (3.7%)	109 (100%)
Middle	264 (86.0%)	43 (14.0%)	307 (100%)
High	75 (86.2%)	12 (13.8%)	87 (100%)
Total	444 (88.3%)	59 (11.7%)	503 (100%)

Pearson chi2 (2) = 8.7339 Pr = 0.013 Source: He and Li's (2005) survey

Table 4.3: Borrowing propensity by level of deposits

	Demand								
	Yes	No	Total						
Deposit	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)						
0-5,000 RMB	321 (90.7%)	33 (9.3%)	354 (100%)						
5000-10,000 RMB	61 (84.7%)	11 (15.3%)	72 (100%)						
more than 10,000 RMB	62 (80.5%)	15 (19.5%)	77 (100%)						
Total	444 (88.3%)	59 (11.7%)	503 (100%)						

Pearson chi2 (2) = 7.3251 Pr = 0.026Source: He and Li's (2005) survey

	Numbers of households (percentage)	Numbers of households (percentage)
Received formal loans		336 (70.6%)
Did not receive	-	
No need of loans	35 (7.4%)	
Preemptively rationed	58 (12.2%)	
Rejected	42 (8.8%)	
Did not answer	5 (1.1%)	
Subtotal		140 (29.4%)
Total	-	476 (100%)

Table 4.4: Formal market participation by application and credit rationing

Source: He and Li's (2005) survey

T٤	ıb	le	4.	5:	A	\pp	lica	ant	ra	itio	oni	ing	by	lev	vel	0	f ł	nous	seł	10	ld	pro	pert	tv
													•											•

	Applicant rationed										
	Yes	No	Total								
Property	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)								
Low	18 (42.8%)	91(19.8%)	109 (21.7%)								
Middle	22 (52.4%)	285 (61.8%)	307 (61.0%)								
High	2 (4.8%)	85 (18.4%)	87 (19.3%)								
Total	42 (100%)	461 (100%)	503 (100%)								

Pearson chi2 (2) = 14.2178 Pr = 0.001Source: He and Li's (2005) survey

	Preemptively rationed									
	Yes	No	Total							
Property	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)							
Low	21 (36.2%)	4 (11.4%)	25 (26.9%)							
Middle	34 (58.6%)	23 (65.7%)	57 (61.3%)							
High	3 (5.2%)	8 (22.9%)	11 (11.8%)							
Total	58 (100%)	35 (100%)	93 (100%)							

Table 4.6: Preemptive rationing by level of household property

Pearson chi2 (2) = 10.9363 Pr = 0.004

Source: He and Li's (2005) survey

Table 4.7: Amount rationing	by leve	l of household	property
------------------------------------	---------	----------------	----------

	Amount rationed							
	Yes	No	Total					
Property	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)					
Low	23 (20.7%)	7 (8.9%)	30 (15.8%)					
Middle	66 (59.5%)	54 (68.3%)	120 (63.1%)					
High	22 (19.8%)	18 (22.8%)	40 (21.1%)					
Total	111 (100%)	79 (100%)	190 (100%)					

Pearson chi2 (2) = 4.8824 Pr = 0.087Source: He and Li's (2005) survey

Table 4.8: Purposes of the loan by level of household property

	Production loan								
	Yes	No	Total						
Property	Number of households (percentage)	Number of households (percentage)	Number of households (percentage)						
Low	58 (43.0%)	77 (57.0%)	135 (100%)						
Middle	180 (52.2%)	165 (47.8%)	345 (100%)						
High	67 (60.9%)	43 (39.1%)	110 (100%)						
Total	305 (51.7%)	285 (48.3%)	590 (100%)						

Pearson chi2 (2) = 7.8937 Pr = 0.019Source: He and Li's (2005) survey

	AGE	EDU	LAB	DPD	WEA	DPS	EXP	RAT	SHA	OUT	POW	FIN
AGE	1.00											
EDU	-0.25	1.00										
LAB	0.34	-0.09	1.00									
DPD	-0.02	0.00	-0.26	1.00								
WEA	-0.06	0.32	0.07	-0.08	1.00							
DPS	-0.01	0.19	0.08	0.02	0.61	1.00						
EXP	-0.15	0.29	0.04	0.13	0.43	0.30	1.00					
RAT	-0.08	0.16	0.02	0.00	0.16	0.13	0.19	1.00				
SHA	-0.03	0.05	0.01	-0.05	0.08	0.03	0.06	0.07	1.00			
OUT	0.00	-0.12	0.04	-0.02	-0.05	-0.06	-0.06	-0.05	0.03	1.00		
POW	-0.02	0.10	-0.02	-0.05	0.01	0.05	0.08	-0.02	0.00	-0.82	1.00	
FIN	-0.04	0.02	0.04	-0.01	0.06	0.14	0.11	-0.12	0.01	-0.17	0.45	1.00

Table 4.9: Correlation matrix of explanatory variables

Number of observation: 458 Source: He and Li's (2005) survey

Table 4.10:	\mathbf{R}^2	and F	values	from	the	auxiliary	regressions	of regress	ors in
the demand	equ	ation							

Demand equation						
Dependent Variables	\mathbf{R}^2	F value				
AGE	0.1876	11.3151				
EDU	0.1964	11.9756				
LAB	0.1966	11.9908				
DPD	0.1386	7.8841				
WEA	0.4701	43.4703				
DPS	0.3903	31.3674				
EXP	0.2623	17.4227				
OUT	0.7248	129.0523				
POW	0.7777	171.4229				
FIN	0.3624	27.8507				

Number of observations: 501

Table 4.11: Pseudo \mathbf{R}^2 and \mathbf{F} values from the auxiliary regressions of regressors in the rationing equation

Rationing equation								
Dependent								
Variables	Pseudo R	² value F value						
SHA	0.0201	0.8307						
RAT	0.0585	2.5165						
NT 1		150						

Number of observations: 458

Note: since most of the explanatory variables in the rationing equation are identical with those in the demand equation, Table 4.11 only lists the explanatory variables that are not included in the demand equation. Because SHA and RAT are 0/1 dummy variables, logit regressions are applied to the auxiliary regressions and, as a result, pseudo R^2 values are reported instead of R^2 values.

Auxiliary	regression for	r EDU	Auxiliary regression for POW				
	Coef.	t		Coef.	t		
AGE	-0.018	-4.93	AGE	0.000	-0.79		
LAB	-0.024	-0.74	EDU	0.003	0.84		
DPD	-0.014	-0.51	LAB	0.000	-0.1		
WEA	0.382	1.94	DPD	-0.007	-2.84		
DPS	0.001	0.03	WEA	-0.044	-2.44		
EXP	0.181	1.32	DPS	-0.003	-1.01		
W_E	-0.007	-0.11	EXP	-0.017	-1.39		
OUT	-0.434	-0.53	W_E	0.011	1.88		
POW	0.421	0.84	OUT	-1.394	-34.79		
FIN	-0.025	-1.15	FIN	0.025	14.96		
_cons	2.375	2.46	_cons	1.591	31.65		
$R^2 = 0.196$	4		$R^2 = 0.7777$				
Number of	f observation:	s=501	Number of observations=501				

Table 4.12: Auxiliary regressions for EDU and POW

	Demand Equation					Rationing Equation				
	Coef.	Std. Err.	Z	odds ratio	Coef.	Std. Err.	Z	odds ratio		
AGE	-0.086	0.065	-1.33	0.918 (1.089)	-0.012	0.1	-0.12	0.988 (1.012)		
AGE2	0.001	0.006	1.19	1.001	0	0.001	0.02	1		
LAB	0.163	0.125	1.31	1.177	0.042	0.11	0.38	1.043		
DPD	0.005	0.109	0.05	1.005	0.114	0.096	1.19	1.121		
WEA	-2.035	0.813	-2.5***	0.131 (7.634)	1.649	1.263	1.31	5.201		
WEA2					-0.553	0.35	-1.58	0.575 (1.739)		
DPS	-0.324	0.118	-2.75***	0.723 (1.383)	-0.26	0.12	-2.16**	0.771 (1.297)		
EXP	-0.827	0.628	-1.32	0.437 (2.288)						
W_E	0.633	0.289	2.19***	1.883						
SHA					-0.917	0.304	-3.02***	0.400 (2.500)		
RAT					-2.546	0.459	-5.55***	0.078 (12.821)		
OUT	1.603	1.542	1.04	4.966	-4.999	1.516	-3.3***	0.007 (142.857)		
FIN	0.025	0.072	0.35	1.025	-0.067	0.066	-1.01	0.930 (1.070)		
_cons	6.288	2.54	2.47		3.381	2.932	1.15			
	LR chi2	(10)=31.34			LR chi2	(11)= 98.60				
	Prob > c	chi2=0.0005			Prob > chi2 =0.0000					
	Pseudo R2= 0.0862				Pseudo R2= 0.2328					
	Log likelihood =-166.0					Log likelihood = -162.5006				
	Number	of obs=502	2		Number of obs =434					

Table 4.13: Maximum likelihood results for the demand and supply equations

Note: Estimation of Binary Logit model.

In demand equation, dependent variable DEM =1 if the household indicated a need for formal credit; 0 otherwise. In rationing equation, dependent variable RTN =1 if the household is creditrationed by formal lenders; 0 otherwise.

The inverse of the odds ratio for the variables that negatively affect the dependent variable are presented in the parentheses beside the original odd ratios in order to compare the magnitude between positive and negative effects.

*: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level.

Appendix 2: Questionnaire to households

Source: The data were collected by Dr. Guangwen He and Dr. Lili Li in 2005. Dr. He is Director of the Center for Rural Finance & Investment Research (CRFIR) at the China Agricultural University (CAU). Dr. Li Lili is a senior research fellow at the CRFIR/CAU. The questionnaire included in the appendix is translated from Chinese and used with permission from the Asian Development Bank (ADB) to reproduce in English.

Note that not all the questions in the questionnaire are relevant to the analysis. Questions that have been used in this study are as follows.

- Age of head of household
- Education
- The number of members of the household
- The number of labourers over 16 years old
- Self-estimation of the level of household property relative to others in the village
- Total expenses in 2004
- What was the balance of your deposit account at the end of 2004?
- Have you had a time when you needed a loan from a bank or a RCC?
- Have you ever received a loan from a bank or a RCC?
- If you have not received a loan from a bank or a RCC, what was the reason?
- If you did not apply, what was the reason? (multiple responses possible)
- Are you a shareholder of a RCC?
- Have you been credit rated and granted a credit line by a RCC?
- Does the credit line meet your credit needs?

Questionnaire to households

1. HOUSEHOLD CHARACTERISTICS

- ♦ Town
- ♦ Village
- Age of head of household
- The number of members of the household
- The number of labourers over 16 years old
- Education:
- illiterate
- elementary school

- junior high school
- high school
- College degree or above
- Industries that main household labourers are engaged in (multiple responses possible):
 - cultivation
 - livestock farming
 - forestry
 - aquaculture
 - mining
 - construction
 - service industry
 - teachers or civil service
 - transportation or farm products processing industry
 - other
- Major income source:
 - cultivation
 - livestock farming
 - doing business
 - wages as teachers or civil servants
 - migrant workers
- Area of total land at the end of 2004 (Mu^6)
 - area of arable land (Mu)
 - area of mountainous land (Mu)
 - area aquatic plants (Mu)
- Residential housing area at the end of $2004 \text{ (m}^2)$
- Approximate value of the house(s) (RMB)
- Consumer durables that the family has (multiple responses possible):
 - washing machine
 - refrigerator
 - television
 - air conditioner
 - motorbike
 - haulage vehicle

 $^{^{6}}$ Mu is a unit of square measure in the Chinese system of weights and measures. 1Mu \approx 0.067 Ha

- camera
- video camera
- computer
- telephone
- Self-estimation of the level of household property relative to others in the village:
 - upper
 - middle
 - lower
- Self-estimation of level of household income in the village:
 - upper
 - middle
 - lower
- Total cash income in 2004:
 - ≤1000 RMB
 - 1000-5000 RMB
 - 5000-10000 RMB
 - ≥10000 RMB
- Total expenses in 2004:
 - ≤1000 RMB
 - 1000-5000 RMB
 - 5000-10000 RMB
 - ≥10000 RMB

2. DEPOSIT ACTIVITY

- How would you deal with money that is not used currently
 - deposit in a bank
 - deposit in RCCs
 - deposit in a postal office
 - lend to others
 - store at home

- buy bonds
- reinvest
- If you need to deposit, which institutions would you choose:
 - RCCs
 - banks
 - Agricultural Bank of China
 - postal office
 - other
- What would be the purpose for deposit:
 - future consumption
 - purchase production assets in the future
 - house building
 - children's education
 - business
 - repayment of loans
 - purchase consumer durables
- If there is a RCC in your village, would you be willing to deposit there?
 - Yes
 - No
- What was the balance of your deposit account at the end of 2004:
 - <1000 RMB
 - 1000 3000 RMB
 - 3000 5000 RMB
 - 5000 10,000 RMB
 - >10,000 RMB
- Why didn't you deposit in a RCC or a bank (multiple responses possible):
 - difficult to withdraw
 - did not trust in RCCs or banks
 - bad service they provide
 - distance from RCC or bank
 - no surplus fund
 - low interest rate

3. CREDIT

3.1 BORROWING BEHAVIOUR

- If you urgently need funds, which institution or individual would you prefer to borrow from:
 - Agricultural Bank of China
 - a RCC
 - other bank
 - a private financial institution
 - a friend or a relative
 - a money lender
- If you need funds to start or develop your operation, which would you prefer:
 - own savings
 - borrow from a bank or a RCC
 - borrow from friends and relatives
 - borrow from money lenders
- Have you had a time when you needed a loan from a bank or a RCC?
 - yes
 - no
- If you do not need a loan from a bank or a RCC, what is the main reason?
 - current funds are sufficient
 - I want to borrow, but there is no profitable project
 - cheaper financing alternatives available (informal loans)
 - other
- Have you ever received a loan from a bank or a RCC?
 - yes
 - no
- If you have not received a loan from a bank or a RCC, what was the reason?
 - did not apply
 - renounced after application
 - rejected

- If you did not apply, what was the reason? (multiple responses possible)
 - no need of credit
 - the amount was not sufficient
 - could not provide collateral
 - did not have the ability to repay
 - unaware that farmers could apply for loans
 - ignorant of lending procedures
 - private loans were more convenient
 - other
- What was the reason that your loan application was rejected? (multiple responses possible)
 - no profitable project
 - unable to repay
 - no collateral
 - shortage of funds in the bank
 - no networking in the bank
 - other
- What was the reason that you withdrew your loan application? (multiple responses possible)
 - complicated procedures
 - bad service (of the institution)
 - the credit line given was not sufficient
 - short duration
 - long distance (between the institution and you)
 - high interest rate
 - other

3.2 LOANS OF RCCS

- Are you a shareholder of a RCC?
 - yes
 - no
- When did you become a shareholder?
 - before 2000
 - between 2000 and 2002

- after 2002
- How much was your equity capital? (RMB)
- How did you pay your equity capital?
 - cash payment
 - a certain amount was deducted from the loan as equity capital
 - a certain amount was deducted from the loan as equity capital for each loan application⁷
- Is there micro credit in your local RCC?
 - yes
 - no
- Have you been credit rated and granted a credit line by a RCC?
 - yes
 - no
- What is the amount of your credit line? (RMB)
- Does the credit line meet your credit needs?
 - yes
 - no
- What is maximum credit line you would like to have? (RMB)
- Is it easy to get a loan within the amount of your credit line⁸?
 - I can get a loan if I apply for it
 - It is still difficult to get a loan
- Are the procedures complicated when you apply for a loan within the amount of your credit line?
 - easy
 - still complicated

⁷ It is possible that the deduction for equity capital is not completed in a single loan application. Some households might experience repeated deductions from the loan as equity capital each time they apply for a loan.

⁸ In the micro credit program of the RCCs, being granted a credit line does not guarantee that an individual can withdraw any amount of funds up to the predetermined credit limit. Whether or not an individual can get the loan still depends on the RCC's approval.

- How much was your largest amount of a loan after being granted a credit line? (RMB)
- What was the reason that you were not credit rated by a RCC?
 - There was no credit rating service in the (local) RCC
 - I did not need to be credit rated
 - The (local) RCC was unwilling to do credit rating for my household
- Are you satisfied with RCCs' service?
 - very satisfied
 - quite satisfied
 - fairly satisfied
 - quite unsatisfied
 - very unsatisfied
- Compared with the past, is it easer to borrow from RCCs now?
 - more difficult
 - easier
 - unchanged
 - I don't know
- What do you think are the determents of obtaining a loan from a RCC (multiple responses possible):
 - the ability to repay
 - personal creditability
 - guarantee by civil servants or a group
 - collateral
 - networking in the RCCs
- What do you think is the main problem of RCC lending:
 - difficult to borrow from the RCCs
 - short duration
 - high interest rate
 - complicated procedures
 - bad service
- How do you think the RCCs can improve their services? (multiple responses possible)
 - improve their attitude in attending to customers
 - lower the interest rates for loans
 - simplify procedures

- make their procedures better known to individuals
- I don't know
- ◆ To your knowledge, what is the approximate proportion of farmers borrowing from the RCCs in the total number of farmers in your village? (%)

3.3 GROUP LENDING BY RCCS

- Have you borrowed from a RCC by the forming a lending group?
 - yes
 - no
- ♦ Have you received a loan from group lending?
 - yes
 - no
- Are you willing to join a lending group?
 - yes
 - no
- If you are not willing to join a lending group, what is the reason (multiple responses possible):
 - difficult to organize a lending group
 - afraid of being affected by default of other group members
 - It's easier to get a loan individually than by a lending group

3.4 INFORMAL LOANS

- Are there informal financial institutions in your village?
 - yes
 - no
- What is the maximum and minimum annual interest to borrow 100 RMB from an informal financial institution? (RMB)
- Have you borrowed from informal financial institutions?

- yes
- no
- Why did you borrow from an informal financial institution? (multiple responses possible)
 - convenient procedure
 - no collateral required
 - met the amount of loans I desired
 - Banks and the RCCs are too far away from home
 - rejected by the RCCs or banks
 - insufficient amount of loans from the RCCs or banks

3.5. RECENT LENDING AND BORROWING⁹

- Did you borrow between 2002 and 2004?
 - yes
 - no
- When did you borrow?
- How much did you borrow? (RMB)
- ♦ Source of the loan:
 - a RCC
 - Agricultural Bank of China
 - another bank
 - an informal financial institution
 - a relative or a friend
 - an entrepreneur
 - an international project
 - other
- Duration of the loan (months)
- Interest rate (interest per 100 RMB)
- What was the reason for borrowing?
 - do business
 - medical expense

⁹ Questions in Section 3.5 were asked repeatedly for each loan up to six loans in order to gather information for all the loans made between 2002 and 2004.

- repay other loans
- purchase for agricultural production
- purchase livestock
- marriage or funereal
- house building
- prepare for migrate working
- Was collateral required?
 - yes
 - no
- Value of the collateral (RMB)
- If collateral was not required, then was a guarantor required?
 - yes
 - no
- Who was the guarantor?
 - a relative or a friend
 - a civil servant
 - group guarantee
 - other
- How many times did you go to the lender for this loan?
- On average, how long was your travel time each time you went to the lender?
- Total cost of transportation for the loan
- Amount of other costs, e.g. gift for the lender
- Amount of the loan that was not repaid at maturity
- What was the reason for not repaying on time?
 - failure of the project
 - · lack of funds to repay
 - unexpected expenses
 - others defaulted
- Source of funds for repayment
 - income from the project
 - income from cultivation
 - income from aquaculture
 - income from migrant working

- savings of my own
- another loan

3.6. WILLINGNESS TO BORROW

- When you need a large amount of money, through which source would you desire to get the money?
 - a RCC
 - Agricultural Bank of China
 - another bank
 - a friend, a relative or a neighbour
 - a local private financial institution
 - other
- How much do you wish to borrow per loan (when you need a large amount of money)?
 - <3000 RBM
 - 3000-5000RBM
 - 5000-10000 RBM
 - 10000-50000 RBM
 - >50000 RMB
- What is the optimal loan duration for you (when you need a large amount of money)?
 - 6 months
 - 1 year
 - 2 years
 - 3 years
 - 5 years or above
- What is the optimal repayment period for you (when you need a large amount of money)?
 - 6 months
 - 1 year
 - lump-sum repayment at maturity
- ♦ What is the maximum interest rate acceptable to you (when you need a large amount of money)? (%)
- With the current interest rate, are you willing to borrow from banks?
 - yes
 - no

- Which loan requirement is acceptable to you?
 - collateral
 - guarantee by a third party
 - guarantee with own credibility
 - group lending
- What are you willing to provide as collateral? (multiple responses possible)
 - consumer durables
 - the using right of the land
 - animals
 - certificate of deposit
 - houses
 - securities
 - other
- Who would you like you to be your guarantor?
 - a relative or a friend
 - a civil servant
 - group guarantee
 - other
- In a few years, what would be the costly project that you need to invest in?
 - do business
 - planting or breeding
 - purchase of agricultural machinery
 - house building
 - repayment of loans
 - tuition
 - marriage or funeral
 - medical expenses
 - other
- Would your own savings be able to meet the need for this project?
 - yes
 - no
- Would you be able to get a loan from a bank or a RCC?
- yes
- no
- If you would not be able to get a loan from a bank or a RCC, would you be able to finance through alternative means?
 - yes
 - no
- Through which source would you desire to finance your project?
 - others' investment
 - borrow from a friend or a relative
 - borrow from a private financial institution
 - other
- Would you be able to borrow from an individual in your locality?
 - yes
 - no
- What would be the maximum amount that you would be able to receive per loan (from an individual)?
 - <1000 RMB
 - 1000-3000RMB
 - 3000-5000RMB
 - 5000-10000RMB
 - >10000RMB

3.7. WILLINGNESS TO LEND

- Have you lent money to others since 2002?
 - yes
 - no
- What is the relationship between you and the borrower?
 - a relative
 - a friend or a neighbour
 - someone introduced by a friend

• other

- Did you have an IOU?
 - yes
 - no
- Did the loan have collateral or guarantee?
 - yes
 - no
- How long was the duration of a loan usually?(months)
- Was interest charged?
 - yes
 - no
- How much was the annual interest rate? (%)
- Can you usually get the repayment on time?
 - yes
 - no
- How much matured debt is owed to you right now? (RBM)

4. INSURANCE

- Do you think you or your family need insurance?
 - yes
 - no
- Did you insure your family or yourself?
 - yes
 - no
- How did you obtain the insurance?
 - voluntarily

- persuaded by a salesperson
- mobilized by a civil servant
- administrative order
- Buying insurance was required when applying for a loan
- Which type of insurance did you obtain?
- Annual insurance premium (RMB)
- ♦ Insured amount (RMB)
- Insurance period (years)
- Has an insured incident occurred to your household since you obtained the insurance?
 - yes
 - no
- Was your insurance claim settled in a timely fashion?
 - yes
 - no
- Do you think the settlement of the insurance claim was done according to the insurance contract?
 - yes
 - no
- Why didn't you obtain insurance?
 - insufficient funds
 - high insurance premium
 - Insurance claim was too troublesome
 - Children are the insurance
 - other
- Do you think insurance is worthwhile?
 - yes
 - no
- Which type of insurance would farmers need most?
 - planting and breeding insurance
 - property insurance
 - personal injury protection insurance
 - medical insurance

- life insurance
- other