

An Economic Analysis of Microcredit Lending

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ABSTRACT

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An Economic Analysis of Microcredit Lending

Supervisor: Dr. Murray E. Fulton

This study explores a number of the issues around the provision of micro-loans by credit unions and the agencies with which they work. One of the issues is how information asymmetry in the provision of microcredit and the resulting rationing of credit to low collateral entrepreneurs are addressed by the bundling of microcredit with the provision of non-financial services (e.g., mentoring). The other issue of interest is the advantages and disadvantages of investor-owned firms (IOFs) – e.g., chartered banks – versus credit unions in providing microcredit.

Two models of the credit market with both adverse selection and moral hazard are set up to analyze credit rationing of low collateral entrepreneurs and the potential role of non-financial services as a selection instrument in mitigating information asymmetry. The first model investigates the situation where entrepreneurs cannot be distinguished by wealth and the second model looks at the situation where entrepreneurs cannot be distinguished by entrepreneurial skill.

A model of a monopoly credit union is developed to examine whether credit unions have advantages over IOFs in providing microcredit. By offering a community investment saving deposit program, the credit union has access to loan funds for microcredit at below-market rates of interest. The model takes into account both pecuniary and non-pecuniary incentives of savers for participating in the saving program.

A key result is that with information asymmetry, a perfectly competitive credit market will not produce the first-best efficient level of investment when collateralizable wealth is unavailable. Micro-entrepreneurs with insufficient collateral face credit rationing. Rationing arises because, in a perfectly competitive credit market, the collateral constraint limits lenders' ability to design a set of incentive-compatible contracts. In response, lenders randomize the credit delivered under the contract designed for the low collateral entrepreneurs to deter other entrepreneurs from

choosing it. The smaller is the collateralizable wealth of the low collateral entrepreneurs, the greater is the credit rationing that occurs.

This study provides a new explanation for the provision of non-financial services such as mentoring along with microcredit. Non-financial services have traditionally been seen as a way of providing training to borrowers and increasing the likelihood of them repaying their loans. The research in this thesis demonstrates that non-financial services can play a role in having borrowers select the types of loans they wish to obtain. The resulting separation means that the resources designated for micro-entrepreneurs will not be used by other entrepreneurs. The bundling of micro-loans with the provision of non-financial services imposes extra costs on entrepreneurs that obtain a micro-loan in comparison to a traditional loan. Assuming heterogeneity in the entrepreneurs' costs of obtaining a micro-loan, it is argued that entrepreneurs who are the target clients of microcredit programs incur the lowest cost of obtaining a micro-loan, while other entrepreneurs incur a relatively higher cost of obtaining a micro-loan. If this outcome occurs, then the higher cost discourages the latter from obtaining micro-loans. Thus, the use of non-financial services, along with the interest rate and collateral, in the loan contract results in a perfect separation and a more efficient level of investment.

The analysis also suggests that credit unions, in comparison with IOFs, have advantages in providing microcredit to micro-entrepreneurs. Credit unions' advantage stems from their focus on the welfare of their members rather than on the profits earned. The result suggests that credit unions are likely to be more capable of successfully operating a microcredit program than are IOFs. All else equal, credit unions are able to obtain greater support from their saver members, and thus have more loan funds available for delivering microcredit.

The result also suggests that the member orientation of a credit union can create a deadweight loss – the stronger the credit union prefers one member group over the other group, the greater is the deadweight loss – and thus have an impact on both the total benefits for members and the distribution of the benefits between micro-loan borrower members and saver members. Despite this, the presence of a credit union leads to a better outcome in terms of both the level of investment that is financed and the benefits to borrowers and savers.

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Chapter 1

Introduction

1.1 Background

The availability of capital is critical for the development, growth and survival of a business (Blanchflower and Oswald [1998]). In developed countries, such as Canada, sophisticated and flexible financial markets have been developed to facilitate the creation and growth of businesses. While it is reasonable to expect that these markets provide ample and diversified sources of capital to large firms, the picture is quite different for small businesses, and especially for micro-businesses.¹

Lack of capital is one of the barriers for entrepreneurs in initiating or expanding their businesses. For example, in the British Social Attitudes (BSA) Survey, half of the respondents claimed that insufficient capital was the reason why they did not operate their own businesses, although they had considered operating their own businesses very seriously (Blanchflower and Oswald [1998]).² Since financial institutions are an important source of finance, credit rationing by these organizations, if present, can have important implications for entrepreneurs, and micro-entrepreneurs in particular, since most of this latter group have limited sources of finance.

¹The primary sources of finance for small businesses are personal savings, bank loans and borrowing from friends/families (Knight [1985] and Bates [1997]). Large firms have more diversified sources of financing, for example, debt finance and equity finance.

²BSA surveyed 5,947 randomly chosen employees. 451 respondents (16.8%) expressed that they had considered operating their own businesses seriously. In 1983, 1984 and 1986, BSA asked this group of respondents why they did not become self-employed. On average, 51.3% claimed that lack of capital was the reason.

Recent empirical work provides mixed evidence on credit rationing (see Parker [2004] for a review). Perez [1998] suggests that there is widespread credit rationing, while Berger and Udell [1992] conclude that credit rationing “if it exists, may be relatively small and economically insignificant” (Berger and Udell [1992], p. 1071). However, even if credit rationing is empirically unimportant, the perception of it may discourage some potential entrepreneurs from approaching financial institutions for loans (Levenson and Willard [2000] and Cowling [1998]). In addition, as will be discussed below, lack of access to credit from financial institutions (e.g., banks) would seem to be particularly important when borrowers have limited collateral to offer, which is typically the case with at least some micro-entrepreneurs.

Information asymmetry may be one of the reasons why micro-entrepreneurs are not able to obtain commercial loans. In the credit market, borrowers often have better information about their own creditworthiness and willingness to repay the loans than lenders. This asymmetry is especially the case for micro-enterprises, since banks often have poor knowledge of and little experience with these businesses, and, importantly, micro-enterprises are ill-equipped to provide the formally recorded information.³ Banks’ profits are affected not only by the interest rate that they charge but also the quality of the risk portfolios. To positively affect the quality of the risk portfolios, banks may restrict credit. Thus, credit rationing may arise in perfectly competitive credit markets (for example, see Stiglitz and Weiss [1981]; Stiglitz and Weiss [1992]; Cater [1986]).

To address information asymmetry, banks have developed and employed sophisticated loan arrangements such as collateral and credit scores to protect themselves from default risk. However, as a number of researchers have demonstrated, the use of these additional instruments may not eliminate credit rationing (e.g., Stiglitz and Weiss [1992]; Jaffee and Stiglitz [1990]; Coco [1999]). Moreover, the use of collateral and credit scores by banks makes access to loans difficult for micro-entrepreneurs. Micro-entrepreneurs are typically those who are in a disadvantaged or marginalized position in their communities. They may not have the collateral required to obtain a loan and/or they may not have the business experience (perhaps because of an inability to

³Banks determine whether to approve loans or not according to their judgement on the creditworthiness of the applicants. This judgement is based on track record, projections of future cash flows and collateral. Consequently, banks are in a better position to provide loans to bigger enterprises than to micro-enterprises.

obtain a loan) to have a credit rating. Evidence of this difficulty is shown from a survey of 30 Canadian and 86 U.S. entrepreneurial, small business counselling and financing organizations (CEDSEDI [1990] cited by Russell [2001]). The Corporation for Enterprise Development points out that “institutional lenders are frequently unwilling to make loans to welfare recipients, the unemployed, minorities and residents of poor communities” (CEDSEDI [1990] cited by Russell [2001], p. 29).

The financing gap of micro-entrepreneurs can be bridged in a number of ways. Microcredit represents one such attempt. Microcredit is the delivery of small amounts of unsecured credit to those who otherwise have no access to capital to undertake income-generating activities. It is based on the idea that, with a small amount of credit, the entrepreneur can start up a business, repay the loan with the income generated from the business and gradually become self-reliant.

Grameen Bank in Bangladesh, the pioneer of microcredit, has achieved significant success. By the end of 2008, it had lent out US\$7.6 billion to poor individuals. In 2006, Grameen Bank and its founder, Muhammad Yunus, were awarded the Nobel Peace Prize. The success of Grameen Bank has inspired similar projects in more than 40 countries. Microcredit is by far the most successful attempt to improve the access of credit for the underserved micro-entrepreneurs. It is “the latest solution to the age-old challenge of finding a way to combine the banks’ resources with the local informational and cost advantages of neighbours and moneylender” (Armendariz de Aghion and Morduch [2005], p. 8).

In developing countries and economies in transition, micro-loans are very small, ranging from a few dollars to up to several thousand dollars, depending on the country and the local financial market (Von Pischke [2002]). To lend to the “unbankable”, a number of innovations have been made to enable the microcredit providers to address information asymmetry and to improve the repayment performance. The most significant innovation is the introduction of group lending with joint liability. The loans are delivered to a group of individuals who are often self-selected. If one member fails to repay the loan, all group members would be sanctioned by being denied future credit, unless the loan is repaid. By means of this arrangement, microcredit lenders can make use of local information and transfer at least part of the lender’s responsibilities onto borrowers, including screening potential borrowers (Stiglitz [1990] and Ghatak [1999]) and

enforcing repayment (Besley and Coate [1995]). Group lending “ is a way to achieve efficient outcomes even when the lender remains ignorant or unable to effectively enforce contracts” (Armendariz de Aghion and Morduch [2005], p. 115).

More recently, microcredit programs have started to operate in developed countries such as Canada. Like their counterparts in the developing world, the core activity of Canadian microcredit programs is to provide unsecured small loans to those who are in a marginalized or disadvantaged position.

In Canada, the primary microcredit providers are non-profit organizations and credit unions. The microcredit programs operated by urban credit unions in Western Canada are the focus of this thesis. Based on the interviews with the staff at three credit unions, namely, Affinity Credit Union in Saskatoon (formerly FirstSask Credit Union), Assiniboine Credit Union in Winnipeg and Vancity Credit Union in Vancouver, the staff of seven agencies that work with the credit unions and nine micro-loan borrowers, the major characteristics of micro-loans delivered by the credit unions are summarized as follows.

1. Loans are delivered to individual entrepreneurs. Although a few credit unions adopt the group lending mechanism, they seldom hold group members responsible for each other's loans.
2. The loans are unsecured and the contract terms (e.g., interest rate, size and term) are comparable to commercial loans delivered to small and medium enterprises (SMEs).
3. Individuals ineligible for conventional credit are eligible for micro-loans. The loans are not designed exclusively for a specific group of individuals (e.g., low-income or women entrepreneurs) like those offered by non-profit organizations.
4. Flexible criteria are employed to screen the applications with a focus on the viability of the business plans and personal characters of the applicants.
5. The provision of loans is often bundled with non-financial services, e.g., mentoring, training and after care. Different approaches have been used to provide non-financial services. Some credit unions provide these services themselves (e.g., Affinity Credit Union); some

send the entrepreneurs to local community development organizations (e.g., Assiniboine Credit Union); and some combine the above two approaches (e.g., Vancity Credit Union).

6. Some credit unions operate a special deposit program to finance micro-loans (e.g., Assiniboine Credit Union and Vancity Credit Union). The interest rate on such saving deposits is below the market rate. Members voluntarily make contributions by participating in these deposit programs.

1.2 Research Objectives

The purpose of this dissertation is to explore a number of the issues around the provision of micro-loans by credit unions and the agencies with which they work. One of these issues is information asymmetry which is critical in capital markets, especially in the provision of credit to micro-entrepreneurs. A number of credit unions have found ways to provide microcredit to Canadian micro-entrepreneurs. In doing so, they appear to have at least partially addressed information asymmetry. The approach used by credit unions relies not on group lending, as is the case in the developing world, but instead on the bundling of credit with non-financial services, e.g., mentoring and technical assistance.

A significant portion of the research in this dissertation focuses on the informational problems that would cause credit to be rationed to micro-entrepreneurs. More specifically, the thesis develops two models – one that considers a situation where entrepreneurs cannot be distinguished by wealth and another that considers a situation where entrepreneurs cannot be differentiated by entrepreneurial skill. In both models, rationing of credit to entrepreneurs who have insufficient collateral may occur in equilibrium. It is shown that linking the provision of microcredit to the provision of non-financial services can result in a relaxation of credit rationing, thus providing benefits to micro-entrepreneurs who have insufficient collateral.

The modelling work outlined above is carried out under the assumption of perfect competition in the capital market. With perfect competition, any and all firms would be prepared to offer microcredit programs of the type outlined above. Yet this is not the pattern that is observed. While credit unions and non-profit organizations are major players in the microcredit market, chartered

banks are not active at all in this market. As well, credit markets are generally oligopolistic in nature, with a few large chartered banks dominating the industry.

To examine the advantages and disadvantages of investor-owned firms (IOFs) – e.g., chartered banks – versus credit unions in providing microcredit, a model of a monopoly credit union is developed. This model explicitly considers the different roles played by borrowers and savers and the potential conflict that exists between them.⁴ To raise loan funds for micro-loans, the credit union offers a special deposit program that pays a below-market rate of interest. Given this, the potential conflict between borrowers and savers is particularly critical.⁵ Meanwhile, members' non-pecuniary concerns (i.e., positive spillovers created by the provision of microcredit and the consumption of warm glow) are taken into account, because they are one of the primary reasons for saver members to make contributions to the credit union's microcredit program through participating in the special deposit program. The conclusion from the model is that a credit union that weighs equally the interests of borrowers and savers provides better contract terms to both borrowers and savers than does an IOF. One of the conclusions to draw from the model is that credit unions may thus have an advantage in the provision of microcredit over IOFs.

1.3 Organization of Thesis

The rest of the thesis is organized as follows. Chapter 2 introduces the concepts of microcredit and the social economy with a focus on a specific organization – credit unions. Chapter 3 reviews the literature on credit rationing, explores the mechanisms commonly adopted by microcredit programs to deal with informational problems, such as group lending and dynamic incentives, and summarizes the literature on the impact of member orientation on credit unions' pricing policies. Chapters 4 and 5 are devoted to two credit rationing models. The first model examines credit rationing in the environment where lenders cannot distinguish borrowers according to their wealth. The second model examines credit rationing in the environment where lenders cannot

⁴Borrowers prefer lower loan interest rates and savers prefer higher deposit interest rates, while other factors remain constant. Making one group better off is thus at the cost of another group.

⁵A credit union has the objective of maximizing the welfare of its membership. As a result, the potential conflict between different member groups is an important factor that needs to be taken into account by the credit union when it makes pricing policies. Unlike the credit union, an IOF tries to maximize its profits. Thus, in its pricing decisions, the potential conflict between borrowers and savers are not important.

distinguish borrowers according to their quality. In each model, the potential role of non-financial services in relaxing credit rationing is examined. Chapter 6 presents a model for credit union decision-making. This study concludes in Chapter 7 with a summary of the key findings, and an outline of the limitations and a discussion of the areas of further study.

Chapter 2

A Brief Review of Microcredit and Credit Unions

2.1 Introduction

Entrepreneurship is the engine for economic growth. As Drayton notes, “from the fall of Rome (ca. 476) to the eighteenth century, there was virtually no increase in per capita wealth generation in the West. With the advent of entrepreneurship, however, per capita wealth generation and income in the West grew exponentially by 20 percent in the 1700s, 200 percent in the 1800s, and 740 percent in the 1900s” (cited by Dubreuil and Mirada [2008], p. 2). In this sense, communities with greater “entrepreneurial strength” are more likely to be in a better position to deal with social and economic challenges. Experience indicates that the economies that provide the most support for entrepreneurship have experienced the highest growth rates (Farmer [1977] and Parker [2004]).

Today, entrepreneurship plays an important role in the Canadian economy. By 2003, there were 2.41 million self-employed Canadians, accounting for 16% of the total workforce (Tal [2003]). The self-employment sector’s contribution to GDP is significant, although very small when compared with the other sectors. For example, unincorporated self-employment – accounting for just over 60% of all self-employed enterprises – generated about 9.4% of total GDP or \$93.2 billion in 2005 (Rispoli [2009]).

The majority (around 80%) of self-employment initiatives are micro-enterprises (Tal [2006]). According to Self Employment Development Initiatives, the leading Canadian authority on self-employment programs, micro-enterprises are defined as being small businesses that are operated

and managed by the owners with less than three employees, and that usually require less than \$25,000 to start-up; many of them are home-based businesses.¹

Only a portion of micro-entrepreneurs succeed. Micro-entrepreneurs are typically those who are at the margins of the mainstream economy. They are in a disadvantaged position in their communities mainly because they have a lower level of education, resources or support. Therefore, although micro-businesses have significant potential for helping their owners build wealth and become self-reliant (Soloman [1992]), not surprisingly, only a portion of micro-entrepreneurs can achieve enough success to contribute to the social and economic development of their communities. Most newly established micro-businesses only survive for a very short period of time.² To realize the full potential of entrepreneurship as an engine for growth, a favourable environment which enables micro-businesses to grow and prosper would be an asset.

2.2 Access to Credit – A Barrier for Micro-entrepreneurs to Becoming Self-employed

Potential micro-entrepreneurs face barriers to becoming self-employed. Lack of access to capital is one of the important barriers since access to capital at appropriate terms in a timely manner is important for a business to start-up, survive and expand.

Lack of access to capital has been identified as one of the most important reasons why the entrepreneurs who considered self-employed seriously did not start their businesses (Blanchflower and Oswald [1998]; Blanchflower, Oswald, and Stutzer [2001]). In a survey in Metro Toronto, around 30% of entrepreneurs indicated that access to capital was difficult (Russell [2001]).

Unlike large enterprises who have diversified sources for capital, micro-enterprises rely heavily on financial institutions for capital to start-up or to grow; however, access to credit is difficult for them. In recent years, micro-entrepreneurs' access to credit has not been improved (Wilson and Bailey [2004]), despite the growth of their activities. In order to increase the market share in small businesses (including micro-enterprises), banks have lowered their interest rates

¹There is no single definition for micro-enterprises. For instance, Statistics Canada defines a micro-enterprise as a business with less than four employees.

²For example, Tal [2006] reports that in a typical year, around 150,000 small businesses (including the self-employed) start operation and 130,000 or so close.

and the size of their loans, but have significantly increased the security requirement for loans.³ Between 2001 and 2004, the average security required is \$1.52 for each dollar borrowed (CFIB [2003]). This has made conventional loans more difficult to access for micro-enterprises.

In a survey of 30 Canadian and 86 U.S. entrepreneurial, small business counselling and financing organizations, the Corporation for Enterprise Development points out that “access to capital was a key problem for the poor trying to start a business... institutional lenders are frequently unwilling to make loans to welfare recipients, the unemployed, minorities and residents of poor communities” (CEDSEDI [1990] cited by Russell [2001], p. 29). Goldenberg [2006] reports that the self-employed rely heavily on personal credit cards and personal savings for finance; only 34% use commercial financing, while 49% of small and medium enterprises (SMEs) use commercial financing.⁴

Although there is anecdotal and theoretical evidence (which will be discussed later) that suggests that a certain class of entrepreneurs may have relatively difficult access to credit, the empirical work provides mixed evidence. Berger and Udell [1992] conclude that credit rationing “if it exists, may be relatively small and economically insignificant” (Berger and Udell [1992], p. 1071). Similar result is reported by Levenson and Willard [2000]. They estimate that only 2.14% of small businesses fail to obtain the loans they desired. However, some studies suggest that the size of firm could be a dimension according to which banks deny credit, which in turn leads to credit rationing. Levenson and Willard [2000] report the probability of credit denial and the size of firm are negatively related. According to Thompson Lightstone, smaller firms face challenges with terms of credit and access to bank loans, in comparison with bigger firms (cited by EMC [2002]). Levenson and Willard [2000] and Cowling [1998] provide empirical evidence that the perception of credit rationing may discourage some potential entrepreneurs from approaching mainstream financial institutions for loans, even if credit rationing is unimportant.

Information asymmetry may be one reason why micro-entrepreneurs are underserved by mainstream financial institutions, e.g., banks. Banks are exposed to default risk. As a result,

³According to Industry Canada, small businesses have less than 100 employees (if it is a goods-producing business) or less than 50 employees (if it is a service-based business).

⁴Statistic Canada defines an SME as any business establishment with 0 to 499 employees and less than \$50 million in gross revenues.

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their profits are affected by not only the interest rates they charge but also the quality of their loan portfolios – i.e., the creditworthiness of borrowers. However, credit markets are notorious for information asymmetry – i.e., borrowers often have better information about their own creditworthiness and willingness to repay the loans than do banks. The interest rate, thus, becomes an instrument for controlling the quality of the loan portfolio, rather than an instrument for clearing the market. Therefore, it is possible that banks restrict credit even if the market does not clear (Stiglitz and Weiss [1981]).

To address information asymmetry, banks have developed and employed security arrangements such as collateral and credit ratings. Bester [1985] demonstrates that the use of the collateral together with the interest rate may achieve perfect separation without rationing. However, such results are not robust. They depend on the assumptions made. As the assumptions are modified, the results may change dramatically. As Hillier and Ibrahim [1993] conclude, “the agency costs associated with asymmetric information may arise in various ways, and that the implications for theory and policy may differ from model to model. It is, therefore, important to choose between the different models before attempting to draw firm conclusions from the literature. Making this choice will require further theoretical as well as empirical work” (Hillier and Ibrahim [1993], p. 300).

Information asymmetry and micro-entrepreneurs’ position in the community together make access to credit difficult for micro-businesses. Information asymmetry is more prominent when lending to micro-businesses, because banks have little knowledge and a poor understanding of micro-entrepreneurs – most of whom are in the informal sector, and micro-entrepreneurs are ill-equipped to provide the formally recorded information. The result is that, in the absence of conventional information supporting creditworthiness, banks tend to perceive micro-businesses as bad risks rather than try to identify the good risk. As an OECD report points out, “limited market power, the lack of management skills, high share of intangible assets, the absence of adequate accounting track records and insufficient assets, all tend to increase the risk profile of SMEs” (cited by Goldenberg [2006], p. 28). This argument applies to micro-businesses as well. It means that more collateral or better credit ratings are likely to be a necessity for micro-entrepreneurs to obtain a loan. Therefore, access to credit is difficult for them.

2.3 Bridging the Financing Gap of Micro-entrepreneurs – Microcredit

The microcredit movement represents one approach used to address the financing gap of micro-entrepreneurs. Around the world, microcredit programs have emerged and proliferated since the 1970s.⁵ Unlike the provision of subsidized credit channelled by development banks, microcredit focuses on the creation of local businesses. Experiments in Asia have indicated that the poor can help themselves establish a business, generate income, build wealth and become self-reliant with a small amount of credit. The president of the World Bank claims that microcredit has “brought the vibrancy of the market economy to the poorest villages and people of the world... (and) allowed millions of individuals to work their way out of poverty with dignity” (cited by Williams [2004], p. 146). Microcredit is by far the most successful attempt to improve the access of credit for micro-entrepreneurs, and in particular those with low incomes. It is “the latest solution to the age-old challenge of finding a way to combine the banks’ resources with the local informational and cost advantages of neighbours and moneylenders” (Armendariz de Aghion and Morduch [2005], p. 8).

Microcredit has a great potential in individual development and economic growth (Bevilacqua [1998]). Inspired by the pioneers in developing countries and attempting to fill the financing gap, a number of Canadian microcredit programs have emerged since the end of the 1980s.

2.3.1 Nature of Microcredit

Microcredit is the provision of unsecured small loans to micro-entrepreneurs who need credit to invest in a small business but have limited or no access to traditional credit. The core activity of microcredit programs is to supply micro-loans. Micro-loans are different from conventional loan products in at least three aspects:

1. They target marginalized individuals in the community. All microcredit programs have the objective of delivering credit to individuals in a disadvantaged or marginalized social and economic position in the communities in which the programs operate. In developed countries, the people who choose micro-loans are typically the working poor, those who

⁵There are more than 2,500 microcredit programs worldwide serving nearly 70 million low-income individuals; each program serves 25,000 low-income individuals on average (Armendariz de Aghion and Morduch [2005]).

become unemployed as a result of economic restructuring, those who cannot meet their ends and those who cannot integrate into the mainstream for other reasons (Bhatt, Tang, and Painter [2001]).

2. They focus on income-generating activities. Micro-loans are intended to generate income for borrowers. The creation and development of local businesses is the goal and the provision of credit is the means for achieving this goal.
3. They provide small amounts of unsecured loans. Microcredit programs deliver small loans. There is usually an upper limit on the size of such loans which varies across programs. Meanwhile, micro-loans are in essence 'unsecured' loans as they require little or no traditional collateral. As a result, those who otherwise have no access to credit due to a lack of collateral can obtain the credit and undertake investments, and the financing gap is bridged or at least reduced.

2.3.2 Impact of Microcredit Programs

Most literature on the impact of microcredit concentrates on programs in developing countries (Morduch [1998], Hulme and Mosley [1996] and Shaw [2004]). Studies on microcredit programs in developed countries have shown that microcredit has produced positive social and economic impacts. Microcredit programs can improve individual and family stability (Mount Auburn Associates [1994]), and increase education, self-confidence and economic options (Servon [1999]). Wehrell, Campbell, Cunningham, Mathie, and Lee [2002] report similar findings based on a study of four microcredit programs in Atlantic Canada: 73% of respondents indicated that they had higher self-confidence; the 263 micro-entrepreneurs surveyed created a net gain of 173 full time jobs and 65 part time jobs in addition to the self-employment they created for themselves; and 61% expressed the view that self-employment is why they were able to remain in their communities (Wehrell et al. [2002]). These results indicate that at the community level microcredit programs can generate positive impact on the local economy – e.g., to combat depopulation resulting from the decline in employment in the community, to diversify local economies and to reduce the dependence on social welfare.

However, the impact of microcredit programs in developed countries is more limited (Schreiner and Morduch [2002]). Microcredit programs in these countries have difficulties in achieving the impact that their counterparts in developing countries have achieved. Even if they can impact individuals as do the programs in developing countries, their overall impact is limited. Schreiner and Morduch [2002] argue that there are two important factors that have an impact on the performance of microcredit programs in the United States. One is the structure of the industrial economy, which is more complicated and has more barriers for micro-entrepreneurs in comparison with in developing countries.⁶ Another factor is the small number of micro-entrepreneurs. Schreiner and Morduch [2002] cite three pieces of empirical evidence – Vroman [1997], Dallinger [1989] and Schreiner [1999b]. The first two “suggest that microfinance may help about 1 in 100 displaced workers become self-employed who otherwise would not have” and the last one suggests that “the ratio for people on public assistance may be closer to 1 in 1,000” (Schreiner and Morduch [2002], p. 54).

2.3.3 Microcredit in Canada

Canada is a developed country with a well-established financial system. The cause of credit rationing of micro-entrepreneurs is the result of “the excesses of market forces rather than their under-development. New technology has led to the ability of financial service providers to segment their markets precisely and effectively in the context of rampant competition, so forcing them to ensure that returns in any market segment are being maximized and cross-subsidy between different parts of their business is being kept to a minimum” (Johnson [1998], p. 802). According to Johnson, microcredit programs seek to “re-invent” the financial system in a way that focuses on “social, economic and environmental costs and benefits” (Johnson [1998], p. 802).⁷

The context in which Canadian microcredit programs operate is similar to that in other developed countries but quite different than that in developing countries. First, the market size of

⁶For instance, unlike their counterparts in the developing world, micro-enterprises in developed countries compete with large firms (e.g., large retailers and service providers) or against imported goods, and they also face regulatory constraints.

⁷In developing countries where credit rationing is the result of an under-developed financial system, a lack of infrastructure and a poor legal system, microcredit programs focus on sustainability and outreach (Johnson [1998]).

An Economic Analysis of Microcredit Lending

microcredit is very small. Entrepreneurs' push toward being self-reliant is weakened by things such as abundant wage jobs, the social welfare net and regulatory barriers (Schreiner [2003]). The experience of Calmeadow – the microcredit pioneer in Canada – indicates that it is difficult to achieve the scale required to be self-sustainable (Frankiewicz [2001]).

Second, human capital is crucial for an entrepreneur's success. Canadian micro-entrepreneurs must be decathletes who excel in many tasks such as providing services or goods, paying taxes, and complying with regulations (Schreiner [2003]). However, micro-entrepreneurs, especially those with low incomes, often lack human capital (Bates and Servon [1998]). Thus, in addition to financial capital, microcredit programs often provide non-financial services – e.g., training, mentoring and technical assistance – to ensure the success of micro-entrepreneurs.

Third, group lending with joint liability, an innovation adopted by many microcredit programs in the developing world, tends to not work in Canada due to the lack of strong social capital, the prevailing individualism and the availability of alternative financing channels (for instance, credit cards) (Schreiner [2003]).

Fourth, microcredit service is more expensive in Canada than in the developing world where there are economies of scale in microcredit provision, overhead is lower and it is easier to obtain financial support from national and international donors (Schreiner [2003]).

2.3.4 Complementary Non-financial Services

Non-financial services have been one of the important components of many microcredit programs in developed countries. The objective of non-financial services is not only to provide business skills, but to help the entrepreneur develop a new and viable business (Balkin [1992]). Non-financial services include business training, classes, workshops, business mentoring and counselling, technical assistance, and after care services.

Financial capital and human capital are complements. With adequate human capital, the entrepreneurs are more likely to operate their businesses successfully. Based on four Canadian microcredit programs, Wehrell et al. [2002] report that 73% of respondents who had received technical assistance and business loans reported that they had increased business planning skills;

61% of respondents said they had increased budgeting and financial management skills; and 73% of respondents expressed enhancement of self-confidence.

However, given the wide range of problems that micro-entrepreneurs may face, it is difficult to develop a set of non-financial services that can teach the entrepreneurs a wide array of skills that fits the needs of different businesses (Schreiner [2003]). Schreiner [1999a] suggests that the main impact of general training may be to warn the potential entrepreneurs of the risks that they may face. Entrepreneurs may be discouraged rather than be encouraged if such services are too generic (see, for example Bhatt et al. [2001] and Bhatt and Tang [2002]).

Non-financial services can play important roles beyond the transferring of knowledge and skills. For example, the development of a business plan can help the lender track the effort made by an entrepreneur (Denis [1987]). The training attendance, progress made through developing a business idea into a business plan, and completion of the training are all signals of the entrepreneurs' commitments to their businesses. The addition of upfront non-financial services not only helps the entrepreneurs build capacity, but also helps the program screen the entrepreneurs (Carr and Tong [2002]). However, the screening role may create tension between the services that try to make the entrepreneurs feel good about their business ideas and those that focus on imparting knowledge and assessing the viability of the business plans (Bhatt, Plainter, and Tang [2002]).

To conclude, microcredit is different from traditional credit. It is the delivery of small and unsecured loans to micro-entrepreneurs for their income-generating activities. As will be elaborated in the next chapter, many innovations have been made to address information asymmetry so that microcredit programs transfer the "unbankable" into "bankable". All over the world, the operation of microcredit programs varies significantly across programs and contexts. Microcredit is by far the most successful attempt to bridge the financing gap experienced by micro-entrepreneurs (Schreiner and Morduch [2002]).

Microcredit creates positive spillovers in a number of ways, e.g., empowering women, reducing depopulation and improving nutrition and education. However, operating a microcredit program means taking on more risks and more costs. Banks, although they have the expertise and infrastructures to deliver micro-loans, often have no real interest in it.

In Canada, the primary providers of microcredit are non-profit organizations and credit unions. Both of them are part of the social economy. The next section explores the concept of the social economy. Since the focus of this study is the urban credit unions in Western Canada, the characteristics of credit unions will be described in detail, followed by a description of the microcredit programs delivered by three credit unions, namely, Vancity Credit Union, Assiniboine Credit Union and Affinity Credit Union (formerly FirstSask Credit Union).

2.4 Canada's Social Economy

Recognizing the importance of supporting micro-businesses, a number of Canadian organizations in the social economy have established and developed microcredit programs to bridge the financing gap of micro-entrepreneurs. In 2003, there were nearly 200 microcredit programs operating in Canada (Chaput [2003]). These programs can generally be classified into two categories: the programs operated by non-profit community development organizations and the programs operated by credit unions.⁸

Over the past two decades, the social economy has become a topic of interest. People call upon the social economy for an increasing role in the provision of products and social services in the public interest. The social economy, sometimes referred to as 'the third sector', 'the voluntary sector' or 'the non-profit sector', describes the activities and the organizations that mobilize economic resources for the satisfaction of people and that belong to neither the for-profit sector nor the government (Moulaert and Ailenei [2005]). The social economy is a grass-root response to the failures of the market and the public sector in providing essential services to people and the community in need.

The social economy consists of a variety of organizations, including non-profit organizations, co-operatives, charity organizations and social economy enterprises. They are involved in a variety of activities, such as education, health and day care, and they have a particular focus on

⁸The Government of Canada provides financial assistance to micro-entrepreneurs as well. The supports are provided through a number of government institutions and organizations. For example, regional economic development agencies of the Canadian government – e.g., the Atlantic Canada Opportunities Agency (ACOA), and Western Economic Diversification Canada (WD) – support micro-entrepreneurs with access to capital. These agencies also offer a variety of financial assistance programs in collaboration with other government departments or the private sector. Some of the programs offered include: the Community Futures; Business Development Program; and the WD Loan Investment Fund program.

the disadvantaged individuals. These activities are the means to achieve the social objectives of the social economy organizations and community economic development organizations (Quarter, Mook, and Armstrong [2009]).

2.4.1 Defining the Social Economy

There are differing definitions for the social economy (Bouchard, Ferraton, and Michaud [2006, 2008] and McMurtry [2010]). However, there is a general agreement on its key features based on the types of organizations in this sector (Government of Canada [2004]).

Quarter et al. [2009] defines the social economy as “a bridging concept for organizations that have social objectives central to their mission and their practice, and either have explicit economic objectives or generate some economic value through the services they provide and purchase that they undertake” (Quarter et al. [2009] , p. 4). This definition focuses on two core concepts: social mission and economic value. The social economy thus refers to a large array of organizations with a social mission. Some are market-based and overlap with those in the private sector, and some are civil society organizations and overlap with those in the public sector. The organizations that fall in the social economy share some common characteristics: (1) social objectives that are central to the organization’s mission from its establishment; (2) social ownership, which means that the organization generally does not belong to a particular individual and thus the surplus revenues generated are used for an improvement in the services it provides (if there is a loss, then its services would be reduced); (3) volunteer and social participation directed to enhance the services the organization provides; and (4) civic engagement which provides “a space through which people can engage with each other in a constructive manner” (Quarter et al. [2009], p. 24).

Social economy organizations are neither private nor public. They operate within the traditional market-based system, but their primary objective is the improvement of the social well-being of members of a community through economic activities, rather than the maximization of profits. Bouchard et al. [2006, 2008] identify four criteria to further clarify this concept:

1. The organization must engage in an economic activity producing either a service or a product;

2. Distribution of surplus among the members is limited or even prohibited;
3. The organization is a voluntary association of members; and
4. A democratic governance process is employed, that is, the decision-making is based on the use of the services or goods rather than capital investment.

A broader definition is given by McMurtry [2010], who refers to the social economy as “economic activity neither controlled directly by the state nor by the profit logic of the market; activity that prioritizes the social well-being of communities and marginalized individuals over partisan political directives or individual gain” (McMurtry [2010], p. 31).

The central aspect of these definitions is that social economy organizations are established for social objectives; commercial interests, if there are any, serve to achieve the social objectives. People participate in the social economy because they want to make a difference in their own lives or their communities and because there is a belief that the existing market-based options are insufficient to meet their needs or the needs of their communities. The development of the social economy occurs because there is a desire to find new ways to meet the unmet needs caused by market or government failures and address important social and economic issues. As McMurtry argues, people who want to make the changes, as social economy actors, “must begin to conceptualize themselves not as individual agents, but rather as constituting a part of a movement...” (McMurtry [2010], p. 30)

The emergence of the social economy can be linked to information asymmetry. As Peter Lloyd indicates, social economy organizations “represent a form of economically rational response to certain kinds of market failure; an important instrument to respond to conditions where imperfect and asymmetric information exists between buyers and suppliers, workers and managers; an efficient way to cope with high transaction costs in those activities where this is an issue, and above all, they have real competitive weight under circumstances where trust is a key component of the provider-client inter-relationship” (cited by Morrissey and McIvor [2008], p. 11).

2.4.2 Credit Unions as a Part of the Social Economy

“A credit union is not an ordinary financial concern, seeking to enrich its members at the expense of the general public. Neither is it a loan company, seeking to make a profit at the expense of the unfortunate... The Credit Union is nothing of the kind; it is an expression, in the field of economics, of a high social ideal” (Alphonse Desjardins cited by Coyle and Wehrell [2006], p. 4).

Co-operatives (including credit unions) are organizations that are owned and democratically governed by members. The owners of a co-operative are also the users of the products or services provided by the co-operative. These organizations are part of the social economy, and typically balance economic and social objectives.⁹ Co-operatives serve the common needs of their members within a community – for example, they can fill a market gap, or correct market imbalance or empower people.¹⁰ The democratic structure helps the co-operative to give priority to its members rather than return on capital. The Rochdale principles set out in the middle of the 19th century have formed the foundation for the development of co-operatives and help ensure that co-operatives serve the social and economic objectives of their members.¹¹

Credit unions are co-operatives that provide financial services for members. Their economic and social philosophy is very different from that of the banks owned by investors. The philosophy of credit unions emphasizes ‘the supremacy of people over money’ (Hannafin and McKillop [2006], p. 2). Credit unions exist to maximize the economic and social benefits of the membership (Ferguson and McKillop [1997]).

Credit unions are one of the most pervasive forms of social economy organizations in Canada. According to Credit Union Central of Canada, across the country, credit unions (including *caisse populaire*) have nearly 11 million members, accounting for around one third of the population; in

⁹There is a debate about whether all or only some co-operatives are part of the social economy. For example, in his ‘new social economy’, William Ninacs only includes non-profit co-operatives in housing, daycare and health-care in the social economy, and excludes co-operatives that are active in competitive markets (Ninacs [2002]).

¹⁰Many Canadian credit unions were formed for this reason – to provide credit to low-income individuals and farmers who otherwise had no access to it. Currently, credit unions are the sole financial service provider in more than 900 Canadian communities (Ketilson and Brown [2009]).

¹¹The principles are: (1) voluntary and open membership; (2) democratic member control; (3) member economic participation; (4) autonomy and independence; (5) education, training and information; (6) co-operation among co-operatives; and (7) concern for the community.

2009 there were approximately 1,000 credit unions (including caisses populaires) with aggregate assets of more than \$226 billion (CUCC [2010]).

Organizational Characteristics of Credit Unions

Credit unions have a number of distinguishing organizational characteristics. These characteristics not only qualify credit unions as a social economy organization, but also make them a good candidate for operating a microcredit program.

1. Credit unions are owned by their membership. The membership is voluntary and open to all persons who want to use the services and accept the member's responsibilities without discrimination. By purchasing a share, an individual becomes a member of the credit union, and thus has access to the financial services provided by the credit union. Members are not only the users of the financial services provided by credit unions, but also the suppliers of the inputs (loan funds) (Taylor [1971]). Credit unions, therefore, are both producer co-operatives and consumer co-operatives.

This characteristic is important because it provides credit unions with an incentive to operate a socially-oriented program. Such programs usually produce social benefits (an externality) but little economic benefits. Members – who live or work in communities – are able to capture at least some of the benefits. At least a portion of members – especially those who care about their community – are willing to see that their money is reinvested in their community in a socially-responsible way. Since they are owned by the membership, credit unions need to serve the needs identified by the membership. Therefore, credit unions may have the incentive to carry out microcredit programs.

2. Credit unions are operated on a non-profit basis. The surplus is used to strengthen the organization and to improve the services. Dividends – if paid – are based on the use of the services, not on the amount of shares that a member holds. The distribution of surplus is ultimately determined by the membership.
3. Credit unions employ a democratic governance structure. Members control credit unions through a board of directors. At general meetings, members elect the directors from the

membership based on the democratic principle of one-member, one-vote. The directors – typically community leaders – are responsible for supervising the performance of the management and determining the general direction and policies of the credit union. The directors should be responsive to members, otherwise they may be replaced by new directors elected by members.

This structure enables credit unions to decentralize power, to be responsive to the needs of the membership and to be innovative in designing and delivering new services to better serve the membership (Jones [2001]).¹²

Strengths of Credit Unions

Like all co-operatives, one of the reasons for the formation of credit unions is to address market failures (Walter [2006]). In credit markets, a common source of market failure is informational asymmetry.

Historically in Canada, the lack of credit provision in rural areas and among the working poor was a major factor in the formation of credit unions in Quebec (e.g., the caisses populaire) and in Western Canada (CICA [1984]). The credit union idea was brought to Canada in the late 1890s. During that time, the economy was at the early stages of economic development and “co-operative effort was often the only way for mutual survival” (CICA [1984] p. 5). Banks concentrated exclusively on the more well-to-do segment and ignored the financial needs of farmers and the working poor. As a result, there was a lack of provision of financial services. Inspired by the spirit of co-operation and self-help, committed individuals came together and formed their own credit unions, which provided them with the credit they needed for the purchase of inputs and equipment. Since then, credit unions have grown rapidly in size and members. Despite these changes, credit unions are the only financial services provider in nearly 900 communities (Ketilson and Brown [2009]).

¹²This democratic arrangement has disadvantages as well. A credit union’s activity may not necessarily reflect its members’ interest if members are inactive. Moreover, the democratic governance makes decision-making process expensive and difficult (Staatz [1987]), and sometimes results in inefficient outcomes. This aspect will be discussed in the next chapter.

In their early years, credit unions were formed around a common bond – either occupational, organizational or residential. With a common bond, “credit union members were differentiated from unknown borrowers because of in-depth information among the group of members about the character and economic prospects of one another” (Walter [2006], p. 1-2). This restriction on the membership gave credit unions a comparative advantage in screening and monitoring the borrowers (Walter [2006]). Fischer [1998] highlights the importance of the common bonds by pointing out that the success of credit unions often depends on the strength of the bond.

In addition, credit unions often lent money on the basis of character – the manager and members of a credit union often had much better information on the creditworthiness of a borrower than a commercial lender.

However, as credit unions grow and expand, their informational advantages are not as strong as before due to a number of factors. For example, the common bond of the membership is no longer required in Canada; the introduction of new technologies, such as credit ratings, has improved the availability of borrower information. As well, and particularly in urban areas, the people requiring loans are very diverse – often from different cultures and speaking different languages. These changes have weakened credit unions’ advantages to some extent.

Despite this, credit unions, especially rural credit unions, still have informational advantages over banks due to their deep roots in the community. In fact, this could be the case for large urban credit unions. During the interviews, the staff of credit unions indicated that they tried to take advantage of their connections with the communities to deliver micro-loans. For example, they may rely on an individual who knows the community very well for information to assess a loan application, or rely on a local organization for such information.¹³

Weakness of Credit Unions

While credit unions have their strengths, they have weakness as well.

Heterogeneity of the membership is inherent in credit unions. The greater this heterogeneity, the more difficult it is to design the services that allow all members to benefit. This issue is more important for credit unions because there are two broad groups of members – i.e., borrowers and

¹³Source: Personal Interviews.

savers – whose interests are very different from each other. This issue and its implications will be elaborated in detail in the next chapter.

Credit unions also suffer from the agency problems between the managers of credit unions and the board of directors, and between members and the board of directors, the free rider problem and member individualism (see Fulton [2005] for a review).

Despite some weakness, credit unions are important for a socially-oriented microcredit program. However, it is not sufficient for them to get involved in such programs. They need good reasons to justify their involvement.

Reasons for Participation

Credit unions have a number of reasons for engaging in microcredit programs.

1. Members have a concern for their community. The well-being of individual members is linked to the economic and social conditions of their community. For instance, people tend to feel insecure in communities experiencing high levels of unemployment, poverty and social breakdown. Therefore, members would like to see their credit unions demonstrate a concern for and a commitment to the community through implementing a socially oriented program, such as a microcredit program. Empirically, this concern for community appears to be a differentiating feature of credit unions. As an example, a survey in Alberta shows that credit unions' involvement with the local community is one of the major reasons for patronizing credit unions (Dakurah, Goddard, and Osuteye [2005]).
2. Microcredit lending represents a new niche for credit unions. Historically, credit unions have focused on consumer lending and mortgage lending, and they have been very successful in doing this. However, with deregulation and the entry of foreign banks, and combined with the fundamental changes in values among Canadians, these two markets are no longer as profitable and secure as they once were (Delbrouck [1994]). Clearly, credit unions need new niches. Microcredit lending represents such an opportunity. In fact, micro-enterprise is one of the fast growing sectors of the economy. It has potential for growth.

Of course, it is difficult for credit unions to make profits from lending micro-loans to micro-businesses. But as micro-entrepreneurs build their businesses, they may need more loans and other services from which credit unions can make profits. Therefore, even though credit unions cannot make money on micro-entrepreneurs today, they can expect to make money on them from the conventional services tomorrow, particularly if micro-entrepreneurs remain loyal to their credit unions.¹⁴

3. Microcredit lending offers an opportunity for credit unions to differentiate themselves from other financial institutions. With deregulation and growing competition, credit unions become less distinguishable from their competitors. To compete for members and build loyalty, credit unions need to build a strong public image that makes them different from the competitors. Microcredit lending provides such an opportunity. The active involvement in microcredit lending and other community-based initiatives can clearly demonstrate a difference to members and the public, and keep members with their credit unions.
4. The fate of a credit union is closely linked to the health of the community. In the case where a community experiences continuous decline, it is difficult for the credit union to operate and survive (Fairbairn, Ketilson, and Krebs [1997]). This is because the decline in members' wealth translates into reduced demand for services, and importantly, it is difficult for credit unions, as a locally-owned and locally-controlled organization, to leave the local community easily when the economy is in decline. This is particular the case for small credit unions.
5. Large credit unions, with a geographically diversified membership, are being created in Canada as a result of a number of recent mergers. Large credit unions may find it easier than their smaller counterparts to close a branch that serves a small community, since doing so only affects a small fraction of their membership base. However, due to their history, values, philosophy and governance, such decisions may still be difficult for large credit

¹⁴During the interview, a credit union loan officer indicated that the micro-loan borrowers remain loyal and continue to transact with the credit union after graduation because the credit union was the only financial institution that was willing to lend money to them.

unions to make. Indeed, as noted from discussions with people that watch the credit union sector closely, some of the large credit unions have retained a concern for community, even as they have grown larger. In other cases, however, the credit unions have paid little attention to this aspect.

2.4.3 Three Examples

A number of Canadian credit unions operate microcredit programs. To understand the current status and characteristics of the microcredit programs operated by credit unions, the staff of three urban credit unions in Western Canada (Vancity Credit Union in Vancouver, Assiniboine Credit Union in Winnipeg and Affinity Credit Union (formerly FirstSask Credit Union) in Saskatoon), the staff of seven agencies that work with these three credit unions, and nine micro-loan borrowers were interviewed.

The seven agencies include governments (Western Economic Diversification Canada (WD) and Manitoba Business Start Program in Winnipeg) and community development organizations (SEED Winnipeg, YMCA-YWCA of Winnipeg, Jubilee Fund in Winnipeg, Women's Enterprise Centre (WEC) in Winnipeg and MOSAIC in Vancouver). These agencies either provide financial support (e.g., loan guarantee) or deliver non-financial services that are complementary to credit unions' micro-loan services.

The borrowers that were interviewed are located in Vancouver and Saskatoon. They include new immigrants, unemployed single moms and low-income individuals. Most of them operate a small home-based business, for instance, hair-cutting. Most of the borrowers interviewed report positive benefits from their investments.

The interviews were semi-structured and were designed to understand why credit unions implement their microcredit programs and how they work with their micro-loan borrowers. A copy of the interview questions is found in Appendix A.

The remainder of this section first briefly introduces the three microcredit programs operated by the respective credit unions and then summarizes their common features. The material in this section is drawn largely from the interviews.

Vancity Credit Union

Vancity was founded in 1946. It is Canada's largest credit union with \$14.1 billion in assets, more than 390,000 members and 59 branches throughout Greater Vancouver, the Fraser Valley, Victoria and Squamish. Vancity's operation is guided by a commitment to help people and communities thrive and prosper through the provision of financial services. Each year, Vancity invests 10% of its profits in the community. In 1989, the Vancity Community Foundation was created to deliver Community Development Lending Programs.

In 1997, Vancity took over a peer loan portfolio from Calmeadow.¹⁵ Since then, Vancity has delivered two types of microcredit programs – i.e., a peer lending program and individual lending programs.

1. Peer Lending Program

Vancity's peer lending program targets entrepreneurs who have not established a sound credit history. The first loan level is \$1,000 or \$2,000 for the graduates of a self-employment program, and the maximum loan level is \$5,000. The interest rate is prime rate plus three percentage points. The repayment terms range from 3 months to 24 months (Vancity [2005]).

The loans are extended to a group of people, usually three to six, who come together for the purpose of a loan. The group members assess and approve each other's loan application. Approval is based on the confidence that each member has in the other's commitments, resources and ability to repay. After approval, group members must meet once a month to review the progress in their businesses and loan repayment.¹⁶

By 2004, Vancity's peer lending program had lent out approximately \$1.1 million to 301 entrepreneurs with 680 loans (Strandberg [2004]). Currently, Vancity's peer lending portfolio is worth around \$150,000 with approximately 100 borrowers.¹⁷

2. Individual Loan Programs

¹⁵Calmeadow ceased operations in 2001.

¹⁶Vancity's peer members provide 'moral collateral' since they are not required to repay the other group members' loans.

¹⁷Source: personal interviews.

Vancity has developed several individual loan programs, including the Self Reliance Loans Program. These programs provide lines of credit or personal loans of up to \$35,000 based on the borrower's character or credit history. The loan term is 5 years at maximum. The interest rate is prime rate plus a risk premium of 4 percentage points. To be eligible, borrowers must enrol in or have graduated from a self-employment program or a similar pre-entrepreneurial program.

Vancity also designed a micro-loan program for Canadians with disabilities. The Advice and Business Loans for Entrepreneurs with Disability (ABLED) program is a joint initiative between Vancity and Western Economic Diversification Canada (WD). This program provides entrepreneurs with disabilities with loans of up to \$75,000.

To date, more than \$13 million have been lent out to over 800 entrepreneurs (Hart and Tousesnard [2008]).

In 1993, Vancity launched a socially-responsible investment fund 'Shared Growth' – a Community Investment Deposit Program. Since the inception of microcredit programs, a portion of funds deposited under this program have been directed to micro-loans.¹⁸

Shared Growth deposits are one to five year term deposits. The minimum investment is \$500 and the maximum investment is \$150,000. These deposits provide Vancity with funds at below-market rates of interest. The difference reduces the debt burden on micro-loan borrowers. By the end of June 2004, approximately \$4 million had been deposited by members under this program (Strandberg [2004]).

Assiniboine Credit Union (ACU)

ACU is headquartered in Winnipeg. The credit union was established in 1943. In 2009, its assets amounted to \$2.62 billion (ACU [2009]). It has a mandate to make a profit while making a difference in the community it serves. It is involved in various socially-oriented programs. Microcredit program is one such program.

ACU has implemented a microcredit program since 1993 when ACU's board of directors wanted to make the organization more responsible to the community and took an interest in

¹⁸The rest of the funds is used to finance other socially responsible projects, such as affordable housing.

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community economic development. However, at that time, ACU was small, and given the importance of the non-financial services that it was unable to provide, ACU was unable to operate a micro-loan program alone. Therefore, ACU, together with other organizations in the community, helped create SEED Winnipeg – a community development organization targeting low-income individuals. ACU was responsible for administering a loan portfolio and SEED Winnipeg was responsible for providing additional non-financial services for borrowers. At that point of time, loans were small, typically ranging from \$1,000 to \$10,000.¹⁹

Today, in addition to special community loan funds (SEED Winnipeg and Jubilee Fund), ACU administers a micro-loan program from WD.²⁰ With these supports, ACU is now able to lend out larger loans, up to \$35,000. The interest rate is prime rate plus a risk premium ranging from 3 to 6 percentage points (mostly plus 3 percentage points).²¹ The maximum loan term is five years. Loan applications are processed on a case by case basis with a focus on personal character. ACU does require some physical collateral as an indication of one's commitment to the investment.

In 2009, ACU lent out \$1.5 million to 55 organizations, and its outstanding micro-loans amounted to \$3.4 million (ACU [2009]). Cumulatively, ACU has helped more than 400 entrepreneurs to develop their own businesses.²²

ACU mainly relies on local business development organizations and agencies, such as YMCA-YWCA and SEED Winnipeg, to provide non-financial services to micro-loan borrowers.

ACU offers Social Responsible Investment (SRI) mutual funds, Jubilee Investment Certificates, and ACU Guaranteed Investment Certificates. In 2008, members invested an additional \$7.9 million in SRI products, bringing total SRI assets managed by ACU to \$35.3 million at year end (ACU [2009]).

Jubilee Investment Certificates, which take the form of three to five year term deposits, are administered by ACU. The interest rate is 2 percent below the regular rate of interest (GIC

¹⁹Sources: personal interviews.

²⁰Jubilee Fund provides loan guarantee and ACU provides credit. The projects must meet the investment criteria of the Jubilee Fund.

²¹For the interest rate of loans financed by SEED Winnipeg, the interest rate is prime rate plus 2 percentage points.

²²Sources: personal interviews.

interest rate).²³ The funds are used to secure and leverage loans. Jubilee Investment Certificates are an innovation in providing a socially responsible investment product to the general public.

Affinity Credit Union

In 1999, Saskatoon Credit Union, which later merged into FirstSask Credit Union and then merged into Affinity Credit Union, entered into a partnership with WD to create a micro-loan program. A \$1.5 million micro-loan program was created to provide access to credit for eligible entrepreneurs with good business ideas but no access to traditional credit. Borrowers can apply for loans up to \$35,000. The loan term is a maximum of five years.²⁴

Affinity provides non-financial services to help micro-loan borrowers build skills and financial knowledge. Micro-loan borrowers are required to meet with Affinity's staff once a month.

In its first five years, the program lent out more than \$1.3 million in 75 loans. These loans created around 160 new jobs in Saskatoon area.²⁵

Common Features

The above microcredit programs share some common features.

1. Social benefits rather than profits motivate the credit unions. As a loan officer described, "what we have determined as a company is that it is the market that is not being served. We would not necessarily like our micro lending portfolio itself to give us a same rate of return, or even in some cases a rate of return comparable with our other components of our business operation. (...) So our company made the decision that here is the market that is underserved in the traditional way. (...) We want to serve that market. We do not necessarily want to make it profitable. (...) We recognize and we accept the fact that many of the small or micro-loans [are] not bringing financial return[s] on our balance sheets or the bottom line, but it serves the need of our community that is not being met presently, and it fulfills our mandate as having a very strong values statement in terms of how we

²³Sources: personal interviews.

²⁴Source: personal interview.

²⁵Source: personal interview

reinvest in our community, and the types of services we are providing to the underserved in our communities.”²⁶

2. Loans are delivered to individual entrepreneurs. It should be noted that the peer lending mechanism employed by Vancity is significantly different from the peer lending programs that prevail in developing countries since group members in the Vancity program are not responsible for each other’s repayment.
3. Loan terms (e.g., interest rate, size and term), with the exception of Vancity’s peer lending loans, are similar to commercial loans delivered to SMEs. However, due to the lower collateral requirement, micro-loans may seem more attractive than commercial loans for SMEs.
4. The programs are not designed for low-income individuals exclusively. Individuals who are not on a low income but have difficulties in accessing credit can apply for micro-loans as long as they are eligible.
5. Non-financial services (e.g., mentoring and technical assistance) have formed an important part of the microcredit programs administered by the three credit unions. Such services are either provided by the credit unions directly or by community development organizations operating in the communities. In many cases, entrepreneurs are required to enrol in a self-employment program. Such a program may take from several days to several weeks, or even a year, to complete; while such non-financial services produce benefits to entrepreneurs, they do impose extra costs on entrepreneurs as well.

2.5 Summary

Lack of capital is frequently a barrier for micro-entrepreneurs to becoming self-employed. They are underserved by mainstream financial institutions. Information asymmetry in the credit market, combined with the micro-entrepreneurs’ disadvantaged social and economic positions in communities, are the main reason for this under-provision.

²⁶Source: Interviews.

Microcredit is an approach to bridge the financing gaps experienced by micro-entrepreneurs. Micro-loans are essentially unsecured small loans. Microcredit programs impact individuals directly and create positive spillover as well. However, compared with traditional credit, microcredit is riskier and more expensive. Mainstream financial institutions have little interest in microcredit and are not directly involved in it.

Credit unions are important microcredit providers in Canada. Their commitment to the socially-oriented microcredit programs and their strengths in correcting market failures stem from their co-operative nature.

The next chapter first presents a review of the literature on credit rationing and information asymmetry in the credit market. The loan-delivering mechanisms of microcredit is then introduced since many innovations have been developed to address information asymmetry and thus reduce rationing. The chapter is concluded with a review of the literature on credit union decision-making with a focus on the issue of member heterogeneity and member orientation.

Chapter 3

A Literature Review: Credit Rationing, Collateral, Innovations in Microcredit and Credit Union Decision-Making

The credit market is subject to serious information problems between the borrowers and financial institutions. To solve these problems, financial institutions set loan contract terms such as the interest rate and the collateral requirement to reveal borrower information. Rationing may arise when these techniques are ineffective.

Given that the problem of asymmetric information tends to be more serious in small enterprises – and micro-enterprises in particular – and these organizations tend to be less capable of signalling their creditworthiness to the lender (for example, by providing collateral as required), obtaining credit financing may be very difficult for these businesses.

Lack of capital is an important barrier for people who want to be self-employed. In a survey in the period from 1983 to 1986 in the United Kingdom, about half of the respondents claimed that they had considered self-employment seriously but gave up the idea due to a lack of capital (Blanchflower and Oswald [1998]). A consulting report Russell [2001] provided similar anecdotal evidence. Based on a survey in Canada in 1981, Bernhardt [1994] reported that the probability of an individual choosing self-employment increases with the amount of wealth possessed by the individual and the family.

This chapter presents a review of the current literature related to credit rationing, microcredit and credit unions' pricing policies. It is organized as follows. Section 3.1 presents a review of the current literature on credit rationing, with a focus on the role of collateral. Collateral is

an important component of loan contracts and often serves as a barrier to credit for the poor. Section 3.2 presents a brief review of the literature on loan delivery mechanisms of microlenders, including the famous mechanism of group lending with joint liability that has been adopted by microcredit programs to bridge the financing gap. This mechanism allows lenders to solve the information problems in a cost-saving way through group dynamics (peer monitoring, peer selection and peer sanctions), and to transform the ‘unbankable’ poor to ‘bankable’. Section 3.3 provides a review of the studies on the credit union’s pricing policies, with a focus on the impact of member orientation on the credit union. Section 3.4 concludes.

3.1 Credit Rationing and Information Asymmetry

Credit rationing refers to the denial of credit at the going price (Bhattacharya and Thakor [1993]). That is, banks offer credit at a price where there is an excess demand. Some borrowers are denied credit even though: (1) they are willing to pay a higher interest rate or pledge more collateral; and (2) they are observationally indistinguishable from the borrowers who do receive a loan. Rationing can also occur when borrowers receive a smaller loan than the amount for which they applied. In this study, the focus is the first type of rationing.

3.1.1 Information Asymmetry and Credit Rationing

Financial institutions are exposed to repayment risk or default risk. In the credit market, the borrowers receive the loans or credit at one point of time, and do not need to honour their obligations until some time later. This raises the problem of repayment risk: are the borrowers able and willing to pay back the loans when they are due?

The profits of financial institutions are affected not only by the interest rate that they charge the borrowers, but also the repayment risk of the loans that they have made. The repayment risk depends crucially on the borrowers’ ability and willingness to repay the loans, an ability that is private information to the borrowers and unobservable to the lenders. The lenders can only screen potential borrowers on the basis of observable characteristics. They also may not be able to monitor the borrowers’ investment activities, especially when the monitoring cost is sufficiently high. As a result, the credit market is characterized by information asymmetry between the lenders and the borrowers. This feature prevents the conventional price mechanism

from clearing the market: the interest rate does not always adjust to clear the market and credit rationing emerges as a result.

After the work of Akerlof [1970] and Arrow [1963, 1968], the idea that information asymmetry may affect the market outcome has been widely recognized and applied to the credit market. Akerlof and Arrow focused on different problems associated with information asymmetry. Akerlof considered the problem of adverse selection. The sellers – knowing the quality of their products – offer products of different qualities to the buyers who cannot detect the difference in quality. The buyers offer a price to the sellers based on their perceptions of the average quality of the products. This price is likely to discourage sellers who sell good quality products that have a reservation price that exceeds the price offered. The outcome is that the good quality products are driven away by the bad quality products.

Arrow considered the problem of moral hazard. The principal enters into a contract with the agent. The principal can neither stipulate what actions the agent should take because of the incompleteness of the contract, nor monitor the agent's actions. The principal and the agent have different preferences, but are both affected by the agent's actions. To discourage the agent from taking undesired actions, the principal designs a contract to ensure that the agent's interest is aligned with the principal's. "The key point is that the behaviour of the agent, which the principal wishes to control, is a function of the terms of the contract between them" (Hillier and Ibrahim [1993], p. 275).

Stiglitz and Weiss [1981] applied the idea of adverse selection and moral hazard to the credit market. Stiglitz and Weiss explained that an increase in the interest rate may affect the quality or the riskiness of the pool of loans by either: (1) discouraging good risk borrowers (adverse selection); or (2) causing the borrowers to undertake undesired actions (moral hazard). The problem of adverse selection arises where some borrowers are inherently bad risk and some are inherently good risk. While the borrowers know their types, the lenders do not have this information. Under these conditions, the interest rate plays a role as a screening device: those who are willing to pay a higher interest rate are bad risk – they are willing to borrow at a higher rate because they know their probability of repaying the loan is low.

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The problem of moral hazard arises if the lenders have no control over the borrowers' investment choices. With an increase in the interest rate, the borrowers' return from the investment decreases. As a result, it becomes more profitable to undertake the riskier investments (one that has a higher return if successful).

With adverse selection or moral hazard, the increase in the interest rate has an adverse impact on the riskiness of the risk pool. The lenders' profits are affected by both the interest rate charged and the riskiness of the loan portfolio. Consequently, the lenders' profits increase slowly compared to the increase in the interest rate, and beyond a point, may actually fall. If the optimal rate at which the lenders' profits are maximized is lower than the rate at which the market clears, rationing may occur because the lenders have no motivation to charge a higher rate to clear the market.

Ghatak [1999] focused on adverse selection and found a similar pattern. In Clemenz [1986], the borrowers have different costs of default. Honest borrowers have high costs of default. Given the high default costs, honest borrowers are on the margin of borrowing. The result is that an increase in the interest rate forces them to withdraw first. The adverse selection effect emerges. The rationing result in Stiglitz and Weiss [1981] may occur.¹

Parker [2001] argued that the difference in the borrowers' ability to carry out their investments may give rise to credit rationing. The reason is that the most able entrepreneurs are more likely to find a satisfying paid job, hence a higher interest rate discourages this type of borrower from borrowing. Thus, the high interest rate results in a decrease in the average ability and the probability of success of the borrower pool, and therefore may negatively affect the lenders' expected profits.²

¹Barham, Boucher, and Carter [1996] extended the results of Stiglitz and Weiss [1981] and suggested that imperfect information may give rise to quantity-rationing outcomes – the second type of rationing. In the model, they allowed the size of the loans to change with the interest rate. The size of the loans supplied depends on the interest rate and the riskiness of the loan portfolio. With imperfect information, the lenders offer a single interest rate that reflects the average risk. In equilibrium, compared to the situation with perfect information, bad risk borrowers borrow more, while good risk borrowers borrow less. In the case where the demand for loans are different across borrowers, those who need loans of small sizes may be completely rationed. Barham et al. [1996] thus provided one explanation why small borrowers are often denied.

²Schreft and Villamil [1992] demonstrated that with market power, a profit-maximizing lender can price discriminate by setting “an inverse relationship” between the loan size and the interest rate – through this schedule, the lender can reveal the endowment of the borrowers. In the model, all borrowers except the largest borrowers are credit rationed: smaller borrowers are more rationed.

Watson [1984] took another approach. In his model, the borrowers respond to an increase in the interest rate by reducing their effort. So a higher interest rate increases the cost of monitoring for the lenders. Therefore, it is possible that in equilibrium the borrowers who are denied credit cannot 'bid loans away' from those who receive loans by offering a higher interest rate. This is because doing so would result in a fall in the profits of the lenders.

A feature of these models is that the interest rate cannot work efficiently because it not only directly affects the lenders' expected profits, but also indirectly affects the riskiness of the risk pool. Therefore, the interest rate is used as an instrument for impacting the riskiness of the risk pool, rather than as an instrument for clearing the market.

It should be noted that the rationing result is model sensitive. If the assumptions are modified, the possibility of rationing can be ruled out. For example, de Meza and Webb [1987] is a well-known model in which credit rationing may not arise in an environment of asymmetric information. These authors have shown that when the projects have the same expected returns, but differ in the success probabilities, the interest rate may have a positive selection effect: as the interest rate increases, the borrowers with riskier projects withdraw from the market. The lenders benefit from the higher repayment rate as a result of the increase in the interest rate and the improvement in the risk of the risk pool. If there is excess demand for loans, the lenders would always want to charge a higher interest rate to clear the market. In this situation, rationing would not occur. Moreover, sub-optimal projects are financed and the equilibrium investments exceed the socially optimal level.

However, these credit rationing models neglect the use of other contract terms, such as collateral (Bester [1985]), equity (Myers and Majluf [1984]) and loan size (Milde and Riley [1988]). The next section examines the literature on the role of collateral in solving information asymmetry.

3.1.2 Collateral as a Selection Device

Collateral is considered to be an indispensable element of loan contracts by banks. Boot, Thakor, and Udell [1991] demonstrated that, to reduce the repayment risk of the pool of loans, the lenders have an incentive to increase the collateral requirements on both good risk borrowers and bad

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risk borrowers in an environment in which the borrowers exhibit adverse selection and moral hazard.

In addition to providing protection to the lenders against defaults, collateral has a mitigating effect on information asymmetry. Therefore, it is expected to play a role in reducing credit rationing. A number of theoretical efforts have been made to investigate collateral as an instrument to mitigate information problems. The studies can be divided into two categories depending on the problems addressed (Leland and Pyle [1977]).

The studies in the first category consider collateral as a screening device, dealing with the problem of adverse selection. Compared to bad risk borrowers, good risk borrowers are willing to provide more collateral because their chances of actually losing the collateral are lower. Given this difference, collateral has a signalling role to play: the borrowers can signal their creditworthiness to the lenders by providing more collateral (see Chan and Kanatas [1985], Bester [1985] and Besanko and Thakor [1987]). In equilibrium, good risk borrowers provide more collateral than bad risk borrowers.

The second category of studies regards collateral as an incentive device that can deal with the problem of moral hazard. The interest rate on the collateralized loan (secured loan) is lower than the uncollateralized loan (unsecured loan). This reduction reduces the marginal return to effort for the borrowers. As a consequence, the collateralized loan contract results in a smaller reduction in the return to the borrowers because “it smoothes the borrower’s repayment cost over successful and unsuccessful states” (Boot and Thakor [1994], p. 903). The conclusion of these studies are in contrast with the conclusions in the first strand: bad risk borrowers provide more collateral than good risk borrowers.

These studies assume that the borrowers of different types have different preferences or attitudes toward collateral. This difference, thus, suggests that collateral can play a role in mitigating information asymmetry and consequently reducing credit rationing.

However, the effectiveness of this separation mechanism may be very limited. First, in practice, the borrowers may be different in many dimensions. In this case, the interest rate and collateral requirement may be insufficient to achieve a perfect separation, and the rationing result is persistent (see Jaffee and Stiglitz [1990]). An example is Stiglitz and Weiss [1981] where

the borrowers differ in both the risk of their investments and the level of initial wealth – being rich also means being less risk-averse. As a result, both the best risk borrowers and the worst risk borrowers will provide collateral. Based on the framework in Stiglitz and Weiss [1981], Coco [1999] focused on the effect of moral hazard, and demonstrated that rationing may still occur if the borrowers differ in their risk preferences. In these studies, collateral cannot effectively separate the borrowers according to their types because the borrowers are different in more than one dimension. As a result, credit rationing may still arise and more devices are necessary to solve the problem. Cater [1986] analyzed credit rationing in the agricultural sector, where small farms are rationed out of the market. Small farms are considered to be less productive and riskier than big farms. This “farm size statistical discrimination” combined with the problem of adverse selection and moral hazard make access to credit difficult for small farms: they are rationed out of the credit market. Barham et al. [1996] provided similar results.

Second, the borrowers may have insufficient wealth to pledge as collateral. In this situation, the pooling equilibrium with rationing emerges again (Bester [1987], Besanko and Thakor [1987], and Chan and Thakor [1987]). According to Chan and Thakor [1987], in the competitive credit market where the lenders compete for the borrowers with each other, rationing does not occur unless the borrowers have insufficient wealth.

Third, competition in the credit market may lead to persistent rationing. With imperfect competition among the lenders, the lenders may maximize profits by offering a single pooling contract. This outcome is examined by Besanko and Thakor [1987]. Chan and Thakor [1987] found that in the market where the level of competition for the borrowers is low and the level of competition for savers is high (that is, the interest rate on deposits is endogenously determined), a rationing equilibrium may emerge.

Fourth, as Mattesini [1990] demonstrated, the usefulness of collateral as a screening tool crucially depends on the composition of the borrowers. Because the use of collateral is costly to the lenders, only when the proportion of bad risk borrowers is sufficiently high, it is optimal for the lenders to incur the costs of using collateral and to offer a set of separating contracts since the cost is compensated by the benefits of screening; otherwise, it is optimal to offer a single contract and rationing still may occur.

Finally, the nature of the game between the borrowers and the lenders may determine whether a separating or a pooling equilibrium arises (Hellwig [1987]).

To conclude, credit rationing may arise in a number of different ways and in different lending environments. Collateral has the potential to solve information asymmetry problems in some cases. However, such a security requirement may result in the rationing of the borrowers who have insufficient collateral.

3.2 A Remedy against Credit Rationing – Microcredit

As illustrated in the above theoretical work, the lenders prefer to reject some borrowers and require collateral because of the adverse selection effect and the incentive effect (moral hazard) of information asymmetry. A possible solution to credit rationing is to explore local information about the borrowers. One approach is through a social evaluation in which the loan officer and the people who hold specific information get together through social networks and make loan decisions. Ferrary [2003] provided an example where the lenders resort to financial counsellors who have a good understanding and rich knowledge of the community to provide information necessary to make a risk evaluation.

Many microcredit providers take another approach. They rely on innovative program arrangements to deal with the information problems.

3.2.1 Group Lending with Joint Liability

Group lending with joint liability is an arrangement whereby individuals without collateral get together and form groups for the purpose of obtaining a loan from a lender. Under this mechanism, individual borrowers receive loans, but sanctions (in the form of being cut off from future loans) are imposed on the group if any individual borrower in the group defaults on the loan. Instead of lending directly to individual borrowers, microcredit providers lend to the groups formed by self-selected borrowers.

Group lending prevails in many developing countries. The success of some programs, such as Grameen Bank in Bangladesh (Morduch [1999]) and Banco Sol in Bolivia (Gonzalez-Vega, Schreiner, Meyer, Rodriguez-Meza, and Navajas [1997]) is attributable to the implementation

of this mechanism. For example, the Grameen Bank has lent \$1 billion to more than two million borrowers and maintains a repayment rate of around 97% (Wydick [2001]).

This mechanism enables the lenders to make use of local information to which they otherwise have no access, and consequently it has the potential for improving the repayment rate, especially in an environment where the borrowers have strong social ties or social connections with each other. Group lending with joint liability has been considered as “one of the most innovative and promising means of making credit available to those without access to the formal financial market” (Wydick [2001], p. 463), and has rapidly drawn the attention of researchers.

Under group lending, the borrowers self-select with respect to their risks through peer selection (Ghatak [1999] and Van Tassel [1999]). The imposition of joint liability on the groups provides the borrowers with the incentive to choose group members with care. As each borrower prefers to choose good risk borrowers, and good risk borrowers prefer to stay with good risk borrowers, assortative matching can be achieved in equilibrium. Good risk borrowers end up with good risk borrowers because they do not want to cross-subsidize bad risk borrowers who are more likely to default on the loans and thus increase the burden on their fellow members. Group homogeneity is the result of peer selection and is linked to a higher level of repayment rate (Ghatak [1999]).

Armendariz de Aghion and Gollier [2000] applied this mechanism to developed countries where the borrowers are not informed about each other’s types. They argue that due to a “collateral effect” – “cross subsidization amongst borrowers acts as a collateral behind a loan” (Armendariz de Aghion and Gollier [2000], p. 633), the lender can reduce the interest rate under group lending. This collateral effect can offset the joint liability effect: when the defaulting partner is a bad risk borrower, a good risk borrower suffers less than a bad risk borrower. With no local information, group lending makes “repayment rates be random for both types of borrowers, but it does so in a way that reduces the extent to which risky borrowers can take advantage of being pooled with safe borrowers in the same – unsegregated – credit market whilst at the same time saving on auditing costs” (p. 639).

Group lending provides the borrowers with an incentive to monitor each other’s investment actions, because each member’s payoff is affected by fellow members’ actions. Therefore, the

problem of moral hazard can be mitigated (Stiglitz [1990] and Laffont and Rey [2003]). Stiglitz argued that by transferring default risk from the lenders to the borrower groups, the lenders can offer a joint liability loan to improve the welfare of the borrowers. Madajewicz [2004] went further. He demonstrated that group monitoring is more efficient than the monitoring conducted by the lenders – to achieve the same result, the borrowers incur lower costs of monitoring than the lender.

However, it should be noted that group lending is subject to the free rider problem. Under group lending, each member is responsible for the repayment of the group. It means that the borrower member has to share his returns with the peers. Consequently, the borrower tends to make less effort in the investment. Thus, compared to individual lending, the borrower members may be less motivated in generating their returns (Che [2002]). Moreover, the free rider problem is more likely to arise in large groups – each prefers that her peer members monitor and “incur the ill will that would result from reporting offenders who have misused the funds lent to them” (Stiglitz [1990], p. 361). Another problem is that members may collude and default on their loans.

If group members have close social connections with each other, the social cost of defaulting may be very high. In this case, social sanctions by peer members against the strategic defaulter serves as an efficient mechanism for enforcing repayment (see Besley and Coate [1995] and Diagne [1998]).

Group lending is capable of reducing transaction costs for the lenders (Bhatt and Tang [1998]). It enables the lenders to deal with groups, and thus save costs of transacting with several individuals. In many cases, it is slightly more expensive to administer a group of several loans than to administer a single loan (Schaefer-Kehnert [1982]). More importantly, group lending allows the lender to not only make use of local information and relations – through the dynamic of the groups, but also transfer some risk and costs (such as screening, monitoring and enforcing repayment) to the borrowers. As a result, the lender enjoys both low transaction costs and low default risk.

Despite the strengths of group lending, this arrangement has significant disadvantages that make joint liability loan contract less attractive: (1) under joint liability, the lenders pass on some

costs and risks to the borrowers; (2) given the diversified demand of the borrowers for loans, it is difficult to design a ‘tailored’ contract to make each borrower in the group satisfied; and (3) some borrowers simply do not like joint liability contracts as they do not want to be held responsible for the consequence of other people’s actions. So the application of joint liability contracts is quite limited and mainly confined to the delivery of micro-loans.

Group lending often comes along with other innovative arrangements that enhance the borrowers’ willingness to repay, such as dynamic incentives and regular repayment requirements.

3.2.2 Dynamic Incentives

Dynamic incentives are an important mechanism for assuring high repayment rates. The key element is the threat of the denial of future access to loans. The cost of defaulting is to be cut off from future loans. To forward-looking borrowers whose need for credit is on-going, the access to future loans is very important, or in other words, their cost of defaulting is very high. The high defaulting cost deters the borrowers from defaulting strategically. As Armendariz de Aghion and Morduch [2005] put it, “even without recourse to peer monitoring, collateral, or social sanctions, microlenders can give incentives to the borrowers by threatening to exclude defaulting borrowers from future access to loans. In this way, microlenders have a weapon that was unavailable to failed state-run banks of the past” (Armendariz de Aghion and Morduch [2005], p. 123). A clear disadvantage of this mechanism is that it is not useful if the borrowers do not need to borrow again.

Another element is the so-called progressive lending. Under this arrangement, the borrowers start with a small loan. Then, upon their repayment performance, the loan sizes are gradually increased. As Ghosh and Ray [1997] stated, progressive lending has “the unique advantage of testing the borrowers with small loans, allowing the lenders to develop relationships in time and so sort out potential defaulters before the loan scale is expanded” (Ghosh and Ray [1997], p. 493).

3.2.3 Frequent Repayment Installments

Microlenders usually require that the loans be repaid in small installments, starting very soon after the disbursement. The installments may be weekly or monthly, varying across the programs.

This arrangement helps the lenders to select the good risk borrowers (Armendariz de Aghion and Morduch [2005]; Jain and Mansuri [2003]), and serves as an early warning system. Since the repayment starts very soon, the borrowers should have other sources of income to repay the early installments. For example, the borrowers may have to borrow from an informal lender. Thus, the requirement of frequent repayment installments means the lenders in effect lend “partly against that stream of outside income, not just the proceeds from the project” (Armendariz de Aghion and Morduch [2005], p.131). In this way, the lenders can indirectly ‘coopt’ the informal lenders who have good information of the borrowers.

3.2.4 Other Incentive Mechanisms

Micro-lenders have developed other complementary incentive mechanisms to reduce credit rationing on the poor populations (Armendariz de Aghion and Morduch [2005]). One example is that they accept collateral in non-traditional forms. This collateral may be not valuable to the lenders but represent a valuable asset to the borrowers. Thus, the provision of non-traditional collateral makes a borrower who is considered as “unbankable” due to the lack of traditional collateral become ‘bankable’, and plays a signalling role.

Making repayments public (Rahman [1999]) and cross-reporting (Rai and Sjoström [2004]) can be used to improve repayment rates through peer pressure and social sanction. Women seem to be more reliable than men in repaying their loans (Hossain [1988]). The evidence suggests that targeting women may be a viable strategy.

3.3 Member Orientation of Credit Unions

Co-operative theory has shown that the creation of a co-operative can help members achieve a more efficient outcome compared to the outcome under an IOF who has some market power.

Credit unions are financial co-operatives owned by members. After purchasing a share, individuals become the members of the credit union. The credit union mobilizes savings from members and lends loans out of the pools of saving deposits to members. Since their own money is being lent out, members have a keen interest in seeing the loans repaid in a timely manner. This kind of internally generated funds (hot money) tend to result in a sense of ownership and respect for loan contract enforcement (e.g., Bennett, Goldberg, and Hunte [1996]), a strong incentive

for monitoring each other (e.g., Stiglitz [1990]; Laffont and Rey [2003]; Banerjee, Besley, and Guinnane [1994]; Guinnane [2001]; Huppi and Feder [1990]) and enforcing loan contracts (e.g., Besley and Coate [1995]; Guinnane [2001]), and thus achieve an efficient outcome compared to the outcome under chartered banks (e.g., Hansmann [1990]; Besley, Coate, and Loury [1993]).

Credit unions are not-for profit. After retaining a proportion of surplus for operation or future development, credit unions return the remainder to the membership – the owners – according to their patronage. Therefore, credit unions have no profit motive of their own. Their ultimate objective is to improve the well-being of the members by delivering services to meet the members' needs and to help them generate income and accumulate wealth (Smith [1984]). Navratil [1981] provided empirical evidence of this different objective. He examined U.S. credit unions and concluded that credit unions are loyal to their historical goal of providing members with low cost consumer credit even if some potential revenues are sacrificed.

Members control their credit union through electing a board of directors and holding them accountable. At general meetings, members elect their directors from the membership. Each member has one vote, regardless of the number of shares that he/she holds. The major responsibilities of directors are to determine the general direction and policies and to supervise the performance of the management. They should be responsive, otherwise, they may be removed by members.

Like any organization, the behaviour of credit unions depends on certain elements of their internal structure. For instance, as in any firm whose managers are not also its owners, there may be a divergence of interest between the managers and the members of the credit union. Such divergence may cause conflicts and the diversion of the credit union from the objective of maximizing the welfare of the membership. Two factors further complicate this problem: (1) members are the users; and (2) directors are democratically elected by the members from the membership. Thus, "it is difficult for an individual to exert pressure on management, except through the democratic process, which (...) suffers from severe free-rider problems. In the cooperative, then, management may be more entrenched than they would be in a public corporation" (Hart and Moore [1998], p. 45). This manager-member relation has been considered crucial for

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credit unions by some economists and has been examined under different frameworks (see Fischer and Mahfoudhi [2003] for a brief review).

Another problem that is particularly important in credit unions is that the power distribution may lead to the maximization of the welfare of a section of the membership, rather than the total membership. In each credit union, there are two broad types of members: borrowers and savers. The supply of loan funds is provided by savers. The simultaneous presence of savers and borrowers may cause conflicts between them. Borrower members and saver members have different economic reasons for joining the credit union. All else constant, borrowers prefer a lower interest rate on loans, low transaction costs and lax discipline; while savers prefer a higher interest rate on saving deposits and strict disciplines to strengthen the viability of the credit union. Once inefficiencies have been removed from the organization, it is impossible for the credit union to make the two groups better off at the same time – for example, to reduce the loan interest rate and increase the deposit rate simultaneously. The improvement in the welfare of one group is a cost to the other group.

Member heterogeneity makes price setting and cost allocation difficult. These decisions “directly affect the stockholders’ willingness to patronize and contribute financially to the organization” (Staatz [1987], p. 38). However, with heterogeneous members, it is difficult to make all members benefit simultaneously. Meanwhile, managers’ ability to cut prices and cross-subsidize may be very limited because it could be difficult to convince members who use a particular product or service to finance the subsidies for the provision of the product or service that they seldom use.

There is some empirical evidence on the member orientation of credit unions. The first quantitative evidence was provided by Flannery [1974] who reported that among 589 U.S. credit unions over 50% were subject to member bias (cited by Ferguson and McKillop [1997]). Patin and McNeil [1991a] analyzed a sample of 9660 U.S. credit unions in 1984. Taking into account the regulatory changes that had occurred, they concluded that 2.7% of the sample were extremely borrower orientated; 12.9% were weakly borrower oriented; 45.1% were neutral; 29.7% were weakly saver oriented; and 9.6% were strongly saver dominated.

A considerable portion of theoretical efforts have been devoted to exploring how credit unions distribute surplus among different member groups and the possible impacts of regulatory and supervisory requirements.

Taylor [1971] noted that conflicts between members are inherent in credit unions because they cannot make each group better off at the same time. Based on the assumption that credit unions minimize costs, he described credit union behaviour in the most basic form. He showed that in a saver-dominated credit union, the objective is to maximize average net returns. The entry of new borrowers can enhance the credit union's ability to pay dividends. Therefore, the dominant saver groups consider such an entry as being complementary to their own interests. However, the entry of new savers may reduce dividend payment for all members. Thus, existing borrower members have an incentive to restrict the entry of new savers. In a credit union dominated by borrowers, savers represent the lowest cost source of loan funds. Therefore, it is in the interest of the dominant borrower group's interest to allow all savers in the potential membership to access the deposit services offered by the credit union. However, the entry of new borrowers is restricted because of the negative impact on the loan interest rates. Finally, existing members in a neutral credit union are less likely to restrict the membership, especially if there are economies of scale. The work of Patin and McNeil [1991b] provided some empirical evidence in favour of Taylor's arguments.

Almost all the subsequent theoretical works recognize that saver-borrower relation or member-group orientation may affect the operation of credit unions. Based on previous work, Smith, Cargill, and Meyer [1981] provided a general objective function of the credit union. Their contribution is the introduction of explicit weights which are defined as the behavioural preferences of the credit union toward different member groups. The objective function of the credit union is the maximization of the sum of weighted benefits for the membership. The benefits for borrowers are defined as the decrease in the interest rate on loans if borrowing from the credit union rather than the next best alternative lender; and the benefits for savers are defined similarly as the increase in the interest rate on deposits if making deposits at the credit union rather than the next best financial institution (Walker and Chandler [1977]). The authors demonstrated that compared with a neutral credit union, all else equal, the borrower-dominated credit union charges a

lower interest rate on loan services, and the saver-dominated credit union offers a higher interest rates on saving deposits. In an regulatory environment where there are interest rate ceilings, the saver-dominated credit union may retain an excessive amount of earnings as reserve to bind the deposit rate ceilings. This is because by doing so the credit union can better ensure the future dividends.

Smith [1984] extended the above model into multi-periods. He took into account the intertemporal nature of deposit and saving transactions. Smith [1984] examined the comparative static properties and highlighted the factors that affect the optimal interest rates. These factors include operating costs and regulatory constraints. He showed that when the preference or orientation of the credit union is evident, the preferred group absorbs disturbances. For example, if the borrowers are the preferred group, the credit union will adjust the loan interest rate to respond to the changes in the operating environment, while the deposit interest rate remains constant. This result occurs because the borrower-oriented credit union attempts to make as much profit as possible from savers to subsidize the borrowers, and any adjustment in the deposit interest rate will negatively affect the profit from savers, and thus negatively affect the borrowers.

Emmons and Schmidt [2001] considered credit unions who have as their goal the maximization of consumer surplus. They solely focused on the deposit interest rate and found that, in a one-member, one-vote governance structure, a saver-dominated credit union will set the interest rate on saving deposits at the minimum that is required for the credit union to collect sufficient savings to finance loans to borrowers. As the number of borrowers increases, the deposit interest rate is raised so that savers can extract more surplus from borrowers.

Canning, Jefferson, and Spencer [2003] investigated the optimal pricing policy in an environment where credit unions return surplus in the form of a subsidy to interest rates with rationing. The introduction of interest rate subsidy without rationing is inefficient because it creates a profit motive and distorts members' decisions. For example, a subsidy on the loan interest rate attracts more borrowers, and leads to a deadweight loss. The optimal policy is “ to set the volume of loans and deposits equal to those that would prevail at the market rate, adjusted for any business costs and risk, and to distribute earnings to [dominant] members through interest rate subsidies,

which are rationed as not to affect the levels of lending and borrowing” (Canning et al. [2003], p. 259).

While not focused on credit unions, the work of Hart and Moore [1996] provided important insights. They focused on IOFs and co-operative organizations and argued that both of them may lead to inefficiency. Based on the median voter theorem, they pointed out that a small change in the membership preference has no impact on an IOF but can have dramatic impact on the outcome in a co-operative.

Based on Hart and Moore [1996], Emmons and Mueller [1997] focused on credit unions’ governance structure. They considered the credit union in an environment where its preference shifts from one group to the other group as a result of the change in the composition of the membership. The democratic governance mechanism allows the credit union to shift its policy as the member preference shifts. The authors found that in the credit union, as the preference (median member) shifts from borrowers to savers, the credit union adjusts its policy from “underpricing credit toward the provision of competitively priced credit and deposit services” (Emmons and Mueller [1997], p. 1) to keep the equilibrium between saver and borrower members. They concluded that “the threat of withdrawal of borrowing members served as a powerful disciplining device” (Emmons and Mueller [1997], p. 27).

Emmons and Schmidt [2000] extended the model further to study the pricing and dividend policies in open credit unions. These credit unions transact with both members and non-members on a non-discriminatory basis but return the surplus to members only. Thus the conflict between profit-maximization (in members’ interest) and output-maximization (in non-members’ interest) complicates the problem of member-group orientation. The optimal pricing policy is now affected by both the preference and the volume of transactions with non-members, since the credit union has to keep a balance between borrowers and savers, as well as between members and non-members.

The above studies focus on the governance structure of credit unions as both a producer co-operative (from the perspective of borrowers) and a consumer co-operative (from the perspective of savers) and investigate how credit unions internalize the conflicts between different groups, produce and price financial services.

These models are based on the assumption that people pursue their own ‘material self-interest’ only – i.e., they perceive the services provided by credit unions and those provided by the banks to be homogeneous. Price becomes the only factor that affects the decisions of the members. Non-economic motives have been ignored. Peterson [1980] raised this point in his critique, “credit union behaviour can’t simply be classed as saver-oriented, borrower-oriented or managerial. Our credit union frequently makes “uneconomic” decisions in order to be ‘fair’ or ‘altruistic’ (‘help the little guy’ – by making very small loans, providing share-draft services with no service charge, or charging below market rates on used-car loans). However, such behaviour may help our credit union attract or retain deposits when interest rates are high. Many savers appear to be willing to sacrifice some yield to support an institution that is equitable and charitable” (Peterson [1980], p. 551).

Non-economic incentives may have important implications. For example, Bundt, Chisea, and Keating [1989] argued that member orientation of associational credit unions may be affected by ‘fraternalistic altruism’, thus reducing the labour costs through voluntarism. In a more sophisticated way, Amess and Howcroft [2001] explained the behavioural patterns of the membership. According to them, people join credit unions for two reasons: (1) they cannot obtain the services elsewhere; and (2) they are socially minded and “believe in the ethos of credit unions and the spirit in which they operate” (Amess and Howcroft [2001], p. 61). These studies help explain why credit unions may make ‘uneconomic’ decisions, for example, implementing a socially oriented project which cannot generate more profits or the returns that are comparable to that from other services.

3.4 Summary

This chapter has presented a review of the literature on credit rationing, the role of collateral in mitigating information asymmetry and reducing rationing, the innovative loan delivery mechanisms adopted by microcredit providers and credit unions’ price determination.

The current literature explores credit rationing as a result of information asymmetry. Financial institutions need good quality borrower information to carry out risk evaluations and make loan decisions, but they often cannot obtain this information. In a response, they either impose a

restriction on the loans (credit rationing) or require a positive amount of collateral to solve the information problems they face. However, these arrangements limit access to credit for some borrowers. It should be noted that the results in the literature are not robust. When an assumption is changed, significant changes may occur to the results. Despite this, many studies have demonstrated that access to credit is difficult to those who have insufficient collateral.

The innovative arrangements derived by microcredit providers – including group lending with joint liability and dynamic incentives – offer an alternative to deal with information problems and reduce the rationing of the poor. Some of these innovations (dynamic incentives and frequent repayment installments) have been used by Canadian microcredit programs. However, as mentioned in Chapter 1, the peer lending mechanism – the most significant innovation – tends to not work well in Canada.

Finally, the review of the literature on the credit union's pricing policies indicates that member orientation is an important factor that affects the credit union's decisions, in addition to the degree of market competition and the cost of the services. However, in the current literature, non-economic motives have been largely ignored, while evidence suggests that members care about not only their economic interest but also non-economic interest.

In the next chapter, a theoretic model will be developed to illustrate the wealth impacts on the credit market, and the role of mentoring and technical assistance as a substitute for collateral.

Chapter 4

Credit Rationing and Non-Financial Services as a Selection Device, Model I

4.1 Introduction

Chapter 3 presented a review of the current literature on credit rationing. The literature explores credit rationing as a consequence of information asymmetry in the credit market. Under asymmetric information, the interest rate charged by the lender affects the quality of the loan portfolio and the lender's profits. One of the consequences may be credit rationing (defined as the denial of credit at any price (Bhattacharya and Thakor [1993])). The profit-maximizing lender chooses not to raise the interest rate to the market clearing level because of the negative effects on the quality of the loan portfolio and profits (Stiglitz and Weiss [1981]). When more contracting variables are introduced, such as collateral, rationing may still arise in equilibrium. For example, some studies have explored the impact of wealth on credit rationing (Besanko and Thakor [1987], Stiglitz and Weiss [1992] and Cater [1986]).

Credit rationing is more serious for micro-entrepreneurs, especially those with low incomes, since the lenders often have very limited information on and a poor understanding of these entrepreneurs' businesses, and because these entrepreneurs have limited resources. Microcredit programs are aimed at bridging the financing gap of credit-constrained micro-entrepreneurs. However, micro-loans appear to be similar to commercial loans delivered to SMEs. For example, many microcredit programs extend loans to individual entrepreneurs. The interest rates charged on micro-loans are around prime rate plus two or three percentage points, which are close to

the interest rates on commercial loans to SMEs. The upper limit on the size of micro-loans is \$35,000, very close to the average size of commercial loans to SMEs. Micro-loans, however, usually have lower collateral requirements than commercial loans.

Given these characteristics, the following questions arise. What is the difference between commercial loans and micro-loans? What mechanisms are used to ensure that only the low-income micro-entrepreneurs obtain micro-loans?

A key distinguishing feature of microcredit programs is that the supply of credit services is packaged with the supply of non-financial services, e.g., mentoring and technical assistance. These non-financial services form an important part of microcredit programs. However, such services are not provided to the entrepreneurs who borrow commercial loans. The standard interpretation of mentoring and technical assistance is that they contribute to the survival and success of micro-entrepreneurs (Sievers and Vandenberg [2007]). However, although they provide benefits to micro-entrepreneurs, these activities increase the entrepreneurs' costs of obtaining a micro-loan. The entrepreneurs have to spend time and effort on participating in these activities. The consequences are loss of working hours and extra expenses (e.g., transportation). It is likely that there is a differential between the entrepreneurs – i.e., non-financial services make micro-loans more costly for entrepreneurs with sufficient resources (i.e., wealthier entrepreneurs) than those with insufficient resources (i.e., low-income entrepreneurs).¹ Therefore, only low-income micro-entrepreneurs find it optimal to choose micro-loans, and other entrepreneurs choose conventional loans. Thus, bundling the provision of credit with non-financial services results in a self-selection process which enables microcredit programs to target low-income micro-entrepreneurs.

In this chapter, a model is developed based on Stiglitz and Weiss [1992] to demonstrate that information asymmetry between entrepreneurs and lenders may lead to rationing on the low-income entrepreneurs who are collateral-constrained. This model has three key assumptions:

- The loans are always partially secured in the sense that the net value of collateral is less than the principal plus interest, and hence the lender is exposed to default risk.

¹Of course, the costs associated with non-financial services may be costly to some low-income entrepreneurs as well (for example, a single mom who has to look after her kids while running a business, or a micro-entrepreneur who has two part-time jobs), and thus discourage them from borrowing. However, to most low-income entrepreneurs, it is still attractive to borrow micro-loans.

- The lender can neither distinguish between individuals nor monitor individuals' behaviour.

- Wealthier entrepreneurs are less risk-averse than low-wealth entrepreneurs.

Given these assumptions, the role of non-financial services as a selection tool is examined. To do this, non-financial services are treated as an extra contract variable – one that is assumed to have no effect on the entrepreneur's entrepreneurial skills – and the focus is put on the impact of these services on the entrepreneur's costs of obtaining a loan. With the presence of a cost differential between the entrepreneurs, the self-selection of entrepreneurs will occur: only credit-constrained entrepreneurs choose micro-loans. Therefore, non-financial services can be used as a way of providing micro-credit only to credit-constrained entrepreneurs.

The outline of the chapter is as follows. Section 4.2 presents the basic model. Section 4.3 analyzes the equilibrium in the credit market as well as the extent of rationing. Section 4.4 examines the potential role of non-financial services in inducing self-selection of the entrepreneurs. Section 4.5 concludes the chapter.

4.2 The Basic Model

In this model, there are two types of agents in the market: lenders and entrepreneurs. Lenders are banks or other financial institutions. Entrepreneurs wish to make risky investments but lack the necessary capital, and thus turn to lenders for external finance. The timing of the game is as follows.

At time 0, lenders announce their loan contract sets. Entrepreneurs compare the announced loan contracts, choose the one with the most attractive terms, and make a loan application. Upon receipt of the application, lenders make loan decisions. If an application is approved, the loan is disbursed and the investment is undertaken; otherwise, the game ends.

At time 1, entrepreneurs obtain the returns from the investments. If the investments are successful, the loans are repaid according to the terms stipulated in the contracts; otherwise, the loans are defaulted. The game ends. In this game, there is no strategic default.

4.2.1 Entrepreneurs

Each entrepreneur has the opportunity to invest a fixed amount (normalized at unity) in one project at most. Let e be the entrepreneur's initial wealth. For simplicity, it is assumed that initial wealth cannot be used to invest in the project, and yields zero return: after one period, initial wealth is still e . Therefore, to make the investment, the entrepreneur has to borrow from a lender.

The entrepreneur can choose between two possible techniques – good and bad – to undertake the investment. If the project is successful, it yields a return of I_j , where the subscript $j = g$ or b represents the good or bad technique, respectively, and $I_g < I_b$. If the project is unsuccessful, it has a return of zero. The probability of success of the project is p_j . The project with the good technique is more likely to succeed – i.e., $p_g > p_b$. Furthermore, it is assumed that the expected return from the project with the good technique is higher than that from the project with the bad technique – i.e., $p_g I_g > p_b I_b$. This assumption implies that it is not efficient to finance a project with the bad technique.

A loan contract E consists of two elements: the repayment requirement R ($R = 1 + r$, where r is the interest rate on the loan) and the amount of collateral C . The probability of obtaining a loan is given by γ ($0 \leq \gamma \leq 1$), where γ indicates the fraction of the entrepreneurs who can obtain the loans at the specified contract.

At the end of time 1, given technique j , the entrepreneur's wealth is $Y_j^1 = e + I_j - R$ if the project is successful, or $Y_j^0 = e - C = Y^0$ if it is unsuccessful. It is assumed that all entrepreneurs have the same utility function U (U increases in wealth at a decreasing rate – that is $U'(Y) > 0$ and $U''(Y) < 0$). It is assumed there is decreasing absolute risk aversion – that is $dA/dY < 0$, where A is the absolute risk aversion ($A = -U''(Y)/U'(Y)$).² Thus, as will be shown later, the entrepreneur with more initial wealth is less risk-averse and tends to invest with

²This assumption has been made in Stiglitz and Weiss [1992] and Coco [1999], and has been proved to be critical to the rationing outcome in the credit market.

the bad technique, compared with the one with less initial wealth. At the end of period 1, the entrepreneur's expected utility from making a loan application under contact E is

$$EU_j(E, \gamma) = \begin{cases} \gamma[p_j U(e + I_j - R) + (1 - p_j)U(e - C)] + (1 - \gamma)U(e) & \text{if } C < R, \\ \gamma[p_j U(e + I_j - R) + (1 - p_j)U(e - R)] + (1 - \gamma)U(e) & \text{if } C \geq R. \end{cases}$$

If the loan is fully secured ($C \geq R$), the entrepreneur always pays off the loan. In this situation, the entrepreneur's utility decreases with R and is independent of C . As a result, the indifference curve is vertical in $R - C$ space.

However, a full collateral requirement ($C \geq R$) results in limited credit provision, especially to low wealth entrepreneurs. As a result, the focus is put on the situation where only partial collateral is required ($C < R$). When the loan is partially secured ($C < R$), the indifference curve in $R - C$ space is downward sloping,

$$-\frac{dC}{dR}\Big|_{\bar{U}} = \frac{p_j U'(e + I_j - R)}{(1 - p_j)U'(e - C)} > 0, \quad (4.1)$$

since the entrepreneur requires a reduction in the collateral requirement C to compensate for an increase in the repayment requirement R . The indifference curve is also concave in R and C as shown in panel *a* of Figure 4.1.³ Notice that γ does not affect the shape of the indifference curve.

In panel *a* of Figure 4.1, curves \bar{U}_g and \bar{U}_b are the indifference curves associated with the good technique and the bad technique, respectively, given γ . The two curves are drawn on the assumption that, with the given technique, the entrepreneur is indifferent between the contracts on curve \bar{U}_g and \bar{U}_b . Curve \bar{U}_g is steeper than curve \bar{U}_b at any point (R, C) . This is because, with the good technique, the entrepreneur is more likely to succeed and repay the loan, and thus is less likely to lose the collateral. Therefore, when he/she invests with the good technique, the

³The slope of the indifference curve decreases in R , since

$$\frac{d^2 C}{dR^2}\Big|_{\bar{U}} = -\frac{p_j}{1 - p_j} \frac{U'(e + I_j - R)}{U'(e - C)} \left[-\frac{U''(e + I_j - R)}{U'(e + I_j - R)} + \frac{U''(e - C)}{U'(e - C)} \frac{dC}{dR} \right] < 0.$$

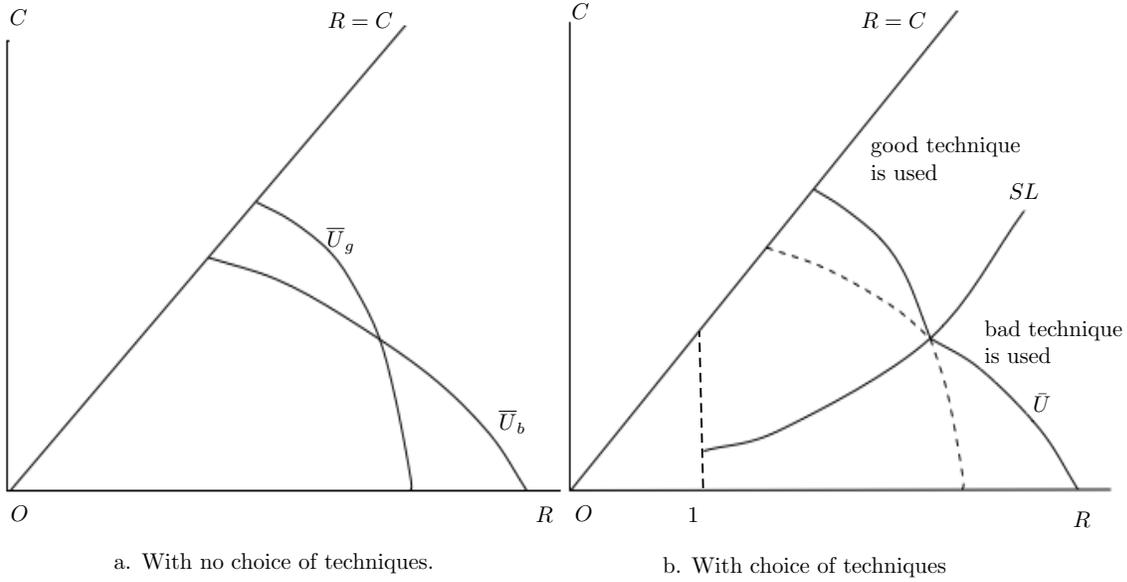


Figure 4.1: Entrepreneur's indifference curves and switch line.

entrepreneur is willing to accept a larger increase in the collateral requirement C in exchange for a given reduction in the repayment requirement R than when he/she uses the bad technique:

$$-\frac{dC}{dR}\Big|_{\bar{U}^g} = \frac{p_g U'(e + I_g - R)}{(1 - p_g) U'(e - C)} > \frac{p_b U'(e + I_b - R)}{(1 - p_b) U'(e - C)} = -\frac{dC}{dR}\Big|_{\bar{U}^b}. \quad (4.2)$$

It is assumed that the entrepreneur is rational, and that he/she chooses the contract and the technique that gives him/her the highest level of expected utility. The locus of the contracts at which the entrepreneur is indifferent between the two techniques is called the switch line and is graphed as an upward sloped curve SL in $R - C$ space in panel b of Figure 4.1. This switch line is upward sloping, since

$$\frac{dC}{dR}\Big|_{U_g=U_b} = \frac{p_b U'(e + I_b - R) - p_g U'(e + I_g - R)}{(p_b - p_g) U'(e - C)} > 0. \quad (4.3)$$

Assumption 4.1. When full collateral is required, i.e., $R = C$, the entrepreneur prefers the good technique; when zero collateral is required, i.e., $C = 0$, the entrepreneur prefers the bad technique since defaulting is costless.

This assumption guarantees that, for the same γ , the entrepreneur's indifference curves associated with different techniques (curves \bar{U}_g and \bar{U}_b) cross and cross only once in the area

where $R > C$ (see panel a in Figure 4.1). The switch line SL is thus an upward sloping curve in this area (see panel b in Figure 4.1), and it is truncated by line $R = 1$ since $R \geq 1$.

For R and C combinations that lie above the switch line SL , the entrepreneur chooses the good technique. Thus, a relatively low repayment requirement R and a relatively high collateral requirement C will give rise to the choice of the good technique. Below SL , R is high and C is low, and thus the bad technique is chosen. Therefore, by specifying R and C , the lender can indirectly control the entrepreneur's choice of techniques. Notice that γ does not affect the switch line.

The indifference curves are not concave if the entrepreneur can choose the technique. As shown in panel b in Figure 4.1, the indifference curve is depicted by curve \bar{U} – the upper envelop of the indifference curves associated with the good technique and the bad technique, respectively.

The following additional assumptions about the entrepreneur's behaviour are made:

- If the entrepreneur is indifferent between the two techniques, he/she chooses the good technique; and
- If the entrepreneur is indifferent between two contracts, he/she chooses the one that is designed for his/her type.

Assume that there are two types of entrepreneurs – wealthy entrepreneurs (r) (hereafter called rich entrepreneurs) and low wealth entrepreneurs (p) (hereafter called poor entrepreneurs). To simplify the illustration, the rich entrepreneur hereafter is referred to as a male and the poor entrepreneur is referred to as a female. The rich entrepreneur has more initial wealth than the poor entrepreneur – i.e., $e_r > e_p$. Let β_i denote the proportion of type i entrepreneurs in the market, where $i = r, p$ and $\sum_i \beta_i = 1$.

The assumption of decreasing absolute risk aversion implies that a difference in initial wealth results in a difference in the indifference curves: the poor entrepreneur's indifference curve at any point in $R - C$ space is flatter than that of the rich entrepreneur, given that the same technique is employed. This result occurs because the rich entrepreneur is less risk-averse. He thus requires a smaller reduction in the repayment requirement R to compensate for a certain increase in the collateral requirement C than does a poor entrepreneur:

$$\frac{\partial \frac{dC}{dR}}{\partial e} = -\frac{p_j}{1-p_j} \frac{U'(e+I_j-R)}{U'(e-C)} \left[\frac{U''(e+I_j-R)}{U'(e+I_j-R)} - \frac{U''(e-C)}{U'(e-C)} \right] < 0. \quad (4.4)$$

The assumption of decreasing absolute risk aversion also implies that initial wealth has an impact on the entrepreneur's choice of techniques. The bad technique is more attractive to a rich entrepreneur than it is to a poor individual given the same contract. This can be seen from the switch lines: the rich entrepreneur's switch line lies above the poor entrepreneur's switch line. This is because when the poor entrepreneur is indifferent between the two techniques, the rich entrepreneur must prefer the bad technique, and thus an increase in the collateral requirement is necessary to make him indifferent between the two techniques. A switch from the good to the bad technique can be considered as "a mean utility preserving change" and it would cause "a reduction in one's expected utility for a more risk averse individual" (Stiglitz and Weiss [1992], p. 170). The switch lines SL_r and SL_p are depicted in Figure 4.2. Because the rich entrepreneur's switch line (curve SL_r) is steeper than the poor entrepreneur's (SL_p), the two curves never cross.

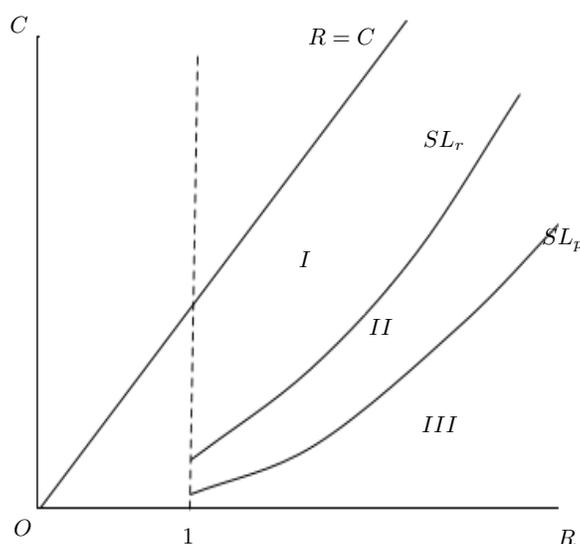


Figure 4.2: Entrepreneurs' switch lines SL_r and SL_p .

In Figure 4.2, three areas can be identified. Any contract that falls in area I results in all entrepreneurs investing with the good technique. In area II , the rich entrepreneur invests with the bad technique and the poor entrepreneur invests with the good technique. In area III , all entrepreneurs invest with the bad technique. Moreover, at any point in area I and III , the indifference curve of the rich entrepreneur is steeper than that of the poor entrepreneur. However, at any point in area II , the indifference curve of the rich entrepreneur may be either steeper or flatter than that of the poor entrepreneur.

Assumption 4.2. At any contract $E(R, C)$ in area II, $\Delta EU_{pg} < \Delta EU_{rb}$, where $\Delta EU_{pg} = p_g U(e_p + I_g - R) + (1 - p_g)U(e_p - C) - U(e_p)$ and $\Delta EU_{rb} = p_b U(e_r + I_b - R) + (1 - p_b)U(e_r - C) - U(e_r)$.

According to Assumption 4.2, at any contract in area II, the expected utility gain of the rich entrepreneur is greater than that of the poor entrepreneur. This assumption means that if a poor entrepreneur finds a contract between the switch line SL_r and SL_p desirable, so does a rich entrepreneur.

4.2.2 Lenders

The credit market is competitive. Homogenous lenders finance loans by funds from depositors. Each lender faces a perfectly elastic supply schedule of loan funds at an exogenous market-determined rate r_f . Lenders are assumed to be risk neutral, since they hold sufficiently large and diversified loan portfolios to achieve risk-pooling. The lender's expected return from a loan extended to an entrepreneur who uses technique j is:

$$\pi_j = p_j R + (1 - p_j)C - R_f \quad (4.5)$$

where $R_f = 1 + r_f$.

The iso-profit curve is a linear downward sloping curve in $R - C$ space:

$$-\frac{dC}{dR}\Big|_{\pi_j} = \frac{p_j}{1 - p_j} > 0 \quad (4.6)$$

The slope of the curve indicates the riskiness of the technique used. Specifically, when the entrepreneur uses the good technique, the lender's iso-profit curve is steeper than when the entrepreneur uses the bad technique, since

$$-\frac{dC}{dR}\Big|_{\pi_g} = \frac{p_g}{1 - p_g} > \frac{p_b}{1 - p_b} = -\frac{dC}{dR}\Big|_{\pi_b} \quad (4.7)$$

Moreover, as only partial collateral is required ($R < C$), the lender is exposed to default risk, since the entrepreneur repays the loan only if his/her investment is successful. Therefore, the lender's expected return is affected by the entrepreneur's choice of techniques. This is shown in Figure 4.3. The iso-profit curve when lending to a rich entrepreneur is depicted by segments AB and CD . Along segment AB , the rich entrepreneur uses the good technique, and along segment CD he uses the bad technique. The iso-profit curve is not continuous because of the

entrepreneur's change of technique when the R and C combination falls on the switch line. Segments AB' and $C'D$ are similarly defined for the poor entrepreneur.

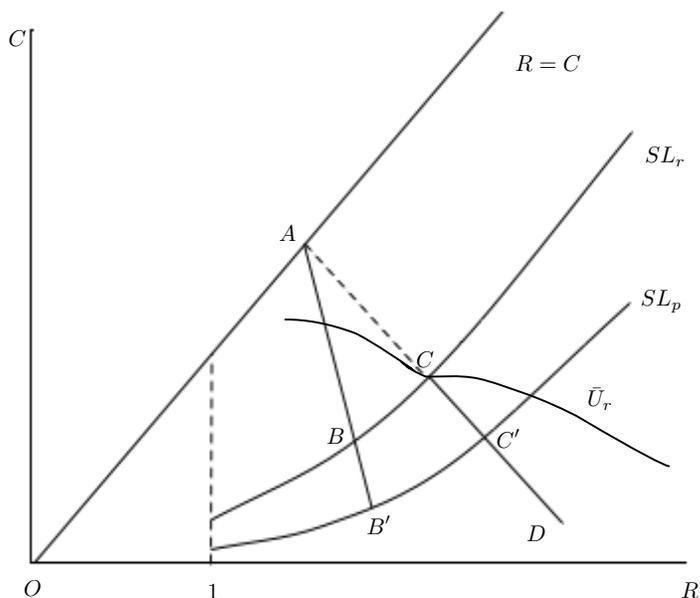


Figure 4.3: Lender's iso-profit curves

Notice that at any point the entrepreneur's indifference curve is flatter than the lender's iso-profit curve given the same technique j because the entrepreneur is risk-averse and the lender is risk neutral:⁴

$$-\frac{dC}{dR}|_{\bar{U}_{ij}} < -\frac{dC}{dR}|_{\bar{\pi}_j}$$

Thus, when the loan is partially secured ($R > C$), the entrepreneur's indifference curve and the lender's iso-profit curve cannot be tangent to each other. This is depicted in Figure 4.3, where the indifference curve of the rich entrepreneur (curve \bar{U}_r) is shown. The same argument applies to the poor entrepreneur.

Assumption 4.3. $EU_i(E(R_f, R_f), 1) > U(e_i)$ for $i = r, p$.

This assumption implies that all the contracts on the lender's zero profit curve above the type i entrepreneur's switch line – either rationing or non-rationing – are desired by the type i entrepreneur.

⁴The entrepreneur invests in only one investment, and thus cannot diversify his/her investment risks. The lender, however, manages a large loan portfolio, and thus is able to absorb losses on any one investment. As a result, the lender tends to be less risk-averse than the entrepreneur.

4.3 The Equilibrium

The credit market contains a large number of individually insignificant lenders and entrepreneurs, and is assumed to be competitive. Lenders are Bertrand competitors. It is assumed that they do not want to finance the projects with the bad technique.⁵ To simplify the analysis, it is assumed that the entrepreneur can only apply to one lender during the period.

The analysis concentrates exclusively on Nash equilibria. Because in the long-run, no lender can operate while earning negative profits, the focus is on Nash equilibria that produce non-negative profits. The analysis is first undertaken under the assumption of perfect information. This assumption is then relaxed.

4.3.1 Perfect Information

With perfect information, the lender can distinguish the entrepreneurs, and an optimal contract can be developed for each entrepreneur type. In equilibrium, the contracts must satisfy the participation constraints of the entrepreneurs:

$$EU_i(E_i, \gamma_i) \geq U(e_i). \quad (4.8)$$

The contracts must also encourage the use of the good technique:

$$EU_{ig}(E_i, \gamma_i) \geq EU_{ib}(E_i, \gamma_i). \quad (4.9)$$

In addition, because of the competition among lenders, each lender must make zero profit on the contract offered to each entrepreneur type (if positive profits could be earned, then lenders would have an incentive to modify their contract terms to earn more profits):

$$\pi_i = 0. \quad (4.10)$$

The equilibrium contract thus maximizes the entrepreneur's utility subject to constraints (4.8), (4.9) and (4.10). According to Assumption 4.3, all the contracts on the lender's zero profit curve and above the type i entrepreneur's switch line satisfy the type i entrepreneur's participation

⁵This assumption implies a slight deviation from risk-neutral behaviour. Profit-maximizing is the primary objective of the lender. However, the lender is also concerned about default risk to which the lender is exposed. Therefore, among the possible contracts that produce the same level of profits, the lender prefers the one that is associated with the lowest level of default risk. So the lender does not want to finance the investments with the bad technique.

constraint (4.8). Since the optimal contract must be on the lender's zero profit curve (constraint (4.10)), constraint (4.8) is redundant and can be dropped. As the entrepreneur is better off when moving down along the lender's zero profit curve given the same technique, constraint (4.9) must be binding in equilibrium. Therefore, the optimal contract for the type i entrepreneur must be at the point where the lender's zero profit curve above the type i entrepreneur's switch line crosses his/her switch line.

Proposition 4.1. *With a perfectly elastic supply of loanable funds, the Nash equilibrium under perfect information is given by:*

$$E_r^* = E_r^*(R_r^*, C_r^*), \quad E_p^* = E_p^*(R_p^*, C_p^*) \quad \text{and} \quad \gamma_r^* = \gamma_p^* = 1,$$

where E_r^* (E_p^*) is the contract under which the lender's zero-profit curve above the rich (poor) entrepreneur's switch line crosses the rich (poor) entrepreneur's switch line (see Figure 4.4).

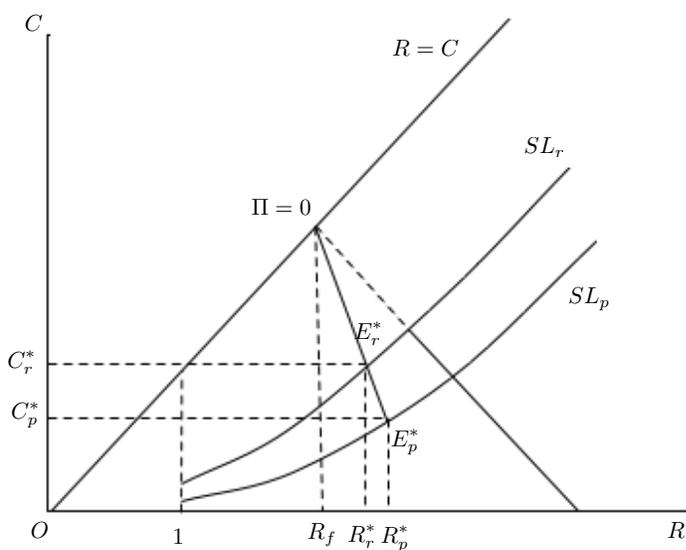


Figure 4.4: Equilibrium under perfect information

This result is straightforward. If contract E_r^* (E_p^*) is offered to the rich (poor) entrepreneur, no new contract can be offered profitably. No lender would deviate from these contracts unilaterally. Furthermore, no lender restricts credit since denying credit is unprofitable if sufficient collateral is available. However, rationing may arise if and only if an entrepreneur is unable to provide sufficient collateral – i.e., $e_i < C_i^*$.

Finally, according to Proposition 4.1, the rich entrepreneur posts more collateral than the poor entrepreneur – i.e., $C_r^* > C_p^*$. To compensate, the rich entrepreneur is charged a lower repayment requirement – i.e., $R_r^* < R_p^*$. This result occurs because the less risk-averse rich entrepreneur is the riskier borrower in the sense that he is more likely to choose the bad technique. As a result, a higher collateral requirement is necessary to deter him from using the bad technique.

4.3.2 Imperfect Information

Now consider the situation where the lender can neither observe nor have direct control over the entrepreneur's choice of techniques. They know that there are rich entrepreneurs and poor entrepreneurs. They also know the distribution of each entrepreneur type, but they do not know whether a specific entrepreneur is rich or poor, since a rich individual can always claim that he is poor and mimic a poor individual's behaviour if it is in his best interest to do so.

It is easy to verify that, without rationing, the full information equilibrium contracts are not incentive-compatible under imperfect information. A rich entrepreneur always finds the contract designed for the poor more attractive since $EU_r(E_p^*, 1) > EU_r(E_r^*, 1)$ and thus always chooses it. Therefore, a new equilibrium must be found.

The equilibrium contracts must be incentive-compatible so that no entrepreneur chooses the contract that is not designed for his/her type.⁶ It is easy to verify that, to be incentive-compatible, the rich entrepreneur should be indifferent between the contracts that are offered, and the poor entrepreneur should not choose the contract designed for the rich type:

$$EU_r(E_r, \gamma_r) = EU_r(E_p, \gamma_p) \text{ and } EU_p(E_p, \gamma_p) > EU_p(E_r, \gamma_r). \quad (4.11)$$

Meanwhile, the lender must not lose money:

$$\pi_i \geq 0 \text{ for } i = r, p. \quad (4.12)$$

Let \hat{E}_i ($i = r, p$) be the optimal contract designed for the type i entrepreneur under imperfect information.

⁶The lender uses the loan contracts to induce the entrepreneur to reveal his/her type truthfully while ensuring that the entrepreneur uses the good technique. Since the entrepreneur reveals his/her type to the lender, if the application is denied, even though he/she can apply to the lender for a loan under another contract (if there is any), he/she would not be able to obtain the loan.

Proposition 4.2. *With imperfect information and a perfectly elastic supply of loan funds, $\hat{E}_r = E_r^*$ and $\hat{\gamma}_r = 1$.*

In this model, the rich entrepreneur benefits from the presence of the poor entrepreneur due to information asymmetry. Since the credit market is competitive, it is impossible to design a contract that is more favourable than E_r^* for the rich type. Therefore, the contract designed for the rich entrepreneur \hat{E}_r must be identical to E_r^* .

Proposition 4.2 states that with an unlimited supply of loan funds, no lender would restrict credit delivered at contract \hat{E}_r (or E_r^*). The intuition is as follows. Restricting credit at contract \hat{E}_r makes all entrepreneurs worse off. Therefore, by reducing rationing at contract \hat{E}_r , new contract(s) can be added for more profits.

Two possible scenarios are depicted in Figure 4.5. Suppose at contract \hat{E}_r , the probability of obtaining a loan is $\gamma_0 < 1$. In panel *a*, a less attractive contract *A* is designed for the poor entrepreneur. The probability of obtaining a loan at this contract is γ_1 . To keep the contracts incentive-compatible, $\gamma_0 < \gamma_1$ is necessary. Curves $U_r(\gamma_0)$ and $U_r(\gamma_1)$ are the rich entrepreneur's indifference curves associated with γ_0 and γ_1 , respectively, and the expected utilities of the rich entrepreneur on the two curves are the same. Curve $U_p(\gamma_1)$ is similarly defined for the poor entrepreneur. Notice that the poor entrepreneur prefers contract *A* with γ_1 to contract \hat{E}_r with γ_0 although it is not shown in the figure. Suppose that a lender offers a new contract *B* with γ_1 . Contract *B* is the intersection of the switch line SL_r and the indifference curve $U_p(\gamma_1)$. Contract *B* with γ_1 is thus more attractive to both the rich and the poor entrepreneurs, compared with contract *A* with γ_1 and contract \hat{E}_r with γ_0 . Therefore, to deter the rich entrepreneur, this lender can increase γ_0 to restore the incentive compatibility constraint such that only the poor entrepreneur chooses contract *B* with γ_1 . By doing so, this lender can attract all entrepreneurs. Moreover, the profit from lending to the poor entrepreneur at contract *B* is higher than that from lending to her at contract *A* (recall that the lender's iso-profit curve is steeper than the entrepreneur's indifference curve). Therefore, the lender who offers the new contract and increases γ_0 accordingly can make more profits.

Now consider the second option. In panel *b*, contract *A'* is designed for the poor entrepreneur, at which the probability of obtaining a loan is γ'_1 . The incentive compatibility constraint requires $\gamma_0 > \gamma'_1$. In this situation, a new contract *B'* can be offered profitably. Contract *B'* is on the poor entrepreneur's indifference curve $U_p(\gamma'_1)$ (the dashed curve) and is as rationing as contract *A'*, so the poor entrepreneur is indifferent between them. The rich entrepreneur, however, strictly

prefers the new contract. However, the incentive compatibility constraint can be restored by increasing γ_0 such that the rich is indifferent between contracts \hat{E}_r and B' with γ'_1 , while the poor entrepreneur strictly prefers contract B' . Since the lender's zero profit curve is steeper than the entrepreneur's indifference curve given the same technique, the lender who offers contract B' with γ'_1 and reduces rationing at contract \hat{E}_r can make more profits. Therefore, in equilibrium, no lender rations credit at contract \hat{E}_r – i.e., $\hat{\gamma}_r = 1$.

Notice that the above argument is based on the assumption that the poor entrepreneur's indifference curve is steeper than the rich entrepreneur's in the region between the two switch lines. The argument also applies to the situation where the poor entrepreneur's indifference curve is flatter than the rich entrepreneur's in this region. To conclude, the lender has no incentive to ration credit under the contract designed for the rich entrepreneur.

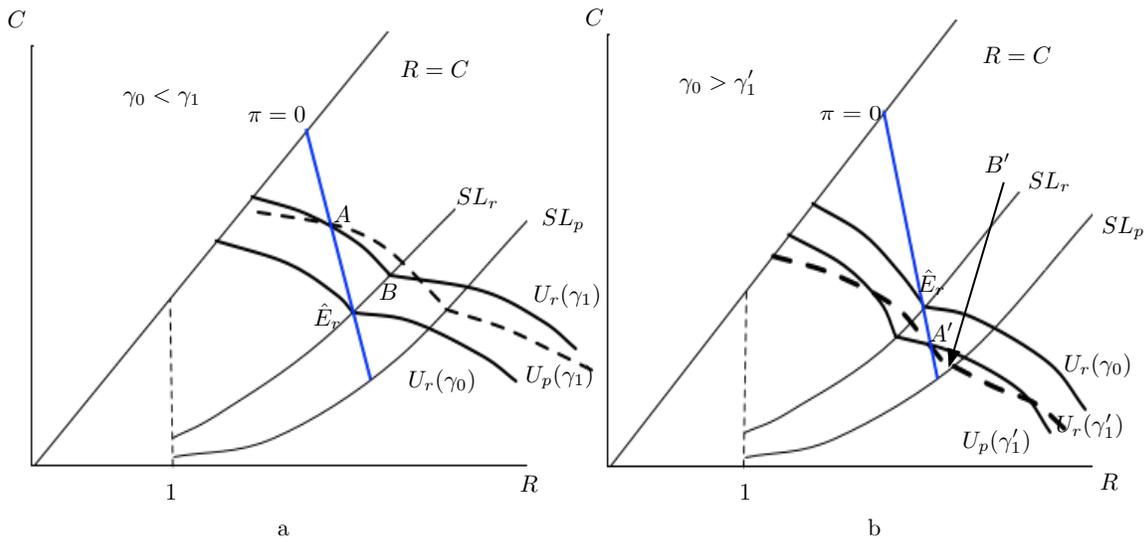


Figure 4.5: Rich entrepreneurs are not credit rationed.

Lemma 4.1. *In equilibrium, $\pi_i = 0$ must hold for $i = r, p$.*

Proof. Proposition 4.2 implies that $\pi_r = 0$ must hold, since contract \hat{E}_r is on the lender's zero profit curve.

According to the incentive compatibility constraint (4.11) and Proposition 4.2, the optimal contract that can be designed for the poor entrepreneur must lie in the shadowed area in Figure 4.6. According to Assumption 4.2, for any contract in this area,

$$\frac{d\gamma}{dR}\Big|_{\bar{U}_{pg}} = \frac{\gamma p_g U'(e_p + I_g - R)}{\Delta EU_{pg}} > \frac{\gamma p_b U'(e_r + I_b - R)}{\Delta EU_{rb}} = \frac{d\gamma}{dR}\Big|_{\bar{U}_{rb}} > 0 \quad (4.13)$$

must hold as long as the contract is desired by the poor entrepreneur (i.e., $\Delta EU_{pg} > 0$). It means that the marginal rate of substitution between R and γ of a poor entrepreneur who chooses the good technique is greater than that of a rich entrepreneur who uses the bad technique, while C is held constant.

Thus, in equilibrium the lender's profit from lending to the poor entrepreneur at the contract designed for her type must equal zero, because otherwise a new contract can be added to the market profitably. (Q. E. D.)

The intuition is as follows. At any contract in area II in panel a of Figure 4.6, the marginal rate of substitution between R and γ of the poor entrepreneur is greater than that of the rich entrepreneur when C is held constant. This is because at such a contract: (1) the poor entrepreneur chooses the good technique and the rich entrepreneur chooses the bad technique; and thus the former benefits more from a small reduction in R than does the latter; and (2) the poor entrepreneur suffers less as a result of a slight reduction in γ than does a rich entrepreneur (Assumption 4.2). As a result, when the collateral requirement is held constant, the poor entrepreneur is willing to accept a larger reduction in γ for a given reduction in R than the rich entrepreneur. In this situation, if $\pi_p > 0$, a new contract can be added profitably. Each lender then has the incentive to modify the contract designed for the poor type for more profits. Eventually, competition drives the profit down to zero. This is shown in Figure 4.6.

Consider a sequence of contracts $A(R_A, C_A)$, $B(R_B, C_A)$ and $C(R_C, C_A)$ (in panel a), the collateral requirements of which are fixed at C_A . These contracts are designed such that the poor entrepreneur strictly prefers contract $A(R_A, C_A)$ to \hat{E}_r , and the rich entrepreneur is indifferent between any one of these contracts and contract \hat{E}_r . Note that to make the rich entrepreneur indifferent, the respective probabilities of obtaining a loan must be ranked as follows: $\gamma_C < \gamma_B < \gamma_A < 1$ (see panel b). Suppose that initially the non-rationing contract \hat{E}_r and the rationing contract $A(R_A, C_A)$ with γ_A are offered. Given this situation, a lender has an incentive to add contract $B(R_B, C_B)$ with γ_B for more profits. As shown in panel b , curves $U_p(C_A)$ and $U_r(C_A)$, respectively, are the indifference curves of the poor entrepreneur and the rich entrepreneur, given

a collateral requirement C_A .⁷ Curve $U_p(C_A)$ is steeper than $U_r(C_A)$. The poor entrepreneur thus strictly prefers contract $B(R_B, C_A)$ with γ_B to contract $A(R_A, C_A)$ with γ_A . The lender who offers the new contract can get all the poor entrepreneurs who are the profitable borrowers, and thus make more profits. Therefore, all lenders modify their contracts designed for the poor entrepreneur for more profits until the rationing contract $C(R_C, C_A)$ with γ_C is offered, because beyond this contract, they would lose money. To conclude, each lender makes zero profit from each entrepreneur type.

Define σ_{ij} as the marginal rate of substitution between γ and C of a type i entrepreneur who uses technique j , when the lender's profit equals zero: $\sigma_{ij} = \frac{dC}{d\gamma} \Big|_{\bar{U}_i, \Pi=0}$ for $i = r, p$. The term σ_{ij} measures the increase in C necessary to make both the entrepreneur and the lender indifferent given a small increase in γ :

$$\sigma_{ij} = - \frac{\Delta EU_{ij}}{\gamma(1-p_g) \left[\frac{p_j}{p_g} U'(e_i + I_j - R(C)) - \frac{1-p_j}{1-p_g} U'(e_i - C) \right]} > 0, \quad (4.14)$$

if $\Delta EU_{ij} = p_j U(e_i + I_j - R(C)) + (1-p_j) U(e_i - C) - U(e_i) > 0$, where $R(C) = \frac{R_f - (1-p_g)C}{p_g}$. Notice that according to assumption 4.3, all the contracts along the lender's zero-profit curve associated with the good technique are desired by the entrepreneurs, i.e., $\Delta EU_{ij} > 0$ must always hold. It thus means that σ_{ij} must be positive.

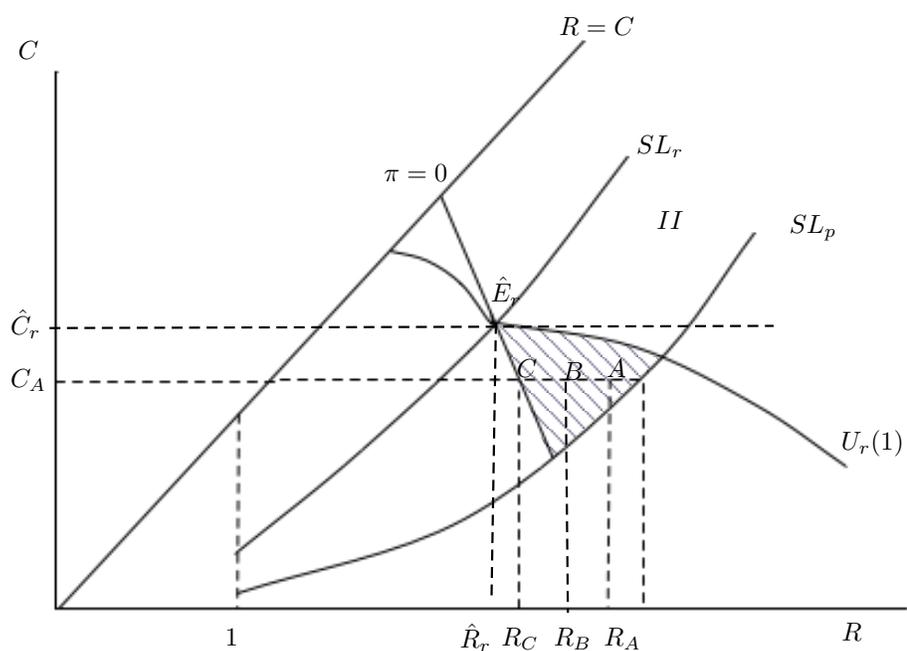
Now consider the equilibrium in the environment of imperfect information. Three possible situations may arise: (1) $\sigma_{rb} < \sigma_{pg}$ holds at any combination of C , $R(C)$ and γ ; (2) $\sigma_{rb} > \sigma_{pg}$ holds at any combination of C , $R(C)$ and γ ; and (3) σ_{rb} may be less than or greater than σ_{pg} , depending on the values of C , $R(C)$ and γ .

Case I: $\sigma_{rb} < \sigma_{pg}$ holds at any combination of C , $R(C)$ and γ .

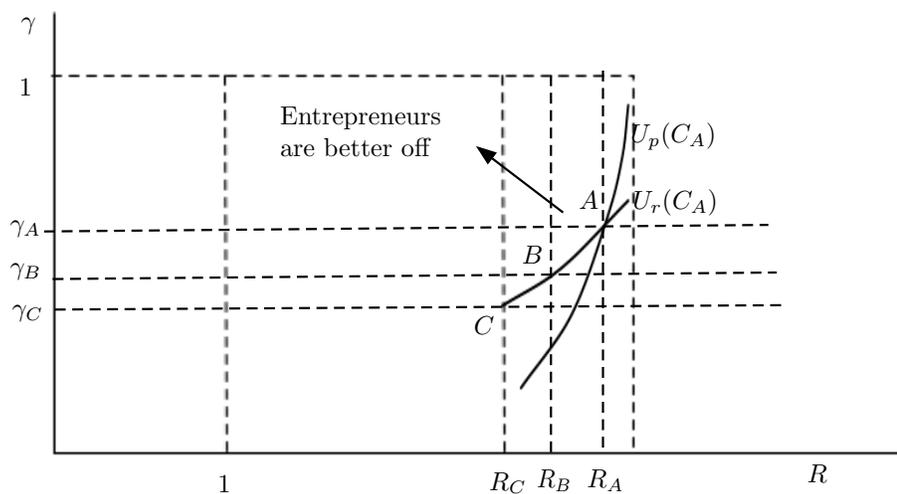
This situation may arise if the difference in wealth between entrepreneurs ($e_r - e_p$) is small and the difference between the techniques ($p_g - p_b$) is sufficiently large. In this situation, the indifference curve of the rich entrepreneur between the two switch lines is much flatter than that

⁷Indifference curves $U_r(C_A)$ and $U_p(C_A)$ are concave in R and γ , because

$$\begin{aligned} \frac{d^2\gamma}{dR^2} \Big|_{\bar{U}_{pg}} &= \frac{\Delta EU_{pg} \left[\frac{d\gamma}{dR} \Big|_{\bar{U}_{pg}} U'(e_p + I_g - R) - \gamma U''(e_p + I_g - R) \right] + p_g \gamma (U'(e_p + I_g - R))^2}{(\Delta EU_{pg})^2} > 0; \\ \frac{d^2\gamma}{dR^2} \Big|_{\bar{U}_{rb}} &= \frac{\Delta EU_{rb} \left[\frac{d\gamma}{dR} \Big|_{\bar{U}_{rb}} U'(e_r + I_b - R) - \gamma U''(e_r + I_b - R) \right] + p_b \gamma (U'(e_r + I_b - R))^2}{(\Delta EU_{rb})^2} > 0. \end{aligned}$$



a.



b.

Figure 4.6: Profit from lending to the poor equals zero.

of the poor entrepreneur. Given a downward movement along line $E_r^*E_p^*$ – i.e., the segment of the lender’s zero profit curve associated with the good technique that is located between the two switch lines – the rich entrepreneur is much better off than the poor entrepreneur. If this is the case, although the rich entrepreneur derives a higher level of disutility from a reduction in γ (recall that $\Delta EU_{rb} > \Delta EU_{pg}$), he requires a smaller downward movement along line $E_r^*E_p^*$ to compensate for a reduction in γ than does a poor entrepreneur. Thus $\sigma_{rb} < \sigma_{pg}$ always holds at any combination of C , $R(C)$ and γ .

Proposition 4.3. *In the environment where there is imperfect information, lenders have a perfectly elastic supply of loan funds, the rich entrepreneur has sufficient collateral (i.e., $e_r \geq C_r^*$), and $\sigma_{rb} < \sigma_{pg}$ always holds at any combination of C , $R(C)$ and γ :*

1. *if the poor entrepreneur has sufficient collateral (i.e., $e_p \geq C_r^*$), there exists a unique pooling equilibrium E_r^* where rationing does not occur;*
2. *if the poor entrepreneur has insufficient collateral (i.e., $C_p^* \leq e_p < C_r^*$), there exists a unique separating equilibrium with rationing. The contract designed for the poor entrepreneur is given by $\hat{E}_p = E_p^{**}$ and $\hat{\gamma}_p = \gamma_p^{**}$ (see Figure 4.7). Specifically,*

$$\hat{R}_p = \frac{R_f - (1 - p_g)e_p}{p_g}, \quad \hat{C}_p = e_p; \quad \text{and} \quad \hat{\gamma}_p = \frac{\Delta EU_r(E_r^*, 1)}{\Delta EU_r(E_p^{**}, 1)}$$

3. *if the poor entrepreneur has very limited collateral (i.e., $e_p < C_p^*$), there exists a separating equilibrium where only the rich entrepreneur borrows at contract $\hat{E}_r = E_r^*$ without being rationed, and the poor entrepreneur leaves the credit market.*

As indicated in Proposition 4.3, credit rationing may or may not arise in equilibrium, depending on the poor entrepreneur’s capacity to pledge collateral. First consider the situation where the poor entrepreneur has sufficient collateral, i.e., $e_p \geq C_r^*$. Separation is impossible because the poor entrepreneur has an incentive to increase collateral up to C_r^* . Consider contracts A and E_r^* on line $E_p^*E_r^*$ (i.e., curve $\pi_g = 0$) in Figure 4.7. The probability of obtaining a loan at contract A is γ_A so that the rich entrepreneur feels indifferent between these contracts (see panel b). Contract A with γ_A and contract E_r^* with $\gamma = 1$ are on curve $U_r|_{\pi=0}$. This curve depicts the combinations of loan contracts and the probabilities of obtaining a loan at which the rich entrepreneur’s utility and the lender’s profit remain constant. Curve $U_p|_{\pi=0}$ is the poor entrepreneur’s indifference curve, while the lender’s profit equals zero. The entrepreneurs are better off with a higher γ and

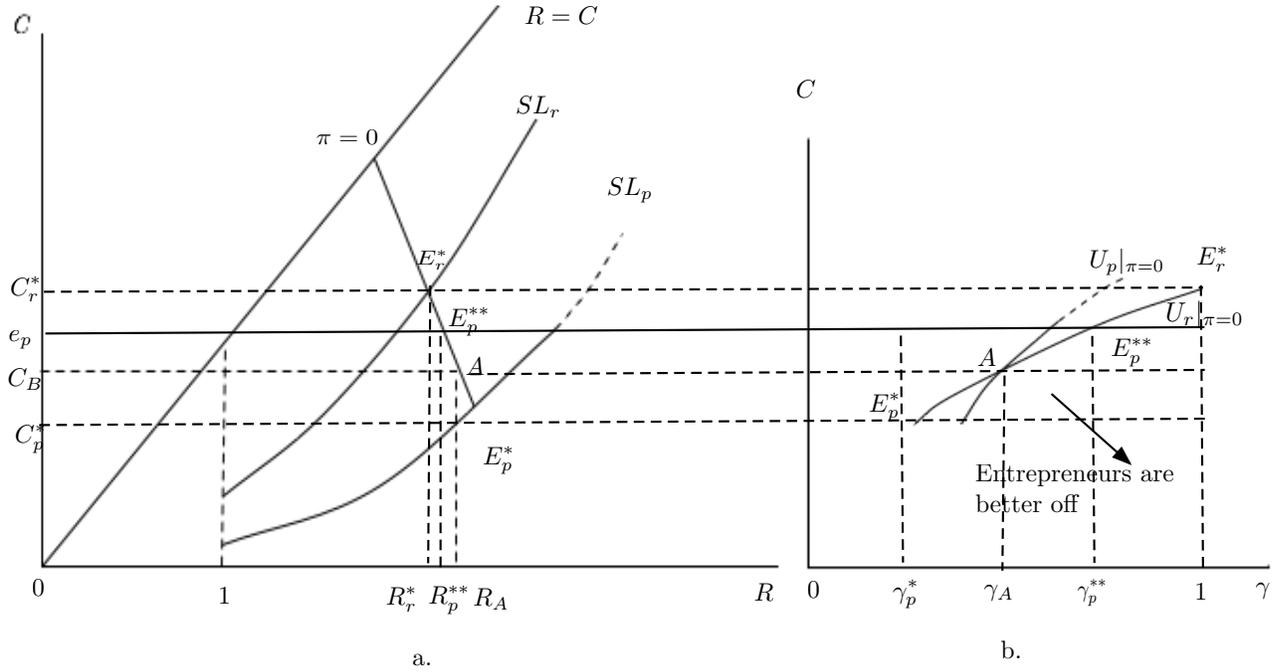


Figure 4.7: Derivation of equilibrium under imperfect information: $\sigma_{rb} < \sigma_{pg}$

a lower C . Curves $U_r|\pi=0$ and $U_p|\pi=0$ are upward sloping, and $U_r|\pi=0$ is flatter than $U_p|\pi=0$ since $0 < \sigma_{rb} < \sigma_{pg}$.⁸

Suppose that initially the non-rationing contract E_r^* is offered. Now suppose that, in addition, a lender adds contract A with γ_A . The rich entrepreneur is indifferent between contract A with γ_A and the non-rationing contract E_r^* , and thus chooses the non-rationing contract E_r^* by assumption. The poor entrepreneur, however, strictly prefers the non-rationing contract E_r^* to the rationing contract A (see panel b). The lender who offers the new contract thus attracts no entrepreneurs. Therefore, in equilibrium, no lender has the incentive to deviate from E_r^* unilaterally. The equilibrium is a pooling one without rationing: all entrepreneurs obtain the loans at the same contract E_r^* .

Now consider the situation where the poor entrepreneur has insufficient collateral, i.e., $C_p^* \leq e_p < C_r^*$. As shown in Figure 4.7, curves SL_p and $U_p|\pi=0$ are truncated by line $C = e_p$. Due to the

⁸Curves $U_r|\pi=0$ and $U_p|\pi=0$ are concave in γ and C because

$$-(1-p_g) \frac{d^2 C}{d\gamma^2} |_{U_{ij}, \Pi=0} = \left[\frac{1}{\gamma A} \frac{\partial \Delta E U_{ij}}{\partial C} + \frac{1}{\gamma} + \frac{1}{A} \frac{\partial A}{\partial C} \frac{dC}{d\gamma} \right] \frac{dC}{dR} > 0$$

for $i = r$ and $j = b$; and $i = p$ and $j = g$, where $A = \frac{p_j}{p_g} U'(e_i + I_j - R(C)) - \frac{1-p_j}{1-p_g} U'(e_i - C)$. Thus, the entrepreneurs' indifference curves on the zero profit hyperplane are concave in C and γ .

collateral constraint, a pooling equilibrium is impossible. Since $\sigma_{rb} < \sigma_{pg}$, the poor entrepreneur would pledge all her wealth as collateral in exchange for a higher probability of obtaining a loan. Consider the non-rationing contract E_r^* and contract E_p^{**} – the intersection of collateral constraint line $C = e_p$ and line $E_p^*E_r^*$ (see panel *a*). The probability of obtaining a loan at E_p^{**} equals γ_p^{**} so that the rich entrepreneur is indifferent between two contracts and chooses the non-rationing contract E_r^* by assumption. The poor entrepreneur strictly prefers contract E_r^* but cannot afford it, and thus chooses the rationing contract E_p^{**} . When these two contracts are offered, no contract can be added to the market for more profits. The equilibrium is thus a separating one with rationing of the poor entrepreneur.

Finally, if $e_p < C_p^*$, it is impossible to design a contract for the poor entrepreneur that allows the lender to break even. As a result, a single contract E_r^* is offered. Only the rich entrepreneur obtains the loan, and the poor entrepreneur leaves the market.

Part 1 of Proposition 4.3 states that with imperfect information, even though the lender can offer multiple loan contracts, a pair of incentive-compatible contracts does not exist and the equilibrium is a pooling one, provided that the entrepreneurs can provide sufficient collateral.⁹ This is because, in this case, the willingness to pledge more collateral in no way signals an investment with the good technique (recall the assumption that the lender does not want to finance the investment with the bad technique) or a less risky (more risk-averse) loan applicant. Coco [1999] also demonstrates that it is impossible to use collateral as a selection tool in a similar setting where the entrepreneur's choice of the investments is determined by her attitude toward risk.

Pooling of the two types, however, implies the possibility of a rationing equilibrium, if the poor entrepreneur is collateral-constrained (i.e., $e_p < C_r^*$) (parts 2 and 3 of Proposition 4.3). With the collateral constraint on the poor, the equilibrium cannot be a pooling one, because otherwise the lender can profitably add a new contract. Hence, the equilibrium must be the one with multiple contracts. The contract designed for the poor has a collateral requirement of e_p .

⁹Taking a different approach, Stiglitz and Weiss [1992] derive the same results in their appendix. They consider the situation where the entrepreneur strategically selects the loan contracts. The entrepreneur understands that the lender can make an inference about her characteristics from her choice of loan contract. Among the loan contracts offered, there is one contract which is designed for the entrepreneurs with the least desirable characteristics, and the lender restricts the loans granted under this contract. Recognizing this, the individual entrepreneur does not select this contract, even though it is more favourable. By the same logic, the entrepreneur does not make a loan application on the contract from which the second least desirable characteristics can be inferred by the lender, and so on. In equilibrium, the entrepreneurs end up borrowing at the same contract, even though the lender offers multiple contracts.

However, the contract designed for the poor is attractive to the rich entrepreneur. If the rich entrepreneur chooses it, he would invest with the bad technique, since $e_p < C_r^*$ – the minimum collateral requirement that enables the lender to at least cover the costs and to solve the incentive problem of the rich entrepreneur. As a result, the lender’s profit would be negatively affected. Therefore, the lender restricts the credit granted under the contract designed for the poor to deter the rich from choosing it. Perfect separation with rationing arises in equilibrium: the rich entrepreneur obtains credit at the non-rationing contract, and the poor entrepreneur applies for a loan at the rationing contract, but a proportion of $1 - \hat{\gamma}_p$ (or $1 - \gamma_p^{**}$) the poor entrepreneur cannot obtain credit. Moreover, if $e_p < C_p^*$, the poor entrepreneur is completely rationed.

Corollary 4.1. *With imperfect information, if $\sigma_{rb} < \sigma_{pg}$, the contract designed for the poor entrepreneur involves more collateral than contract E_p^* , i.e., $\hat{C}_p = C_p^{**} \geq C_p^*$.*

This can be seen in Figure 4.7: contracts E_r^* and E_p^{**} require more collateral than contract E_p^* . This result occurs because, compared with the rich entrepreneur, the poor entrepreneur who invests with the good technique is more concerned about the probability of receiving the loan relative to the collateral.

Case II: $\sigma_{rb} > \sigma_{pg}$ holds at any combination of $C, R(C)$ and γ .

This situation may arise if the wealth difference $e_r - e_p$ is sufficiently large and the technique difference $p_g - p_b$ is small. Under this situation, the rich entrepreneur’s indifference curve in $R - C$ space is steeper than the poor entrepreneur’s at any point. Then given a small downward movement along line $E_r^*E_p^*$, the rich entrepreneur benefits less than the poor entrepreneur. Meanwhile, given a reduction in γ , the rich entrepreneur derives a higher level of disutility (recall that $\Delta EU_{rb} > \Delta EU_{pg}$). Thus, the rich entrepreneur accepts a larger upward movement along line $E_r^*E_p^*$ in exchange for a reduction in γ than does a poor entrepreneur. As a result, the condition $\sigma_{rb} > \sigma_{pg}$ always holds.

Proposition 4.4. *With imperfect information, if $\sigma_{rb} > \sigma_{pg}$ holds at any combination of $C, R(C)$ and γ , there exists a unique separating equilibrium with rationing of the poor entrepreneur:*

$$\begin{aligned} \hat{E}_r &= E_r^* \quad \text{and} \quad \hat{\gamma}_r = 1; \\ \hat{E}_p &= E_p^* \quad \text{and} \quad \hat{\gamma}_p = \gamma_p^* = \frac{\Delta EU_r(E_r^*, 1)}{\Delta EU_r(E_p^*, 1)}. \end{aligned}$$

The condition $\sigma_{rb} > \sigma_{pg}$ implies that for a small increase in γ , a rich entrepreneur is willing to pledge more collateral than a poor entrepreneur, given that the lender's profit remains zero. This is illustrated in Figure 4.8.

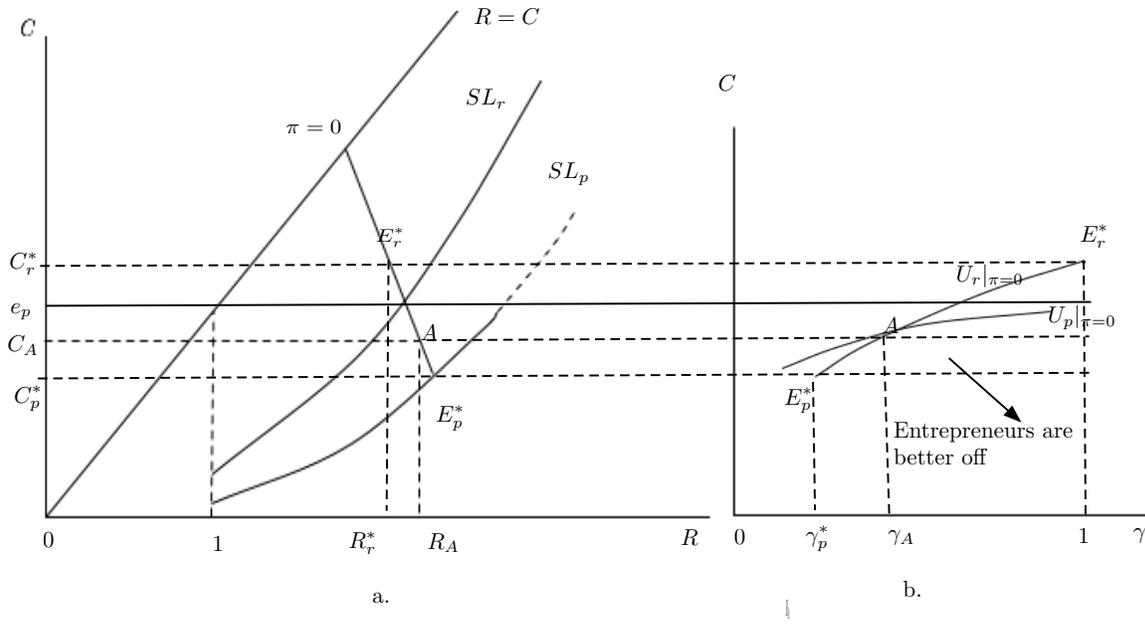


Figure 4.8: Derivation of equilibrium under imperfect information, $\sigma_{rb} > \sigma_{pg}$.

Consider contracts E_p^* and A . The respective probabilities of obtaining a loan are set at γ_p^* and γ_A so that the rich entrepreneur is indifferent between any one of these two contracts and the non-rationing contract E_r^* . This is shown in panel b. Contract A with γ_A and contract E_p^* with γ_p^* are on curve $U_r|_{\pi=0}$. Note that curve $U_r|_{\pi=0}$ is steeper than $U_p|_{\pi=0}$ since $\sigma_{rb} > \sigma_{pg}$. Suppose that initially the non-rationing contract E_r^* and the rationing contract E_p^* with γ_p^* are offered. The rich entrepreneur is indifferent between them and thus chooses the non-rationing contract E_r^* by assumption; and the poor entrepreneur strictly prefers the rationing contract E_p^* . In this situation, no contract can be added profitably. For example, suppose that contract A with γ_A is offered. This new contract is unattractive to both the rich and the poor entrepreneurs. Thus, the lender who offers the new contract cannot increase profits. The result is that no lender unilaterally deviates from the non-rationing contract E_r^* and the rationing contract E_p^* . In equilibrium, perfect separation is attainable, with rationing of the poor entrepreneur.

When $\sigma_{rb} > \sigma_{pg}$, the contract designed for the poor entrepreneur is identical to the one designed for her type under perfect information. This result arises because the poor entrepreneur cares more about the loan terms than the probability of obtaining a loan. Therefore, separation

is possible. A rationing contract with more favourable terms is more attractive to the poor entrepreneur, while the rich entrepreneur is indifferent between the two contracts and thus chooses the one that is designed for his type by assumption. Note that in this situation, rationing occurs even if the poor entrepreneur has sufficient collateral – i.e., $e_p \geq C_r^*$.

Case III: σ_{rb} may be less than or greater than σ_{pg} , depending on the values of C , $R(C)$ and γ

Case III implies that there exists a combination of C , $R(C)$ and γ at which $\sigma_{rb} = \sigma_{pg}$ holds. From the above discussion, an immediate result is given as below.

Proposition 4.5. *With imperfect information, if σ_{rb} may be less than or greater than σ_{pg} , depending on the values of C , $R(C)$ and γ , the equilibrium may be either a pooling one or a separating one when there is sufficient collateral. The optimal contract designed for the poor entrepreneur is either the non-rationing contract E_r^* , or the rationing contract E_p^* with γ_p^* , or the rationing contract E_p^{***} with γ_p^{***} , depending on which contract gives the poor entrepreneur the highest level of utility. E_p^{***} and γ_p^{***} solve*

$$\sigma_{rb} = \sigma_{pg}; EU_{rb}(E, \gamma) = EU_{rg}(E_r^*, 1); \pi_g(E) = 0.$$

If however, there is insufficient collateral, i.e., $e_p < C_r^ = \hat{C}_r$, the equilibrium is a separating one with rationing of the poor entrepreneur. The optimal contract designed for the poor is either E_p^* with γ_p^* , or E_p^{**} with γ_p^{**} , or E_p^{***} with γ_p^{***} , depending on which contract gives the poor the highest level of utility.*

Proposition 4.5 states that in Case III the equilibrium can be either a non-rationing pooling one or a separating one with rationing of the poor entrepreneur. Moreover, the optimal contract designed for the poor entrepreneur may be either an interior solution (i.e., E_p^{***} with γ_p^{***}) or a corner solution (i.e., either the non-rationing contract E_r^* or the rationing contract E_p^* with γ_p^*), depending on the curvature of the indifference curves in $\gamma - C$ space. This proposition also states that rationing always arises when there is insufficient collateral.

Clearly, this situation is an interim between Case I and Case II. As the key results remain unchanged, the discussion hereafter focuses on Case I and Case II.

Now consider the impact of information asymmetry on the welfare.

Proposition 4.6. *Imperfect information has no impact on the rich entrepreneur, but imposes a negative impact on the poor entrepreneur.*

This result is immediate. The rich entrepreneur benefits from the presence of the poor entrepreneur when information is imperfect. In the first case – i.e., $\sigma_{rb} < \sigma_{pg}$ always holds at any combination of C , $R(C)$ and γ – with sufficient wealth ($e_p \geq C_r^*$), the poor entrepreneur has to borrow at contract E_r^* , rather than at contract E_p^* . She has to post more collateral than what is necessary to enable the lender to deal with the problem of moral hazard without worrying about losing profits – i.e., C_p^* . If, however, she has insufficient wealth – i.e., $C_p^* \leq e_p < C_r^*$ – the poor entrepreneur has to borrow at a rationing contract E_p^{**} and thus derives a lower level of utility. While the welfare of the lender and the rich entrepreneur remain unaffected, the welfare of the poor entrepreneur are negatively affected by information asymmetry.

Similarly, in the second case – i.e., $\sigma_{rb} > \sigma_{pg}$ always holds at any combination of C , $R(C)$ and γ – although the poor entrepreneur is able to borrow at contract E_p^* , she faces a positive probability of being denied credit. She is thus worse off as a result of information asymmetry.

Corollary 4.2. *The use of collateral is positively correlated with risk.*

The acceptance of collateral in a loan contract cannot signal an entrepreneur's willingness to take on risk. The rich entrepreneur, who is less risk-averse and thus riskier since he is more likely to employ the bad technique, chooses the contract with a higher collateral requirement; and the poor entrepreneur, who is more risk-averse and thus safer, chooses the contract with a lower collateral requirement. This result is in contrast with most theoretic models that predict a negative relationship between wealth and the willingness to post collateral (for example, Bester [1985]). However, the positive correlation derived in this study is consistent with conventional wisdom and some important empirical studies (e.g., Berger and Udell [1990]; Leeth and Scott [1989]; Chan and Kanatas [1985]).

If the poor entrepreneur has sufficient wealth (i.e., $e_p \geq C_r^*$), credit rationing may or may not arise in equilibrium. If the poor entrepreneur cares about the collateral more than her access to credit, compared with the rich entrepreneur, credit rationing may arise. If instead, the poor entrepreneur cares about her access to credit more than the collateral, compared with the rich entrepreneur, rationing would not occur in equilibrium.

Despite this, the analysis indicates that information asymmetry negatively affects the poor entrepreneur's access to credit and welfare. Under imperfect information, the lender has at least three objectives to accomplish: (1) to deter the entrepreneurs from choosing the bad technique;

(2) to induce self-selection; and (3) to be competitive and make non-negative profits. The lender needs more instruments – in addition to R and C – to achieve these objectives. Rationing is such an instrument. But this instrument is useful if either another imperfection is present – some entrepreneurs are collateral-constrained (i.e., $C_p^* \leq e_p < \hat{C}_r$) or the poor entrepreneur is more concerned about collateral than being rationed relative to the rich entrepreneur (i.e., Case II). In the former situation, the degree of rationing is negatively affected by e_p ; while in the latter situation, rationing always occurs, and the degree of rationing is independent of e_p provided that $e_p \geq C_p^*$.

4.4 Non-Financial Services as a Selection Tool

In microcredit lending, the supply of credit is often linked to the supply of non-financial services (e.g., mentoring and technical assistance). The purpose of this section is to analyze the role of non-financial services as a selection tool in facilitating microcredit programs to reach the targeted individuals.¹⁰

Define a contract with a component of non-financial services as a mentoring loan contract. If an entrepreneur borrows under a mentoring loan contract, he/she has to use the non-financial services designated by the lender.

Although the entrepreneurs who are qualified for commercial loans could benefit from mentoring activities to some extent, they have more resources and supports, and thus tend to consider that a micro-loan with a mentoring component is not worthwhile. As will be shown, the mentoring requirement plays a role in inducing self-selection: only the low-income micro-entrepreneurs choose micro-loans.

In the model that is developed below, the focus of the analysis is on the impact of the mentoring requirement on the entrepreneurs' costs of obtaining a loan. For simplicity, it is assumed that the poor entrepreneur has insufficient collateral – i.e., $C_p^* \leq e_p < C_r^*$ – since rationing arises in equilibrium in this situation in each case.

4.4.1 Impact of Mentoring Requirement

Non-financial services produce benefits to entrepreneurs. The benefits include the improvement in knowledge and skill necessary to undertake the investments, problem-solving capabilities and self-confidence. Being in a less advantaged situation, the poor entrepreneur tends to benefit more from non-financial services than does the rich entrepreneur.

¹⁰Hereafter, the terms of non-financial services and mentoring and technical assistance are used interchangeably.

Non-financial services impose extra costs on entrepreneurs as well. The costs mainly take two forms: (1) the loss of working time as a result of using the lender's mentoring services – e.g., the time spent on producing the information required by the lender; and (2) the psychological cost of information disclosure if the entrepreneur is reluctant to reveal information. The rich entrepreneur is assumed to have a higher value for time (or opportunity cost) and a lower willingness to disclose information, and thus a higher cost of obtaining a mentoring loan.

Given these benefits and costs, the net benefit captured by a poor entrepreneur is greater than the net benefit captured by a rich entrepreneur. Assume that the net benefit is negative, or the mentoring requirement imposes a net cost of B_i ($B_i \geq 0$) on the type i entrepreneur. Let b_i denote the type i entrepreneur's marginal cost of obtaining a mentoring loan. It is assumed that $b_r > b_p$. Let m be the intensiveness of the mentoring requirement. The net cost B_i is defined as a function of b_i and m : $B_i = b_i m$. As the lender's mentoring activities become more intensive, the mentoring loan contract becomes more costly to the entrepreneur. It is assumed that $e_r - b_r m > e_p - b_p m$ for all possible m . Without loss of generality, it is assumed that $b_p = 0$. The entrepreneur's expected utility from borrowing a loan is given as¹¹

$$EU_{ij}(E, m) = \begin{cases} p_j U(e_r + I_j - b_r m - R) + (1 - p_j) U(e_r - b_r m - C) & \text{if } i = r, \\ p_j U(e_p + I_j - R) + (1 - p_j) U(e_p - C) & \text{if } i = p. \end{cases}$$

The impacts of the mentoring requirement on the entrepreneurs are illustrated in Figure 4.9. Curves $U_r(0)$ and $U_r(m)$ are the indifference curves of the rich entrepreneur associated with mentoring requirements 0 and m , respectively. The rich entrepreneur is indifferent between the commercial loan contracts on $U_r(0)$ and the mentoring loan contracts on $U_r(m)$ – i.e., the utility associated with $U_r(0)$ equals the utility associated with $U_r(m)$. The cost B_r can be considered as a reduction in wealth. As a result, curve $U_r(m)$ lies everywhere below curve $U_r(0)$ and it shifts inward as m increases. Clearly, the rich entrepreneur requires more favourable loan terms to compensate for being forced to use the mentoring services.

The mentoring requirement also forces the switch line of the rich entrepreneur to shift down to $SL_r(m)$. The greater m is, the greater is the shift. The poor entrepreneur, however, is not affected by the mentoring requirement since $B_p = b_p m = 0$. Thus, her indifference curves (not shown

¹¹ An alternative treatment is to assume that the mentoring requirement produces positive benefits to entrepreneurs. Since the poor entrepreneur benefits more than the rich entrepreneur, one can assume that the rich entrepreneur is not affected by the mentoring requirement, while the poor entrepreneur is positively affected. Such treatment does not lead to dramatic changes in the key results.

in the figure) and switch line remain unaffected. Finally, the switch line of the rich entrepreneur lies everywhere above that of the poor entrepreneur under the mentoring loan contracts, since it is assumed that $e_r - b_r m > e_p$ for all possible m .

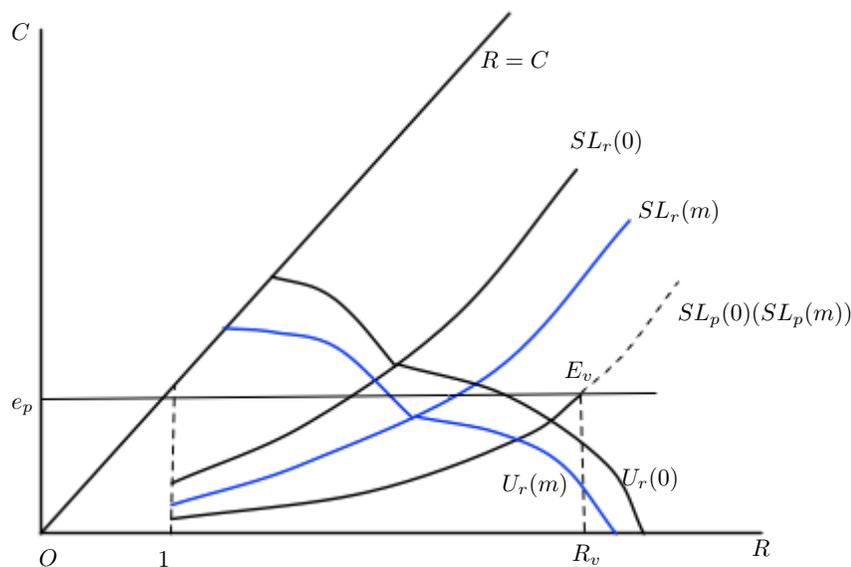


Figure 4.9: Impact of mentoring on indifference curves and switch lines.

Since the mentoring requirement affects the rich and the poor entrepreneurs differently in terms of increasing the costs of obtaining a loan, it suggests that the mentoring requirement, along with the repayment requirement R and the collateral requirement C , can be used as a selection tool to reduce the impact of information asymmetry on the poor entrepreneur.

Mentoring is costly to the lender as the lender has to assign staff and other resources to conduct such activities. The profit function is given by:

$$\pi_j = p_j R + (1 - p_j)C - R_f - cm. \quad (4.15)$$

where c is the lender's marginal mentoring cost.

Assumption 4.4. $p_g R_v + (1 - p_g)e_p - R_f - cm_v \geq 0$, where contract $E_v(R_v, e_p)$ (see Figure 4.9) and mentoring requirement m_v solve:

$$EU_{pg}(E_v, 0) = EU_{pb}(E_v, 0) \text{ and } EU_r(E_v, m_v) = EU_r(E_r^*, 0).$$

This assumption means that the lender can make non-negative profits at contract E_v at which the poor entrepreneur pledges all her wealth as collateral and feels indifferent between the two

techniques. The mentoring requirement m_v is what is necessary to make the rich entrepreneur indifferent between the commercial loan contract E_r^* and the mentoring loan contract E_v .

The effectiveness of mentoring in inducing separation and reducing credit rationing is affected by b_r , c and e_p . As will be shown later, Assumption 4.4 excludes the extreme case where b_r is low, c is high and e_p is very limited such that it is impossible to use mentoring requirement to deal with information imperfection.

With this background, now consider the equilibrium. With perfect information, no lender has the incentive to offer mentoring loan contracts. The equilibrium contracts are thus still E_r^* and E_p^* for the rich entrepreneur and the poor entrepreneur, respectively. With imperfect information, the lender can design a pair of incentive-compatible contracts to encourage entrepreneurs to separate according to their types:

$$EU_r(E_r, m_r) = EU_r(E_p, m_p) \text{ and } EU_p(E_p, m_p) > EU_p(E_r, m_r). \quad (4.16)$$

The equilibrium contracts maximize the expected utility of entrepreneurs, subject to the incentive compatibility constraint (4.16). Meanwhile, these contracts must produce non-negative profits for the lender:

$$\pi_{ij} = p_j R_i + (1 - p_j) C_i - R_f - c m_i \geq 0 \text{ for } i = r, p \text{ and } j = g, b. \quad (4.17)$$

Note that the profit from lending to the rich entrepreneur must just cover the cost, because otherwise a new contract can be added profitably. The equilibrium contracts also encourage the use of the good technique

$$EU_{ig}(E_i, m_i) \geq EU_{ib}(E_i, m_i) \text{ for } i = r, p, \quad (4.18)$$

the contracts must be desired by the entrepreneurs

$$EU_i(E_i, m_i) \geq U(e_i) \text{ for } i = r, p, \quad (4.19)$$

and the poor entrepreneur can afford the contract designed for her type

$$C_p \leq e_p. \quad (4.20)$$

A check over the variables is used to denote the equilibrium.

Lemma 4.2. *In equilibrium, $\tilde{m}_r = 0$.*

Lemma 4.2 states that the contract designed for the rich entrepreneur must be a commercial loan contract. This is straightforward. Because the poor entrepreneur is collateral-constrained, the incentive compatibility constraint (4.16) implies that $m_r \leq m_p$ in equilibrium. Suppose instead $m_r > m_p$, then a new contract can be added to the market profitably. This contract is the same as the one that is designed for the rich type but has a lower mentoring requirement. Thus, the new contract is more attractive to the rich entrepreneur (recall that the poor entrepreneur is not affected by the mentoring requirement). It is clear that the lender who offers this new contract can make more profits from the rich entrepreneur because: (1) the profit from lending to each rich entrepreneur is increased due to the reduction in the mentoring requirement; and (2) the new contract attracts all rich entrepreneurs. Therefore, each lender has the incentive to reduce m_r for more profits. Thus $m_r > m_p$ is impossible in equilibrium.

Furthermore, if $0 < m_r \leq m_p$, a new contract can be added to the market profitably. This is shown in Figure 4.10. Curve $U_r(m_k)$ ($k = A, B$ and C) is the rich entrepreneur's indifference curve associated with mentoring requirement m_k . The rich entrepreneur is indifferent among the contracts on the three curves. Notice that to keep the rich entrepreneur indifferent, the following ranking of mentoring requirement is necessary: $m_A > m_B > m_C$. The dashed curve U_p is the poor entrepreneur's indifference curve. Line $\pi(m_k)$ is the lender's zero profit curve associated with mentoring requirement m_k . Contract A with a mentoring requirement of m_A is designed for the poor entrepreneur, and contract B (on line $\pi(m_B)$) with a mentoring requirement of m_B is designed for the rich entrepreneur. Suppose that initially contract A with m_A and contract B with m_B , are offered. The rich entrepreneur is indifferent between the two contracts, and is assumed to choose contract B with m_B by assumption; the poor entrepreneur strictly prefers contract A with m_A . In this situation, a new contract C , which has a mentoring requirement m_C , can be offered profitably. Only the rich entrepreneur chooses this new contract by assumption. Since C is above the zero profit curve $\pi(m_C)$, the lender who provides this contract is able to earn more profits. Therefore, each lender has the incentive to reduce m_r for more profits until $m_r = 0$. In equilibrium the mentoring requirement of the contract designed for the rich entrepreneur thus must equal zero.

An immediate result of Lemma 4.2 is as follows.

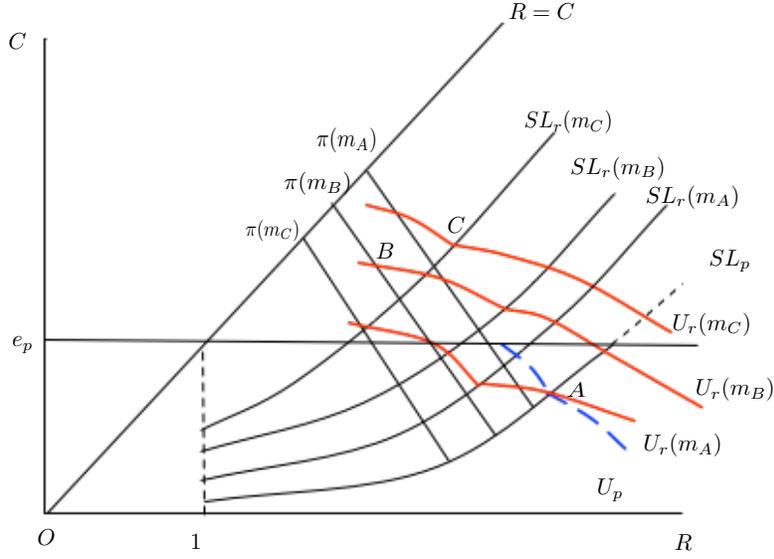


Figure 4.10: Rich entrepreneurs borrow commercial loans

Proposition 4.7. *With imperfect information, the optimal contract designed for the rich entrepreneur is defined as: $\check{E}_r = E_r^*$ and $\check{m}_r = 0$.*

This proposition indicates that the best contract that can be designed for the rich entrepreneur is identical to the one designed for them under perfect information. Given this result, the incentive compatibility constraint (4.16) is reduced to

$$EU_r(\check{E}_r, \check{m}_r) = EU_r(E_r^*, 0) = EU_r(E_p, m_p), \quad (4.21)$$

since the poor entrepreneur is unable to afford contract E_r^* . Thus, the following result can be derived:

Lemma 4.3. *In equilibrium, $\check{\pi}_p = 0$.*

In equilibrium the lender makes zero profit from lending to the poor entrepreneur due to competition pressure among lenders. If instead positive profits can be earned from lending to the poor type, a new contract that is only more favourable to the poor entrepreneur can be added profitably. This contract has more favourable loan terms (R and C) but a higher level of m .

Define ϕ_i as the marginal rate of substitution between R and C of the type i entrepreneur, when the lender's profit equals zero (given the good technique): $\phi_i = \frac{dC}{dR} |_{\bar{U}_i, \pi_g=0}$ for $i = r, p$. The term measures the increase in the collateral necessary to make both the type i entrepreneur and the lender indifferent given a small reduction in the repayment requirement. The derivation of

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ϕ_i can be determined with the aid of Figure 4.11. Curve AD is the indifference curve of the rich entrepreneur when the lender's profit equals zero. Notice that along curve AD the mentoring requirement is not constant. At contract A with mentoring requirement m_0 , the expected utility of the rich entrepreneur equals $U_r(m_0)$. Curve $U_r(m'_0)$ depicts the loci of the contracts at which the rich entrepreneur's utility remains at $U_r(m_0)$ when the mentoring requirement is reduced to m'_0 ($m'_0 < m_0$). The reduction in mentoring requirement forces the lender's iso-profit curve to shift down from $\pi(m_0)$ to $\pi(m'_0)$. At contract D – the intersection of $\pi(m'_0)$ and $U_r(m'_0)$ – with mentoring requirement m'_0 , both the rich entrepreneur and the lender are as well-off as at contract A with mentoring requirement m_0 . The slope of curve AD gives ϕ_r ,

$$\phi_r = -\frac{p_j}{1-p_j} \left[\frac{(1 + \frac{b_r p_g}{c})U'(e_r + I_j - R - b_r m(R, C)) + (1 - p_j)\frac{b_r}{c}U'(e_r - C - b_r m(R, C))}{p_j \frac{b_r}{c}U'(e_r + I_j - R - b_r m(R, C)) + (1 + \frac{b_r(1-p_j)}{c})U'(e_r - C - b_r m(R, C))} \right], \quad (4.22)$$

where $m(R, C) = \frac{p_g R + (1-p_g)C - R_f}{c}$ and j is the technique that the rich entrepreneur chooses. Notice that curve AD is steeper than the indifference curve $U_r(m_0)$. The dashed curve U_p is similarly defined for the poor entrepreneur. Since the poor entrepreneur is not affected by the mentoring requirement, curve U_p is identical to the indifference curve of the poor entrepreneur that goes through D' . Thus, ϕ_p equals the slope of the poor entrepreneur's indifference curve

$$\phi_p = -\frac{p_g U'(e_p + I_g - R)}{(1 - p_g)U'(e_p - C)}. \quad (4.23)$$

Note that ϕ_r is affected by b_r and c . Two extreme cases should be taken into account. First, when c is low – i.e., the lender is not too sensitive to the mentoring requirement (its iso-profit curve shifts only a small amount as a result of the change in m) – and b_r is high – i.e., the rich entrepreneur is very sensitive to the mentoring requirement (or his cost of obtaining a loan increases a lot with a small increase in m) – ϕ_r could be very low such that $\phi_r < \phi_p$ always holds at any combination of R, C and $m(R, C)$. When this occurs, it means that among the contracts at which both the rich entrepreneur and the lender are indifferent, the poor entrepreneur prefers the one associated with the lowest collateral requirement. As shown in Figure 4.11, the poor entrepreneur prefers contract A among the contracts on curve AD . Second, if b_r is low and c is high – i.e., the lender (the rich entrepreneur) is very (not very) sensitive to the mentoring requirement – then ϕ_r would be high, such that $\phi_r > \phi_p$ always holds at any combination of R, C and $m(R, C)$. In this situation, the poor entrepreneur prefers the contract with the highest

collateral requirement among the contracts at which both the rich entrepreneur and the lender are indifferent.

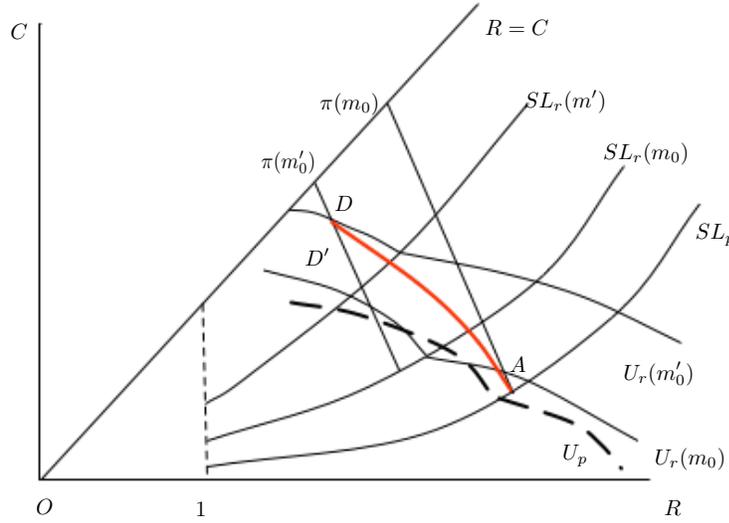


Figure 4.11: Derivation of ϕ_r and ϕ_p

Now consider the equilibrium. The optimal contract designed for the poor entrepreneur is the one that maximizes the expected utility of the poor entrepreneur, subject to $\pi_p = 0$, $EU_p(E_p) > U(e_p)$, $EU_{pg}(E_p) > EU_{pb}(E_p)$, $C_p \leq e_p$ and incentive compatibility constraint (4.16). According to Kuhn-Tucker theorem, there must exist a unique solution \check{E}_p and \check{m}_p to this maximization problem.

Proposition 4.8. *With the introduction of mentoring services,*

1. *if $e_p \geq C_p^c$, then perfect separation without rationing can be attained in the environment of imperfect information, where C_p^c is the collateral requirement at contract E_p^c (the intersection of curves SL_p and E_r^*A , see Figure 4.12).*

The rich entrepreneur borrows commercial loans at contract \check{E}_r : $\check{E}_r = E_r^$ and $\check{m}_r = 0$ and the poor entrepreneur borrows under a mentoring loan contract \check{E}_p with \check{m}_p , which is given by*

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- (a) if $\phi_r < \phi_p$ always holds at any combination of R, C and $m(R, C)$ where $C_p^c \leq C \leq e_p$, then the optimal contract designed for the poor entrepreneur \check{E}_p is contract \check{E}_1 as shown in panel b in Figure 4.12. Contract \check{E}_p and \check{m}_p solve

$$\begin{aligned} EU_{pb}(E) &= EU_{pg}(E), \\ p_g R + (1 - p_g)C - R_f - cm &= 0, \\ EU_r(E(R, C), m) &= EU_{rg}(E_r^*, 0); \end{aligned} \tag{4.24}$$

- (b) if $\phi_r > \phi_p$ always holds at any combination of R, C and $m(R, C)$ where $C_p^c \leq C \leq e_p$, then the contract designed for the poor is contract \check{E}_2 with \check{m}_p^2 in panel c in Figure 4.12, which solve

$$\begin{aligned} C &= e_p, \\ p_g R + (1 - p_g)e_p - R_f - cm &= 0 \\ EU_r(E_p(R, e_p), m) &= EU_{rg}(E_r^*, 0); \end{aligned} \tag{4.25}$$

- (c) if ϕ_r is greater or less than ϕ_p , depending on the values of R, C and $m(R, C)$, then the optimal contract designed for the poor entrepreneur is either the mentoring contract \check{E}_p^1 with \check{m}_p^1 , or \check{E}_p^2 with \check{m}_p^2 , or \check{E}_p^3 with \check{m}_p^3 (see panel a in Figure 4.12), depending on which contract gives the poor entrepreneur the highest level of utility. Contract \check{E}_p^3 and \check{m}_p^3 solve

$$\begin{aligned} \phi_r &= \phi_p, \\ p_g R + (1 - p_g)C - R_f - cm &= 0, \\ EU_r(E(R, C), m) &= EU_{rg}(E_r^*, 0); \end{aligned} \tag{4.26}$$

2. if $e_p < C_p^c$, the use of mentoring is ineffective, and the poor entrepreneur has no access to credit.

Proposition 4.8 indicates that the effectiveness of mentoring services as a selection tool is limited by the poor entrepreneur's wealth. This result occurs because if the poor entrepreneur has very limited wealth – i.e., $e_p < C_p^c$ – it is impossible to design a feasible mentoring loan contract that is unattractive to the rich entrepreneur, that encourages the poor entrepreneur to use the good technique, and that enables the lender to at least break even (see panel d in Figure

4.12). Curve E_r^*A is drawn on the assumptions that: (1) m is adjusted such that the lender's profit remains zero; (2) the rich entrepreneur is indifferent between any two contracts along this curve. Curve BCD is similarly defined as E_r^*A for the poor entrepreneur (it is identical to the poor entrepreneur's indifference curve and it goes through contract C). It is clear that all the contracts that can be designed for the poor entrepreneur should lie on curve E_r^*A and below line $C = e_p$. However, such contracts lie below switch line SL_p , and thus violates the good technique constraint and consequently negatively affects the lender's profit. So if $e_p < C_p^c$, no mentoring loan contract can be designed for the poor entrepreneur.

If $e_p \geq C_p^c$, then mentoring is effective in inducing self-selection. A mentoring loan contract can be designed for the poor type. Proposition 4.8 describes the optimal contract \check{E}_p and mentoring requirement \check{m}_p . \check{E}_p and \check{m}_p can be either an interior solution or a corner solution, depending on b_r and c . The various possibilities are shown in Figure 4.12.

First, consider the situation where ϕ_r is greater or smaller than ϕ_p , depending on the values of R, C and $m(R, C)$. Under this situation, there exists a unique combination of R, C and $m(R, C)$ at which $\phi_r = \phi_p$ holds, or curves E_r^*A and BCD are tangent (see contract $\check{E}_p^3(\check{R}_p^3, \check{C}_p^3)$ with \check{m}_p^3 in panel a of Figure 4.12). If curve BCD lies below E_r^*A as shown in panel a, then there exists an interior solution which is $E_p^3(\check{R}_p^3, \check{C}_p^3)$ with \check{m}_p^3 . In this situation, any contract on E_r^*A except \check{E}_p^3 is less favourable than contract \check{E}_p to the poor entrepreneur. If instead, curve BCD lies above E_r^*A (not shown in the figure), then there exists a corner solution. This solution could be either contract $\check{E}_p^1(\check{R}_p^1, \check{C}_p^1)$ (the intersection of curves E_r^*A and SL_p) with \check{m}_p^1 , or contract $\check{E}_p^2(\check{R}_p^2, \check{C}_p^2)$ (i.e., the intersection of curve E_r^*A and line $C = e_p$) with \check{m}_p^2 , depending on which contract gives the poor entrepreneur a higher level of utility.

Now consider the situation where b_r is small and c is high such that $\phi_r < \phi_p$ always holds at any combination of R, C and $m(R, C)$ where $C_p^c \leq C \leq e_p$, then there exists a corner solution as shown in panel b. \check{E}_p is contract \check{E}_p^1 (it is identical to E_p^c – the intersection of the poor entrepreneur's switch line SL_p and curve E_r^*A). This result follows since along curve E_r^*A , contract $\check{E}_p^1(E_p^c)$ is the most attractive contract that encourages the choice of the good technique.

Finally, if, as discussed, b_r is large and c is low such that $\phi_r > \phi_p$ always holds at any combination of R, C and $m(R, C)$ where $C_p^c \leq C \leq e_p$, then \check{E}_p is the intersection of curve E_r^*A and the poor entrepreneur's collateral constraint curve $C = e_p$ or \check{E}_p^2 (see panel c of Figure 4.12), since now the poor entrepreneur would like to accept more intensive mentoring requirement in return for a reduction in the repayment requirement.

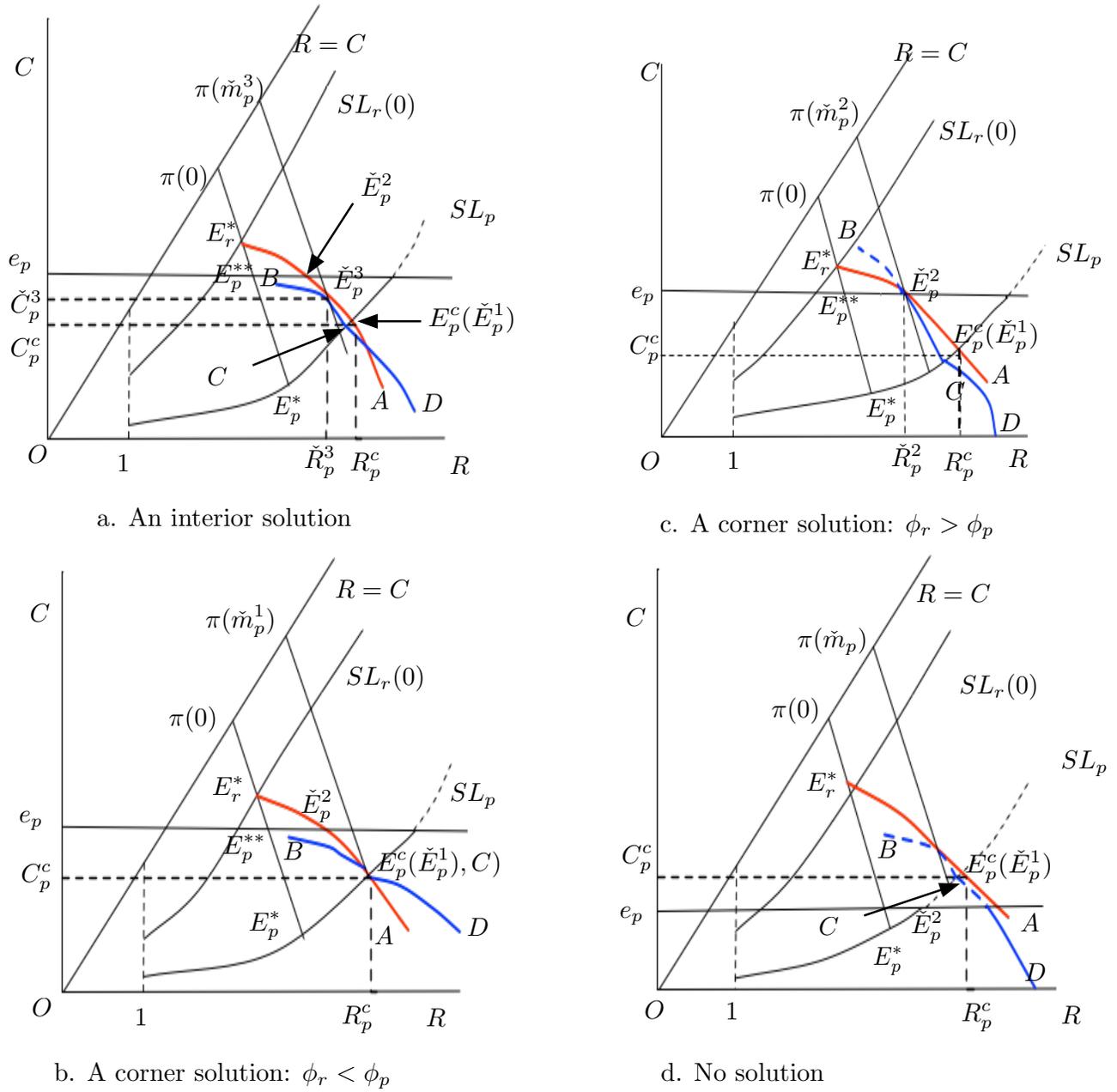


Figure 4.12: Derivation of \check{E}_p and \check{m}_p

Proposition 4.8 states that if the poor entrepreneur has moderate wealth – i.e., $e_p \geq C_p^c$ – the mentoring requirement can play a role in inducing self-selection. The equilibrium is characterized by perfect separation without rationing. The intuition is as follows. Due to the wealth impact, mentoring affects the rich and the poor entrepreneurs differently. Although the loan terms of the mentoring loan contract designed for the poor are more favourable to the rich type, the extra costs caused by the use of mentoring services make the contract less attractive, and thus deter the rich entrepreneur from choosing it. As a result, the rich entrepreneur chooses the commercial loan contract. The poor entrepreneur has no choice of contracts due to her limited wealth, and thus chooses the mentoring loan contract.

Corollary 4.3. *Compared with the collateral requirement of contract \hat{E}_p , if $\sigma_{rb} > \sigma_{pg}$ (Case I), $\check{C}_p \leq \hat{C}_p$ and $\check{R}_p \geq \hat{R}_p$; if $\sigma_{rb} < \sigma_{pg}$ (Case II), $\check{C}_p > \hat{C}_p$.*

As shown in Figure 4.12, the optimal mentoring contract for the poor entrepreneur must be located on curve E_r^*A and lie below the collateral constraint curve $C = e_p$. Compared with rationing contract E_p^{**} (the best contract designed for the poor under imperfect information where rationing is used to induce selection in Case I), the mentoring loan contract \check{E}_p has a lower collateral requirement but a higher repayment requirement. However, compared with contract \hat{E}_p in the second case – i.e., contract E_p^* – the mentoring loan contract involves more collateral.

Corollary 4.4. *$EU_r(\check{E}_r, 0) = EU_r(\hat{E}_r, 1)$, but it is unclear whether $EU_p(\check{E}_p, \check{m}_p) \geq EU_p(\hat{E}_p, \hat{\gamma}_p)$ or not.*

It is difficult to determine whether or not an individual poor entrepreneur is better off at the mentoring contract \check{E}_p , compared to at the rationing contract \hat{E}_p . However, since each entrepreneur obtains a loan and invests with the good technique at the mentoring contract \check{E}_p , the problem of underinvestment is solved. In this sense, a better outcome is achieved compared to where the lender uses rationing to mitigate their information problems.

It is clear that the effectiveness of the mentoring requirement as a selection tool is limited by the poor entrepreneur's wealth. If she has very limited wealth (i.e., $e_p < C_p^c$), it is impossible to design a mentoring contract for the poor. The poor entrepreneur is excluded from the credit market.

However, with the use of mentoring services, credit rationing can be solved to some extent. This is because the mentoring services can facilitate screening and monitoring. Through this process, the lender can generate entrepreneur information and use it to screen entrepreneurs and monitor their investment activities. This means that mentoring not only affects an entrepreneur's

costs of obtaining a loan, but also his/her choice of techniques. In the next section, the model is extended by including the impact of mentoring services on the entrepreneur's choice of techniques.

4.4.2 An Extension

With mentoring activities, the lender is likely to know the entrepreneur's choice of techniques. Thus, the entrepreneur may find the bad technique to be less attractive, because, with the bad technique, he/she would have to spend more effort to convince the lender that he/she is using the good technique. As a result, for each entrepreneur the marginal cost of obtaining a mentoring loan is higher if he/she uses the bad technique than that if he/she uses the good technique: $b_{ig} < b_{ib}$. For simplicity, it is assumed that $0 = b_{pg} < b_{pb} < b_{rg} < b_{rb}$.

So under the mentoring contracts, given the same mentoring requirement, the switch lines of both the rich entrepreneur and the poor entrepreneur shift down; and the switch line of the rich shifts more than does the poor entrepreneur's switch line. In Figure 4.13, the mentoring requirement m'_v forces the poor entrepreneur's switch line to shift from $SL_p(0)$ to $SL_p(m'_v)$. The change in the poor entrepreneur's switch line increases the choice set of the lender and thus makes it possible to achieve a separating equilibrium without rationing in the situation where the poor entrepreneur has very limited wealth, i.e., $e_p < C_p^*$ (note that $C_p^* < C_p^c$).

The marginal rate of substitution between R and C of the type i entrepreneur where the lender's profit equals zero can be rewritten as follows,

$$\phi_i = -\frac{p_j(1 + \frac{b_{ij}p_g}{c})U'(e_i + I_j - R - b_{ij}m(R, C)) + (1 - p_j)\frac{b_{ij}p_g}{c}U'(e_i - C - b_{ij}m(R, C))}{p_j\frac{b_i(1-p_g)}{c}U'(e_i + I_j - R - b_{ij}m(R, C)) + (1 - p_j)(1 + \frac{b_{ij}(1-p_g)}{c})U'(e_i - C - b_{ij}m(R, C))}, \quad (4.27)$$

for $i = r, p$ and $j = g, b$. The derivation of ϕ_r and ϕ_p is illustrated in Figure 4.13. Along curve E_r^*A , the utilities of the rich and the lender remain constant. The slope of E_r^*A gives ϕ_r . Similarly, along curve E_p^*B , the utilities of the poor entrepreneur and the lender remain constant, and thus the slope gives ϕ_p .

Assumption 4.5. Assume that b_{pb}, b_{rg} and b_{rb} are sufficiently large and c is sufficiently small such that the condition $p_g R'_v + (1 - p_g)e_p - cm'_v \geq 0$ holds at contract $E'_v(R'_v, e_p)$ with mentoring requirement m'_v , where contract $E'_v(R'_v, e_p)$ is the intersection of curves E_r^*A and $C = e_p$ above the switch line $SL_p(m'_v)$ (see Figure 4.13).

This assumption implies that non-negative profits can be made at contract $E'_v(R'_v, e_p)$ when the mentoring requirement m'_v is set at what is necessary to deter the rich entrepreneur from choosing this contract. Note that the mentoring contract $E'_v(R'_v, e_p)$ must encourage the poor entrepreneur to choose the good technique. It means that entrepreneurs are sensitive to the mentoring requirement and the lender's mentoring costs are not very high, such that it is possible to design a feasible mentoring contract that induces self-selection.

Proposition 4.9. *Perfect separation without rationing can be attained by means of the mentoring requirement even if $e_p < C_p^*$. The mentoring loan contract is given by*

1. if $\phi_r < \phi_p$ always holds at any combination of R, C and $m(R, C)$, \check{E}_p and \check{m}_p solve

$$\begin{aligned} EU_{pb}(E) &= EU_{pg}(E) \\ p_g R + (1 - p_g)C - R_f - cm &= 0 \\ EU_r(E(R, C), m) &= EU_{rg}(E_r^*, 0); \end{aligned} \quad (4.28)$$

2. if $\phi_r > \phi_p$ always holds at any combination of R, C and $m(R, C)$, \check{E}_p and \check{m}_p solve

$$\begin{aligned} C &= e_p \\ p_g R + (1 - p_g)C - R_f - cm &= 0 \\ EU_r(E(R, C), m) &= EU_{rg}(E_r^*, 0); \end{aligned} \quad (4.29)$$

3. if ϕ_r is greater or smaller than ϕ_p , depending on the values of R, C and $m(R, C)$, \check{E}_p and \check{m}_p solve either (4.28), or (4.29) or the following expressions, depending on which contract gives the poor entrepreneur the highest level of utility.

$$\begin{aligned} \phi_r &= \phi_p \\ p_g R + (1 - p_g)C - R_f - cm &= 0 \\ EU_r(E(R, C), m) &= EU_{rg}(E_r^*, 0). \end{aligned} \quad (4.30)$$

Proposition 4.9 states that if the entrepreneurs are sensitive to the mentoring requirement and the lender is not very sensitive, then the mentoring requirement can be used to facilitate self-selection and to reduce rationing. In Figure 4.13, curve E_r^*A represents the combinations of contracts and mentoring requirements that enable the lender to make zero profit while allowing the

rich entrepreneur to derive a utility of $EU_r(E_r^*, 0)$, when $b_r = b_{rg} < b_{rb}$. Because the mentoring requirement makes the choice of the bad technique less attractive, this curve is steeper than E_r^*A which is associated with $b_{rg} = b_{rb} = b_r$. Similarly, along curve E_r^*B the utilities of the poor entrepreneur and the lender remain constant. Notice that curve E_r^*B becomes steeper as b_{rp} increases. The optimal contract designed for the poor entrepreneur must lie on the segment of curve E_r^*A between the poor entrepreneur's new switch line under the optimal mentoring requirement, and below the collateral constraint line $C = e_p$.

Corollary 4.5. *As either b_{rb} or b_{pb} increases, the poor entrepreneur's access to credit can be further improved. They can obtain loans even if $e_p < C_p^*$. A more efficient outcome than the one with perfect information is achieved.*

The intuition is as follows. As b_{rb} increases, the choice of the bad technique appears to be less favourable under a mentoring contract to the rich entrepreneur. As a result, curve E_r^*A becomes steeper. Similarly, a higher b_{pb} means the poor entrepreneur feels the choice of the bad technique is less attractive under a mentoring contract. Consequently, her switch line, given the same mentoring requirement, shifts down further. Thus, even though $e_p < C_p^*$, there may still exist a contract that satisfies the conditions in Assumption 4.5. According to Proposition 4.9, the equilibrium should be a separating one where all entrepreneurs obtain the loans they need.

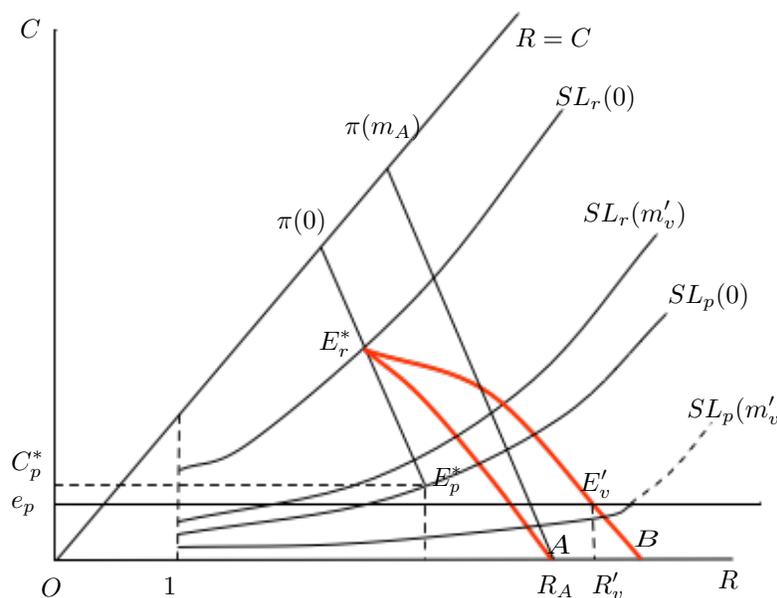


Figure 4.13: Derivation of ϕ_r and ϕ_p : $b_{rb} > b_{rg} > b_{pb} > b_{pg}$

4.4.3 A Special Case: $e_p = 0$

Now consider an extreme case. Suppose the poor entrepreneur has no wealth, i.e., $e_p = 0$, and she never chooses the bad technique under a mentoring contract since b_{pb} is prohibitively high. With the aid of Figure 4.13, the following proposition can be stated.

Proposition 4.10. *When $e_p = 0$, and if b_{pb} is prohibitively high, there exists a unique separating equilibrium: the contract designed for the rich is \check{E}_r (identical to E_r^*) with $\check{m}_r = 0$; and the contract designed for the poor $\check{E}_p^m = A$ (see Figure 4.13) with $\check{m}_p = m_A$. Credit rationing does not arise in equilibrium, since each entrepreneur obtains a loan.*

The loan terms and mentoring requirement can be determined by solving:

$$\begin{aligned} C &= 0, \\ P_g R + (1 - p_g)C - cm &= 0, \\ EU_r(E(R, C), m) &= EU_r(E_r^*, 0). \end{aligned} \tag{4.31}$$

This proposition states that if the incentive problem of the poor entrepreneur can be solved through mentoring services, a more efficient outcome (compared with the one under perfect information) is possible, even if the poor entrepreneur is unable to provide any collateral to secure the loan.

The intuition is as follows. Since mentoring services make the bad technique unacceptable, the poor entrepreneur never chooses this technique under a mentoring loan contract. Because there is no incentive problem, it is not necessary to require positive collateral under the mentoring loan contract. So even though she is unable to provide any collateral, the poor entrepreneur can obtain the loan at the mentoring contract. Due to the increase in the costs of obtaining a loan, the rich entrepreneur obtains a commercial loan and stays away from the mentoring contract.

The above analysis assumes that $b_{pg} = 0$. Now consider a general case that $b_{pg} > 0$ and investigate its impact on the welfare.

Corollary 4.6. *If $b_{pg} > 0$, then as b_{pg} increases, the welfare of individual poor entrepreneurs decrease; the rich entrepreneur is not affected.*

Since the poor entrepreneur finds it more expensive to obtain a mentoring loan even though she uses the good technique, her utility from borrowing a mentoring loan will be lower, since:

$$EU_p(\check{E}_p, \check{m}_p) = p_g U(e_p + I_g - \check{R}_p - b_{pg}\check{m}_p)$$

and $dEU_p(\check{E}_p, \check{m}_p)/db_{pg} = -p_g \check{m}_p U(e_p + I_g - \check{R}_p - b_{pg} \check{m}_p) < 0$. She may decide not to borrow if $EU_p(\check{E}_p, \check{m}_p) < U(0)$.

4.5 Summary

In this chapter, a model is developed that combines adverse selection and moral hazard considerations to study the impacts of wealth on market equilibrium and entrepreneur's access to credit. In contrast to other models that treat wealth as the same across entrepreneurs (Besanko and Thakor [1987]), the model in this chapter allows the entrepreneurs to have different levels of wealth, and thus different attitudes toward risk. Moreover, the lenders use rationing directly as a tool to facilitate entrepreneurs' self-selection. This treatment enables the establishment of a link between wealth and credit rationing. Specifically, the more wealth/collateral-constrained individuals have more limited access to credit. This result explains the often cited outcome that many low-income micro-entrepreneurs are unable to access the credit they need. However, the link between wealth and rationing is not robust – under some conditions, rationing always arises in equilibrium although all entrepreneurs can pledge sufficient collateral.

Non-financial services are an important component of microcredit programs. The empirical work of Schreiner and Woller [2003] highlights the important role of mentoring and technical assistance in ensuring the success of microcredit programs. Barry and Bruno [2008] argue that mentoring increases the probability of success of an individual with a low level of entrepreneurial skill.

This study provides a new explanation in the role of non-financial services: they can play a role in mitigating information asymmetry by encouraging the entrepreneurs to select the type of contract that they wish to obtain: only those who would otherwise be credit rationed find it optimal to choose a micro-loan, while other entrepreneurs choose to obtain conventional loans. In this way, the use of non-financial services enables microcredit programs to reach out to their target individuals and to consequently improve their access to credit.

One of the challenges of microcredit programs is to understand the needs of their entrepreneurs and tailor the services to meet their requirements. In many cases, non-financial services could be a costly substitute for collateral to micro-entrepreneurs. For example, in large urban cities, a significant fraction of micro-entrepreneurs are new immigrants. Some may face social and economic barriers to participate in and benefit from the activities organized by the programs. So if non-financial services are not well designed to better fit their needs, they may

be discouraged by the high costs of obtaining the loans and leave the program. Kon and Story [2003] demonstrate that entrepreneurs whose cost of obtaining a loan is high are forced to exit the credit market.

Another challenge is the high operation costs. Non-financial services increase the costs of operating a microcredit program. If the costs are sufficiently high such that the lenders cannot expect to break even, then the lenders may be deterred from microcredit lending. To address this problem, some microcredit programs have reduced their auxiliary services to a minimum level, and partner with community development organizations that are able to provide the complementary non-financial services. In this way, the lenders can specialize in the area – lending – where they have advantages and let the organizations specializing in non-financial services provide the complementary services. In this way, the programs can save operation costs.

In this chapter, the analysis is based on the assumption that the lenders are unable to distinguish entrepreneurs according to their initial endowments. This may be the case in many situations – e.g., lending to new immigrants – where it is difficult for the lenders to understand the social and economic status of the entrepreneurs due to the social and cultural barriers. In the next chapter the analysis is extended to the case where the lenders are able to distinguish entrepreneurs according to their wealth, and develop a new model to show how non-financial services can facilitate self-selection.

Chapter 5

Credit Rationing and Non-Financial Services as a Selection Device, Model II

5.1 Introduction

A credit rationing model was presented in the previous chapter. That model investigates how wealth affects individual entrepreneurs' access to credit. It has been shown that with the presence of both adverse selection and moral hazard, collateral alone is not useful in inducing the entrepreneurs to self-select into different groups. Furthermore, credit rationing may occur for entrepreneurs with insufficient wealth/collateralizable assets. This result is based on a key assumption – the lender cannot distinguish the entrepreneurs according to their wealth. In this chapter, the situation considered is where the lenders can observe the wealth of entrepreneurs, and thus categorize them into different groups and accordingly design a set of contracts for each group. In this way, the effects of wealth can be reduced to a minimum.

However, there is another type of hidden information – entrepreneurial skill. This characteristic is important since it affects an entrepreneur's choice of projects as well as his/her probability of succeeding. However, this characteristic is more difficult to observe than wealth. A number of studies focus on this type of hidden information – see, for example, Bester [1987], Besanko and Thakor [1987] and Chan and Kanatas [1985].

This chapter investigates how this information imperfection leads to credit rationing and how mentoring and technical assistance facilitate the screening of the entrepreneurs. The arguments center around the fact that linking non-financial services with loan provision results in extra costs for the entrepreneurs to obtain loans.¹ There is a cost differential between entrepreneurs

¹The terms of non-financial services and mentoring are used interchangeably.

of different qualities. The low quality entrepreneurs have higher costs since the use of non-financial services makes it difficult for them to convince the lenders that they are high quality and creditworthy. Thus, the mentoring loan contract is rejected by these entrepreneurs, and it is accepted only by the high quality entrepreneurs who would otherwise be rationed. Perfect separation without rationing of high quality entrepreneurs thus can be achieved in equilibrium by means of non-financial services.

The entrepreneurs' outside choices affect the loan contracts in the credit market (e.g., de Meza and Webb [2000] and Ghatak, Morelli, and Sjostrom [2001]). For example, the entrepreneurs can choose to be an entrepreneur or an employed worker. Their decisions are affected by the wage rates in the labour market. These decisions determine the quality of the lender's loan portfolio which in turn determines the lender's lending policies and the extent of credit rationing – in other words, the level of investment implemented in the economy. The credit market is not treated in isolation. There is a feedback from the labour market to the credit market. The impact of the wage rates offered in the labour market on credit rationing is examined.²

The outline of this chapter is as follows. Section 5.2 presents the basic model. Section 5.3 analyzes the equilibrium in the credit market, as well as the impact of wage rates on the loan contracts and the extent of credit rationing. Section 5.4 examines the potential role of mentoring and technical assistance which forms an important component of micro-loans as a selection device. Section 5.5 concludes the chapter.

5.2 The Basic Model

There are two types of agents in the model: entrepreneurs and lenders.

5.2.1 Entrepreneurs

Each entrepreneur has the opportunity to invest a fixed amount (normalized at unity) in one project at most. The entrepreneur has some initial wealth e which is not liquid, and hence cannot be directly used to finance the project. For simplicity, it is assumed that the initial wealth yields a return of zero after one period. To make the investment, the entrepreneur has to borrow from a lender. It is assumed that each entrepreneur borrows from one lender at most.

²The level of investment implemented may have an impact on the wage rates in the labour market. However, the focus of this study is on the credit access of the micro-entrepreneurs underserved by financial institutions. They account for a small share in the economy in developed countries. The impact of their investment decisions on the labour market are thus ignored.

There are two types of projects: good (g) and bad (b). The good project yields a return of I_g if it is successful and 0 if it is unsuccessful. Moreover, the return from the good investment is assumed to be verifiable. Thus, if an entrepreneur invests in such a project, he/she must repay the loan if the investment is in the good state.

The bad project yields a private return I_b . The private benefits are not verifiable and therefore cannot be appropriated by the lenders. The introduction of private benefits captures the idea that an entrepreneur may direct some part of the loan for the purposes other than the investment, and the lender cannot recover the diverted funds (Ghatak et al. [2001]). It is assumed that if an entrepreneur invests in a bad project, he/she always defaults on the loan.

Entrepreneurs are of either high quality (H) or low quality (L). The high quality entrepreneur has a higher level of entrepreneurial skill. Such an entrepreneur can invest in either a good project or a bad project. If she invests in a good project, her probability of succeeding is p (to simplify the illustration, the high quality entrepreneur is hereafter referred to as a female and the low quality entrepreneur is referred to as a male). The low quality entrepreneur who has a lower level of entrepreneurial skill invests only in a bad project. If an entrepreneur decides not to make an investment, he/she can take an employment job. The wage rate in the labour market is w .

Let $E(R, C)$ be the loan contract, where R is the repayment requirement ($R = 1 + r$, where r is the loan interest rate) and C is the collateral requirement. The entrepreneurs are assumed to have the same utility function U and are risk-averse – i.e., $U' > 0$ and $U'' < 0$.

A type i ($i = H, L$) entrepreneur's expected utility from obtaining a loan at contract $E(R, C)$ is defined as

$$EU_{Hj} = \begin{cases} pU(e + I_g - R) + (1 - p)U(e - C) & \text{if } j = g, \\ U(e + I_b - C) & \text{if } j = b, \end{cases} \quad (5.1)$$

$$EU_{Lb} = U(e + I_b - C), \quad (5.2)$$

where $j \in [g, b]$ indicates the project type.

Assumption 5.1. $(1 - p)U'(e - C) < U'(e + I_b - C)$.

This assumption implies that, when investing in a good project, the high quality entrepreneur's marginal benefit from a small reduction in C is smaller than that of an entrepreneur who invests in a bad project.

Consider the case where only partial collateral is required – i.e., $R > C$. The low quality entrepreneur always chooses the bad project if he decides to invest, and thus his indifference curve U_L is a horizontal line in the $R - C$ space (see panel a in Figure 5.1).

The high quality entrepreneur, with a good project, requires a reduction in the collateral C to compensate for an increase in the repayment requirement R . Her indifference curve U_{Hg} , given the good project, is downward sloping and concave in $R - C$ space (see panel b in Figure 5.1).³

The slope of the indifference curve is given by

$$\frac{dC}{dR} \Big|_{\bar{U}_{Hg}} = \frac{pU'(e + I_g - R)}{(1 - p)U'(e - C)} < 0. \quad (5.3)$$

When she invests in a bad project, her expected utility depends only on the collateral requirement

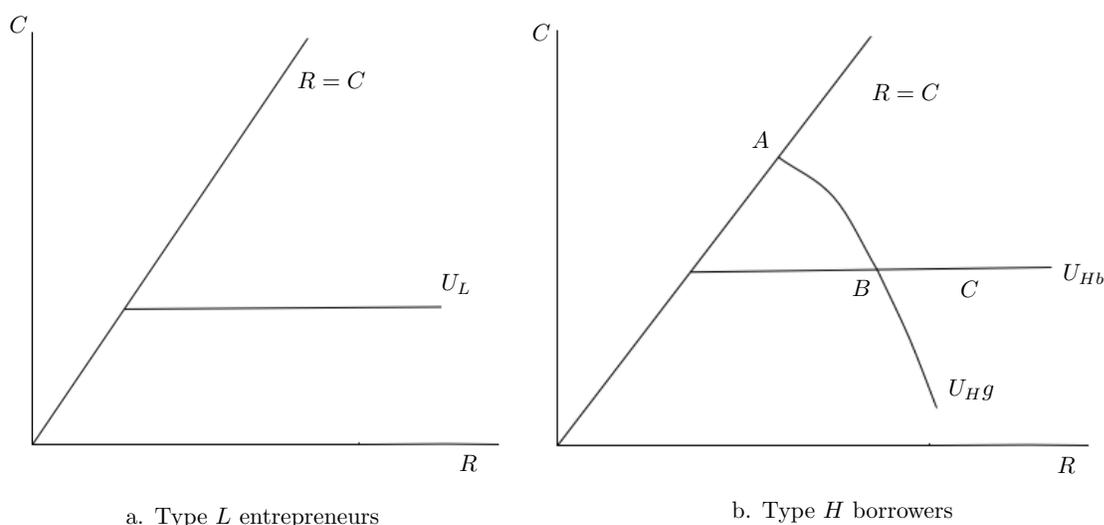


Figure 5.1: Entrepreneurs' indifference curves: with no choice of projects

C . Thus, the indifference curve U_{Hb} is a horizontal line in the $R - C$ space. In this situation, the high quality entrepreneur is better off with a lower C , and is not affected by R . Curves U_{Hb} and U_{Hg} are drawn on the assumption that the expected utility of the high quality entrepreneur is the same along the two curves.

³With a good project, the high quality entrepreneur's indifference curves are concave in R and C , since

$$\frac{d^2C}{dR^2} \Big|_{\bar{U}_{Hg}} = -\frac{p_g}{1 - p_g} \frac{U'(e + I_g - R)}{U'(e - C)} \left[\frac{U''(e + I_g - R)}{U'(e + I_g - R)} - \frac{U''(e - C)}{U'(e - C)} \frac{dC}{dR} \right] < 0.$$

With a choice of projects, the high quality entrepreneur's indifference curve is the upper envelope of the indifference curves associated with different projects (see curve ABC in panel b of Figure 5.1).

The locus of the contracts at which the high quality entrepreneur is indifferent between the two projects is called the switch line, shown by the upward sloped curve SL in Figure 5.2. The slope of SL is given by:

$$\frac{dC}{dR} \Big|_{EU_{Hg}=EU_{Hb}} = -\frac{pU'(e + I_g - R)}{(1-p)U'(e - C) - U'(e + I_b - C)} > 0. \quad (5.4)$$

Since $r \geq 0$, curve SL is truncated by line $R = 1$. This curve is also truncated by the participation constraint curve PA_H . At any contract above the switch line, the high quality entrepreneur

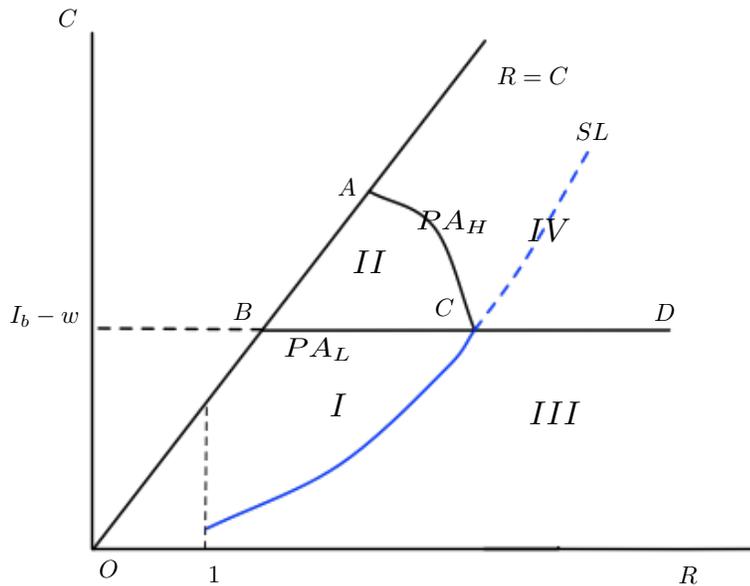


Figure 5.2: Entrepreneurs' participation constraints.

chooses the good project; at any contract below the switch line, she chooses the bad project.

Now consider the entrepreneurs' participation constraints. A type i entrepreneur borrows money if and only if $EU_i(E(R, C)) \geq U(e + w)$. Curves PA_H (curve ACD) and PA_L (the horizontal line BD) in Figure 5.2, respectively, depict the participation constraints of the high quality and the low quality entrepreneurs. Above curve PA_H/PA_L , the high/low quality entrepreneur does not borrow. Underneath PA_H , the high quality entrepreneur chooses the good project if the loan contract is above her switch line SL , or she chooses the bad project if the

contract lies below SL . Underneath curve PA_L , the low quality entrepreneur invests in the bad project.

Four areas in Figure 5.2 can be identified: (1) for any contract that falls in area I , the high quality entrepreneur invests in the good project and the low quality entrepreneur invests in the bad project; (2) in area II , the high quality entrepreneur invests in the good project and the low quality entrepreneur does not invest; (3) in area III both types invest in the bad projects; (4) in area IV , no investment is undertaken.

5.2.2 Lenders

Lenders are homogenous. They finance loans out of deposit funds. Each lender faces a perfectly elastic supply schedule of loan funds at an exogenous market-determined rate r_f . Lenders are assumed to be risk-neutral.⁴ Let π_H and π_L be the expected profits from lending to a high quality and a low quality entrepreneur, respectively,

$$\pi_{Hj} = \begin{cases} pR + (1-p)C - R_f & \text{if } j = g, \\ C - R_f & \text{if } j = b, \end{cases} \quad (5.5)$$

$$\pi_L = C - R_f, \quad (5.6)$$

where $R_f = 1 + r_f$.

The iso-profit curve $\bar{\pi}_H$ (linear lines AB and CD) is depicted in Figure 5.3. This curve is not continuous. Above the switch line SL , the iso-profit curve is the downward sloping line AB since the high quality entrepreneur invests in the good project; below SL , the iso-profit curve is the horizontal line CD because the bad project is carried out. This shape emerges because of the high quality entrepreneur's discrete change in projects that occurs at the switch line. Figure 5.3 also depicts the relationship between $\bar{\pi}_H$ and the indifference curve of the high quality entrepreneur \bar{U}_H . Above the switch line, the iso-profit curve $\bar{\pi}_H$ is steeper than curve \bar{U}_H :

$$-\frac{dC}{dR}\Big|_{\bar{\pi}_{Hg}} = \frac{p}{1-p} > \frac{pU'(e + I_g - R)}{(1-p)U'(e - C)} = -\frac{dC}{dR}\Big|_{\bar{U}_{Hg}} \quad (5.7)$$

This result arises because entrepreneurs are risk-averse, while lenders are risk neutral.

⁴Unlike the entrepreneur, the lender holds large and diversified loan portfolios to achieve risk pooling. Thus the lender is less risk-averse. Without loss of generality, it is assumed that the lender is risk-neutral.

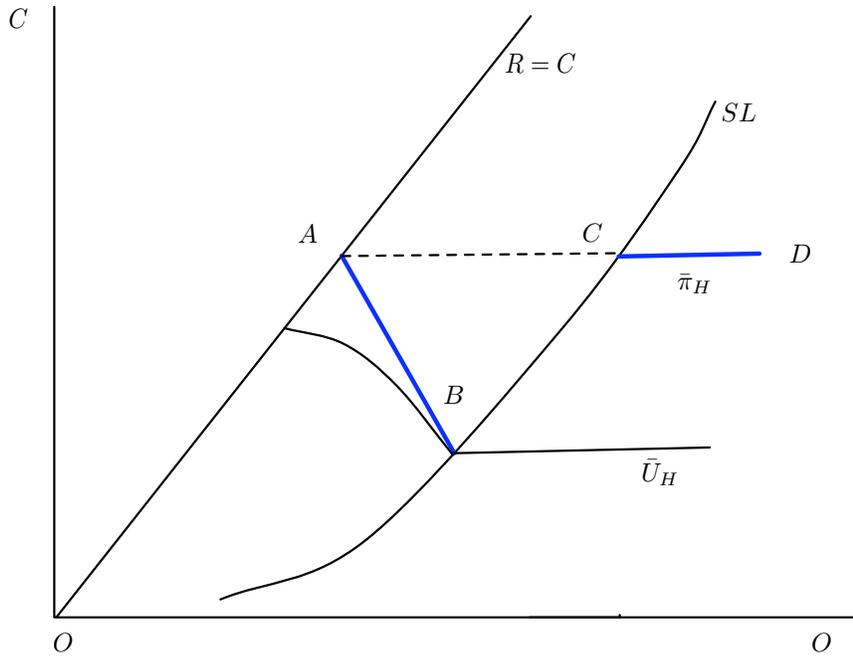


Figure 5.3: Lender's iso-profit curve $\bar{\pi}_H$.

The iso-profit curve $\bar{\pi}_L$ is a horizontal line in the $R - C$ space, since the lender's profit is now determined by the collateral requirement C , and is independent of R . Note that the low quality entrepreneur never repays his loan since $R > C$.

Assumption 5.2. $I_b < R_f + w$.

This assumption has two implications. First, the lender can never make non-negative profits from an entrepreneur who invests in a bad project. Recall that the entrepreneur with the bad project never repays his/her loan. Thus it is clear that the lender tries to stay away from such entrepreneurs, unless the lender is able to offer them a contract in which the collateral requirement is at least as large as R_f . However, at contract $E(R, R_f)$ ($R > 0$), no entrepreneurs invest in the bad projects, since $U(e + I_b - R_f) < U(e + w)$ if $I_b < R_f + w$.

Second, it is socially inefficient to finance the bad projects since at the contract where the lender makes zero profit, the net gains from investing in a bad project are lower than the net gains from taking an employment job. As a consequence, the first-best level of investment is that all the high quality entrepreneurs invest in the good projects, while all the low quality entrepreneurs take the employment jobs. Therefore, in this study the focus is exclusively on the high quality entrepreneurs' access to credit, because it is optimal to have the low quality entrepreneurs in the labour market.

Assumption 5.3. $pU(e + I_g - R_f) + (1 - p)U(e - R_f) > U(e + w)$.

Assumption 5.3 implies that contract $E(R_f, R_f)$ is desired by the high quality entrepreneur. This assumption thus means that all the contracts on the lender's zero profit curve above the switch line are desirable to the high quality entrepreneur. Moreover, at contract $E(R_f, R_f)$, the high quality entrepreneur must invest in the good project, since the bad project is unattractive according to Assumption 5.2.

5.3 The Equilibrium

The credit market contains a large number of individually insignificant lenders and entrepreneurs, and is assumed to be competitive. Lenders are Bertrand competitors. They do not want to finance the bad projects (Assumption 5.2). To simplify the analysis, assume that the entrepreneur can only apply to one lender during the period. The timing of the game is as follows.

1. At the beginning of the time period, the lenders announce their loan contracts. Given the lenders' offerings and the wage rates in the labour market, the entrepreneur decides whether to invest in a project or to take an employment job. If the entrepreneur chooses to take a job, the game ends; otherwise, the entrepreneur forgoes employment. That is, even if the loan application is denied, the entrepreneur cannot work for someone else. If the application is approved, the entrepreneur implements the investment.
2. At the end of the time period, the entrepreneur obtains the returns from the investment and repays the loan if and only if he/she invests in a good project successfully. The game ends.

The analysis focuses exclusively on Nash equilibria. Because no lender can operate while earning negative profits in the long run, Nash equilibria that produce non-negative profit is examined. The analysis is first undertaken under the assumption of perfect information. This assumption is then relaxed.

5.3.1 Perfect Information

With perfect information, the lender can distinguish the entrepreneurs according to their entrepreneurial skill, but have no control over their choice of projects. In equilibrium, no lender lends to the low quality entrepreneur. These entrepreneurs have to enter the labour market and

take an employment job. Only the high quality entrepreneur can obtain a loan. The optimal contract must satisfy the high quality entrepreneur's participation constraint

$$EU_{Hg} \geq U(e + w), \quad (5.8)$$

and encourage the investment in the good project:

$$EU_{Hg} \geq EU_{Hb}. \quad (5.9)$$

In addition, because of competition among lenders, each lender must make zero profit from the high quality entrepreneur (if positive profits could be earned, then lenders would have an incentive to modify their contract terms to earn more profits):

$$\pi_{Hg} = 0. \quad (5.10)$$

The equilibrium contract thus maximizes the high quality entrepreneur's utility subject to constraints (5.8), (5.9) and (5.10). The optimal contract must be on the lender's zero profit curve and above the switch line. According to Assumption 5.3, all such contracts are desirable to the high quality entrepreneur. Therefore, constraint (5.8) is redundant and can be dropped.

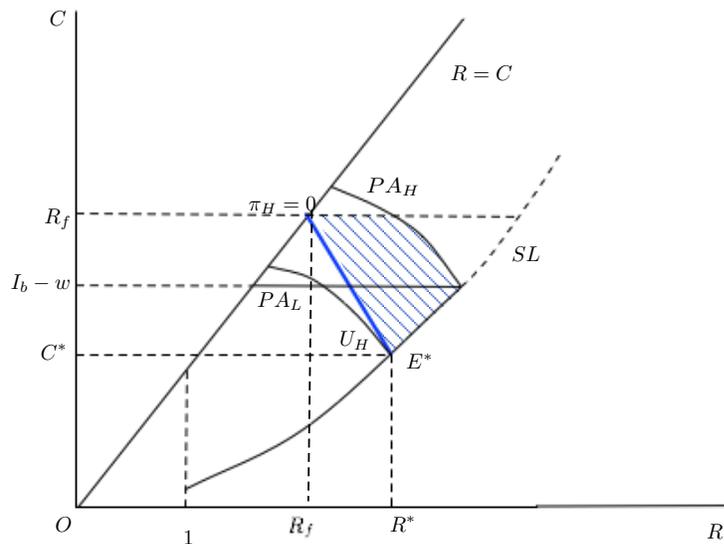


Figure 5.4: Equilibrium with perfect information

Proposition 5.1. *With perfect information and a perfectly elastic supply of funds, each high quality entrepreneur obtains a loan at contract E^* and invests in a good project, where contract E^* is where the lender's zero profit curve above the switch line of the high quality entrepreneur crosses the switch line of the high quality entrepreneur (see Figure 5.4). No low quality entrepreneur can obtain a loan and make an investment.*

Corollary 5.1. *Contract E^* is independent of the wage rate w .*

Corollary 5.2. *High quality entrepreneurs' welfare is independent of w ; however, low quality entrepreneurs' welfare increases as the wage rate w rises.*

According to Proposition 5.1, with perfect information, the first-best investment level can be achieved. Credit rationing of the high quality entrepreneur does not arise in equilibrium, unless some of them are unable to provide sufficient collateral. Furthermore, with perfect information, the optimal loan terms are not affected by the wage rate offered in the labour market.

5.3.2 Imperfect Information

Now consider the situation where the lenders have imperfect information. They are unable to distinguish the entrepreneurs according to their entrepreneurial skill levels or to observe the projects in which they invest. It is easy to verify that contract E^* is not the equilibrium contract with imperfect information. A new equilibrium should be determined.

Since lending to the low quality entrepreneur is unprofitable, the lender needs to design a contract that is not attractive to these entrepreneurs. That is:

$$U(e + I_b - C) \leq U(e + w) \quad (5.11)$$

Expression (5.11) is the incentive compatibility constraint. With imperfect information, the equilibrium contract must maximize the expected utility of the high quality entrepreneurs subject to constraints (5.8), (5.9), (5.10) and (5.11).

Proposition 5.2. *With imperfect information and a perfectly elastic supply of loan funds, the optimal contract is $\hat{E}(\hat{R}, \hat{C})$,*

$$\hat{R} = \frac{R_f - (1 - p)(I_b - w)}{p} \text{ and } \hat{C} = I_b - w \quad (5.12)$$

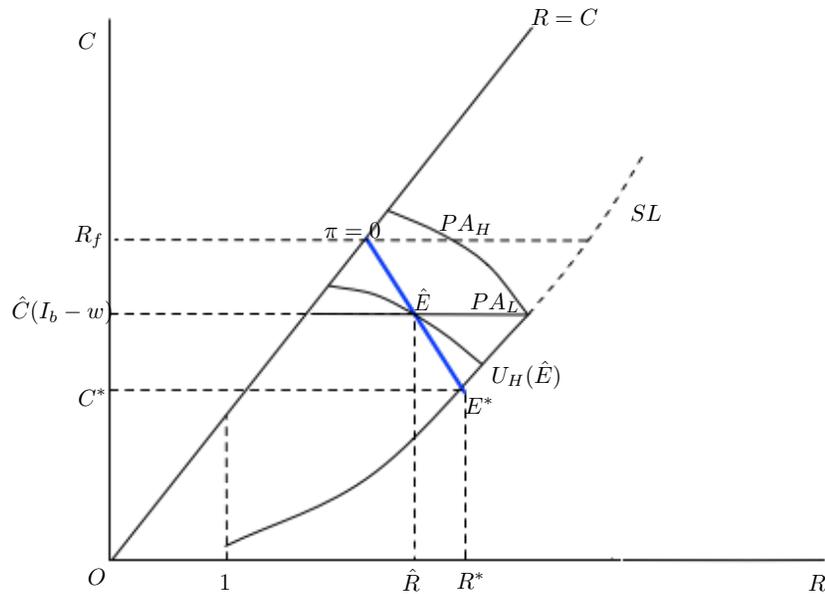


Figure 5.5: The equilibrium with imperfect information

Each high quality entrepreneur obtains a loan and invests in a good project, while the low quality entrepreneur exits the credit market.

This is a straightforward result. Due to the competition pressure, the equilibrium contract must lie on the lender's zero profit curve $\pi = 0$ (constraint (5.10)) and above the switch line (constraint (5.9)). When contract \hat{E} is offered, no contract on curve $\pi = 0$ above the switch line SL can be added to the market for more profits. For example, any contract below \hat{E} attracts the low quality entrepreneurs and results in a reduction in the lender's profit. Any contract above \hat{E} is unattractive to all entrepreneurs. Therefore, in equilibrium no lenders would deviate from contract \hat{E} unilaterally. Contract \hat{E} is the Nash Equilibrium. Perfect separation is achieved in equilibrium with the offering of a single contract \hat{E} : only the high quality entrepreneur obtains a loan and makes the investment.

Collateral is useful in inducing self-selection. The intuition is as follows. With imperfect information, the lender is unable to distinguish the entrepreneurs. However, the lender can indirectly control the high quality entrepreneur's choice of the projects while discouraging the low quality entrepreneur from borrowing. The lender thus raises the collateral requirement to the level that is unacceptable to either a low quality entrepreneur or a high quality entrepreneur who chooses the bad project (recall that the entrepreneur with a bad project is not affected by R

since he/she never repays the loan). This collateral requirement equals $I_b - w$. In equilibrium, perfect separation is achieved, since only the high quality entrepreneurs obtain the loans.

This result is different from that in the previous chapter. This is because here the assumption is that the low quality entrepreneur always chooses the bad technique. As a result the lender's zero profit curves associated with different entrepreneurs coincide below the switch line SL , rather than above it. Therefore, a single contract \hat{E} can be offered, one which only the high quality entrepreneur prefers.

Corollary 5.3. *With imperfect information, high quality entrepreneurs have to pay information rents to distinguish themselves from low quality entrepreneurs.*

The first-best investment level is achieved, however, at a cost to the high quality entrepreneur's welfare. Compared with contract E^* , at contract \hat{E} , the high quality entrepreneur has to pledge more collateral: $C^* < \hat{C}$. Moreover, the reduction in the repayment requirement R is insufficient to compensate the increase in the collateral requirement C : $EU_H(E^*) > EU_H(\hat{E})$ since the entrepreneur's welfare increases as she moves down along the lender's zero profit curve above the switch line. As shown in Figure 5.5, contract \hat{E} is less favourable to the high quality entrepreneur than contract E^* .

Corollary 5.4. $d\hat{C}/dw < 0$ and $d\hat{R}/dw > 0$.

Corollary 5.5. *Entrepreneur's welfare increase in w .*

Corollary 5.4 and 5.5 state how the loan terms and the welfare change with an increase in wage rate w . As w increases, for example because of a higher demand in the labour market, the collateral requirement can be reduced while still ensuring that the low quality entrepreneur prefers to work rather than to borrow. Recognizing this, the lender has an incentive to alter the loan terms for more profits by reducing the collateral requirement and increasing the repayment requirement. As a result, the high quality entrepreneur benefits from the improvement in the loan terms, and her welfare increases as the wage rate w rises. The low quality entrepreneur who takes the employment job benefits from the higher wage rate in the labour market as well.

5.3.3 Credit Rationing

Now consider the case where the entrepreneurs have different collateralizable wealth. The entrepreneur's initial wealth e can be divided into two categories, namely the collateralizable wealth denoted by ce and the non-collateralizable wealth denoted by ne , with $e = ne + ce$.

Some entrepreneurs have more collateralizable wealth, and some entrepreneurs have more non-collateralizable assets. For simplicity, it is assumed that $ce_L = e > \hat{C}$.

The high quality entrepreneurs can be divided into two subcategories according to their collateralizable wealth, namely rich entrepreneurs denoted by r and poor entrepreneurs denoted by p . Their proportions are β and $1 - \beta$, respectively. It is assumed that $ce_{Hr} = e$ and $ce_{Hp} < e$.

It is clear that if $ce_{Hp} \geq \hat{C}$ – i.e., all the high quality entrepreneurs can provide sufficient collateral – the equilibrium is contract \hat{E} , and rationing of the high quality entrepreneur does not occur. However, if the high quality poor entrepreneurs are unable to provide sufficient collateral – i.e., $ce_{Hp} < \hat{C}$ – then rationing of the high quality entrepreneurs may arise in equilibrium. Let γ be the probability of obtaining a loan at loan contract $E(R, C)$.

Define σ_i as the marginal rate of substitution between γ and C of the type i entrepreneur, while the lender's profit equals zero⁵

$$\begin{aligned} \sigma_i &= \frac{dC}{d\gamma} \Big|_{\bar{U}_i, \pi=0} \\ &= \begin{cases} -\frac{pU(e+I_g-R(C))+(1-p)U(e-C)-U(e)}{\gamma(1-p)[U'(e+I_g-R(C))-U'(e-C)]} & \text{if } i = H, \\ \frac{U(e+I_b-C)-U(e)}{\gamma U'(e+I_b-C)} & \text{if } i = L, \end{cases} \end{aligned}$$

where $R(C) = \frac{R_f - (1-p)C}{p}$. The marginal rate of substitution σ_i is positive for $i = H, L$.

Lemma 5.1. $\sigma_H > \sigma_L$ for $C^* \leq C < \hat{C}$.

Proof.

$$\begin{aligned} \gamma(\sigma_H - \sigma_L) &= -\frac{pU(e+I_g-R) + (1-p)U(e-C) - U(e)}{(1-p)[U'(e+I_g-R) - U'(e-C)]} - \frac{U(e+I_b-C) - U(e)}{U'(e+I_b-C)} \\ &\geq [U(e+I_b-R) - U(e)] \left\{ \frac{-1}{(1-p)[U'(e+I_g-R) - U'(e-C)]} - \frac{1}{U'(e+I_b-C)} \right\} \\ &> 0 \end{aligned}$$

according to Assumption 5.3. (Q.E.D.)

This lemma indicates that the high quality entrepreneur's marginal rate of substitution between γ and C is greater than that of the low quality entrepreneur, where R is adjusted to keep the lender's profit equals zero. It means that a high quality entrepreneur is willing to pledge more collateral than does a low quality entrepreneur for an increase in γ , while R is adjusted

⁵The analysis focuses on σ_i s at the contracts above the switch line.

accordingly. As a result, the high quality entrepreneur has the incentive to increase the collateral to signal her quality.

The intuition is as follows. The net benefit from an increase in the collateral captured by a high quality entrepreneur is greater than that captured by a low quality entrepreneur. First, the high quality entrepreneur benefits from both a higher γ and a lower R ; while the low quality entrepreneur benefits only from a higher γ . Second, the increase in the collateral imposes a lower cost on the high quality entrepreneur with a good project than on the low quality entrepreneur with a bad project, since the latter always loses the collateral. Therefore, the high quality entrepreneur is less concerned about the collateral than the low quality entrepreneur, i.e., $\sigma_H > \sigma_L$.

Proposition 5.3. *With imperfect information and a perfectly elastic supply of loan funds,*

1. *if $\hat{C} > ce_{Hp} \geq C^*$, there exists a separating equilibrium: a non-rationing contract \hat{E} designed for high quality rich entrepreneurs and a rationing contract \tilde{E} designed for high quality poor entrepreneurs, at which the probability of obtaining a loan is $\tilde{\gamma}$:*

$$\hat{R} = \frac{R_f - (1-p)(I_b - w)}{p}, \quad \hat{C} = I_b - w; \quad \text{and } \hat{\gamma} = 1;$$

$$\tilde{R} = \frac{R_f - (1-p)ce_{Hp}}{p}, \quad \tilde{C} = ce_{Hp}; \quad \text{and } \tilde{\gamma} = \frac{U(e+w) - U(e)}{U(e+I_b - ce_{Hp}) - U(e)} < 1.$$

Rationing of high quality entrepreneurs arises in equilibrium. All low quality entrepreneurs enter the labour market;

2. *if $ce_{Hp} < C^*$, only high quality rich entrepreneurs obtain loans at non-rationing contract \hat{E} ; high quality poor entrepreneurs and low quality entrepreneurs enter the labour market.*

This proposition can be proved with the aid of Figure 5.6. In panel *a*, curves $PA_{Hr}(\cdot)$, $PA_{Hp}(\cdot)$ and $PA_L(\cdot)$, respectively, are the participation constraints of the high quality rich, the high quality poor and the low quality entrepreneurs, while (\cdot) indicates the respective γ .⁶ Notice that due to the collateral constraint (i.e., $ce_{Hp} < \hat{C}$), the high quality poor entrepreneur's participation constraint curve is a horizontal line $C = ce_{Hp}$ in $R - C$ space and her switch line is truncated by line $C = ce_{Hp}$. The downward sloping line $\pi = 0$ is the lender's zero profit curve associated with the good project. Consider contracts *A*, *B* and \tilde{E} on line $\pi = 0$. The probabilities of obtaining a loan at these contracts are γ_A , γ_B and $\tilde{\gamma}$, respectively. These

⁶Since the lender does not want to lend to the entrepreneurs with the bad projects, the equilibrium contract must lie above the switch line. The contracts below the switch line are thus ignored.

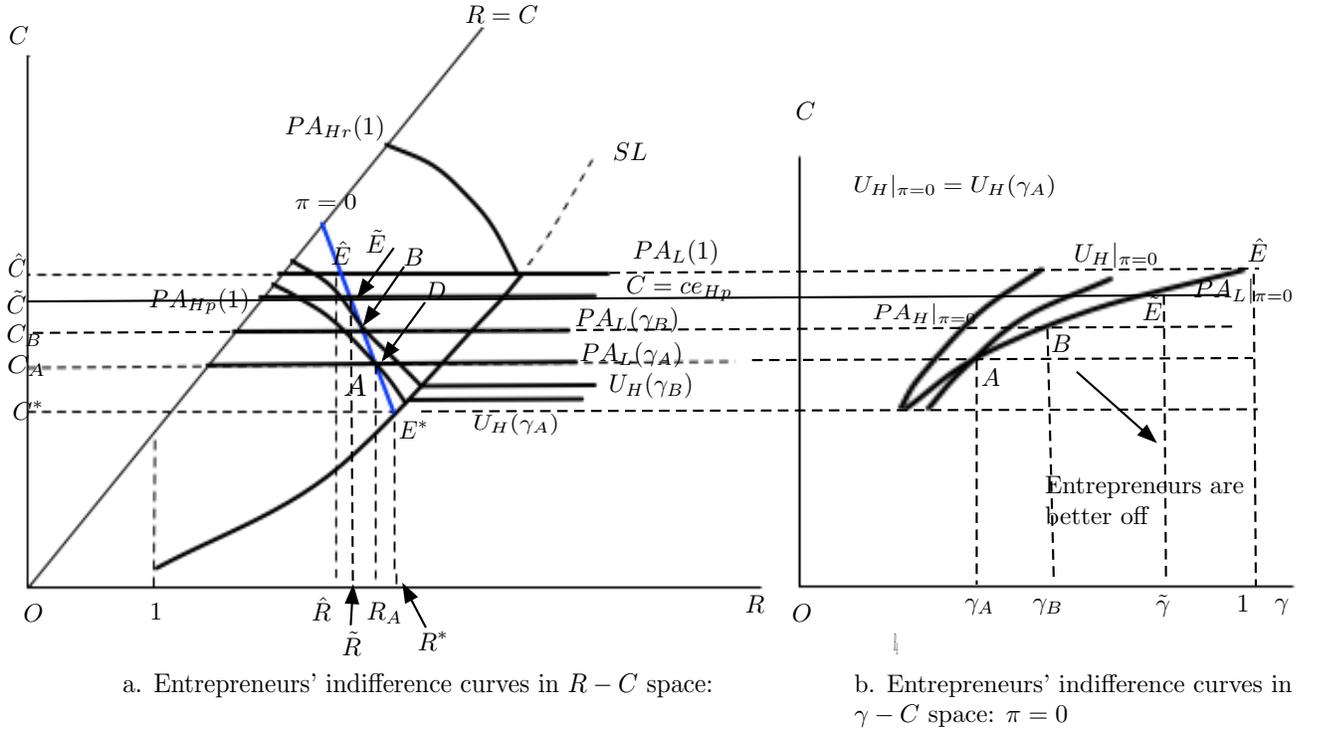


Figure 5.6: Derivation of equilibrium under imperfect information: $ce_{Hp} < \hat{C}$

probabilities are set such that the low quality entrepreneur is indifferent between obtaining a loan and not obtaining a loan, thus the following ranking is necessary: $\gamma_A < \gamma_B < \tilde{\gamma}$. Curve $U_H(\cdot)$ is the high quality entrepreneur's indifference curve. Notice that the high quality entrepreneur is indifferent between the rationing contracts on curves $U_H(\cdot)$ s.

The entrepreneur's indifference curves in $\gamma-C$ space are depicted in panel b, where R is adjusted to ensure that the lender makes zero profit. Curves $PA_H|_{\pi=0}$ and $PA_L|_{\pi=0}$ are the participation constraints of the high quality and low quality entrepreneurs, respectively. Curve $U_H|_{\pi=0}$ is the indifference curve of the high quality entrepreneur. This curve is drawn based on the assumption that the high quality entrepreneur's utility at contracts on this curve equals her expected utility at contract A with γ_A . These curves are upward sloping and concave in γ and C .⁷ Notice that curves $PA_H|_{\pi=0}$ and $U_H|_{\pi=0}$ below line $C = ce_{Hp}$ are the high quality poor

⁷This result occurs, since

$$\frac{d\sigma_H}{d\gamma} = -\frac{2\sigma_H}{\gamma} + \sigma_H^2 \frac{U''(e-C) + (1-p)U''(e+I_g-R)/p}{U'(e-C) - U'(e+I_g-R)} < 0,$$

$$\frac{d\sigma_L}{d\gamma} = -\frac{2\sigma_L}{\gamma} + \sigma_L^2 \frac{U''(e+I_b-C)}{U'(e+I_b-C)} < 0.$$

entrepreneur's indifference curves. The entrepreneurs are better off with a higher γ and a lower C . Since $\sigma_H > \sigma_L$, both curve $PA_H|_{\pi=0}$ and curve $U_H|_{\pi=0}$ are steeper than curve $PA_L|_{\pi=0}$.

Suppose that initially the non-rationing contract \hat{E} and the rationing contract A with γ_A are offered. The low quality entrepreneur is indifferent between the two contracts, and decides to enter the labour market by assumption. The high quality entrepreneur strictly prefers the non-rationing contract \hat{E} . However, due to the collateral constraint, only the high quality rich entrepreneur can afford contract \hat{E} . The high quality poor entrepreneur thus borrows at contract A . In this situation, a new contract D with γ_B can be offered to the market profitably. This contract is as rationing as contract B . As shown in the figure, contract D lies below curve $U_H(\gamma_B)$. Therefore, for the high quality entrepreneur, contract D is more attractive than contract B . It means that contract D with γ_B is more attractive to the high quality entrepreneur than contract A with γ_A . Since contract D is above the zero profit curve, the lender who provides the new contract attracts all high quality poor entrepreneurs and makes more profits from lending. Thus, all lenders have an incentive to modify their contracts designed for the high quality poor entrepreneur until contract \tilde{E} with $\tilde{\gamma}$ is offered because further modification is unprofitable. This contract is the intersection of the lender's zero profit curve $\pi = 0$ and the high quality poor entrepreneur's collateral constraint curve $C = ce_{Hp}$.

The intuition is that, compared with the low quality entrepreneur, the high quality entrepreneur is more concerned about the probability of obtaining a loan than with the collateral. Given two rationing contracts at which both the low quality entrepreneur and the lender feel indifferent, the high quality poor entrepreneur prefers the one that is less rationing, as long as she can provide sufficient collateral. In equilibrium, the high quality poor entrepreneur pledges all her wealth as collateral for a higher probability of obtaining a loan.

Corollary 5.6. $d\tilde{R}/dw = d\tilde{C}/dw = 0$ and $d\tilde{\gamma}/dw > 0$.

Corollary 5.6 describes the labour market's impact on the credit market. First, the wage rate w has no influence on the loan terms of the contract designed for the high quality poor entrepreneur. Second, as the wage rate w increases, more high quality poor entrepreneurs can obtain the loans and make their investments. This result occurs because $\tilde{\gamma}$ is determined by the utility differentials of the low quality entrepreneur at contracts $(R, I_b - w)$ and $\tilde{E}(\tilde{R}, ce_{Hp})$ (recall that his utility is independent of R). The increase in w makes the implementation of an investment less attractive to the low quality entrepreneur. As a consequence, a higher probability of obtaining a loan at

contract \tilde{E} can be introduced while still deterring these entrepreneurs. Therefore, $\tilde{\gamma}$ increases in w . Thus, a positive shock in w in the labour market results in a less rationing outcome in the credit market, and in turn a higher investment level.

Corollary 5.7. *The entrepreneurs' welfare increase in w .*

Corollary 5.7 indicates that all entrepreneurs benefit from the positive shock in the wage rate w in the labour market: (1) the low quality entrepreneur gets a higher wage rate; (2) the high quality poor entrepreneur is more likely to obtain the loan, so more investments are carried out; and (3) the high quality rich entrepreneur borrows under more favourable contract terms. Individually and in aggregate, the entrepreneurs are better off with a higher wage rate in the labour market.

Corollary 5.8. $d\tilde{R}/dce_{Hp} < 0$, $d\tilde{C}/dce_{Hp} > 0$ and $d\tilde{\gamma}/dce_{Hp} > 0$.

Corollary 5.9. *The high quality entrepreneur's welfare increase as ce_{Hp} increases.*

These results are immediate. They indicate how the amount of collateralizable wealth owned by the high quality poor entrepreneur (ce_{Hp}) affects her access to credit and welfare. As shown in Figure 5.6, as ce_{Hp} increases, the loan terms are less favourable; however the benefit from the better access to credit (a higher γ) makes it worth posting more collateral. Thus, the high quality poor entrepreneur is better off as ce_{Hp} increases. The other types of entrepreneurs are not affected.

In this model, the collateral is a useful selection tool. The difference in the entrepreneurial skill results in a difference in attitudes towards the collateral. The high quality entrepreneur who invests in a good project is more concerned about the repayment R and the access to credit γ than the low quality entrepreneur. Therefore, the former has an incentive to provide the collateral up to an amount that is unacceptable to the latter. In equilibrium, a contract that is attractive only to the high quality entrepreneur with a good investment can be designed. Perfect separation is achieved.

If, however, the collateral needed for self-selection exceeds ce_{Hp} , i.e., $ce_{Hp} < \hat{C}$, a collateral requirement of ce_{Hp} is insufficient to deter low quality entrepreneurs from borrowing money. The lender responds to this incentive compatibility problem by reducing the probability of extending credit to a high quality poor entrepreneur, thereby randomizing its credit policy. This rationing contract is designed such that it is unattractive to low quality entrepreneurs. In equilibrium, only

high quality entrepreneurs borrow money and make investments; low quality entrepreneurs take employment jobs.

Rationing of the high quality entrepreneurs takes place in equilibrium if $ce_{Hp} < \hat{C}$. Overall, the proportion of the high quality entrepreneurs who cannot obtain the loans is $(1 - \tilde{\gamma})(1 - \beta)$. Recall that those who do not receive loans cannot obtain employment jobs either. So credit rationing leads to underinvestment and efficiency losses. Measures should be taken to reduce credit rationing. One possible solution is to increase w . As non-participation becomes more favourable to low quality entrepreneurs, a less rationing outcome in the credit market will be attained. However, because the wage rate is determined by the demand for and the supply of labour, arbitrary adjustment will cause an efficiency loss in the labour market. Another solution is to use other selection devices to facilitate the screening of entrepreneurs. Non-financial services (e.g., mentoring and technical assistance) can play such a role in addition to help the entrepreneurs build entrepreneurial skills.

5.4 Non-Financial Services as a Selection Device

In this section, the potential role of non-financial services as a selection vehicle is investigated. As in the previous chapter, the focus is on the impact of non-financial services on the entrepreneurs' costs of obtaining a loan. Again, a loan contract with a component of non-financial services (i.e., mentoring services) is called a mentoring loan contract.

The link between mentoring and loan granting not only produces benefits to entrepreneurs but also impose extra costs on entrepreneurs. Assume that the net benefit of mentoring requirement is negative, or in other words, entrepreneurs have to incur a net cost as a result of mentoring requirement.⁸

Moreover, the mentoring requirement affects different entrepreneurs differently. Let B_{Hk} ($k \in [r, p]$) and B_L be the net cost of obtaining a mentoring loan for the type Hk and the type L entrepreneurs, respectively. The high quality entrepreneurs are more capable individuals and benefit little from the mentoring activities (e.g., business counselling and after-care services). Thus they tend to regard participating in mentoring activities of the lenders as extra costs. However, the costs are different across high quality entrepreneurs.

The mentoring loan contract is the only way for a high quality poor entrepreneur to obtain a loan; while a high quality rich entrepreneur has another option – the conventional loan contract.

⁸Alternatively, one can assume the net benefit of mentoring requirement is positive and carry out the analysis. Such treatment will not change the result dramatically.

Due to the presence of the conventional loan contract, the unconstrained high quality entrepreneur feels that the mentoring requirement is more expensive, compared with the high quality poor entrepreneur, thus $B_{Hr} > B_{Hp}$.

To simplify the analysis, assume that B_{Hr} is sufficiently high such that the high quality rich entrepreneur would never choose a mentoring loan contract. This assumption means that the lender can separate the high quality entrepreneurs by means of mentoring.

The low quality entrepreneurs are less capable, and benefit more from the mentoring activities.⁹ However, they are likely to spend more time and expenses on using these services. For example, they may need to have more frequent meetings with their mentors than do high quality entrepreneurs. Also, they are more likely to be behind on their payments and thus trigger an intensive intervention. Therefore, they have to incur higher costs than do the high quality poor entrepreneurs, thus $B_L > B_{Hp}$.

The net costs of obtaining a mentoring loan – i.e., B_{Hk} and B_L – are assumed to be a function of the entrepreneurs' marginal costs b_{Hk} and b_L , respectively, and the intensiveness of the mentoring services m . Without loss of generality, it is assumed that $b_{Hp} = 0$, so $B_{Hp} = 0$ for $m \geq 0$; $b_L = b > 0$; and $b_{Hr} = \infty$.

The entrepreneurs' expected utility from obtaining a loan at contract $E(R, C)$ with a mentoring requirement m are given by

$$EU_{Hkj} = \begin{cases} pU(e + I_g - R - b_{Hk}m) + (1 - p)U(e - C - b_{Hk}m) & \text{if } j = g, \\ U(e + I_b - C - b_{Hk}m) & \text{if } j = b, \end{cases}$$

$$EU_{Lb} = U(e + I_b - C - bm),$$

for $k = r, p$.

Mentoring has no impact on the high quality poor entrepreneur, so her indifference curves and switch line remain unchanged (see the participation constraint curve $C = ce_{Hp}$, the indifference curve U_{Hp} and the switch line SL in Figure 5.7). The high quality rich entrepreneur faces prohibitively high mentoring costs, thus never finds a mentoring loan contract profitable. Mentoring forces the low quality entrepreneur's participation constraint to shift downward, since an improvement in loan terms (a reduction in C specifically) is necessary to cover the extra costs

⁹It is possible that the low quality entrepreneurs benefit little from the mentoring activities, especially if they borrow loans for other purposes rather than for their businesses.

caused by mentoring (see the movement of the participation constraint from $PA_L(0)$ to $PA_L(m)$ in Figure 5.7). As m increases, the participation constraint shifts down further.

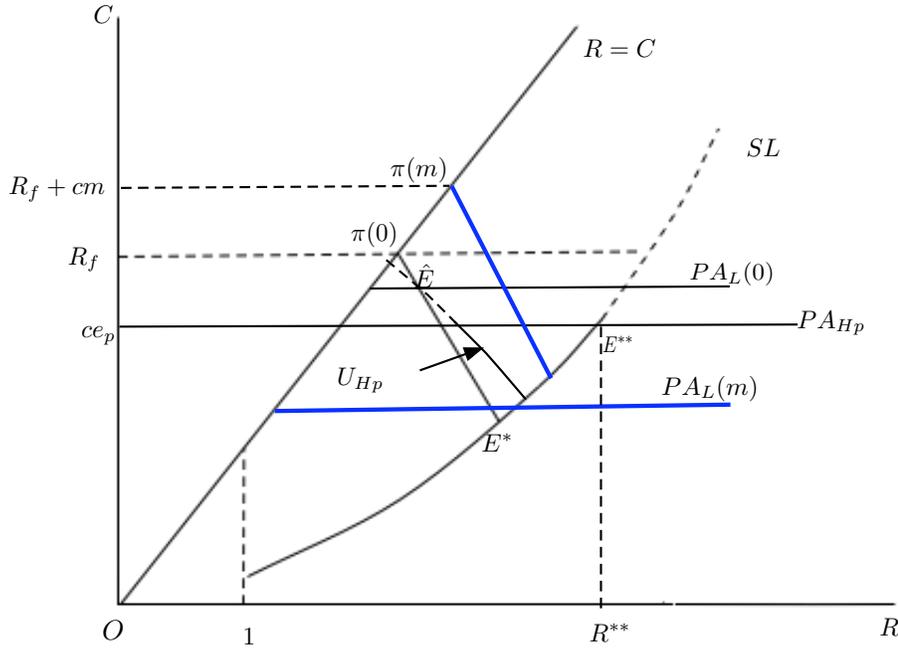


Figure 5.7: Impact of mentoring requirement

Let c be the marginal cost of mentoring for the lender and assume c is the same across the lenders. Assume that there is no fixed cost of mentoring, the lender's profit function is given by

$$\pi_{Hj} = \begin{cases} pR + (1-p)C - R_f - cm & \text{if } j = g, \\ C - R_f - cm & \text{if } j = b, \end{cases} \quad (5.13)$$

$$\pi_L = C - R_f - cm. \quad (5.14)$$

The lender's zero profit curve above the switch line SL shifts upward with an increase in the intensiveness of mentoring services m , since the lender needs either a higher R or a higher C , or both, to cover the cost of mentoring (see the movement of the zero profit curve from $\pi(0)$ to $\pi(m)$ in Figure 5.7).

Assumption 5.4. $c \leq b \frac{pR^{**} + (1-p)ce_{Hp} - R_f}{I_b - ce_{Hp} - w}$, where contract $E^{**}(R^{**}, ce_{Hp})$ is the intersection of the switch line SL and the collateral constraint curve $C = ce_{Hp}$.

This assumption implies that the lender can make positive profit at contract E^{**} , at which the mentoring requirement m^{**} is designed such that the low quality entrepreneur is indifferent between obtaining and not obtaining a loan, when the collateral requirement is ce_{Hp} .¹⁰

The mentoring requirement affects different entrepreneurs differently. This suggests that the mentoring requirement can be used as a substitute for collateral to deal with imperfect information in the environment where some entrepreneurs have difficulties in providing sufficient collateral to secure a loan. However, the effectiveness of mentoring as a selection device is affected by b , c and w . If Assumption 5.4 is violated because, for example, c is high – i.e., the lender requires a large increase in R or C , or both to cover the mentoring costs, or b is low – i.e., the low quality entrepreneur is not sensitive to the mentoring requirement, or w is low – i.e., employment job is less attractive, then there exists no feasible mentoring loan contract. Recall that the low quality entrepreneur is indifferent between contracts that have the same collateral requirement and mentoring requirement. So R^{**} is the highest possible repayment requirement of the mentoring loan contract, when the collateral requirement equals ce_{Hp} and the mentoring requirement equals m^{**} .¹¹ Thus, the violation of Assumption 5.4 means that the lender cannot make non-negative profit at contract $E^{**}(R^{**}, ce_{Hp})$ with mentoring requirement m^{**} , not to mention to increase the mentoring requirement further for a further reduction in the collateral so that the high quality poor entrepreneur can afford the mentoring loan contract. Therefore, Assumption 5.4 ensures the existence of the equilibrium mentoring loan contract.

Lemma 5.2. *All high quality rich entrepreneurs obtain the loans at conventional loan contract \hat{E} .*

Since she never chooses a mentoring loan, the high quality rich entrepreneur can be easily separated from the others. As discussed in a previous section, the conventional loan contract \hat{E} is offered to serve these entrepreneurs' needs for credit.

¹⁰The low quality entrepreneur is indifferent between borrowing and not borrowing money, thus

$$U(e + I_b - ce_{Hp} - bm^{**}) = U(e + w) \implies m^{**} = \frac{I_b - ce_{Hp} - w}{b}.$$

Substitute m^{**} into the lender's profit function,

$$\pi = pR^{**} + (1-p)ce_{Hp} - R_f - c \frac{I_b - ce_{Hp} - w_L}{b} \geq 0.$$

Rearranging this expression gives $c \leq \frac{pR^{**} + (1-p)ce_{Hp} - R_f}{I_b - ce_{Hp} - w_L}$.

¹¹Notice that the mentoring loan contract must lie above the switch line to encourage the investment in the good projects.

Thus, the lender can focus on the submarket consisting of the high quality poor and the low quality entrepreneurs. Due to the competition, the equilibrium contract should maximize the welfare of the high quality poor entrepreneur, subject to the participation constraint (5.8), the good project constraint (5.9), the lender's new participation constraint:

$$\pi = pR + (1 - p)C - R_f - cm = 0, \quad (5.15)$$

as well as the new incentive compatibility constraint:

$$U(e + I_b - C - bm) \leq U(e + w). \quad (5.16)$$

Define ϕ as the marginal rate of substitution between m and C , where R is adjusted such that the lender's profit equals zero:

$$\phi_L|_{\pi=0} = -b, \quad (5.17)$$

$$\phi_{Hp}|_{\pi=0} = \begin{cases} -\frac{cU'(e+I_b-R(C,m))}{(1-p)[U'(e-C)-U'(e+I_b-R(C,m))]} & \text{if } EU_{Hp} > U(e+w), \\ -b & \text{if } EU_{Hp} \leq U(e+w), \end{cases} \quad (5.18)$$

where $R(C, m) = [R_f + cm - (1 - p)C]/p$. The entrepreneurs require a reduction in C – note that R is adjusted accordingly – to compensate for an increase in m . Notice that $\phi_L|_{\pi=0}$ equals a constant. To deter the low quality entrepreneur, the collateral requirement and the mentoring requirement must satisfy $U(e+I_b-C-bm) = U(e+w)$, which means that $e+I_b-C-bm = e+w$ must hold. It in turn means that $\sigma_L|_{\pi=0} = -b$.

Proposition 5.4. *With imperfect information, if $C^* \leq ce_{Hp} < \hat{C}$, the optimal contract designed for the high quality poor entrepreneur is a mentoring loan contract. It can be either contract \hat{E}_1 with mentoring requirement \hat{m}_1 or contract \hat{E}_2 with mentoring requirement \hat{m}_2 . Contracts \hat{E}_1 and \hat{E}_2 and mentoring requirements \hat{m}_1 and \hat{m}_2 are defined as follows*

$$\hat{R}_1 = \frac{R_f - (1-p)ce_{Hp}}{p} + \frac{c(I_b - ce_{Hp} - w)}{pb}, \quad \hat{C}_1 = ce_{Hp}; \quad \text{and} \quad \hat{m}_1 = \frac{I_b - ce_{Hp} - w}{b} = m^{**}.$$

\hat{R}_2, \hat{C}_2 and \hat{m}_2 solve following expressions

$$EU_{Hg} = EU_{Hb}; \quad \pi = 0; \quad \text{and} \quad U(e + I_b - C - bm) = U(e + w).$$

If $EU_{Hp}(\hat{E}_1) \geq EU_{Hp}(\hat{E}_2)$, contract \hat{E}_1 with mentoring requirement \hat{m}_1 will be offered; and vice versa.

The above results are illustrated in Figures 5.8 and 5.9. The only difference between the two figures is that Figure 5.8 is drawn based on the assumption that the high quality poor entrepreneur prefers contract \hat{E}_1 with \hat{m}_1 over \hat{E}_2 with \hat{m}_2 , and Figure 5.9 is based on the opposite assumption.

First examine Figure 5.8. In panel *a*, the horizontal line $PA_L(\cdot)$ depicts the participation constraints of the low quality entrepreneur, where (\cdot) indicates the mentoring requirement. To make these entrepreneurs indifferent among the contracts on curve $PA_L(\cdot)$, the following ranking is necessary: $0 < \hat{m}_1 < m_A < \hat{m}_2$. The downward sloped lines $\pi(0)$, $\pi(\hat{m}_1)$, $\pi(m_A)$ and $\pi(\hat{m}_2)$ are the lender's zero-profit curves associated with the above mentoring requirements. The dashed curves $U_H(\hat{m}_1)$ and $U_H(\hat{m}_2)$ are the high quality poor entrepreneur's indifference curves. Note that the high quality poor entrepreneur derives a higher level of utility along curve $U_H(\hat{m}_1)$ than along curve $U_H(\hat{m}_2)$.

Now consider three contracts \hat{E}_1 , A and \hat{E}_2 . Contract \hat{E}_1 is the intersection of the lender's zero profit curve $\pi(\hat{m}_1)$ and the collateral constraint line $C = ce_{Hp}$; contract A is the intersection of the lender's zero profit curve $\pi(m_A)$ and the low quality entrepreneur's participation constraint curve $PA_L(m_A)$; and contract \hat{E}_2 is the intersection of the high quality entrepreneur's switch line and the low quality entrepreneur's participation constraint curve $PA_L(\hat{m}_2)$.

In panel *b*, the low quality entrepreneur is indifferent between obtaining a loan and not obtaining a loan at contracts \hat{E} , \hat{E}_1 , A and \hat{E}_2 , under which the mentoring requirements are 0 , \hat{m}_1 , m_A and \hat{m}_2 , respectively, since they all lie on curve $PA_L|_{\pi=0}$ – the participation constraint of the low quality entrepreneur in $m - C$ space, where R is adjusted to keep the lender's profit equal to zero. The slope of the line equals $-b$. Curve $U_H(\hat{E}_1)|_{\pi=0}$ is the indifference curve of the high quality entrepreneur in the same space. This curve is convex in m and C .¹² The entrepreneurs are better off with either a lower m or a lower C , or both.

Since the entrepreneur's indifference curves are convex in m and C on the lender's zero profit hyperplane in $m - C$ space, the contract designed for the high quality poor entrepreneur must be a corner solution. In equilibrium, either contract \hat{E}_1 with \hat{m}_1 or \hat{E}_2 with \hat{m}_2 will be

¹²Differentiating equation (5.18) with respect to m gives,

$$\frac{d\phi_{Hp}|_{\pi=0}}{dm} = \frac{U'(e - C)U''(e + I_g - R) \frac{(1-p)\phi_{Hp}-c}{p} + U'(e + I_g - R)U''(e - C)\phi_{Hp}}{(1-p)[U'(e + I_g - R) - U'(e - C)]^2} > 0,$$

where $R = [R_f + cm - (1-p)C]/p$. So the high quality entrepreneur's indifference curves in $m - C$ space (R is adjusted accordingly) is convex in m and C .

offered together with conventional loan contract \hat{E} in equilibrium, depending on which contract the high quality poor entrepreneur prefers.

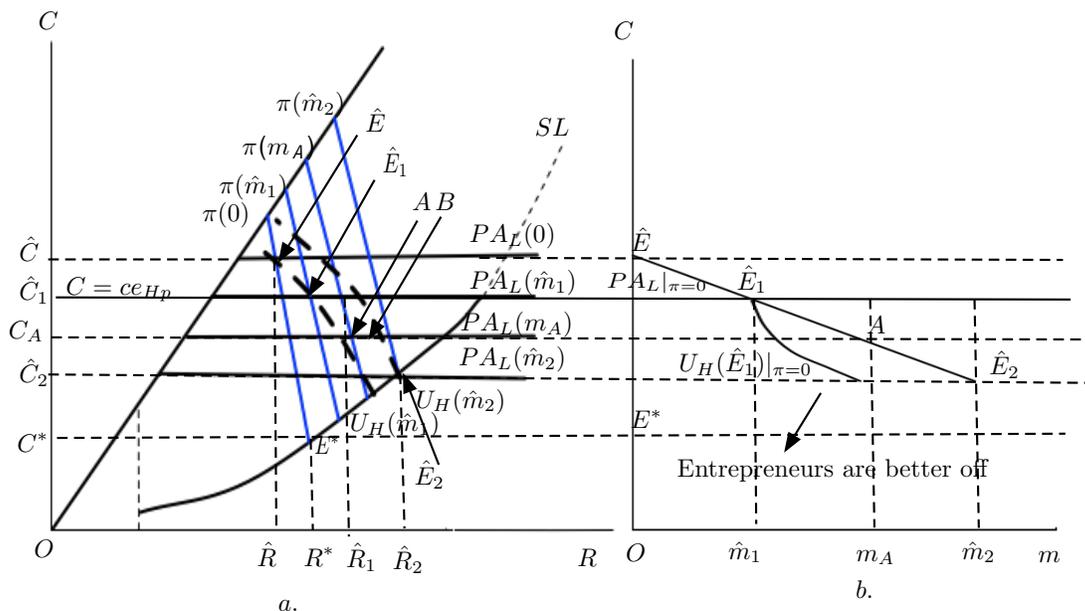


Figure 5.8: Equilibrium mentoring contract: \hat{E}_1 with \hat{m}_1

For example, in Figure 5.8, the expected utility of the high quality poor entrepreneur is at the highest possible level at contract \hat{E}_1 with \hat{m}_1 . This contract is thus designed for these entrepreneurs. To see this, suppose instead initially contract \hat{E}_2 with \hat{m}_2 is offered together with conventional loan contract \hat{E} . In this situation, a new contract B with m_A can be added to the market profitably. Contract B has the same collateral requirement as contract A , but with a bit higher repayment requirement. Contract B lies between curves $U_H(\hat{m}_1)$ and $U_H(\hat{m}_2)$ in panel a, thus it is more favourable than contract \hat{E}_2 but less favourable than contract A to the high quality poor entrepreneur. This contract satisfies the incentive compatibility constraint as well since it lies on curve $PA_L(m_A)$ – the low quality entrepreneur’s participation constraint curve associated with mentoring requirement m_A . Therefore, no low quality entrepreneur borrows at contract B with m_A . Moreover, contract B lies above line $\pi(m_A)$ – the zero profit curve associated with mentoring requirement m_A , so the lender who offers this new contract can make more profits. Thus, all lenders have an incentive to modify their contract terms and mentoring requirement designed for the high quality poor entrepreneur, until contract \hat{E}_1 with \hat{m}_1 is offered, because deviation from this contract is no longer profitable. So the Nash equilibrium is the conventional loan contract \hat{E} and the mentoring loan contract \hat{E}_1 with \hat{m}_1 .

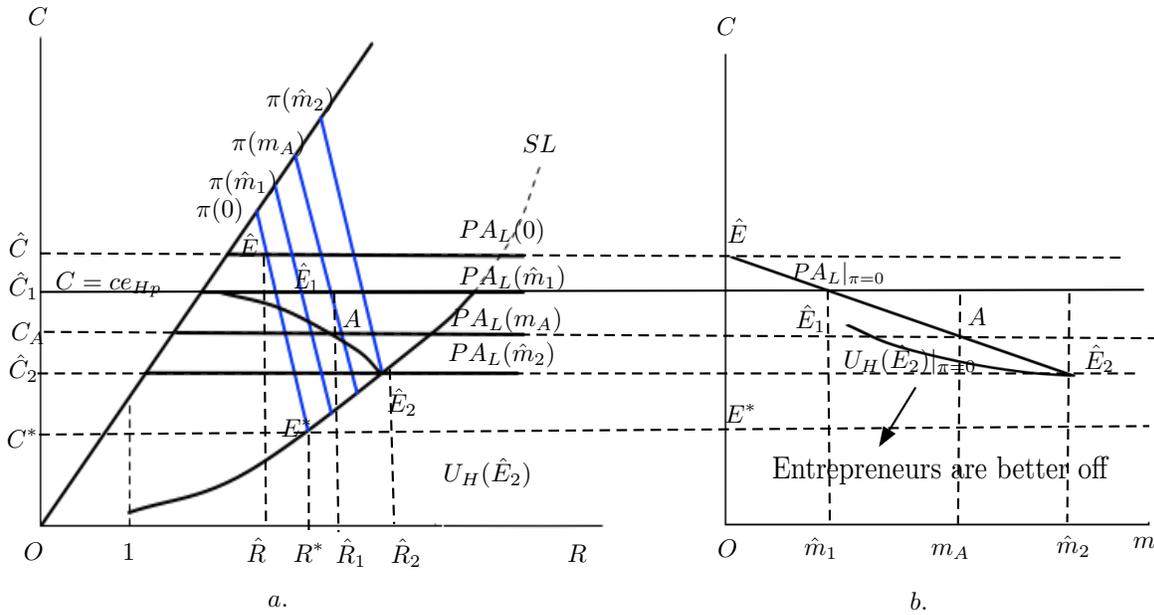


Figure 5.9: Equilibrium contract: \hat{E}_2 with \hat{m}_2

Similarly, as shown in Figure 5.9, if the high quality poor entrepreneur strictly prefers contract \hat{E}_2 over \hat{E}_1 , then contract \hat{E}_2 with \hat{m}_2 is offered together with the conventional loan contract \hat{E} , since deviating from it unilaterally is not profitable.

Corollary 5.10. *When some high quality entrepreneurs lack collateralizable wealth – i.e., $C^* \leq ce_{Hp} < \hat{C}$, mentoring can be used to deal with information imperfections. In equilibrium, rationing of high quality entrepreneurs does not occur: those who can provide sufficient collateral obtain the conventional loans and those who are constrained obtain the mentoring loans. All low quality entrepreneurs take employment jobs. The first-best investment level is achieved by means of mentoring.*

The intuition is as follows. With limited collateralizable wealth, collateral is not effective in facilitating screening, since the collateral requirement of ce_{Hp} is insufficient to signal a high quality entrepreneur with a good project. Because it affects different entrepreneurs differently, mentoring has the potential to facilitate selection. By imposing a mentoring requirement of sufficient magnitude that low quality entrepreneurs find it not worthwhile to obtain a loan, the lender can achieve perfect separation; only high quality entrepreneurs stay in the market, and low quality entrepreneurs move to the labour market. The self-selection of the entrepreneurs occurs and the first-best level of investment is attained.

Notice that in the environment of imperfect information, compared with the optimal rationing contract, high quality poor entrepreneurs could be better off or worse off with the optimal mentoring loan contract. For example, if mentoring loan contract \hat{E}_1 with \hat{m}_1 is offered, these entrepreneurs' utility is $EU_{Hp}(\hat{E}_1, \hat{m}_1) = pU(e + I_g - \hat{R}_1) + (1-p)U(e - ce_{Hp})$. In comparison, their utility at the rationing contract is $EU_{Hp}(\tilde{E}, \tilde{\gamma}) = \tilde{\gamma}[pU(e + I_g - \tilde{R}) + (1-p)U(e - ce_{Hp})] + (1 - \tilde{\gamma})U(e)$. If c is small or b is large such that \hat{R}_1 is much higher than \tilde{R} , it is likely that the condition $EU_{Hp}(\hat{E}_1, \hat{m}_1) > EU_{Hp}(\tilde{E}, \tilde{\gamma})$ will hold, which means the entrepreneurs are better off with the mentoring loan contract.

Corollary 5.11. *The collateral-constrained high quality entrepreneur's welfare EU_{Hp} increase in b and w_L , and decrease in c .*

This result can be derived by investigating the comparative static properties. By differentiating \hat{R}_l , \hat{C}_l and \hat{m}_l with respect to c , w and b , respectively, the following properties can be derived

$$\begin{aligned} d\hat{R}_l/db &< 0 & d\hat{C}_l/db &\leq 0 & d\hat{m}_l/db &\leq 0 \\ d\hat{R}_l/dw &< 0 & d\hat{C}_l/dw &\leq 0 & d\hat{m}_l/dw &< 0 \\ d\hat{R}_l/dc &> 0 & d\hat{C}_l/dc &\leq 0 & d\hat{m}_l/dc &\geq 0 \end{aligned}$$

for $l = 1, 2$.

As his marginal cost b increases, the low quality entrepreneur becomes more sensitive to the mentoring requirement. Thus, a lower mentoring requirement is sufficient to deter him from borrowing. This enables the lender to offer a more favourable loan contract to the high quality poor entrepreneur by reducing either R or both R and C . Therefore, EU_{Hp} increases.

Similarly, as the wage rate w increases, making an investment becomes less attractive. A lower level of mentoring requirement is sufficient to deter the low quality entrepreneur. So EU_{Hp} increases due to the improvement in the loan terms. Recall that the low quality entrepreneur takes the employment job. The increase in w means that the welfare of these entrepreneurs increase as well. The high quality rich entrepreneurs also benefit from the improvement in loan terms due to the increase in w .

However, as c increases, the lender requires an increase in either R or C to cover the mentoring costs. As a response, the lender reduces the mentoring requirement and increases either R or both R and C . Since the loan terms are less attractive to the high quality poor entrepreneur, her welfare decrease.

5.5 Summary

In a model that combines adverse selection and moral hazard, collateral is shown to be a useful selection tool in an environment where lenders can distinguish the entrepreneurs according to their wealth, but cannot observe the quality of the entrepreneurs. High quality entrepreneurs are willing to pledge more collateral to distinguish themselves from low quality entrepreneurs. Perfect separation is attainable in equilibrium. All the high quality entrepreneurs obtain loans and invest in good projects, while all the low quality entrepreneurs participate in the labour market. Meanwhile, the first-best investment level is realized, although at a cost to the entrepreneurs, since high quality entrepreneurs have to post more collateral than what is necessary to deal with the moral hazard problem.

If some high quality entrepreneurs have insufficient collateralizable wealth, credit rationing may occur since the repayment requirement and the collateral requirement are insufficient to mitigate the information problem. The outcome is perfect separation with rationing.

The model in this chapter also demonstrates that non-financial services (e.g., business training, workshops, counselling, mentoring and after-care services) can be an effective selection device, since it increases the low quality type entrepreneur's costs of obtaining a loan, and thus makes a mentoring loan contract unfavourable to this group.

The effectiveness of this strategy relies on the mentoring cost on both lenders and entrepreneurs. For example, if the lenders face prohibitively high mentoring costs, they are unable to work out a mentoring loan contract that would not negatively affect their profits. Alternatively, if the undesired entrepreneurs (the low quality entrepreneurs) have low mentoring costs, it could be advantageous for them to participate in the mentoring activities to secure the loans. In this situation, it would be difficult to discourage them from borrowing. The lesson is that the lenders must design their non-financial services appropriately such that the participation in such activities may cause a large discrete impact on the undesired entrepreneurs, and a relative small impact on the desired entrepreneurs.

There is a positive feedback mechanism that affects the relationship between the credit market and the labour market. The wage rate rises if there is a positive demand shock in the labour market. The higher wage rate affects the entrepreneurs' choices between employment and investment, and leads to a better selection. As a result credit rationing becomes less serious. If the lender offers the mentoring loan contract to solve the information problem, he can reduce the intensiveness of these services in the case where there is a positive shock in the labour market.

An Economic Analysis of Microcredit Lending

As discussed in Chapter 1 and 2, a number of Canadian credit unions have operated micro-credit programs. Unlike the NGOs who obtain capital from outside sources, credit unions finance micro loans out of the deposits of their members. In the next chapter, a model is developed to examine how the credit union prices micro-loans and deposit services.

Chapter 6

A Framework for Analyzing Credit Union Decision-Making

6.1 Introduction

Co-operatives, including credit unions, have been identified as a way of introducing competition to the imperfectly competitive markets. Enke [1945] first investigated co-operatives as a separate form of business. Focusing on consumer co-operatives, he argues that an efficient outcome can be achieved if the co-operative maximizes the sum of producer and consumer surplus. Helmberger and Hoos [1962] analyzed how the presence of a co-operative may affect the market outcome in different market structures. They demonstrated that the single processing co-operative with an open membership policy can lead to an outcome that is closer to that under perfect competition than to the monopoly structure.

A co-operative is a business that is owned and democratically controlled by its members who are also the users of products and services provided by the co-operative. However, members may have different preferences or different reasons for participating in the co-operative. As a consequence, members have “a strong incentive to form coalitions to shift benefits in their direction” (Hansmann [1988], p. 279). These subgroups often can achieve disproportionate influence over the co-operative’s policy. This is particularly the case if the groups are in a better position to participate in the decision-making process. Faced with member heterogeneity, pricing policy becomes more difficult (Staatz [1987]).

In a credit union, member heterogeneity is a concern as outlined in Chapter 3. The credit union consists of two broad groups of members: borrowers and savers. There is fundamental potential conflict between the two groups. Borrowers prefer lower interest rates on loan services, while savers prefer higher interest rates on saving services. The gap between the two is the

profits to the credit union, which are either retained as reserve funds for the future development or returned to the members based on patronage. It is impossible for the credit union to make both groups better off at the same time: the benefits accruing to one group are at the cost to the other group. Preferential treatment of one group would negatively affect the other group.

Traditional models of financial intermediaries and co-operatives cannot be applied directly to model the behaviour of a credit union. Simple profit maximizing models are applicable only if there is perfect competition in the financial market, which is typically not the case. In addition, classic co-operative models are inappropriate because they are based on the assumption of homogeneous members, and thus the maximization of a single objective for these members.

Taylor [1971] was the first who noticed the member orientation/preference of the credit union and incorporated it into a simple theoretic model. His work has inspired a number of theoretical efforts. Chapter 3 presented a brief review of these works, for instance, Smith et al. [1981], Smith [1984], Emmons and Schmidt [2001], and Emmons and Mueller [1997].

In this chapter, a framework is developed for understanding how, in the provision of micro-credit, the presence of a credit union leads to a better outcome compared with the structure that would exist under an IOF (e.g., a chartered bank). The difference between this framework and previous studies is that non-pecuniary motives of members are taken into account. The idea of ‘warm glow’ discussed in Andreoni [1989, 1990] is applied to the behaviour of savers in the model. As will be shown, this non-pecuniary consideration has an influence on the interest rates, and therefore affects the number of investments that can be carried out.

This chapter is organized as follows. The next section models the behaviour of borrowers and savers. Section 6.3 presents a comparison between two outcomes – one is with a monopolistic IOF operating a micro-loan program and the other is with a credit union operating a micro-loan program. Section 6.4 examines how saver commitment affects the outcome, including the interest rates chosen and the resulting benefits to members. The last section concludes with the key results.

6.2 The Framework

Consider a financial institution – either an IOF or a credit union – that operates a micro-loan program to target the underserved micro-entrepreneurs. It also operates a community investment saving program. The savings mobilized through this latter program are used to finance micro-loans. The interest rate on the community investment saving deposits is below the market interest

rate. This lower interest rate allows the financial institution to reduce the capital cost or financing cost of micro-loans.

For simplicity, it is assumed that the clients of the financial institution can be classified into two groups: borrowers and savers, and that each one belongs to one of any one of the two groups.

6.2.1 Borrowers

Borrowers can be further classified into two subgroups: conventional loan borrowers who are not eligible for micro-loans and micro-loan borrowers.

Conventional Loan Borrowers

The financial institution has no incentive to alter its policy for conventional loans after micro-loan and community investment saving programs are initiated, since doing so would result in either its conventional credit services becoming less competitive compared with those provided by other financial institutions (e.g., because of more stringent conditions) or a major loss of revenue (e.g., the resulting credit is provided at a lower interest rate). Therefore, the conventional loan borrowers' access to credit is not affected. For simplicity, it is assumed that the net benefit of the new programs to the conventional loan borrowers can be neglected, and that these borrowers are neutral towards microcredit.¹ As a result, the financial institution can ignore them when introducing the micro-loan services. Hereafter, unless specified, borrowers refer to micro-loan borrowers.

Micro-loan Borrowers

In each period there are n_b potential borrowers who are eligible for micro-loans according to the criteria set by the financial institution. Each has the opportunity to invest in one project at most. The projects are identical. Borrowers have no initial wealth. To finance their projects, they have to borrow funds from the financial institution (i.e., they have no other source of finance). This amount is normalized at unity. The return from the project is $1 + i$ if it is successful, and 0 if it is unsuccessful. The probability of having a successful project is denoted by p .

The micro-loan contract is specified by the interest rate r_b , where $r_b < i$. If the investments are successful, borrowers reap the returns from the investments and pay off their loans (principal

¹Conventional loan borrowers may derive either satisfaction or dissatisfaction from the micro-loan program. For example, if they believe that the provision of micro-loans is worthwhile, they may benefit even though they have not made any contribution to it directly.

plus interest) at the end of the period.² However, in the case where the investment is unsuccessful, borrowers would simply default on the loans since they cannot afford to repay the loans.

Borrowers are heterogeneous with respect to their entrepreneurial skill. Let x denote a borrower's entrepreneurial skill index. Borrowers are assumed to be uniformly distributed in their entrepreneurial skill and x takes on values between zero and one. Moreover, an individual with a higher x is less capable.

Let the type x borrower's investment cost be γx , where $\gamma > 0$ is an exogenous parameter. Thus, a less capable borrower incurs a higher investment cost than a more capable borrower. Assuming that borrowers are risk-neutral, the net expected benefit captured by a borrower whose entrepreneurial skill index is x is:

$$w_b = p(i - r_b) - \gamma x. \quad (6.1)$$

A borrower's borrowing decision is determined by comparing the net benefit derived from obtaining a micro-loan and not obtaining a micro-loan. Figure 6.1 illustrates the decisions and welfare of borrowers. The horizontal line AB represents the expected benefit $p(i - r_b)$ from obtaining a loan to individual borrowers. The upward sloping curve OC graphs the borrowers' cost γx . The difference between AB and OC represents the net expected benefit to individual borrowers from obtaining a loan. The intersection of AB and OC – point E – represents the entrepreneurial skill index of the borrower who is indifferent between obtaining and not obtaining a micro-loan. This borrower's entrepreneurial skill index is given by

$$\hat{x} = p(i - r_b)/\gamma. \quad (6.2)$$

Borrowers located to the right of \hat{x} do not borrow micro-loans because it is unprofitable to do so, while borrowers located to the left of \hat{x} borrow and undertake their investments. The entrepreneurial skill index \hat{x} is also the proportion of borrowers who choose to borrow.

The aggregate benefit accruing to borrowers is given by the area below line AB and above line OC times n_b in Figure 6.1, and is given by:

$$W_b = n_b \int_0^{\hat{x}} w_b dx = n_b \int_0^{\hat{x}} [p(i - r_b) - \gamma x] dx = \frac{n_b p^2 (i - r_b)^2}{2\gamma}, \quad (6.3)$$

²It is assumed that strategic default does not occur.

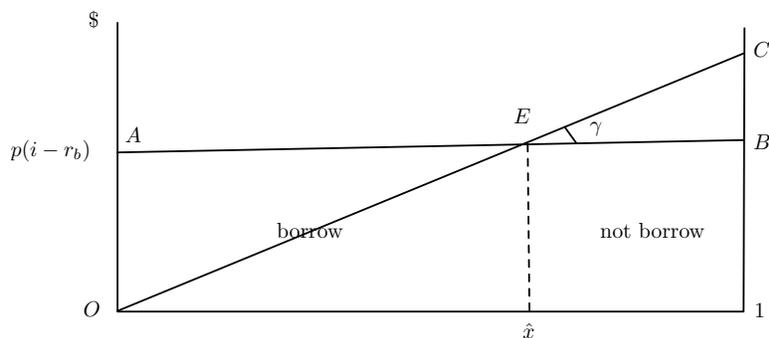


Figure 6.1: The participation of potential borrowers.

for $r_b \leq i$.

6.2.2 Savers

Why Do Savers Participate?

The community investment saving deposits are lent out as micro-loans to the underserved micro-entrepreneurs who otherwise have no access to the credit necessary to finance their small businesses (most of them are on a low income). The provision of microcredit not only directly benefits individual borrowers but also creates positive externalities (social benefits) – e.g., empowering women, reducing depopulation and improving nutrition and education. However, as discussed in Chapter 2, in developed countries the social impact of a microcredit program is often very limited.

Why would individuals contribute to the provision of microcredit? One reason is pure altruism. With pure altruism, savers’ utility is a function of the returns from investing in the saving plan and the benefits captured by borrowers. Another reason is the so-called “warm glow”. Warm glow is a private benefit – a feeling of personal gratification arising from the contribution itself (Andreoni [1989, 1990]). The discussion about warm glow of giving can be directly applied to the case of investing in the community investment saving plan: savers are motivated by the investment returns, the consumption of warm glow and the positive spillover generated.

Savers’ Decision-making

In each time period there are n_s savers who make deposits at the financial institution. They consider whether to make community investment saving deposits on top of their regular saving deposits. It is assumed that the amount deposited in the community investment saving accounts is the same across savers and is normalized at unity.

Let r_s be the interest rate on the community investment saving deposits and r_{ms} be the interest rate on conventional saving deposits (i.e., the market interest rate on savings). The net benefit associated with one unit of investment in the community investment saving plan is defined as

$$w_s = U(r_s - r_{ms}, G, g; y), \quad (6.4)$$

where $-(r_s - r_{ms})$ is the private consumption that the saver has to forgo if she invests in the community investment saving plan, G is the social benefits of the micro-loan program captured by the community; g is the consumption of warm glow; and $y \in [0, 1]$ is the preference of that particular saver for the provision of micro-loans.

Assuming the welfare function is separable and linear, Equation (6.4) can be simplified as below:

$$w_s = \begin{cases} r_s - r_{ms} + \beta y & \text{if the saver participates,} \\ Gy & \text{if the saver does not participate,} \end{cases} \quad (6.5)$$

where $\beta = G + g$.

The term $r_s - r_{ms}$ in equation (6.5) represents the net pecuniary benefits captured by a saver from making community investment deposits (Walker and Chandler [1977]). Since $r_s \leq r_{ms}$ (the purpose of introducing the community investment savings plan is to allow the financial institution to access cheaper loan funds), the net pecuniary gains from the community investment savings must be non-positive.

The term βy is the non-pecuniary benefits from contributing to the provision of micro-loans. The parameter β captures the social benefits and the consumption of warm glow (converted to pecuniary terms). The variable $y \in [0, 1]$ differentiates savers. Savers with a higher y obtain greater satisfaction from their “participation” in the micro-loan program. As a result, they are more likely to make contributions by participating in the community investment saving plan. Those with a lower y derive a lower level of satisfaction from their “participation”, and consequently they are unlikely to participate. For simplicity, it is assumed that savers are uniformly distributed on the interval $[0, 1]$.

In this simple framework, the social impact G does not affect a saver’s decision, since he/she always captures the social benefit Gy . For simplicity, it is assumed that $G = 0$ and thus $\beta = g$.

The savers' decision to participate in the community investment savings plan is illustrated in Figure 6.2. The upward sloping curve AB graphs the benefits from investing in the community investment saving plan to savers of different types (y), while the horizontal curve CD graphs the benefits from making conventional saving deposit. The distance between the two curves is the net benefits captured by individual savers. The intersection of these curves determines the marginal saver who is willing to participate in the community investment saving plan. This saver is given by

$$\hat{y} = \frac{r_{ms} - r_s}{\beta}. \quad (6.6)$$

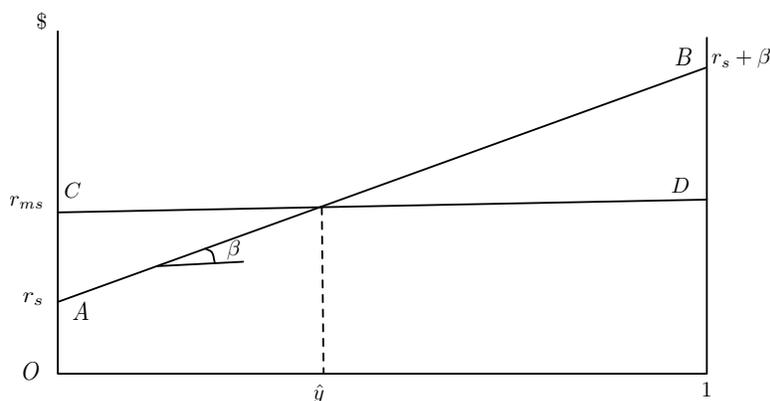


Figure 6.2: Savers' decision and welfare

Savers located to the left of \hat{y} do not invest in the community investment saving plan because it is not worthwhile for them to do so. Only those who located to the right of \hat{y} would make such investments. The proportion of savers who invest in the community investment saving plan is

$$1 - \hat{y} = \begin{cases} \frac{\beta + r_s - r_{ms}}{\beta} & \text{if } r_{ms} > r_s \geq r_{ms} - \beta, \\ 0 & \text{if } r_s < r_{ms} - \beta, \\ 1 & \text{if } r_s = r_{ms}. \end{cases} \quad (6.7)$$

Notice that there is a lower limit on r_s . If r_s is sufficiently low such that $r_s < r_{ms} - \beta$, then no saver would participate.

The aggregate net benefit captured by savers is n_s times the area underneath AB and above CD in Figure 6.2:

$$W_s = n_s \int_{\hat{y}}^1 w_s dy = n_s \int_{\hat{y}}^1 (r_s - r_{ms} + \beta y) dy = n_s \frac{(\beta + r_s - r_{ms})^2}{2\beta} \quad (6.8)$$

for $r_s \geq r_{ms} - \beta$.

6.2.3 Financial Institution

The financial institution's profit function is given by³

$$\Pi = \hat{x}n_b p(1 + r_b) - \hat{x}n_b(1 + c_b) - n_s(1 - \hat{y})(r_s + c_s) + Tr_{in}, \quad (6.9)$$

where c_b and c_s are the marginal costs of administrating micro-loans and community investment saving deposits, respectively; T is the amount that the financial institution invests out of the community investment saving deposits or the amount that the financial institution borrows from other financial institutions to support the micro-loan program, depending on the sign of T ; and r_{in} is the rate at which the financial institution borrows from or lends to other financial institutions.

In equation (6.9), the term $\hat{x}n_b p(1 + r_b)$ is the total expected revenue from micro-loans. In each period, $\hat{x}n_b$ borrowers obtain micro-loans. They repay the loans if and only if they have a successful investment. The expected revenue from each micro-loan equals $p(1 + r_b)$. The next term $\hat{x}n_b(1 + c_b)$ is the total principal and administrative cost of micro-loans. The term $n_s(1 - \hat{y})(r_s + c_s)$ is the sum of the total interest payment to savers who make community investment saving deposits and the management cost of community investment savings.

The term Tr_{in} is the investment income/debt generated due to the micro-loan services. In each period, the following balance sheet constraint must hold:

$$\hat{x}n_b + T = n_s(1 - \hat{y}) \quad (6.10)$$

³Here it is implicitly assumed that the introduction of a community investment savings plan does not affect the total amount of regular saving deposits that savers make at the financial institution, and thus has no impacts on the regular loan services, as well as the profits accruing from providing conventional services. Therefore, the focus is put on the profits generated from the micro-loan program and the community investment saving program.

There could be another scenario in which savers put a proportion of their savings in the community investment saving account. The total amount of saving deposits they make remains unchanged, but the amount that goes to the regular saving account is smaller with the community investment saving plan. To keep the regular loan services unaffected, the financial institution must borrow from other financial institutions. Consequently, a new term $-(\hat{x}n_b - T)(r_{in} - r_{ms})$ needs to be added to the profit function. Under this assumption, the model becomes more complicated, but the main results do not change dramatically.

An Economic Analysis of Microcredit Lending

The left-hand side gives the sum of outstanding micro-loan accounts and the internal investment account (T). The right-hand side gives the liability, namely the deposits in the community investment savings accounts. The financial institution mobilizes the community investment saving deposits and lends out the savings to micro-loan borrowers. In general, the amount of the savings mobilized and the amount of loans lent out are not equal. In the case where there are excess loan funds, the financial institution can make investments, the return rate of which is r_{in} . In this way, the financial institution squares up the balance sheet constraint.

Substituting equations (6.2), (6.6) and (6.10) into (6.9) gives

$$\Pi = \frac{n_b p(i - r_b)[pr_b - (1 - p) - r_{in} - c_b]}{\gamma} + \frac{n_s(\beta + r_s - r_{ms})(r_{in} - r_s - c_s)}{\beta}. \quad (6.11)$$

The slope of the financial institution's iso-profit curve is given by

$$\left. \frac{dr_b}{dr_s} \right|_{\Pi} = -\frac{\gamma n_s[r_{in} - c_s - (\beta - r_{ms}) - 2r_s]}{\beta n_b[pi + (1 - p) + r_{in} + c_b - 2pr_b]}. \quad (6.12)$$

Notice that the profit function Π is concave in r_s and r_b – its Hessian matrix is negative semi-definite for $r_s \leq r_{ms}$ and $r_b \leq i$.⁴

Assumption 6.1. $pi - (1 - p) - r_{in} - c_b > 0$.

Assumption 6.2. $r_{ms} - \beta < r_{in} - c_s < r_{ms} + \beta$.

Assumption 6.3. $0 < \hat{r}_s^1, \hat{r}_s^2 < r_{ms}$, where

$$\hat{r}_s^1 = \frac{r_{in} + r_{ms} - c_s - \beta + \sqrt{(r_{in} - r_{ms} + \beta - c_s)^2 + \frac{\beta n_b[pi - (1 - p) - r_{in} - c_b]^2}{\gamma n_s}}}{2}, \quad (6.13)$$

$$\hat{r}_s^2 = \frac{r_{in} + r_{ms} - c_s - \beta - \sqrt{(r_{in} - r_{ms} + \beta - c_s)^2 + \frac{\beta n_b[pi - (1 - p) - r_{in} - c_b]^2}{\gamma n_s}}}{2}. \quad (6.14)$$

Assumption 6.1 implies that the financial institution's profit-maximizing loan interest rate is lower than i . Similarly, Assumption 6.2 implies the profit-maximizing deposit interest rate falls in the range between zero and $\min(r_{ms}, r_{in} - c_s)$. As will be shown in the next section, these

⁴The Hessian matrix is given by

$$\begin{pmatrix} -2n_b p^2 / \gamma & 0 \\ 0 & -2n_s / \beta \end{pmatrix}.$$

two assumptions are made to ensure that there is an interior solution in the case where an IOF operates the micro-loan program.

Assumption 6.3 implies that the financial institution always loses money if it sets the deposit interest rate at r_{ms} . The rates \hat{r}_s^1 and \hat{r}_s^2 are the deposit interest rates at which the credit union just breaks even if it sets the loan interest rate at the profit-maximizing level. Therefore, at any deposit interest rate either greater than \hat{r}_s^1 or lower than \hat{r}_s^2 (for instance, r_{ms}), the financial institution will lose money even if its loan interest rate is set at the profit-maximizing level.

Given these assumptions, the zero profit curve $AVBHC$ is located and shaped as shown in Figure 6.3. Recall that no savers would invest in the community investment saving plan if $r_s < r_{ms} - \beta$, and no borrowers would borrow if $r_b \geq i$. So the zero profit curve is truncated by a vertical line $r_s = r_{ms} - \beta$ and a horizontal line $r_b = i$.

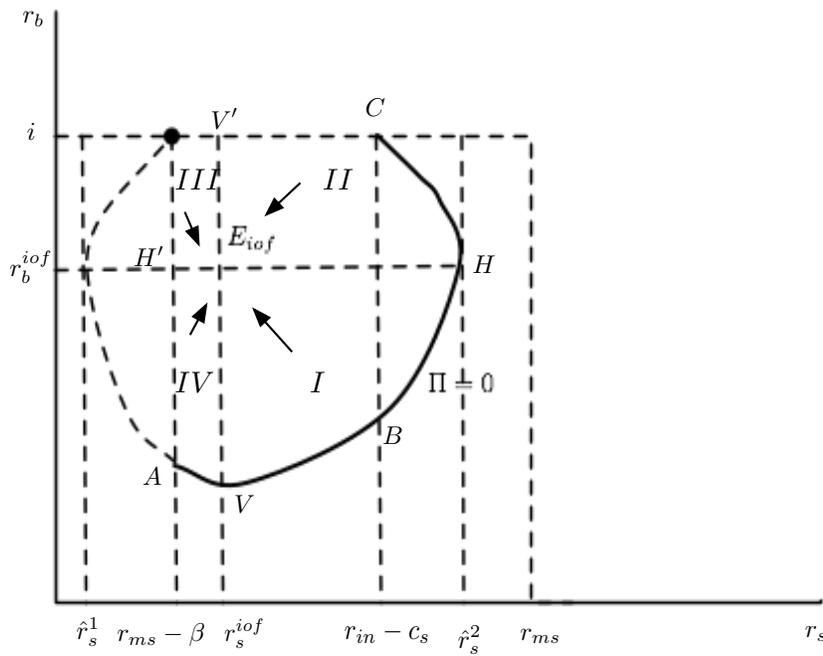


Figure 6.3: Financial Institution's zero profit curve $\Pi = 0$

The horizontal line $H'H$ is the locus of the interest rates that satisfy $\partial\Pi/\partial r_b = 0$. It is horizontal because the solution to $\partial\Pi/\partial r_b = 0$ is independent of r_s ; and it is below line $r_b = i$ according to Assumption 6.1. Similarly, the vertical line $V'V$ is the combinations of the interest rates that satisfy $\partial\Pi/\partial r_s = 0$. This line is on the left of line $r_s = r_{ms}$ according to Assumption 6.2.

Lines $H'H$ and $V'V$ divide the area above the zero profit curve into four regions: (1) in region I, the profit increases in r_b and decreases in r_s ; (2) in region II, the profit decreases in both r_b and r_s ; (3) in region III, the profit decreases in r_b and increases in r_s ; and (4) in region IV, the profit increases in both r_b and r_s .

The analysis focuses on region I. This is because in regions II, III and IV Pareto improvement is possible. That is, it is possible to make one group better off without negatively affecting the other groups. For instance, suppose the financial institution offers point A in region IV. However, by increasing the loan interest rate to r_b^{iof} (see point H'), the financial institution can make more profits and make borrowers better off without affecting savers. It means that the optimal offering must be in region I, where Pareto improvement is impossible.

6.3 Choice of Interest Rates

Assume that the financial institution under consideration is the only service provider in the niche market for micro-loans and community investment saving deposits. As a consequence, it is both a monopoly and a monopsony. The IOF's pricing policy is examined first. Then the credit union's pricing policy, as well as the impact of its member orientation, are analyzed.

6.3.1 IOF

The IOF is profit-driven and it sets r_b and r_s to maximize its profits

$$\max_{r_b, r_s} \Pi \quad (6.15)$$

subject to $\Pi \geq 0$ and $r_s \leq r_{in} - c_s$.

Constraint $r_s \leq r_{in} - c_s$ requires that the IOF does not offer a deposit interest rate that exceeds $r_{in} - c_s$, since it is cheaper to borrow from other financial institutions than to raise deposits if $r_s \geq r_{in} - c_s$.⁵

The IOF's optimal offering is point E^{iof} – the intersection of line HH' and VV' in Figure 6.3. The optimal interest rates are given by

$$r_b^{iof} = \frac{pi + (1 - p) + r_{in} + c_b}{2p} \quad \text{and} \quad r_s^{iof} = \frac{r_{in} + r_{ms} - \beta - c_s}{2}. \quad (6.16)$$

⁵Due to this constraint, the IOF's zero profit curve is curve AVB in Figure 6.3 – it is truncated by line $r_s = r_{in} - c_s$.

The IOF's profit is given by

$$\Pi^{iof} = n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{4\gamma} + n_s \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{4\beta}. \quad (6.17)$$

. According to assumptions 6.1 and 6.2, the IOF makes positive profits from each niche.

Let n_b^{iof} and n_s^{iof} denote the number of the borrowers who borrow micro-loans and the number of the savers who invest in the community investment savings plan, respectively,

$$n_b^{iof} = n_b \frac{pi - (1 - p) - r_{in} - c_b}{2\gamma} \quad \text{and} \quad n_s^{iof} = n_s \frac{r_{in} - r_{ms} + \beta - c_s}{2\beta}. \quad (6.18)$$

Due to the heterogeneity, at least some of the borrowers and savers receive positive net benefit from the new services. The aggregate benefits captured by borrowers and savers are given by

$$W_b^{iof} = n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{8\gamma} \quad \text{and} \quad W_s^{iof} = n_s \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{8\beta}. \quad (6.19)$$

The total net benefits to borrowers and savers equal the sum of W_b^{iof} and W_s^{iof} :

$$W^{iof} = W_b^{iof} + W_s^{iof} = n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{8\gamma} + n_s \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{8\beta}. \quad (6.20)$$

Finally, the total surplus generated equals

$$TW^{iof} = W^{iof} + \Pi^{iof} = 3n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{8\gamma} + 3n_s \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{8\beta}. \quad (6.21)$$

6.3.2 Credit Union

Now suppose a credit union operates the micro-loan program. The credit union is a financial co-operative owned by its members who are also the users of the output (loans) and the suppliers of the input (deposits). Therefore, the credit union would maximize its profits to some extent, since the more profits, the more it can give back to members. The credit union knows that its pricing policies for loan interest rate and deposit interest rate determine the net benefits of the transactions captured by the members, as well as the profits. Therefore, in addition to profits, the credit union takes into account the benefits captured by the members when it designs its pricing policies.

Unlike the IOF, the credit union needs to deal with the conflicts between borrower members and saver members. Based on Smith [1984], the credit union's objective function is defined as:

$$\max_{r_b, r_s} W_{cu} = \alpha W_b + (1 - \alpha) W_s \quad (6.22)$$

subject to

$$\Pi = 0. \quad (6.23)$$

W_{cu} is the total welfare of the members from the perspective of the credit union and is equal to the weighted sum of the net benefits captured by borrowers and savers. On the right-hand side of expression (6.22), the weight α is the behavioral preference parameter. It is scaled such that it falls in between zero and one. The weight α reflects the conflicts between borrowers and savers, as well as the credit union's preference toward different member groups. For example, if $\alpha > 1/2$, micro-loan borrowers are the preferred group; if $\alpha = 1/2$, the credit union is described as being neutral; and if $\alpha < 1/2$, savers are the preferred group. W_b and W_s are defined in (6.3) and (6.8), respectively.

Equation (6.23) requires that the credit union set the interest rates such that it neither earns a profit from the new programs nor uses the profits from conventional services to subsidize the micro-loan program.

The first-order conditions to the problem in equation (6.22) are:

$$\begin{aligned} \frac{\partial L}{\partial r_b} &= \alpha n_b p^2 \frac{(r_b - i)}{\gamma} + \lambda n_b p \frac{pi + 1 - p + c_b + r_{in} - 2pr_b}{\gamma} = 0, \\ \frac{\partial L}{\partial r_s} &= (1 - \alpha) n_s \frac{\beta + r_s - r_{ms}}{\beta} + \lambda n_s \frac{r_{in} - c_s - (\beta - r_{ms}) - sr_s}{\beta} = 0, \\ \Pi &= 0, \end{aligned}$$

where λ is the Langrange multiplier. It is easy to verify that $\max(\alpha, 1 - \alpha) \geq \lambda \geq \min(\min(\alpha, 1 - \alpha), \max(\alpha, 1 - \alpha)/2)$. As a result, the bordered Hessian matrix is negative semi-definite, which means that there exists a unique solution to the credit union's maximization problem (see Appendix 6.6.1 for proof).

The credit union's maximization problem can be solved with the aid of Figure 6.4. Curve W_{cu} graphs the combination of r_b and r_s , at which the overall benefits to borrowers and savers

remain constant from the point of the credit union. Recall that borrowers are better off with a lower r_b and savers are better off with a higher r_s . The slope of curve W_{cu} is

$$\frac{dr_b}{dr_s} \Big|_{W_{cu}} = \begin{cases} \frac{(1-\alpha)n_s\gamma(\beta+r_s-r_{ms})}{\alpha n_b\beta p^2(i-r_b)} \geq 0 & \text{if } \alpha > 0, \\ \infty & \text{if } \alpha = 0, \end{cases} \quad (6.24)$$

for $r_b \leq i$ and $r_s \geq r_{ms} - \beta$. Furthermore, W_{cu} is convex in r_s and r_b as the Hessian matrix is positive semi-definite.

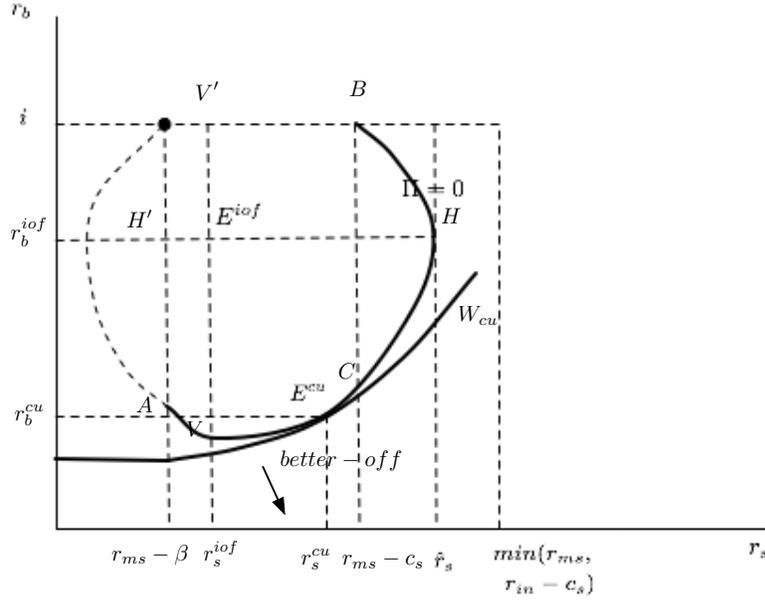


Figure 6.4: The credit union's interest rates: $\alpha \geq 1/2$.

Proposition 6.1. *Compared with the IOF, the credit union offers more favorable interest rates, specifically: $r_b^{cu} \leq r_b^{iof}$ and $r_s^{cu} \geq r_s^{iof}$. Thus, more borrowers and savers participate in the programs operated by the credit union; and the total benefits to members are greater with the credit union than with the IOF.*

The optimal offering must be the point where the credit union's zero profit curve $\Pi = 0$ and curve W_{cu} are tangent to each other. In particular, this point must be on segment VH , depending on α . In Figure 6.4, E^{iof} – the offering of the IOF – lies above segment VH . Recall that like W_{cu} , $W = W_b + W_s$ (the total benefits captured by members) is upward sloped and convex in r_s and r_b . It means that any point on segment VH is more attractive to members than point E^{iof} , i.e., members are better off with the presence of the credit union, compared with the IOF.

The intuition is as follows. The profit-driven IOF has the incentive to exercise its market power in both markets to extract as much surplus as possible from borrowers and savers. So it charges the highest possible loan interest rate and the lowest possible deposit interest rate. The credit union has an objective of maximizing the benefits to members, while just breaking even. Therefore, the credit union offers more attractive interest rates to make members benefit more from the transactions. The favorable interest rates, in turn, attract more members to participate, which in turn leads to a further increase in the benefits to members. The outcome is that more benefits are generated and distributed between borrowers and savers.

Impact of Member Orientation

The credit union produces more benefits to members than the IOF. The increase in benefits and the distribution of the benefits among members are affected by the credit union's member preference or member orientation.

The parameter α reflects the credit union's preference toward borrowers relative to savers: (1) if $\alpha < 1/2$, the credit union is saver-oriented – one unit of benefits to borrowers is less important than the same unit of benefits to savers. As α approaches zero, the credit union is completely saver-oriented and is concerned only with the benefits to savers when determining its interest rates; (2) if $\alpha > 1/2$, the credit union is borrower-oriented. As a result, one unit of benefits to borrowers is worth more than the same unit of benefits to savers. If $\alpha = 1$, the credit union is completely borrower-oriented and is concerned with the benefits to borrowers only; and (3) if $\alpha = 1/2$, the credit union is neutral.

Let r_b^{cu} and r_s^{cu} be the optimal interest rates charged by the credit union.

Proposition 6.2. r_b^{cu} and r_s^{cu} decrease in α , i.e., $dr_b^{cu}/d\alpha < 0$ and $dr_s^{cu}/d\alpha < 0$.

This proposition indicates that as it becomes more borrower-oriented, the credit union reduces both its loan and deposit interest rates, and vice versa (see Appendix 6.6.2 for proof).

The intuition is as follows. As it becomes more borrower-oriented (α increases) – for example, because the number of borrowers increases – the benefits to borrowers are more important to the credit union relative to the same benefits to savers. As a result, the credit union has the incentive to reduce its loan interest rate to make borrowers better off. Since it cannot lose money (zero-profit constraint), the credit union must lower its deposit interest rate to reduce the capital cost of micro-loans. Therefore, both the loan interest rate and the deposit interest rate of the credit union decrease in α .

Corollary 6.1. $d\hat{x}^{cu}/d\alpha > 0$ and $d\hat{y}_b^{cu}/d\alpha > 0$.

Corollary 6.1 states that as the credit union displays stronger borrower-orientation, more borrowers access micro-loans and fewer savers invest in its community investment saving plan. To finance these additional micro-loans with less deposit funds, the credit union borrows more from, or lends less to, other financial institutions to square up its balance-sheet constraint.

Corollary 6.2. *The total benefit to members $W^{cu} = W_b^{cu} + W_s^{cu}$ decreases as the credit union is more oriented toward the preferred member group, and vice versa: (1) $dW^{cu}/d\alpha > 0$ for $\alpha < 1/2$; (2) $dW^{cu}/d\alpha < 0$ for $\alpha > 1/2$; and (3) $dW^{cu}/d\alpha = 0$ for $\alpha = 1/2$.*

Corollary 6.2 describes how member orientation affects the total benefits to members (see Appendix 6.6.3 for proof). The total benefit W^{cu} is at the highest level if the credit union is neutral. As the credit union displays a preference toward a member group – either the borrower group or the saver group – W^{cu} falls. The stronger the preference, the larger is the drop in W^{cu} . However, W^{cu} is always greater than the members' welfare under the IOF.

This result is illustrated in Figure 6.5. Curve W^{cu} depicts the combinations of interest rates at which the total benefits to members remain constant. Curve $W_{cu}(\cdot)$ is the combination of interest rates at which the total benefits to members remain constant in the view of the credit union, where (\cdot) indicates the size of α . Curves W^{cu} and $W_{cu}(\cdot)$ coincide if and only if $\alpha = 1/2$. If $\alpha < 1/2$, curve $W_{cu}(\cdot)$ is steeper than curve W^{cu} , and vice versa (see curve $W_{cu}(0)$ and curve $W_{cu}(1)$). To a neutral credit union, point B – where curve W^{cu} (or $W_{cu}(1/2)$) and the zero profit curve $\Pi = 0$ are tangent – is the best offering. For a borrower-oriented credit union, since curve $W_{cu}(\cdot)$ is flatter than W^{cu} , the best offering must be on segment VB of the zero profit curve (a borrower-oriented credit union offers a lower loan interest rate than does a neutral credit union). Furthermore, as the credit union shows stronger borrower-orientation, its best offering approaches point V . Similarly, for a saver-oriented credit union, the best offering must lie on segment BH and it approaches point H as the credit union is more in favor of saver members. Clearly, the more the credit union's best offering deviates from point B , the lower the total benefits to members. In other words, as the credit union becomes more in favor of its preferred group, members receive less benefits in aggregate.

This result occurs because member orientation distorts the credit union's pricing policy: the interest rates are designed to maximize the benefits to members from the perspective of the credit union, rather than the actual benefits received by members. The more α deviates from $1/2$, or the more the credit union prefers the preferred members group, the greater is the distortion. As a

result, the total benefits to members decrease: even though the preferred members benefit from the more favourable interest rate, the gains are insufficient to cover the losses experienced by the less preferred group.

Corollary 6.3. $dW_b^{cu}/d\alpha > 0$ and $dW_s^{cu}/d\alpha < 0$.

It is obvious that the total benefits to borrower members W_b^{cu} increase in α because (1) individual borrowers benefit from a lower interest rate; and (2) more borrowers borrow loans. Similarly, the benefits to saver members W_s^{cu} decrease in α because (1) individual savers are offered with a lower deposit interest rate; and (2) some savers withdraw. As stated in Corollary 6.3, W_b^{cu} increases in α , while W_s^{cu} decreases in α .

Proposition 6.3. *Compared with the IOF, the presence of the credit union may result in either a more efficient outcome – i.e., $TW^{cu} > TW^{iof}$ ($TW^{cu} = W^{cu}$), or a less efficient outcome – i.e., $TW^{cu} < TW^{iof}$. Let $\Pi_b^{iof} = \frac{n_b[pi-(1-p)-r_{in}-c_b]^2}{4\gamma}$ and $\Pi_s^{iof} = \frac{n_s(r_{in}-r_{ms}+\beta-c_s)^2}{4\beta}$. If*

1. $3\Pi_b^{iof} < \Pi_s^{iof}$, *there exists an $\alpha_1 \in (1/2, 1)$ such that if $\alpha < \alpha_1$, $TW^{cu} > TW^{iof}$ always holds; if otherwise, $\alpha > \alpha_1$, then $TW^{cu} < TW^{iof}$ always holds;*
2. $3\Pi_s^{iof} < \Pi_b^{iof}$, *there exists an $\alpha_2 \in [0, 1/2)$ such that if $\alpha > \alpha_2$, then $TW^{cu} > TW^{iof}$ always holds; and if otherwise, $\alpha < \alpha_2$, then $TW^{cu} < TW^{iof}$ always holds;*
3. *if neither $3\Pi_b^{iof} < \Pi_s^{iof}$ nor $3\Pi_s^{iof} < \Pi_b^{iof}$ hold true, then $TW^{cu} > TW^{iof}$ holds for any $\alpha \in [0, 1]$.*

Classical co-operative theories predict that the presence of the co-operative implies a more efficient outcome compared to with a monopoly IOF. However, Proposition 6.3 indicates that due to the conflicts between heterogeneous member groups and the member orientation of the credit union, it is possible that the outcome under a co-operative (a credit union) is less efficient than the one under an IOF.

For example, consider a completely borrower-oriented credit union. As will be shown in the next section, such a credit union charges the same deposit interest rate as does a monopoly IOF. To make borrowers better off, the credit union gives up all the profits that it can make so that it can charge the lowest possible interest rate on micro-loans. From the point of the credit union, this outcome is the best one that it can achieve. However, if $3\Pi_b^{iof} < \Pi_s^{iof}$ holds, then this outcome is less efficient than the one under the IOF.⁶

⁶In this situation, it would be optimal if the credit union simply follows the IOF's prices. However, as the credit union returns the surplus to its members, this strategy is not sustainable (Fulton [1998]), unless the credit union

Condition $3\Pi_b^{iof} < \Pi_s^{iof}$ is likely to hold if, for example, $n_s \gg n_b$, or γ is very large, or p is very low. In this situation, the difference between the benefits to borrowers under the credit union and the benefits to them under the IOF is smaller than the total profit that can be earned by the IOF (i.e., $\Pi_b^{iof} + \Pi_s^{iof}$). It is clear that the benefits from charging the most favourable loan interest rate are outstripped by the costs (the profits forgone). Therefore, a less efficient outcome arises. As shown in Appendix 6.6.4, there exists a critical value α_1 , if $\alpha > \alpha_1$, the distorting effect of the member orientation leads to a less efficient outcome compared with the situation where a monopoly IOF operates the micro-loan program.

Similarly, if the credit union demonstrates strong saver-orientation and condition $\Pi_b^{iof} > 3\Pi_s^{iof}$ holds, then the outcome under the credit union is less efficient than that under the monopoly IOF. Condition $\Pi_b^{iof} > 3\Pi_s^{iof}$ is likely to hold if, for example, $n_s \ll n_b$, or γ is low, or p is high.

However, as indicated in part 3 in Proposition 6.3, if either $3\Pi_b^{iof} < \Pi_s^{iof}$ or $\Pi_b^{iof} > 3\Pi_s^{iof}$ is possible, then the credit union results in a more efficient outcome than the monopoly IOF, regardless of the credit union's member orientation.

The intuition is as follows. When the credit union is neutral between the interests of borrowers and savers, the outcome is more efficient than that under the IOF. However, as the credit union demonstrates preference towards a member group, a deadweight loss is created. The stronger the credit union's preference, the greater is the deadweight loss. So under some conditions, when the credit union demonstrates a very strong preference, the deadweight loss is sufficiently high such that the total surplus (profit+benefits to members) is lower than that under the IOF, thus leads to a less efficient outcome.

This result arises because the credit union charges a single price for its services. With the presence of heterogeneous members, this pricing strategy is generally not efficient. To achieve a more efficient outcome, non-linear pricing schemes should be applied (for example, see Vercammen, Fulton, and Hyde [1996]).

With these basic results, the impacts of the credit union's member orientation on the interest rates chosen are investigated. Three extreme cases are considered: (1) complete saver-orientation $\alpha = 0$; (2) neutrality $\alpha = 1/2$ and (3) complete borrower-orientation $\alpha = 1$.

- **Case I. Complete saver-orientation:** $\alpha = 0$.

can make lump-sum payments. A recent study Canning et al. [2003] considered the possibility that the credit union returns the surplus in the form of interest rate subsidies. However, in practice, it may be difficult to implement such a strategy .

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In this situation, the credit union cares only about savers: $W_{cu} = W_s$. In Figure 6.5, the total benefit from the point of the credit union W_{cu} is represented by the vertical line $W_{cu}(0)$, since it is independent of r_b . Obviously, point H – where curve $W_{cu}(0)$ and the zero profit curve are tangent – is the best offering of a completely saver-oriented credit union. The interest rates are given below.

$$r_b^{cu}(0) = \frac{pi + (1 - p) + r_{in} + c_b}{2p} = r_b^{iof} \quad \text{and} \quad r_s^{cu}(0) = \hat{r}_s^1,$$

where (\cdot) indicates α .

Let $n_b^{cu}(\cdot)$ and $n_s^{cu}(\cdot)$ be the number of the borrowers who borrow micro-loans and the number of the savers who invest in the community investment savings plan, respectively.

Thus,

$$n_b^{cu}(0) = n_b \frac{pi - (1 - p) - r_{in} - c_b}{2\gamma} = n_b^{iof} \quad \text{and} \quad n_s^{cu}(0) = n_s \frac{\beta + \hat{r}_s^1 - r_{ms}}{\beta} > n_s^{iof}.$$

The benefits captured by borrowers and savers are

$$W_b^{cu}(0) = n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{8\gamma} = W_b^{iof},$$

$$W_s^{cu}(0) = n_s \frac{(\beta + \hat{r}_s^1 - r_{ms})^2}{2\beta} > W_s^{iof}.$$

The total benefits equal

$$W^{cu}(0) = n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{8\gamma} + n_s \frac{(\beta + \hat{r}_s^1 - r_{ms})^2}{2\beta}.$$

As it cares only about savers, the credit union charges the highest possible interest rate on micro-loans which equals the interest rate charged by the IOF, and offers savers with the highest possible interest rate on the community investment saving deposits. It uses the profits from lending to cross-subsidize saver members. Notice that $\partial\Pi/\partial r_b = 0$ and $\partial\Pi/\partial r_s < 0$ at point H .

- **Case II: A neutral credit union:** $\alpha = 1/2$.

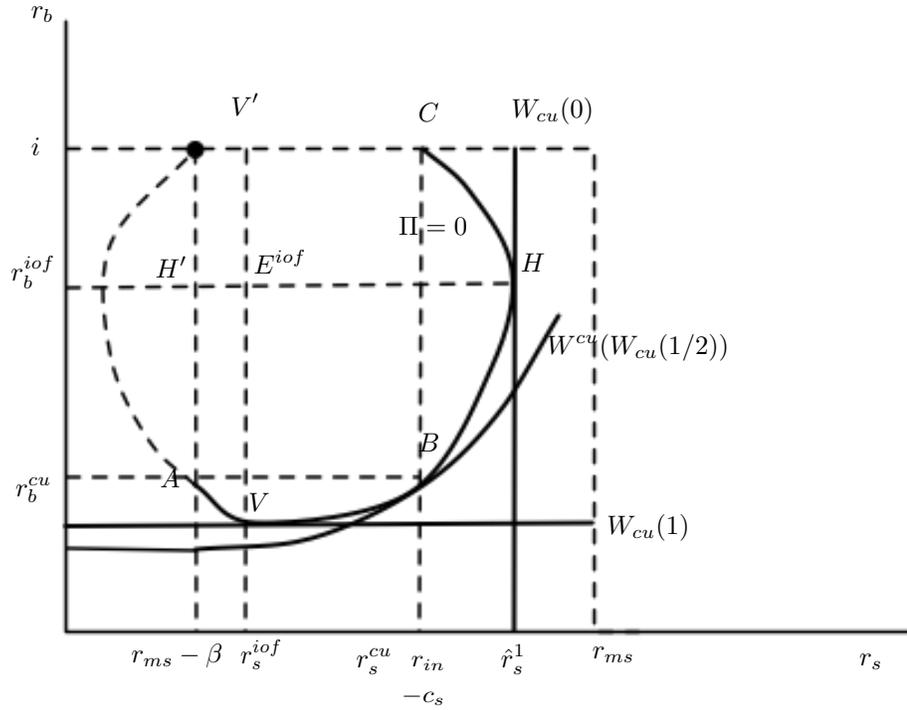


Figure 6.5: Credit union's offerings and its member orientation.

In this scenario, the credit union treats borrowers and savers equally: one unit of benefits to borrowers equals the same unit of benefits to savers. The optimal interest rates are determined by point B in Figure 6.5.

$$r_b^{cu}(1/2) = \frac{1 - p + r_{in} + c_b}{p} < r_b^{iof}; \quad r_s^{cu}(1/2) = r_{in} - c_s > r_s^{iof}.$$

More borrowers and savers participate in the respective programs, compared to under the IOF, since

$$n_b^{cu}(1/2) = n_b \frac{pi - (1 - p) - r_{in} - c_b}{\gamma} > n_b^{iof} \quad \text{and} \quad n_s^{cu}(1/2) = n_s \frac{r_{in} - c_s + \beta - r_{ms}}{\beta} > n_s^{iof}.$$

Furthermore, members are better off than under the IOF, and a more efficient outcome is attained, since

$$\begin{aligned} W_b^{cu}(1/2) &= n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{2\gamma} > W_b^{iof}, \\ W_s^{cu}(1/2) &= n_s \frac{(r_{in} - c_s + \beta - r_{ms})^2}{2\beta} > W_s^{iof}, \\ W^{cu}(1/2) &= n_b \frac{[pi - (1 - p) - r_{in} - c_b]^2}{2\gamma} + n_s \frac{(r_{in} - c_s + \beta - r_{ms})^2}{2\beta} > TW^{iof}. \end{aligned}$$

• **Case III: A completely borrower-oriented credit union: $\alpha = 1$.**

For a completely borrower-oriented credit union, $W_{cu} = W_b$. The curve $W_{cu}(1)$ is horizontal since W_{cu} is independent of r_s . The best offering is determined by point V where curve $W_{cu}(1)$ and the zero profit curve are tangent. The interest rates are

$$\begin{aligned} r_b^{cu}(1) &= \frac{pi + (1 - p) + r_{in} + c_b - \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + \frac{n_s \gamma (r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}}{2p} \\ &< r_b^{iof}, \\ r_s^{cu}(1) &= \frac{r_{in} + r_{ms} - \beta - c_s}{2} = r_s^{iof}. \end{aligned}$$

A completely borrower-oriented credit union sets its interest rate on the saving deposits at the lowest possible level, and offers borrowers with the lowest possible loan interest rate. It uses the profits from savers to cross-subsidize borrowers. Notice that at the above interest rates, $\partial\Pi/\partial r_b > 0$ and $\partial\Pi/\partial r_s = 0$.

The numbers of borrowers and savers who participate in the new programs are

$$\begin{aligned} n_b^{cu}(1) &= n_b \frac{pi - (1 - p) - r_{in} - c_b + \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + \frac{n_s \gamma (r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}}{2\gamma} \\ &> n_b^{iof}, \\ n_s^{cu}(1) &= n_s \frac{r_{in} - r_{ms} + \beta - c_s}{2\beta} = n_s^{iof}, \end{aligned}$$

and the benefits are

$$\begin{aligned}
 W_b^{cu}(1) &= n_b \frac{[pi - (1 - p) - r_{in} - c_b + \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + \frac{n_s \gamma (r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}] ^2}{8\gamma} \\
 &> W_b^{iof}, \\
 W_s^{cu}(1) &= n_s \frac{((r_{in} - r_{ms} + \beta - c_s)^2)}{8\beta} > W_s^{iof}, \\
 W^{cu}(1) &= n_b \frac{[pi - (1 - p) - r_{in} - c_b + \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + \frac{n_s \gamma (r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}] ^2}{8\gamma} \\
 &\quad + n_s \frac{((r_{in} - r_{ms} + \beta - c_s)^2)}{8\beta}.
 \end{aligned}$$

6.4 Impact of Saver Member Commitment

In the previous section, a comparison was made between the outcome generated by a profit-driven IOF and the outcome generated by a welfare-maximizing credit union. It was shown that the credit union reduces credit rationing on micro-enterprises more than does the IOF. This comparison is based on the assumption that the two service providers are identical except in their objectives.

In this section, the impact of saver commitment on the interest rates is considered. Saver commitment is captured by the parameter β (recall that $\beta = g$). A higher β means that the micro-loan program is more important to savers, so savers are more committed to the program. Its impacts on the profits of the IOF and the credit union are depicted in Figure 6.6.

First, consider the credit union's zero profit curve. In Figure 6.6, curve $\Pi_\beta = 0$ (or curve VBH) is the zero profit curve associated with saver commitment β .⁷ Notice that point B is always on the credit union's zero profit curve, if other factors except β are held constant. This point is the best offering of a neutral credit union. A change in β leads to a change in loan funds that are mobilized at $r_{in} - c_s$ from savers. However, the change in loan funds does not translate into a change in the credit union's profits. Recall that the credit union incurs an administrative cost c_s and lends the excess amount to other financial institutions at r_{in} . Despite the change in saver commitment, the credit union always earns zero profits at point B .

Suppose saver commitment grows to β' ($\beta' > \beta$). This increase results in a counterclockwise rotation of curve $\Pi_\beta = 0$ at point B to curve $\Pi_{\beta'} = 0$ (or curve V_1BH_1), which is the zero profit

⁷The focus is on the segment of the zero profit curve that falls in the economic area.

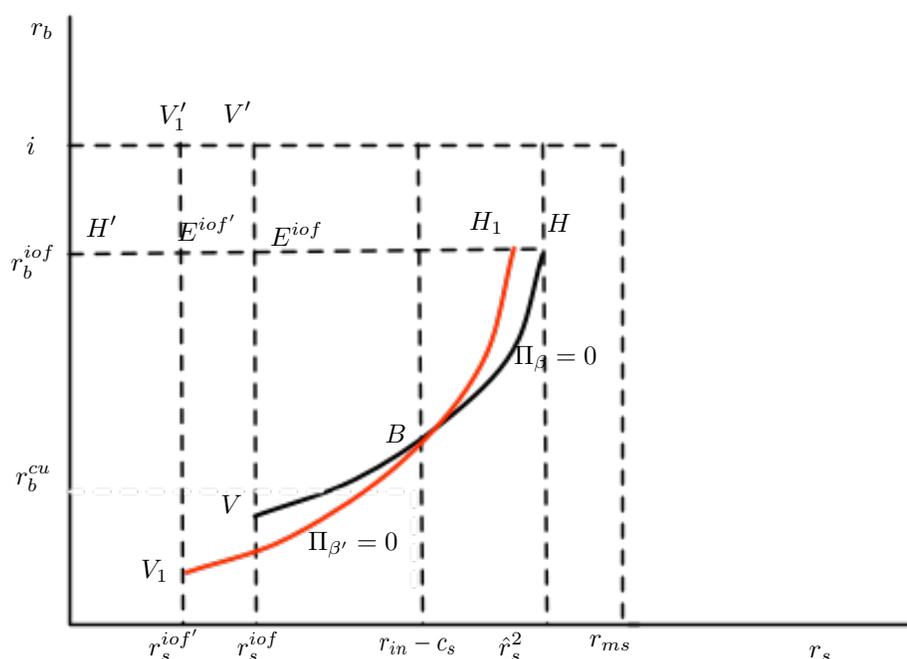


Figure 6.6: The zero profit curves and savers' commitment: $\beta < \beta'$.

curve associated with commitment β' . At any point on curve $\Pi_\beta = 0$ below point B , the credit union cross-subsidizes borrowers with the profits from savers. A stronger commitment leads to more loan funds and thus improves the credit union's profits. To keep the profits equal zero, the credit union can either reduce r_b or r_s , or both. Similarly, at any point above B on curve $\Pi_\beta = 0$, the credit union uses the profits from borrowers to subsidize savers. In this situation, a stronger commitment leads to more loan funds that are more expensive compared with borrowing from other financial institutions and more interest payments to savers. As a result, the credit union needs to either increase r_b or reduce r_s or both to keep the profits unaffected. As shown in Figure 6.6, the zero profit curve thus rotates counterclockwise at point B as a result of a stronger saver commitment.

Notice that the increase in β forces line VV' – the loci of the combinations of interest rates at which $\partial\Pi/\partial r_s = 0$ – to shift inward (see the movement of line VV' to V_1V_1').

Now consider the IOF's zero profit curve. Similarly, as saver commitment grows from β to β' , the IOF's zero profit curve rotates counterclockwise at point B , see the rotation from VB to V_1B in Figure 6.6.

6.4.1 IOF

First consider the situation where an IOF operates the micro-loan program and the community investment saving program.

Proposition 6.4. *As saver commitment to the micro-loan program grows, the IOF lowers its deposit interest rate but does not adjust its loan interest rate:*

$$dr_b^{iof}/d\beta = 0 \text{ and } dr_s^{iof}/d\beta < 0.$$

Corollary 6.4. *A stronger commitment of savers does not improve borrowers' access to credit since $dn_b^{iof}/d\beta = 0$, but it enables the IOF to earn more profits: $\partial\Pi^{iof}/\partial\beta > 0$.*

As shown in Figure 6.6, a higher β forces line VV' to shift inward to $V_1V'_1$, but does not affect line HH' . The IOF's new interest rates are determined by point $E^{iof'}$ – the intersection of line HH' and $V_1V'_1$, and $r_b^{iof'} = r_b^{iof}$ and $r_s^{iof'} < r_s^{iof}$.

The intuition is as follows. To maximize its profits, the IOF sets the loan interest rate such that $\partial\Pi/\partial r_b = 0$. This interest rate r_b^{iof} is independent of saver commitment. Thus, the IOF has no incentive to modify its loan interest rate in response to a change in saver commitment. Therefore, despite more savers participating in the community investment saving plan, and more deposits being mobilized to support the micro-loan program, borrowers' access to credit has not been improved.

On the other hand, a stronger commitment improves the IOF's profits even if it does not adjust its deposit interest rate due to the increased supply of loan funds at the low cost ($r_s^{iof} < r_{in} - c_s < r_{in}$). However, it is profitable to reduce the deposit interest rate because $\partial\Pi/\partial r_s < 0$ at r_s^{iof} after saver commitment increases to β' . Reducing the deposit interest rate has two opposite effects on the IOF's profits: (1) the IOF's profits increase since its interest payments to savers decrease; and (2) the IOF's profits decrease since a lower deposit interest rate discourages some savers and thus leads to less investment income. The first effect outstrips the second effect. Therefore, the IOF has the incentive to lower its deposit interest rate until $\partial\Pi/\partial r_s = 0$ is restored.

The result in Corollary 6.4 suggests that saver members tend to have a low level of commitment if the micro-loan program is offered by an IOF. A higher commitment means that savers would like to see an improvement in access to credit. However, the profit-driven IOF takes advantage of the increase in saver commitment to make more profits rather than improving the

access to credit. Knowing this result would occur, savers tend to make a low commitment to the IOF's micro-loan program.

6.4.2 Credit Union

Proposition 6.5. *As its saver members are more committed to its micro-loan program, the credit union: (1) increases its loan interest rate if it prefers savers; (2) reduces its loan interest rate if it prefers borrowers; and (3) does not change its loan interest rate if it is neutral.*

Corollary 6.5. *As saver member commitment grows, borrowers' access to credit is: (1) improved if and only if the credit union is borrower-oriented, i.e., $\frac{dr_b^{cu}}{d\beta} < 0$ if $\alpha > 1/2$; (2) worsen if the credit union is saver-oriented, i.e., $\frac{dr_b^{cu}}{d\beta} \geq 0$ if $\alpha < 1/2$; and (3) not affected if the credit union is neutral, i.e., $\frac{dr_b^{cu}}{d\beta} = 0$ if $\alpha = 1/2$.*

The intuition is as follows. A saver-oriented credit union values the benefits to savers more than those to borrowers. It sets the interest rates such that the profits from borrowers are used to cross-subsidize savers. With a stronger commitment, more savers participate in the saving plan. It means that the credit union would lose more money on savers. To keep its profits equal zero, the credit union increases the loan interest rate to earn more profits from borrowers. As a result, fewer borrowers obtain micro-loans. Thus in a saver-oriented credit union, a stronger saver commitment leads to a more rationing outcome.

A borrower-oriented credit union values the benefits to borrowers more than those to savers, and it cross-subsidizes borrower members. As saver member commitment grows, the credit union can attract more loan funds which is cheaper compared with borrowing from other institutions, and as a consequence it earns more profits. The increase in profits enables the credit union to lower its loan interest rate to make borrowers better off. The lower loan interest rate attracts more borrowers, and thus improves borrowers' access to credit.

Finally, a neutral credit union has no incentive to modify its interest rates in response to a change in saver commitment. Although the savers' participation is affected by the change in their commitment, the credit union's profits are not affected. It thus has no incentive to alter its interest rates. Since the loan interest rate remains unchanged, borrowers' access to credit is not affected.

Figures 6.7, 6.8 and 6.9 depict three cases: (1) a completely saver-oriented credit union ($\alpha = 0$); (2) a completely borrower-oriented credit union ($\alpha = 1$); and (3) a neutral credit union ($\alpha = 1/2$). Suppose that saver member commitment increases from β to β' . As discussed above,

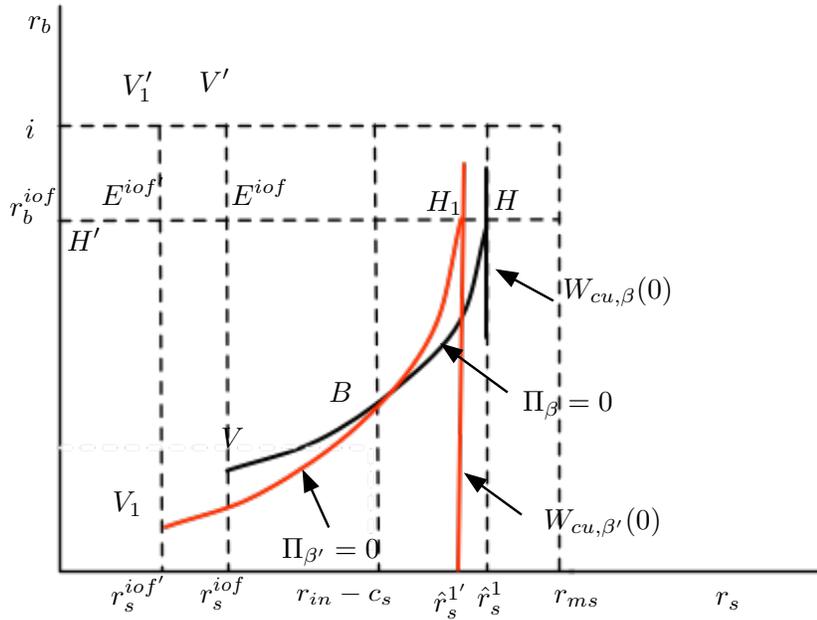


Figure 6.7: Impact of saver commitment on a completely saver-oriented credit union: $\beta' > \beta$

the credit union's zero profit curve rotates counterclockwise at point B from $\Pi_{\beta} = 0$ to $\Pi_{\beta'} = 0$. Curves $W_{cu,\beta}(\alpha)$ and $W_{cu,\beta'}(\alpha)$ ($\alpha = 0, 1, 1/2$), respectively, are the loci of the combinations of the interest rates at which the benefits to members remain constant from the perspective of the credit union, given different levels of saver commitment. The new interest rates are determined by the point where the credit union's zero profit curve $\Pi_{\beta'} = 0$ and curve $W_{cu,\beta'}(\alpha)$ are tangent.

1. $\alpha = 0$.

In Figures 6.7, points H and H_1 are the best offerings of a completely saver-oriented credit union with saver commitment β and β' , respectively. The loan interest rates at the two points equal r_b^{iof} , and the deposit interest rate at point H_1 is lower than that at point H : $\hat{r}_s^{1'} < \hat{r}_s^1$. At loan interest rate r_b^{iof} , despite being saver-oriented, the credit union is unable to alter its loan interest rate for more profits from borrowers to subsidize savers. Recall that $\partial\Pi/\partial r_b = 0$ if $r_b = r_b^{iof}$. Therefore, although member commitment grows, the credit union has no incentive to alter its loan interest rate.

However, the credit union has to drop the deposit interest rate from \hat{r}_s^1 to $\hat{r}_s^{1'}$ to absorb the negative impacts on its profits caused by an increase of expensive loan funds due to a

stronger saver commitment. Although some savers are discouraged by this lower interest rate, overall, more savers participate in the saving plan.⁸

In this situation, the change in saver member commitment affects saver members only. It has two impacts: one is positive and the other is negative. First, a stronger commitment implies a higher level of satisfaction from making contributions and thus more participation of savers. Second, a stronger commitment leads to a lower deposit interest rate and a reduction in the benefits from deposit transactions. In aggregate, the first effect dominates, and the total benefits to savers increase with a stronger commitment: $dW_s/d\beta > 0$. Therefore, the total benefits to members $W_s + W_b$ increase as saver member commitment grows.

2. $\alpha = 1$.

This situation is illustrated in Figures 6.8. Points V and V_1 , respectively, are the completely borrower-oriented credit union's best offerings given saver commitment β and β' , respectively. Compared with at point V , the loan interest rate and the deposit interest rate at V_1 are lower: $r_b^{cu'}(1) < r_b^{cu}(1)$ and $r_s^{iof'} < r_s^{iof}$.

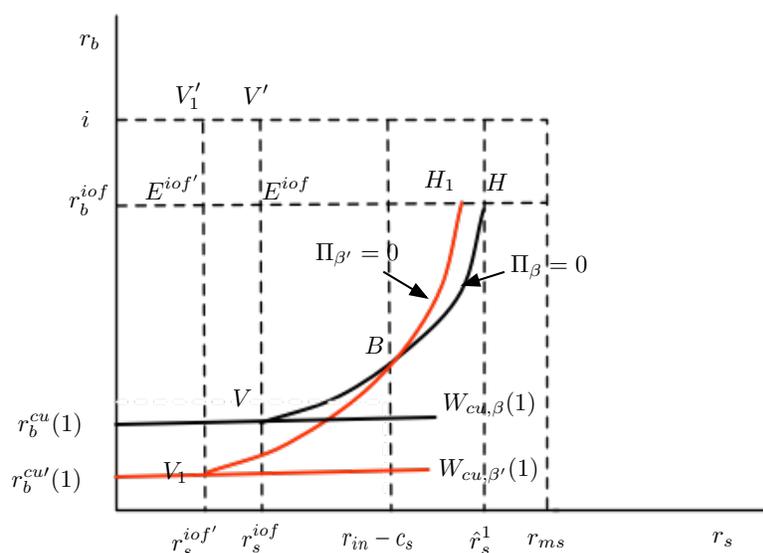


Figure 6.8: Impact of saver commitment on a borrower-oriented credit union: $\beta' > \beta$

The completely borrower-oriented credit union sets its deposit interest rate at the lowest level. Notice that $\partial\Pi/\partial r_s = 0$ at point V with commitment β . As saver commitment grows

⁸Differentiating $\Pi = 0$ with respect to β and rearranging gives $dr_s/d\beta = (r_{in} - c_s - r_s)(r_s - r_{ms})/\beta[r_{in} - c_s - r_s - (\beta + r_s - r_{ms})] < 0$, therefore, $d(1 - \hat{y})/\beta/d\beta = (\beta + r_s - r_{ms})(r_s - r_{ms})/[r_{in} - c_s - r_s - (\beta + r_s - r_{ms})] > 0$ must hold, which means more savers would participate.

stronger, the credit union's profits from savers increase due to an increase in cheaper loan funds. Moreover, it can make more profits on savers by lowering its deposit interest rate since at the new commitment level, $\partial\Pi/\partial r_s < 0$ must hold at point V . With more profits from savers, the credit union can lower the loan interest rate to make its favourite members – borrowers – better off, while still breaking even.

Despite the lower deposit interest rate, more savers invest in the saving plan.⁹ As a result, the benefits to savers increase.

3. $\alpha = 1/2$.

As shown in Figures 6.9, a neutral credit union does not alter its pricing policy in face of a change in saver member commitment. As saver commitment grows stronger, both the credit union's zero profit curve and the curve along which the credit union thinks the benefits to members remain constant rotate counterclockwise, see the movement from $\Pi_\beta = 0(VBH)$ and $W_{cu,\beta}(1/2)(ABC)$ to $\Pi_{\beta'} = 0(V_1BH_1)$ and $W_{cu,\beta'}(1/2)(A_1BC_1)$, respectively. Notice that curve $\Pi_{\beta'} = 0(V_1BH_1)$ and curve $W_{cu,\beta'}(1/2)(A_1BC_1)$ are tangent at point B . As a result, the benefits to borrowers remain unchanged, but the benefits to savers increase since $dW_s/d\beta > 0$. The total benefits to member W^{cu} , also increase.

The impacts of member commitment on interest rates, member participation and the member's welfare are summarized in Table 6.1.

6.4.3 IOF vs. Credit Union

In this model, commitment is the preference for the micro-loan program offered by the financial institution. It is likely that savers prefer to support the micro-loan program operated by a credit union.

First, compared with the IOF, the credit union is a better choice for savers if they decide to make contributions (Hansmann [1980]). Given the difficulty of monitoring the operation and performance of a micro-loan program, savers may fear that the profit-driven IOF will convert some contributions into the profits for its owners. The credit union is formed for a social purpose. Its ultimate objective is to improve the welfare of membership through providing financial

⁹Differentiating $\partial\Pi/\partial r_s = 0$ with respect to β and rearranging give $dr_s/d\beta = -1/2$, thus $d(1 - \hat{y})/d\beta > 0$ must hold.

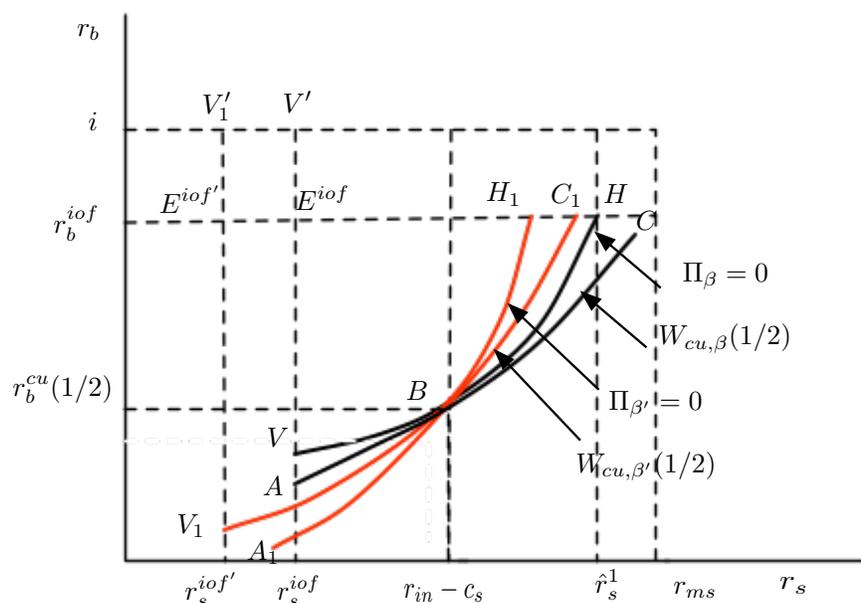


Figure 6.9: Impact of saver commitment on a neutral credit union: $\beta' > \beta$

services to those in need. It has some commercial objectives, but these objectives are within the context of its member welfare maximizing purpose. Operating a micro-loan program is consistent with the credit union's philosophy and can enhance its values. So misuse of funds is less likely at the credit union. Moreover, the credit union has a history and reputation in serving people with low incomes. Thus, the credit union's micro-loan program appears to be more credible and attractive to savers.

Second, as demonstrated in a previous section, the level of investment financed is higher with the credit union than with the IOF, unless the credit union is completely saver-oriented. This means that the micro-loan program operated by the credit union creates more private benefits to borrowers and more social benefits (although they are assumed to equal zero in this model). Thus, savers tend to have a higher value for the credit union's micro-loan program and are more willing to participate in its community investment saving plan.

Third, the IOF translates an increase in saver commitment into more profits without improving borrowers' access to credit as desired by savers. The credit union, however, would improve the borrowers' access to micro-loans if it is borrower-oriented. In a saver-oriented credit union, the increase in saver member commitment may result in more restricted access to credit for borrowers, because the credit union is more concerned about savers. However, the credit union does not take advantage of saver commitment for profits.

Table 6.1: Impacts of saver member commitment

Item	IOF	Credit Union		
		$\alpha = 0$	$\alpha = 1/2$	$\alpha = 1$
$dr_b/d\beta$	0	0	0	-
$dr_s/d\beta$	-	-	0	-
$dn_b/d\beta$	0	0	0	+
$dn_s/d\beta$	+	+	+	+
$dW_b/d\beta$	0	0	0	+
$dW_s/d\beta$	+	+	+	+
$d\Pi/d\beta$	+	0	0	0
$d(W_b + W_s)/d\beta$	+	+	+	+

Assume savers have stronger commitment to the credit union's micro-loan program: $\beta^{cu} > \beta^{iof}$, where the superscripts indicate the organization form of the financial institution. An immediate result is as follows.

Proposition 6.6. *If $\beta^{cu} > \beta^{iof}$, members are better off with the presence of a credit union, compared with the presence of an IOF.*

Savers are more committed to the credit union's micro-loan program. Therefore, the credit union is able to collect more deposits to support the micro-loan program, compared with the IOF. So the stronger commitment enhances the credit union's ability to adjust its interest rates to create more surplus for members. However, the credit union may distribute the surplus unequally between saver and borrower members.

Of course, whether a particular member group benefits from the stronger saver commitment depends on the credit union's preferences. Unless the credit union is completely saver-oriented ($\alpha = 0$), borrowers have better access to credit if the micro-loan program is operated by the credit union, and more investments are carried out.

6.5 Summary

Two outcomes were examined and compared: one is a monopolistic/monoposonistic IOF that operates a micro-loan program; the other is a credit union that operates the micro-loan program. The analysis suggests that credit unions have advantages over IOFs in successfully operating microcredit programs. Credit unions lead to a better outcome in terms of both member participation and benefits to members.

An Economic Analysis of Microcredit Lending

An important aspect of this study is that credit unions balance the interests of borrowers and savers. The member orientation of credit union affects the interest rates charged by credit unions. A saver-oriented credit union tends to offer a higher deposit interest rate and a lower loan interest rate in comparison with a borrower-oriented credit union. This member orientation has negative impact on efficiency: the stronger the preference a credit union exhibits, the less efficient is the outcome.

This result occurs because deviating from neutrality creates a bias and causes a deadweight loss. For example, a borrower-oriented credit union charges a deposit interest rate that is lower than what a neutral credit union charges to make more profits from savers. The borrower-oriented credit union then uses the profit from savers to subsidize borrowers by offering them a lower loan interest rate than that offered by the neutral credit union. In each market, a deadweight loss is created. As the credit union exhibits stronger preference, the deadweight loss increases. Under some conditions, the total surplus under a credit union may be lower than that under an IOF.

This study is different from previous studies which focus solely on pecuniary benefits. In this modelling work, the non-pecuniary benefits play an important role. Warm glow – the satisfaction arising from giving – motivates savers to invest in a community investment saving plan that offers a below-market interest rate. As the warm glow effect becomes more important to savers (or savers are more committed to the micro-loan program), the credit union is able to produce more surplus to members. However, saver commitment may have a negative influence on borrowers' access to credit if the credit union prefers savers.

The lesson from this study is that in order to operate a community economic development (CED) lending project successfully, such as a micro-loan program, the credit union needs a clear commitment from the membership, the board of directors and the management. However, the competitive nature of the financial sector is a barrier for the credit union to engaging in CED lending. As CED lending is often costly and time-consuming, engaging in it may affect the competitiveness and profitability of the credit union. Also members may have no real interest in seeing their credit union engage in CED lending. As shown in the model, like an IOF, the credit union cannot operate a micro-loan program without the commitment of the membership, directors and management

6.6 Appendix

6.6.1 Proof of the existence of a unique solution to the credit union's optimization problem

Proof. Solving r_s and r_b as a function of λ , and substitute into $\Pi = 0$ gives

$$\Pi = \frac{\lambda - \alpha}{(2\lambda - \alpha)^2} A + \frac{\lambda - (1 - \alpha)}{[2\lambda - (1 - \alpha)]^2} B = 0$$

where $A = [pi - (1 - p) - r_{in} - c_b]^2/p > 0$ and $B = [r_{in} - c_s + \beta - r_{ms}]^2 > 0$.

For $\lambda > \max(\alpha, 1 - \alpha)$, $\Pi > 0$ must hold. For $\lambda < \max(\min(\alpha, 1 - \alpha), \max(\alpha, 1 - \alpha)/2)$, $\Pi < 0$ always hold. Furthermore, $\Pi > 0$ if $\lambda = \max(\alpha, 1 - \alpha)$, and $\Pi < 0$ if $\lambda = \max(\min(\alpha, 1 - \alpha), \max(\alpha, 1 - \alpha)/2)$. Furthermore, Π is continuous for $\lambda \in [\max(\min(\alpha, 1 - \alpha), \max(\alpha, 1 - \alpha)/2), \max(\alpha, 1 - \alpha)]$, thus there must exist a unique solution to the optimization problem. (Q. E. D.)

6.6.2 Proof of Proposition 6.2

Proof. Investigating the comparative static property gives

$$\frac{dr_s}{d\alpha} = \frac{\frac{\partial \Pi}{\partial r_b} \frac{\partial \Pi}{\partial r_s} n_b p^2 \frac{(i - r_b)}{\gamma} - \left(\frac{\partial \Pi}{\partial r_b}\right)^2 n_s \frac{(\beta + r_s - r_{ms})}{\beta}}{|H|} < 0, \quad (6.25)$$

$$\frac{dr_b}{d\alpha} = \frac{\frac{\partial \Pi}{\partial r_b} \frac{\partial \Pi}{\partial r_s} n_s \frac{\beta + r_s - r_{ms}}{\beta} - \left(\frac{\partial \Pi}{\partial r_s}\right)^2 n_b p^2 \frac{i - r_b}{\gamma}}{|H|} < 0, \quad (6.26)$$

where $|H|$ is the determinant of the bordered Hessian matrix and $|H| > 0$.(Q.E.D.)

6.6.3 Proof of Corollary 6.2

Proof. Differentiating W^{cu} with respect to α gives

$$\frac{dW^{cu}}{d\alpha} = -n_b p^2 \frac{i - r_b}{\gamma} \frac{dr_b}{d\alpha} + n_s \frac{\beta + r_s - r_{ms}}{\beta} \frac{dr_s}{d\alpha}. \quad (6.27)$$

Substituting equations (6.25) and (6.26) into (6.27) gives

$$\begin{aligned} \text{the sign of } \left(\frac{dW^{cu}}{d\alpha} \right) &= \text{the sign of } \left(\frac{dr_b}{dr_s} \Big|_{\bar{\Pi}} - \frac{dr_b}{dr_s} \Big|_{W^{cu}} \right) \\ &= \begin{cases} + & \text{if } \alpha < 1/2, \\ 0 & \text{if } \alpha = 1/2, \\ - & \text{if } \alpha > 1/2. \end{cases} \end{aligned}$$

6.6.4 Proof of Proposition 6.3

Proof. First, consider a completely borrower-oriented credit union ($\beta = 1$), the total benefit is given by

$$\begin{aligned} TW^{cu}(1) &= W_s^{cu}(1) + W_b^{cu}(1) \\ &= \frac{[pi - (1 - p) - r_{in} - c_b + \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + n_s \gamma \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}]^2}{8\gamma} \\ &\quad + n_s \frac{((r_{in} - r_{ms} + \beta - c_s)^2)}{8\beta} \\ &= \frac{n_b [pi - (1 - p) - r_{in} - c_b]^2}{4\gamma} + \frac{1 n_s (r_{in} - r_{ms} + \beta - c_s)^2}{4\beta} \\ &\quad + \frac{n_b [pi - (1 - p) - r_{in} - c_b] \sqrt{(pi - (1 - p) - r_{in} - c_b)^2 + n_s \gamma \frac{(r_{in} - r_{ms} + \beta - c_s)^2}{n_b p \beta}}}{8\gamma} \\ &= \Pi_b^{iof} + \Pi_s^{iof} + \sqrt{(\Pi_b^{iof})^2 + \Pi_b^{iof} \Pi_s^{iof}}. \end{aligned}$$

Therefore,

$$\begin{aligned} TW^{cu}(1) - TW^{iof} &= \sqrt{(\Pi_b^{iof})^2 + \Pi_b^{iof} \Pi_s^{iof}} - \frac{\Pi_b^{iof} + \Pi_s^{iof}}{2} \\ &= \begin{cases} + & \text{if } 3\Pi_b^{iof} \geq \Pi_s^{iof}, \\ - & \text{if } 3\Pi_b^{iof} < \Pi_s^{iof}. \end{cases} \end{aligned}$$

Similarly, under a completely saver-oriented credit union ($\alpha = 0$), the total benefit

$$\begin{aligned} TW^{cu}(0) &= W_s^{cu}(0) + W_b^{cu}(0) \\ &= \Pi_b + \Pi_s + \sqrt{(\Pi_s^{iof})^2 + \Pi_b^{iof} \Pi_s^{iof}}. \end{aligned}$$

As a result,

$$\begin{aligned} TW^{cu}(0) - TW^{iof} &= \sqrt{(\Pi_b^{iof})^2 + \Pi_b^{iof} \Pi_s^{iof}} - \frac{\Pi_b^{iof} + \Pi_s^{iof}}{2} \\ &= \begin{cases} + & \text{if } 3\Pi_s^{iof} \geq \Pi_b^{iof}, \\ - & \text{if } 3\Pi_s^{iof} < \Pi_b^{iof}. \end{cases} \end{aligned}$$

According to Corollary 6.2, $\frac{dTW^{cu}}{d\alpha} > 0$ if $\alpha < 1/2$ and $\frac{dTW^{cu}}{d\alpha} < 0$ if $\alpha > 1/2$. Therefore,

1. if $3\Pi_b^{iof} < \Pi_s^{iof}$, there exists an $\alpha_1 \in (1/2, 1]$ such that $TW^{cu} > TW^{iof}$ always holds if $\alpha < \alpha_1$, and vice versa;
2. if $3\Pi_s^{iof} < \Pi_b^{iof}$, there exists an $\alpha_2 \in [0, 1/2)$ such that $TW^{cu} > TW^{iof}$ always holds if $\alpha > \alpha_2$, and vice versa;
3. if neither $3\Pi_b^{iof} < \Pi_s^{iof}$ nor $3\Pi_s^{iof} < \Pi_b^{iof}$ holds, then $TW^{cu} > TW^{iof}$ holds true for any $\alpha \in [0, 1]$.

(Q.E.D.)

6.6.5 Proof of Proposition 6.5

Proof. This proposition can be proved by investigating the comparative static property by means of Cramer's rule. Thus,

$$\begin{aligned} dr_b^{cu}/d\beta &= \frac{\partial \Pi / \partial r_b}{|H|} \left[\frac{-(1-\alpha)(\beta + r_s - r_{ms})(r_s - r_{ms})}{\beta^3} \right. \\ &\quad \left. + \lambda \frac{(r_{in} - c_s - r_s)(r_{in} - c_s - r_{ms}) - (\beta + r_s - r_{ms})(r_{in} + r_{ms} - c_s - 2r_s)}{\beta^3} \right], \end{aligned}$$

where $|H| > 0$ is the determinant of bordered Hessian matrix, and $\partial \Pi / \partial r_b \geq 0$. As a result,

$$\begin{aligned} \text{The sign of } dr_b^{cu}/d\beta &= \text{the sign of } \lambda \frac{(r_{in} - c_s - r_s)(r_{in} - c_s - r_{ms}) - (\beta + r_s - r_{ms})(r_{in} - c_s - r_s)}{\beta^3} \\ &= \begin{cases} (+) & \text{if } \alpha \leq 1/2, \\ (-) & \text{if } \alpha \geq 1/2. \end{cases} \end{aligned}$$

(Q. E. D.)

Chapter 7

Summary and Conclusions, and Implications for Further Studies

The purpose of this dissertation is to explore a number of the issues around the provision of microcredit by credit unions and the agencies with which they work, specifically: (1) to analyze how information asymmetry in the provision of microcredit and the resulting rationing of credit to low collateral entrepreneurs are addressed by the bundling of credit with the provision of non-financial services (e.g., mentoring); and (2) to explain the advantages and disadvantages of IOFs (i.e., commercial banks) versus credit unions in providing microcredit.

To achieve these objectives, three theoretical models were developed in Chapters 4, 5 and 6, respectively. This chapter gives a summary of the research findings. Conclusions will be drawn, followed by a discussion of the research limitations.

7.1 Summary and Conclusions

The results of the research carried out in this dissertation show that credit rationing arises in the presence of information asymmetry (both adverse selection and moral hazard) and insufficient collateral. Two different scenarios were considered: (1) entrepreneurs cannot be distinguished by wealth; and (2) entrepreneurs cannot be distinguished by entrepreneurial skill. In each scenario, entrepreneurs with insufficient collateral experience credit rationing. Rationing arises because, in a perfectly competitive credit market, the collateral constraint limits lenders' ability to design a set of incentive-compatible contracts. Without rationing, all entrepreneurs prefer the contract that is designed for the collateral-constrained entrepreneurs, and consequently lenders would incur a loss from lending since they would end up lending to high risk and/or low return borrowers. In response, lenders randomize the credit delivered under the contract designed for the collateral-

constrained entrepreneurs to deter the other entrepreneurs from choosing this contract. Therefore, the equilibrium is characterized by perfect separation with credit rationing of the collateral-constrained entrepreneurs. The smaller is the collateralizable wealth of the collateral-constrained entrepreneurs, the greater is the credit rationing that occurs.

An interesting result is found in the first scenario which suggests that, under some conditions, credit rationing is persistent: low wealth entrepreneurs are always rationed. Rationing is not related to the collateralizable wealth of low wealth entrepreneurs, instead, rationing is related to the total wealth of low wealth entrepreneurs. The less wealth these entrepreneurs have, the larger is credit rationing. This result arises when the difference in wealth between different entrepreneur types is large and the difference between techniques is small.

Another result is that the more favourable are outside options (e.g., wage rate), the less credit is rationed. Thus, lack of credit is a particular problem for collateral-constrained entrepreneurs when the economy is in a downturn.

One of the implications of these models is that, with asymmetric information, a perfectly competitive credit market will not produce the first-best efficient level of investment when collateralizable wealth is unavailable. Micro-entrepreneurs with insufficient collateral are rationed credit.

A number of Canadian credit unions have found ways to provide microcredit to micro-entrepreneurs. In doing so, they appear to have at least partially solved the information asymmetry problem. The approach used by credit unions to do so relies on bundling loan services with non-financial services (e.g., mentoring). The classic explanation for the provision of non-financial services is that financial capital and human capital are complements; thus the requirement to receive non-financial services increases the entrepreneurs' chances of surviving and succeeding.¹ This study provides an additional reason: non-financial services can play a role in allowing borrowers to self-select their loans so that the resources designated for collateral-constrained micro-entrepreneurs are directed towards them and are not used by other entrepreneurs.

The bundling of micro-loans with the provision of non-financial services imposes extra costs on entrepreneurs that obtain a micro-loan in comparison to a traditional loan. Assuming heterogeneity in the entrepreneurs' costs of obtaining a micro-loan, it is argued that entrepreneurs who are the target clients of microcredit programs incur the lowest cost of obtaining a micro-loan, while other entrepreneurs incur a relatively higher cost of obtaining a micro-loan. If this

¹There are other explanations. For example, some training programs provide loan services in order to obtain funds for their true mission because funders are more willing to pay for loans than training (Servon [2001]).

outcome occurs, then the high cost discourages the latter from obtaining micro-loans. Thus, the use of non-financial services, along with the interest rate and collateral, in the loan contract results in a perfect separation and a more efficient level of investment.

The above modelling work was carried out under the assumption that the credit market is perfectly competitive. With perfect competition, any and all firms would be prepared to offer microcredit programs. Yet this is not the pattern that is observed. Instead, credit unions and non-profit organizations are major players in the microcredit market, while the chartered banks are typically not involved. As well, the credit market is oligopolistic in nature. To explain the advantages and disadvantages of IOFs (e.g., chartered banks) versus credit unions in providing microcredit, a model of a monopoly credit union was developed.

Two outcomes were examined and compared: one is a monopoly IOF that operates a microcredit program, and the other is a credit union that operates a microcredit program. Rather than assuming there is a perfectly elastic supply of loan funds, the analysis considered the situation where loan funds for microcredit are raised by offering a community investment saving deposit program. With this saving product, the lender can access loan funds at below-market rates of interest. The model assumes that savers make deposit decisions based on both pecuniary and non-pecuniary motives.

The analysis suggests that credit unions, in comparison with IOFs, have advantages in providing microcredit to micro-entrepreneurs. The presence of a credit union leads to a better outcome in terms of both the level of investment that is financed and the benefits to borrowers and savers. The credit unions' advantage stems from their focus on the welfare of their members rather than on the profits earned.

An important aspect of the analysis is the orientation that the credit union has towards borrowers and savers. The interest rates chosen by the credit union are affected by its member orientation. As the credit union demonstrates a stronger preference towards borrowers, it reduces both loan and deposit interest rates; consequently borrowers will be better off and savers are worse off (the impacts are reversed if the credit union shows a stronger preference for savers). Moreover, the stronger the credit union is in favour of one group (either borrowers or savers), the less efficient is the outcome. Under some conditions, the outcome under the credit union is less efficient than the outcome under the IOF.

This result arises because any deviation from neutrality results in a bias and creates a dead-weight loss. For example, a completely borrower-oriented credit union offers the lowest possible

deposit interest rate in order to make the highest possible profit, as if it is an IOF. The credit union then uses the profit from savers to cross-subsidize borrowers by offering them a loan interest rate that is lower than what a neutral credit union would charge. A deadweight loss is created in each market. As shown in the analysis, under some conditions, the total surplus under a credit union may be lower than that under an IOF.

The impact of the non-pecuniary motives of savers on the pricing policies of the two financial institutions was also examined. The results indicate that when an IOF operates the microcredit program an increase in saver member commitment is translated into more profits for the IOF rather than better access to credit. In comparison, when the credit union operates the microcredit program, an increase in saver member commitment is translated into more benefits to borrowers and savers in aggregate – whether borrowers or savers benefit and how the benefits are distributed between borrowers and savers depends on the member orientation of the credit union. Consequently, in a borrower-oriented credit union, an increase in saver member commitment results in better access to credit for borrowers; this may not be the case in a saver-oriented credit union. This result implies that credit unions are likely to be more capable of successfully operating a microcredit program than are IOFs. All else equal, credit unions are able to obtain greater support from their saver members, and thus have more loan funds available for delivering microcredit.

This study has some practical implications. First, it shows that the practice of bundling microcredit and non-financial services used by credit unions can serve as a way of solving the key information asymmetry problem that plagues microcredit schemes. The findings of the study suggest that the administrators of microcredit programs should pay particular attention to the nature of the non-financial services so that they properly fulfill their role and thus allow low-collateral entrepreneurs to obtain loans.

A second implication is these monitoring services need not be provided by the credit union itself; instead, this service could be provided by outside agencies working in concert with the credit union. Indeed, a mixture of such practices is observed in the credit unions that were identified. A good example of an outside partnership is Assiniboine Credit Union (ACU) and SEED Winnipeg. Since the establishment of SEED Winnipeg, the two organizations have been working together on a number of community-based initiatives, including microcredit lending. ACU is responsible for approving the loan applications and administering the loans. SEED Winnipeg provides the entrepreneurs with information and skills necessary to successfully operate a business through training, workshops and after-care services for a specified period. SEED Winnipeg

not only assists the entrepreneurs to walk through the loan application process, but also provides ACU with assistance in screening and assessing the loan applications by having one staff sitting on the review committee. This alliance with SEED Winnipeg allows ACU to concentrate on its strength (i.e., lending) without committing extra resources and effort to the delivery of the complementary non-financial services.

Finally, the model highlighted the importance of member commitment in the delivery of micro-loans by a credit union. Member commitment enables the credit union to access cheap capital to finance micro-loans. Therefore, for the successful delivery of micro-loans, the cultivation of member commitment is crucial. This may be more challenging for large urban credit unions. Such credit unions serve diversified membership. As a result, members tend to have a weak commitment to the broad community served by their credit union. This weak commitment, in turn, may cause a difficulty in mobilizing deposits which are used to finance micro-loans. Therefore, a credit union that wants to operate a community-oriented program should invest in enhancing its image as a community-minded financial organization and raising members' awareness to distinguish itself from other financial institutions.

7.2 Implications for Further Study

This study contributes to the credit rationing literature and the co-operative literature. However, there are a number of areas that can be further pursued.

First, the lenders were limited in the use of selection instruments, i.e., they can only use the interest rate and collateral to induce self-selection. The outcome is that an entrepreneur either receives the amount of credit that he/she requested or is completely denied credit. However, in practice lenders have more instruments at their discretion. One of such instruments is loan size. Sometimes, lenders provide smaller loans than the amount for which entrepreneurs apply. One area for future work is to allow lenders to make use of the interest rate, collateral and loan size to screen the entrepreneurs. In this way, the analysis can be extended to another type of credit rationing – loan size rationing.

Second, the credit union was assumed to offer a single price. However, such a strategy generally does not yield the most efficient outcome when members are heterogeneous. To overcome this efficiency problem, non-linear pricing schemes could be applied to both borrower members and saver members.

Third, the behaviour of a monopoly credit union was examined and compared to that of a monopoly IOF. In reality, of course, credit unions typically operate alongside IOFs in mixed oligopolies. The operation of a microcredit program can be considered as a strategy that credit unions use to differentiate themselves from their IOF competitors. A possible area for future work is to examine the use of microcredit programs in this context.

Finally, credit unions have amalgamated rapidly in recent years. The result is the creation of large credit unions that often serve quite diversified (e.g., geographic, ethnic, socio-economic) communities. The formation of these new credit unions raises a number of questions. For instance, are these larger credit unions able to use microcredit programs as differentiation strategies, or does member commitment break down in these large organizations. How will the members from one part of the credit union react to microcredit programs directed at members from another part of the credit union? Are the managers of these larger credit unions likely to be more profit focused, and thus less willing to participate in microcredit programs? These questions pose interesting problems for future research.

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Appendix A

Semi-Structured Interview Guide

The following three sets of draft questions identify the areas that the researcher intends to explore through personal interviews with microcredit borrowers; credit union loan officers, staff, and supervising committee members; and managers and staff of the community development organizations, respectively. The questions are intended to guide the participants. It is expected that in some cases, depending on the nature of the response, that the discussion might go outside the expected scope of the interview. The respondents will be allowed and encouraged to tell the stories they think most important.

Each set of questions consists of a few main questions, followed by a number of probing questions. Depending on the participant's response to the main questions, probing questions may be asked in order to collect information of interest.

A.1 Draft Questions I - for microcredit borrowers:

1. Please describe how you became a microcredit borrower.
 - What type of business did you invest in?
 - What were the main barriers to getting credit?
 - Please describe the financial infrastructure in your community. What were the alternative financing sources that you had access to?
 - Why did you choose the credit union? How long have you been a member?
 - How long have you obtained microcredit loans from the credit union?
 - How did you use the microcredit loans?
 - Do you use the other financial services provided by the credit union?

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2. Please describe your borrowing experience.

- How well does the program work?
- What are the main problems with the program (for example, small size, high transaction cost, high interest rate, document requirements, etc)?

3. Please describe your repayment performance.

- Have you ever experienced repayment difficulties? What were the causes (controllable or uncontrollable shocks, etc.) and what was your action?
- Have you ever had to delay your repayment or default on your loans? Why? What happened as a consequence?
- Please describe the lending culture of your community or your ethnic group.
- Do you have problems with book-keeping, cash flow management, etc.?

4. Please describe your relationship with loan officers/staff of credit union.

- How often does the loan officer/staff pay a visit to your house or workplace, or make a phone call to you? What are the main topics of the conversation?
- Have you and the loan officer/staff established a personal relationship? How long did it take to build this relationship?
- Do you think the loan officer understands you - i.e. your culture, religion, values? Is he/she an outsider or insider in your community? Do you trust him/her?
- Do you come to credit union for consultations when you experience difficulties in operating your business? Why or why not?
- Do you actively participate in events and activities organized by credit union? Why or why not?

5. Please describe your relationship with community development organization(s) that are involved in microcredit programs.

- What service do you receive?
- Is there any service that is prerequisite for microcredit? Is it useful to your business?

- Will you continue to participate in the organizations' activities if you no longer need microcredit service?
- How often do you meet the managers/staff of the organizations?
- Do you think the managers/staff of the organizations understand you - i.e., your culture, religion, values, and needs? Do you trust them?
- Do the managers/staff visit your house or workplace regularly?
- Do you go to them for advice or consultation?

6. Please describe your experience with the animators.

- How long has the animator worked in your community?
- What's your personal relationship with the animator?
- Do you trust the animator?
- What service does the animator provide?
- Do you think you need to do something for the animator in return?
- Who do you prefer to work with – the loan officers/staff or the animators? Why?

7. Please describe your demographic characteristics.

- Are you a new immigrant? What is your ethnic background? Your religion? Education level? Language? Family size? Dependent children? Income level? Income sources?
- How long have you been living in this community? Do you plan to move in the near future?

Additional questions for peer lending borrowers:

8. How and when was the lending group formed? What was your relationship with the peer members before the formation of the group (kinship, friends, acquaintances, partners, etc.)

- Do you trust your peers? Do you monitor their investment activities?

9. What is your experience with the peers?

- Do you help each other if anyone faces financial difficulties, or impose social sanctions instead?

- Since the first loan was granted, has any member exited voluntarily or involuntarily?
- What are the key subjects of the regular group meetings? How often do you meet?

A.2 Draft Questions II - for loan officers and staff (including animators) / supervising committee members in credit unions:

1. How and why did the credit union launch and develop the microcredit program?
 - What are the goals and vision?
 - What are the main activities?
 - Who are the targeted population? How does the credit union reach them?
 - What are the major events that have significant impacts on the development of microcredit program, if there are any?
 - How many borrower members? What is the average loan size?
 - What is the role of support from third parties?
2. What are the major barriers to delivering microcredit service?
3. Please describe in detail how a microcredit loan is processed.
 - What are the security requirements?
 - How does the credit union collect borrowers' information?
 - What are the challenges and difficulties Ð i.e. social, cultural, or ethic factors?
4. What is the governance structure of the microcredit program?
5. What are the main policies related to the microcredit program?
 - Loan policies
 - Incentive policies (reward/punishment)
 - How are the policies implemented?
6. What innovations have the credit union made in delivering microcredit service?
 - What innovations in screening, monitoring, enforcement and collection?

- What innovations in educating borrowers and bridging cultural gaps?
 - What are the impacts?
7. What is the relationship between borrowers and the loan officers/staff?
- What are the qualifications or requirements for the loan officers/staff?
 - Is there any personal relationship established? Is it helpful to improve repayment performance?
 - How long does it take to build this relationship?
 - What is the ratio of loan officers/staff to borrowers?
8. Please describe the functions / roles of the community development organizations that are involved in the microcredit program.
- Why and how did they get involved?
 - What are the qualifications or requirements for the organizations to get involved?
 - What service do they provide?
 - What knowledge or skills are necessary to provide the service? Does the credit union provide them with necessary support (i.e. training)?
 - How do you evaluate their service?
 - What policies or mechanisms are in place to ensure that the organizations behave in the credit union's interest?
 - How often do you meet the organizations' personnel? What are the main topics of the meetings?
 - Will the credit union continue to co-operate with the community development organizations in delivering microcredit in the near future?
9. Please describe the functions / roles of the animators.
- Why did the credit union hire the animators?
 - What are the qualifications or requirements? What training is provided?
 - What are the animators' functions?

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- How do the animators report their work?
 - In your view, who do borrowers prefer to work with – the loan officers / staff or the animators?
 - What are the impacts of the introduction of the animators? How do you assess the roles of the animators?
10. What are the challenges and difficulties in operating a microcredit program?
11. What are the repayment rate, loan loss provision, average loan disbursement, actual loan loss, etc?

Questions for Animators

12. Why did you start to work as an animator?
13. What are the major barriers to credit in your community?
- In your community, are there any social, cultural, ethnic or religious factors affecting repayment performance?
14. What's your experience with borrowers?
- How and how often do you reach borrowers?
 - What service do you provide?
 - Do you think there is reciprocity between you and borrowers?
 - What are the problems or difficulties in working with borrowers?
 - What are the benefits of being an animator (except the wage you have received) if there's any?
15. Please describe your social and economic status in the community

A.3 Draft Questions III - for Discussion with managers / staff of community development organizations:

1. Please briefly describe the development history of the organization
- When was the organization established?

- What are the goals, values and vision?
 - What activities are undertaken to achieve the goals?
 - Who is the targeted population? How does the organization reach them?
2. Why and how did the organization begin to get involved in the microcredit programs?
- What are the main barriers to credit?
 - How long has the organization been involved?
 - Will the organization continue to be involved in the future?
 - What is the percentage of the clients requiring credit service? Please describe their social and economic status.
3. Please describe in details the organization's service related to microcredit program.
- What expertise and experience are required?
 - Does the credit union provide necessary training?
 - Does it form an important part of the organization's activities?
 - What are the organization's main concerns?
 - Good repayment performance is very important to the credit union. How this is embedded in the organization's practice?
4. Is there any other service tied to microcredit?
5. Please describe the relationship between the organization and microcredit borrowers.
- How does the organization collect information?
 - Do you visit their houses or workplace, or make phone calls regularly?
 - Do they come to you for advice or consultation?
6. Please describe the relationship between the organization and the credit union.
- How is the borrower information shared?