

Credit Rationing in Microfinance

Abstract

This paper argues that borrowers who are considered to be too risky are excluded from microfinance markets due to credit rationing. Insufficient institutional frameworks imply moral hazard which in turn causes the rationing of credit. Focusing on outreach and pricing issues, it is shown here how the outreach of microfinance depends on capital costs and subsidization. Capital costs worsen credit rationing and the extent to which subsidies mitigate the effects of credit rationing on outreach is typically limited. Market structure has no direct effects on credit rationing but affects the availability of credit through client-maximizing cross-subsidization. Consequently, attempts to improve the outreach of microfinance through subsidization and changes in market structure are believed to have little effect. Instead, it is advocated that institutional changes reduce moral hazard and thus credit rationing.

Starting from a simplistic base case scenario, a model is developed covering both capital costs and subsidies. The model distinguishes between profit- and client-maximizing MFIs and alternates between monopolistic and competitive settings.

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1 Introduction

Many poor people do not have access to formal credit markets. This exclusion is detrimental for development since it prohibits entrepreneurs to start small businesses that contribute to the economic development.¹ The problem arises because financial institutions cannot profitably lend money to very poor people. One of the objectives of so-called MicroFinance Institutions (MFIs) is to increase outreach of formal credit markets to include these clients. New techniques such as group lending, dynamic incentives and subsidies allow the MFIs to access many of these clients.²

This paper examines a mechanism limiting the outreach of MFIs. Risk is costly in credit markets where players are risk averse. In competition, the increased cost from higher risk is normally compensated by a high price (interest rate) until equilibrium is achieved, where supply equals demand.³ Credit rationing affects credit markets in a way that makes high prices unsustainable. The concept was introduced in some form as early as 1965 by Freimer and Gordon and comprehensively by Stiglitz and Weiss in 1981. Understanding the effects of credit rationing is important when developing methods to increase the outreach of formal credit markets.⁴

In recent years, MFIs have faced increasing pressure from the academic world and donors to become profitable, or at least self-sufficient. At the same time, the number of MFIs and the funds available to them have increased dramatically. In other words, the impact of capital costs and subsidization in microfinance markets are of great interest to both scholars and practitioners. By building a model where credit rationing is isolated from other mechanisms in the market, we will look at how these changes can be expected to affect the interest rates and outreach of MFIs with respect to credit rationing.

- **This paper examines credit rationing in microfinance markets, focusing on outreach and pricing issues.**

Due to both a lack of data and a paucity of research within the field of credit rationing in microfinance markets, we have chosen to develop a formal model rather than to conduct a quantitative analysis. To ensure the reader's understanding of the microfinance setting and the theory behind the concepts used in our model, we first describe the environment in which MFIs operate and then outline the relevant theory. Thereafter, we develop our model step by step, starting with a description of a monopoly with no capital costs. Following this, we increase the number of players and introduce capital costs and subsidies. Finally,

¹ Morduch, 1999.

² See Ray, 1998.

³ See for example Bodie et al., 2004.

⁴ See Morduch, 1999; Greenbaum, 1995.

we interpret the outcomes and implications of the model and relate the results to empirical findings by describing an indicative example.

2 Background

This section describes the environment in which MFIs operate. First, microfinance is defined. Second, some important characteristics of credit markets in developing countries are outlined. Third, the actors in these markets are introduced. Finally, we focus on MFIs and describe their objectives and financing.

2.1 Definition of microfinance

We define microfinance as loans to entrepreneurs too poor to have access to the traditional credit market.⁵ These loans are facilitated either through subsidies or novel lending techniques. The purpose is to enable poor people to generate a sustainable income for themselves and growth for the economy through funding of entrepreneurial activity.

2.2 Some characteristics of credit markets in developing countries

Below, we identify some of the most important characteristics of credit markets in developing countries.

2.2.1 Legal system in developing countries

Recent corporate governance literature emphasizes the importance of how the legal systems determine differences in the availability of external finance (equity and credit) between countries.⁶ Some observers argue that this relationship is especially important for developing countries. In such regions, the availability of external finance, particularly in the form of credit, has important effects on the economy in general.⁷

When looking at legal systems, it is important to investigate how efficient laws and regulations are de jure, in theory, as well as how efficient they are de facto, when they are implemented by the courts of law and when corruption is taken into account. One must also bear in mind who has access to the courts of law and who pays for trial costs. These factors determine how efficient the legal institutions will be in protecting creditors from expropriation and other moral hazard effects. LaPorta et al. (1998) show that countries of the same legal origin, e.g. common law or civil law, often have strong similarities in the efficiency of the judicial system, the enforcement quality and the quality of the accounting standards. Generally, common law countries such as the UK and the US have strong protection of creditors and outside investors, while civil law countries lack such protection. LaPorta et al. (2000) argue that strong protection of creditors and outside investors allow broad and deep capital markets to develop.

⁵ In other papers it is common to include different types of savings and insurance in the definition of microfinance.

⁶ Hart, 1995; LaPorta et al., 1998, 2000; Coffee, 2000.

⁷ Berglöf and von Thadden, 1999.

Developing countries that are former colonies often belong to the same legal origin as the former colonizer, e.g. former British colonies have common law systems. While it is beyond the scope of this paper to examine, we would expect the effects of credit rationing to be more pronounced in civil law origin developing countries.⁸

2.2.2 The function of the legal system in rural credit markets

The legal system and courts of law generally play a small role in helping to enforce contracts in rural credit markets or indeed in most developing markets. Whereas they are the principal way of enforcing contracts in developed countries, courts of law and other legal institutions often lack the ability to intervene between lenders and borrowers in developing countries.⁹ This is similar to international debt markets where there is also often a lack of an authority that can intervene between lenders and borrowers. In fact, many observers such as Ghosh et al. (2002) believe that rural credit markets are very similar to international debt markets, where lenders tend to supervise and collect debts more actively rather than depend on seizing collateral with the help of courts of law.

In international credit markets, one of the main incentives of borrowers to abide by contracts is the threat of not being able to borrow money in the future.¹⁰ Therefore, in the same way as analysts closely follow companies and rate their bonds in international markets, lenders in rural markets tend to have close relations with the borrowers and supervise their ability to repay the loans. However, since there are few means of forcing borrowers to repay loans, monitoring has a limited role to play. Even if the lender knows that the borrower has the assets to repay the loan, he may not be able to enforce the contract. Instead, screening is very important, partly to determine who will be able to repay the loan and partly to determine who would have the right incentives to actually do it.¹¹

Hence, in such circumstances there are of two different types of default. In developed countries default is normally involuntary. If the project fails, there is not enough money to repay the loan.¹² In case of voluntary default on the other hand, the borrower chooses to default either by not investing the borrowed money in the project in the first place, or by keeping the returns from the project. Due to the enforcement problems mentioned above, microfinance markets are characterized by a high probability of voluntary defaults. If a project results in either a low or a high outcome, involuntary default implies that the lender will at worst get the lower payoff, and at best get the face value of the loan. Voluntary default on the contrary, usually results in the lender not receiving any repayment at all.¹³

⁸ For a more detailed argumentation of the above, see Ghosh et al., 1999.

⁹ Ghosh et al., 2002.

¹⁰ Banerjee et al., 1993.

¹¹ Ghosh et al., 2002.

¹² See Ray, 1998 for relation to MFI markets.

¹³ Ghosh et al., 1999.

2.2.3 Collateral

One of the basic ways for lenders to protect themselves in case a borrower defaults is by using collateral. A house loan is the typical example where the property is the collateral. If the borrower defaults on his loan, the lender repossesses the building. This is commonly referred to as internal collateral, what the loan finances works as collateral. Initial endowments are another common form of collateral. For example, the house of an entrepreneur can be used as collateral for loans invested in different ventures, e.g. the start-up of a small business.¹⁴ The external collateral, i.e. the borrower's initial endowment, works as collateral. Evidence indicates that a large part of small enterprise start-ups are funded this way in developed countries.¹⁵

As discussed in the previous section, developing markets and especially rural areas are often characterized by a lack of legal systems and property rights for the poor, which makes repossessing of collateral non-viable. De Soto (2000) argues that this is the reason why poor countries are lagging behind rich countries and that granting property rights to people living in slum areas could solve poverty. By allowing them to raise capital to fund entrepreneurial activity, they may themselves create the economic opportunities needed to support development. Once property rights and a functioning legal system with sufficient enforcement are in place, collateral will allow most people to borrow at least some amount of money from traditional banks. MFIs have a role in markets where these conditions are not fulfilled or where the population is so poor that the amount they can borrow is not sufficient to fund entrepreneurial activity.¹⁶

When external collateral is not a viable alternative because of insufficient legal systems, internal collateral still provides a viable, if not complete, alternative. Internal collateral is easy to identify and property rights of physical assets that have been bought from formal enterprises are easily established since there will be receipts and other documentation. In addition, the lender may monitor the use and location of the good.¹⁷

2.2.4 Predatory interest rates

The interest rates charged by different institutions in developing countries vary widely as the risk profiles of customers are very different.¹⁸ Formal institutions such as banks that lend against collateral can charge low interest rates as loans are relatively secure and there are legal institutions to enforce lending contracts. Moneylenders acting on informal credit markets on the other hand charge very high rates, sometimes as high as 10 percent per month (314 percent p.a.).¹⁹ One of the motivations for MFIs has been that moneylenders were thought to abuse borrowers by charging predatory rates.²⁰ However, it has recently been indicated that formal lenders, to be profitable, would also have to charge very high rates to cover the

¹⁴ See Banerjee et al., 1993.

¹⁵ See De Soto, 2000.

¹⁶ See Fischer, 2000.

¹⁷ De Soto, 2000.

¹⁸ Ray, 1998.

¹⁹ The Global Development Research Center, 2005. See section 2.3.3 for description of moneylenders.

²⁰ Reserve Bank of India 1954, cited in Bell, 1990 p. 297.

costs of informational asymmetries and the default risk of borrowers, if they were to act in the same market as moneylenders.²¹ This will be illustrated more closely in the indicative example in section 6.

As argued above, lending money to the poor is problematic since the lack of legal institutions increases costs. The poorer and riskier their clients are, the higher cost institutions have for monitoring, supervising and collecting debt. Loans from moneylenders are also often used for different purposes than money borrowed from the formal sector.²² Often the need for borrowing money arises when an unforeseen event occurs, e.g. when a relative falls ill. To be able to efficiently give credit in such a situation, the lender needs to have local knowledge of the borrower's situation. Therefore, the lender needs to establish a personal relationship with clients. Local moneylenders who live out in the villages seem to be good at this, and the conditions of the loans they offer are suited for these kinds of situations even though the costs of monitoring and debt collection are much higher than for other types of loans.²³

The above has lead many observers to believe that the high interest rates charged by moneylenders are not as severe a problem as previously believed. After all, borrowers voluntarily agree to pay these rates.²⁴ Indeed, some MFIs have realised this and lend money to local moneylenders in order for them to re-lend at higher rates.²⁵ The benefit from bringing these informal lenders into a formal market would be to lower their cost of capital by increasing the availability of credit and perhaps more importantly, improve the legal protection of lenders and borrowers.²⁶

2.3 Description of credit institutions in developing countries

The credit market in developing countries can be divided into the following three groups of lending institutions.

2.3.1 Formal banks and financial markets

Formal lending institutions in developing countries are similar or identical to lending institutions and banks in developed countries. They operate in urban areas and have the affluent part of the population and larger companies as customers. Often they have local branches in the rural areas and try to reach new customers by lending money to smaller companies and farmers. Successful clients of MFIs become customers of these institutions when they have come out of poverty.²⁷

²¹ Ghosh et al., 1999.

²² Morduch, 1999.

²³ Armendáriz de Aghion et al., 2000.

²⁴ Woller, 2002.

²⁵ Perry, 2002.

²⁶ Floro and Ray, 1997 and Bose, 1996.

²⁷ Ghosh et al., 1999.

- Typical loan conditions are characterised by collateral, interest payments and lump sum amortizations at maturity.²⁸

2.3.2 *Microfinance institutions*

The majority of MFIs are subsidized, either by governments or by NGOs (non-governmental organizations). They have a social goal set by the subsidizers to provide cheap credit to poor people that lack the collateral to get normal bank loans.²⁹ MFIs operate among poor people both in urban and rural areas, but have traditionally been most prominent in rural markets with agricultural clients.³⁰ They mainly finance different types of small enterprises and start-ups, e.g. a mobile phone for a woman in a rural village which she can rent to other villagers and thus improve the communications of the whole village while making a living for herself.

- Typical loan conditions are characterized by lack of collateral, group lending, forced savings, regular payment schedules, threats of non-refinancing and direct monitoring.³¹ These characteristics and other aspects of MFIs will be further explored below.

2.3.3 *Moneylenders*

Moneylenders are the traditional informal lenders that charge very high interest rates and lend small sums of money for short periods. They are often accused of charging excessive rates and of using unconventional (and often illegal) ways of securing repayment.³²

- Typical loan conditions are characterized by rapid loan approval, flexible terms, repayment periods measured in days or weeks and lump-sum payments.³³

²⁸ Ray, 1998.

²⁹ The Global Development Research Center, 2005.

³⁰ Morduch, 1999.

³¹ Ray, 1998.

³² Ghosh et al., 1999.

³³ Ray, 1998.

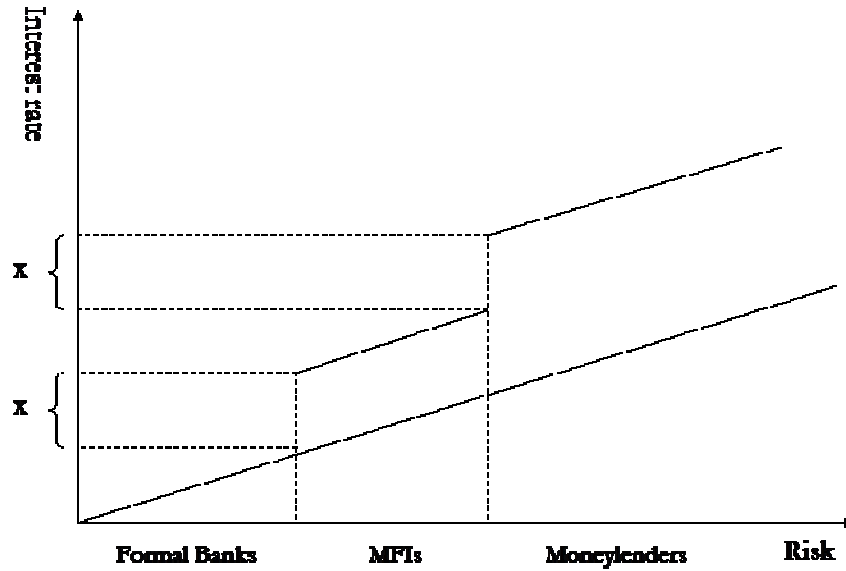


Figure 2.1 Average interest rates by different institutions in developing countries.

In figure 2.1 we show a highly simplified discontinuous representation of average interest rates by different institutions in developing countries. The high interest rates charged by MFIs and especially moneylenders may be explained partly by an increase in the risk of the borrowers and partly by increases in the cost of monitoring and enforcement, x , due to asymmetric information and lack of regulatory institutions.³⁴

2.4 Microfinance institutions

From the above argumentation, it is not obvious that subsidized MFIs will always do a better job than moneylenders at lending money to the extremely poor. However, moneylenders may lack the scale and scope to lend money to individuals who wish to start and build enterprises. This is where MFIs have found their purpose in the late 20th and early 21st century.³⁵ The institutions lend money in larger sums and over longer periods than moneylenders.³⁶ Compared to traditional banks, specific enforcement methods allow MFIs to lend profitably to borrowers unable to pose collaterals. Compared to formal credit institutions, MFIs reach poor individuals more effectively.³⁷

2.4.1 The microfinance market

Globally, one billion people live of less than 1 USD per day and about 500 million households are believed to be in need of microfinance.³⁸ Only around 30 million households were reported to have access to sustainable microfinance services in 2002. Hence, assuming that each household consists of about five

³⁴ See Ray, 1998.

³⁵ Brau et al., 2004.

³⁶ Charitonenko et al., 2002.

³⁷ Fischer, 2000.

³⁸ The Global Development Research Center, 2005.

people, some 150 million people have access to microfinance.³⁹ Estimates of the excess demand are considerably higher. Although there were about 10,000 MFIs worldwide in 2001 of which 70 percent operated in developing countries, they only reached about 4 percent of the potential market.⁴⁰ Notwithstanding the excess demand for microfinance, the number of MFIs has increased substantially during the past two decades. Over the past five years, the number of customers that use microfinance has grown between 25 and 30 percent annually.⁴¹

The microfinance market is segmented, ranging from very small programmes lending to only a few borrowers to large institutions with millions of clients. The top five MFIs in the world reach almost half the market. The most prominent of these large MFIs, the Grameen Bank in Bangladesh, is a widely imitated MFI lending 30 million USD a month to 1.8 million borrowers.⁴²

In addition to the lending described above, an increasing number of MFIs provide saving services to the poor.⁴³ Such services are important both as a safety net for the poor and as a source of funding that does not rely on external sources.⁴⁴ Hence, many MFIs, notably in Africa, use the savings of clients as a principal source of loan funds.⁴⁵ The saving services are, however, outside the scope of this paper.

2.4.2 Enforcement methods

Due to insufficient legal systems and lack of collateral, MFIs rely on non-collateral enforcement methods to give borrowers an incentive to repay the loans. Below, we outline some of the most common methods.

Group lending is a widely used enforcement mechanism. A well-known version of group lending is the Grameen bank model, where borrowers sort themselves into groups of five. Two of these group members receive loans. The process continues and the borrowers take turns to get loans as long as performance is satisfactory. If one member defaults, all five are barred from borrowing in the future. The creation of joint liability induces subtle sanctions to help discipline borrowers through peer pressure rather than direct actions of the MFIs. The borrowers risk social isolation, restrictions on inputs necessary for business or, in some rather extreme cases, physical force.⁴⁶

³⁹ Microcredit Summit Report 2002.

⁴⁰ 2001 World Bank Statistics.

⁴¹ The total number of people with access to microfinance schemes rose from 7.6 million in 1997 to 26.8 million in 2001 (The Global Development Research Center, 2005).

⁴² 2001 World Bank Statistics; The Global Development Research Center, 2005.

⁴³ See Demirgüç-Kunt et al., 2002; Hoggarth et al., 2005; Kane, 2000.

⁴⁴ According to the Microcredit Summit, approximately 10 percent of the USD 21.6 billion needed to provide microfinance to 100 million of the world's poorest families could be raised from borrower's savings alone (The Global Development Research Center, 2005).

⁴⁵ Microcredit Summit Report 2002.

⁴⁶ Armendáriz de Aghion et al., 2000.

However, group lending can be costly. The group members exert a lot of time and effort attending group meetings and monitoring group members. Moreover, borrowers with growing businesses are hindered by the loans being restricted to what the entire group can guarantee. In addition, the borrowers can collude against the bank and agree to default. The costly implementation of group lending implies that MFIs employing group lending rarely cover their costs.⁴⁷

Consequently, other types of enforcement methods, such as individual “lender-borrower” contracts based on dynamic initiatives, increase in popularity. In case of non-refinancing threats, the lenders will not refinance the borrowers who default. In addition, the MFIs may enhance the effect through promises to increase the size of the loans over time to good customers. Moreover, regular repayment schedules, where the borrower starts repaying the loan almost immediately, have proven to increase the repayment ratio.⁴⁸

2.4.3 MFI objectives

Academics as well as practitioners disagree amongst themselves on which are the optimal objectives and methods of MFIs. Different groups emphasize social welfare and financial efficiency respectively. These objectives are somewhat mutually exclusive since there is a trade-off between outreach, impact and sustainability in microfinance lending.⁴⁹

Outreach is defined as the effort of MFIs to extend loans to a wider audience (breadth of outreach), and especially to poor people (depth of outreach). Impact, on the other hand, refers to whether microfinance really helps the borrowers, i.e. raises the incomes and welfare of the poor. The third term, sustainability, implies full cost recovery at worst and profitability considering the cost of capital at best. A sustainable MFI is not dependent on subsidies from governments or donors.⁵⁰

There seems to be a trend towards an increased focus on sustainability among MFIs. A few decades ago, profits from lending to poor people were controversial, and profit-maximizing lenders were considered to be predatory. However, too much dependence on donors and government seem to jeopardize future funding and soft budget constraints may reduce the efficiency of the MFIs. Today profits are believed to attract private investments to the sector, thereby improving sustainability and access to credit of the institutions. Hence, the number of profit-maximizing MFIs is increasing at a steady pace.⁵¹

Nevertheless, there are practitioners, as well as academics, who oppose the current development. They believe that too much emphasis on cost recovery only implies that MFIs refrain from lending to the very

⁴⁷ Morduch, 1999.

⁴⁸ Ibid.

⁴⁹ Conning, 1999.

⁵⁰ Morduch, 1999.

⁵¹ Ibid.

poorest. Moreover, advocates claim that a profit-maximizing approach diverts attention and efforts from the social and political objectives of lending to the poorest and most vulnerable.⁵²

2.4.4 Self-sufficiency and subsidization

As mentioned above, sustainability is often defined in terms of self-sufficiency, i.e. the MFI's ability to cover its costs. However, there are two different kinds of self-sufficiency. Operational self-sufficiency refers to the extent to which the MFIs cover their operational expenses. On the other hand, to be financially self-sufficient, the MFIs must cover financial expenses as well.⁵³

MFIs reach self-sufficiency by cutting their costs and by increasing their revenue. Asian MFIs often achieve a high level of profitability due to low costs, whereas MFIs in the other regions such as Eastern Europe, Latin America and Africa, face higher costs and generally reach self-sufficiency through a combination of higher income and increased productivity.⁵⁴

Many MFIs claiming to be self-sufficient rely on subsidies. The term subsidy is defined as a financial resource received by an MFI at below market prices. Hence, it includes all types of donations.⁵⁵ A majority of the MFIs are subsidized in some way, either by governments or donors. However, due to the trends mentioned above, unsubsidized MFIs increase in numbers.⁵⁶ Therefore, we believe that assessing the effects of subsidization of MFIs is of great relevance.

3 Theory of credit rationing

Having described the microfinance market, we now turn to the relevant theory. First, we explain credit rationing referring to the logic of adverse selection and moral hazard.⁵⁷ Second, we briefly cover previous research on credit rationing and microfinance respectively.

3.1 Credit rationing

Credit markets rarely follow the law of supply and demand.⁵⁸ If they did, agents unable to borrow money at the market rate would be able to do so by paying a higher price, i.e. interest rate. However, that is not the case in many credit markets.⁵⁹

⁵² Hulme, 2000.

⁵³ Conning, 1999.

⁵⁴ MBB, 2002.

⁵⁵ Woller et al., 1999.

⁵⁶ Morduch, 1999.

⁵⁷ It is important to note that there are many different definitions of credit rationing. We try to capture the most basic function and therefore our definition is slightly different and simplified compared to previous definitions e.g. Stiglitz and Weiss, 1981; Keeton, 1979; Freimer and Gordon, 1965.

⁵⁸ Ghosh et al., 1999.

⁵⁹ Brau et al., 2004.

Let us assume that the lender's pay-off from a certain borrower is increasing in risk. The riskier the project is, the higher interest rate the borrower will be prepared to pay. Hence, at high interest rates, only borrowers investing in very risky projects are prepared to borrow money. Thus, the interest rate a player is prepared to pay reveals his risk class. Due to adverse selection described below, only riskier players will want to borrow at very high interest rates. Banks will suspect borrowers willing to pay high interest rates of being very risky. Moreover, the interest rate charged affects the risk of the borrower. As stated in section 3.3, a high interest rate adds to the burden of repayment, which has moral hazard implications on the incentives of the borrower. For these reasons, banks often choose to ration their credit.⁶⁰

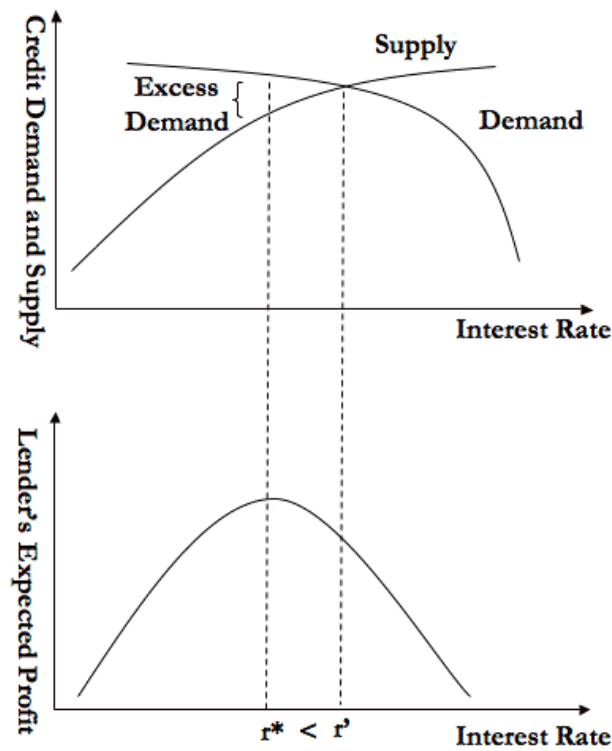


Figure 3.1 Due to credit rationing, the optimal interest rate is above the equilibrium interest rate. Thus, the market-clearing interest rate is not necessarily profit-maximizing.⁶¹

As illustrated in figure 3.1, the relationship between the interest rate charged and the expected return to the bank is a concave function with an optimal interest rate, r^* , after which the return to the bank starts to decrease. The risk of default increases disproportionately among the borrowers willing to accept worsened loan conditions. Because of this profit maximizing solution, demand and supply will not always clear the

⁶⁰ Greenbaum et al., 1995.

⁶¹ Ibid.

market. The level of the profit maximizing interest rate depends on the risk of the borrowers, the cost of capital for the bank and the supply of credit.⁶²

3.2 Adverse selection

When lending money, banks try to determine the risk level of the projects so as to charge the appropriate interest rates. This can be done by various screening methods and by looking at past history of the borrower. While these methods can be highly sophisticated, they are never completely accurate. For a group of borrowers offered the same interest rates based on the risk assessment, the actual risk level always varies between individual projects.⁶³

Assume that banks observe the average risk level within a group, but that borrowers are better informed than banks on the risk level of each individual project.⁶⁴ The projects with higher risk level than the group average will then be subsidized by the projects with lower risk. The borrowers with low risk projects are likely to choose not to borrow or go to another bank because they pay too high a price. This implies an increase in the average risk level of the group. Realising this, the bank will charge a higher interest rate. Once again the borrowers with risk levels below the average will drop out and in the end the only borrowers that are prepared to pay the banks interest rate will be the most risky borrowers.⁶⁵

This leads to a reluctance among banks to lend at high interest rates as this will only attract very risky projects. These high risk projects run a considerable risk of failing and the borrower of defaulting on the loan. The banks profitability will be reduced and, under certain circumstances, completely eroded. However, in addition to causing these involuntary defaults, increased interest rate can have other negative effects on the banks profitability.⁶⁶ For example, it may cause voluntary defaults as we will see below.

3.3 Moral hazard

Even when a borrower has accepted a loan at an interest rate, the interest rate level may still be troublesome to the bank. If the interest rate is high, borrowers incentives to cheat the bank increases. They can do this in two main ways, either by choosing riskier projects or by stopping exerting effort on the project.⁶⁷

Because of the option-like features of a debt-financed project, the borrower only receives the upside of the outcome, which means that he always has incentives to increase the risk level of his projects.⁶⁸ If the interest rate is high, the borrower's upside is smaller and the incentives to increase the risk level are larger. In addition, if it is hard for the bank to verify what project the borrower is actually undertaking, the

⁶² Greenbaum et al., 1995.

⁶³ Stiglitz and Weiss, 1981.

⁶⁴ For an opposing view, see for example Manove et al. forthcoming.

⁶⁵ Greenbaum et al., 1995.

⁶⁶ Stiglitz and Weiss, 1981.

⁶⁷ Greenbaum et al., 1995.

⁶⁸ See appendix A.

potential downside of changing project is smaller for the borrower.⁶⁹ The increased risk means that the loan becomes less profitable for the bank. At some level, the bank will make a loss from lending to the borrower.⁷⁰

The borrower may also choose not to undertake the project at all. If he believes the interest rate is so high that his upside is smaller than his best alternative, i.e. going back to doing what he did before the project, he may simply stop working on it. The borrower may realize this when he has worked for a while and start observing the outcomes of his project. If the profit is not high enough and if the borrower cannot increase the potential upside by changing the nature of the project, he may simply abandon the project. The bank will then lose everything apart from what they can repossess from the project, i.e. investments and inventories given that there is no collateral.⁷¹

The above implies that banks are reluctant to lend at high rates even if the borrowers initially are willing to accept the interest rate.

3.4 Other research

From the above we conclude that credit rationing is based on both adverse selection and moral hazard. In this section we present relevant fields of research. We first turn to the credit rationing literature and present an article where microfinance is not mentioned. Thereafter, we describe a microfinance article disregarding credit rationing.⁷²

Stiglitz and Weiss (1981) present a model based on the option-like characteristics of loan contracts presented in appendix A, implying that lenders are more risk averse than borrowers since the former face all the down-side risk, whereas the latter capture the upside. However, the model was created to describe credit markets where lenders are not aware of borrower characteristics. In microfinance markets on the other hand, information on the characteristics of borrowers and projects is often available to lenders due to the structure of the societies.⁷³ Nevertheless, the ability to observe borrowers activities is limited and costly. Hence, whereas adverse selection is less of a problem in microfinance markets, the moral hazard issue is prominent. Unlike Stiglitz and Weiss' model our model therefore only deals with the latter.

A large part of the microfinance literature is not compatible with the theories on credit rationing presented above. Wydick and McIntosh (2002) investigate microfinance markets in different scenarios, such as monopoly, competition and subsidization. They present a model similar to the model developed in this paper, identifying the effects of new entrants in a monopolistic microfinance market. The outcomes

⁶⁹ Some observers argue that it is actually easier for banks to verify this in rural markets where the institutions are closer to their clients, see Ray, 1998, p. 537.

⁷⁰ Greenbaum et al., 1995.

⁷¹ Stiglitz and Weiss, 1981.

⁷² For a general overview of the microfinance literature see Brau et al., 2004.

⁷³ Ghosh et al., 1999.

of both models concern outreach and interest rate. However, their model is different from ours in several important aspects.

A crucial assumption in Wydick and McIntosh's model is that the probability of default of an investment depends on the initial endowment and the loan size. In other words, a wealthy borrower is more likely to repay the loan than a poor borrower, everything else being the same. Accordingly, the size of the loan will not increase the probability of repayment. However, modelling credit markets for poor people, we find it inappropriate to put too much emphasis on initial endowments. The clients of MFIs are typically very poor, and in case there are any initial endowments at all, weak legal systems complicate the expropriation of collaterals in case of default. Therefore, we believe that the assumptions about initial endowments and loan size weaken the applicability of the theory. Nevertheless, to not lose some of the advantages of Wydick and McIntosh's model, our model can easily be adjusted to allow for external collateral.

Most importantly, we will include the phenomena of credit rationing, disregarded by Wydick and McIntosh. In addition, the MFIs in Wydick and McIntosh's model compete with moneylenders, whereas we believe that moneylenders and MFIs act in different markets.⁷⁴

4 Model

Below, we develop a model to examine the effects of market structure, MFI objectives and subsidization on the actions of lenders under credit rationing. Since we isolate the credit rationing mechanism from other factors, our results are not directly applicable to reality, but rather indications of how credit rationing can be expected to contribute to other effects. The environment in which we develop our model is that of a developing country, and the lending institutions are MFIs.

We start by defining the framework and stating our assumptions. Thereafter, we model a base case scenario, which we later extend to include cost of capital and subsidies. Each case is applied to both a monopolistic and a competitive setting respectively. Finally, we examine some extensions of the model that deal with collaterals.

4.1 Definitions and assumptions

4.1.1 Credit rationing

We define credit rationing as the phenomena that some borrowers will not get to borrow regardless of what interest rate they are prepared to pay, as outlined in section 3.1. To isolate the effects of credit rationing, we assume that projects only have one outcome, successful. The outcome of individual i is

⁷⁴ The exclusion of moneylenders from our model is based on Armendáriz de Aghion and Morduch, 2000.

denoted $\bar{\beta}_i$. However, borrowers may choose not to exert effort if they feel that their upside is too low.⁷⁵ The bank then receives $\underline{\beta}_i$ from individual i .⁷⁶ The higher interest rate the bank is charging the lower is the upside for the borrower. Thus the probability that borrower i will default voluntarily is a function of the interest rate

$$\theta_i = \theta_i(r_i),$$

where θ_i is the probability of default associated with an interest rate r_i charged from individual i .⁷⁷ The constraints on $\theta_i(r_i)$ are that the probability of default must always be above zero but below one

$$0 < \theta_i(r_i) < 1.$$

For these values of $\theta_i(r_i)$ the relationship between probability of default and interest rate must be positive

$$\theta'_i(r_i) > 0$$

and given that

$$\beta_i < 1$$

$$r_i > 0$$

$$\theta_i(r_i) < 1$$

we must have that the derivative of the MFI revenue ($\text{Rev}_i^{\text{MFI}}$) as a function of the interest rate is

$$\frac{\partial \text{Rev}_i^{\text{MFI}}}{\partial r_i} = 0$$

for credit rationing to exist.

In appendix D we develop a function of $\theta_i(r_i)$ which is consistent for a wider range of constraint assumptions than the function we will be using below. However, for the purposes of this paper we limit our investigations to a simpler function. We assume that there is a linear relationship between r_i and θ_i as follows,

$$\theta_i = \varepsilon r_i \tag{Formula 4.A}$$

where ε can be interpreted as the average propensity for borrowers to default. This propensity is dependent upon how the institutional framework and especially the legal framework affect the incentives for moral hazard and adverse selection. As noted in section 2.2, it is well documented that many developing countries have severe deficiencies in their legal framework. This means that the issues raised in section 3.3 concerning moral hazard are relevant to the model. Improved institutional framework will reduce ε which will increase the outreach of MFIs. We assume however, that ε is exogenously given and focus on the effects of credit rationing on microfinance.

⁷⁵ This follows the argumentation in section 2.2.2.

⁷⁶ See section 4.1.2 for further description of $\underline{\beta}_i$.

⁷⁷ In this paper, we only consider real interest rates.

4.1.2 Repossessable asset

In our model, we allow for voluntary default as discussed in section 2.2.2. However, we assume that the MFI can repossess the share of the loan, $\underline{\beta}_i$, that has been invested in physical assets such as machinery and inventory. In doing this we follow the argumentation in 2.2.1-3 that internal collateral is a more viable alternative than external collateral in developing markets where there are deficiencies in the legal system. Anyhow, the concept of the repossessable assets can also be broadened to represent other factors such as external collateral, initial endowment or poverty level without compromising the dynamics of the model.

The repossessable asset $\underline{\beta}_i$ is observable to MFIs because of their screening activities. Hence, adverse selection is not included in the model. Monitoring of borrowers is futile because the lack of legal institutions means that there are no means of repossessing anything beyond $\underline{\beta}_i$. This causes the MFIs to discriminate between borrowers based only on the observed $\underline{\beta}_i$ of the potential projects.

It is worth noting that since lenders choose between borrowers based on the repossessable assets our model captures the effects on the breadth of outreach and not depth of outreach as described in section 2.4.3. If we substitute repossessable assets with poverty level we would capture depth of outreach instead.

4.1.3 The outcome of the projects

We assume that each borrower undertakes one specific project, i.e. they cannot choose what project to undertake. Further, we assume that each project requires an investment of one unit. Each project has an outcome of $\bar{\beta}_i$ which is the successful state when the project has been undertaken. Each project also has an outcome when the borrower chooses not to exert effort, $\underline{\beta}_i$, i.e. the repossessable asset according to the above discussion. As described above, this can be interpreted as the amount invested in fixed investments or inventories that the MFI can repossess in case of default. By common sense we understand that $\bar{\beta}_i > (1 + r_i)$ or else the bank would never lend neither would the borrower borrow. Further, $\underline{\beta}_i < 1$ must hold since otherwise there is no risk to the bank.⁷⁸

This gives that the expected revenue per unit lent by an institution is

$$\text{Rev}_i^{\text{MFI}} = (1 - \theta_i)(1 + r_i) + \theta_i \underline{\beta}_i. \quad ^{79}$$

Inserting the probability of default function from section 4.1.1 we get

$$\text{Rev}_i^{\text{MFI}} = 1 + r_i - \varepsilon_i - \varepsilon_i^2 + \varepsilon_i \underline{\beta}_i \quad \text{Formula 4.B}$$

⁷⁸ This holds true in our base case when there are no capital costs.

⁷⁹ We define $\text{Rev}_i^{\text{MFI}}$ as the *expected* revenue of the MFI from lending to individual i . Throughout the entire paper we refer to the *expected* revenue when we discuss the revenue of the MFI.

The profit constraint on an institution states that, assuming no cost of capital, the expected revenue per unit lent cannot be lower than one.

$$\text{Rev}_i^{\text{MFI}} \geq 1$$

$$1 + r_i - \varepsilon r_i - \varepsilon r_i^2 + \varepsilon \underline{\beta}_i \geq 1$$

$$\underline{\beta}_i \geq 1 + r_i - \frac{1}{\varepsilon}$$

This means that the highest interest rate an MFI can charge without violating the profit constraint is

$$r_i = \frac{1}{\varepsilon} - 1 + \underline{\beta}_i. \quad \text{Formula 4.C}$$

The right-hand side of this equation must be positive for the expression to be meaningful.

Hence, the interest rate will fall in the region

$$0 < r_i \leq \frac{1}{\varepsilon} - 1 + \underline{\beta}_i$$

visualized in figure 4.1. The graph illustrates the lender's revenue at different interest rates.

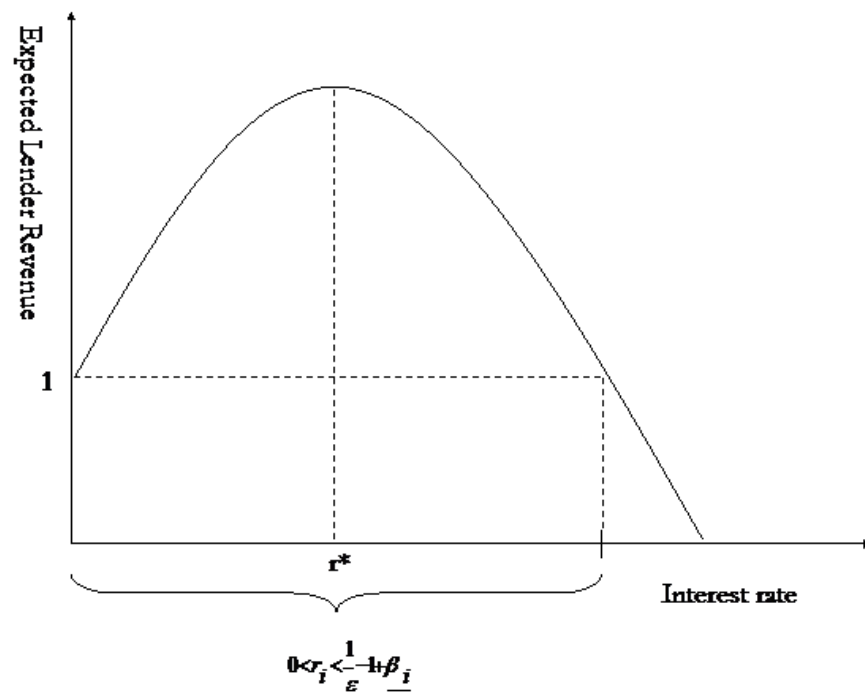


Figure 4.1 The lender revenue curve shows that the lenders maximize their revenue at r^* .

There is a revenue maximizing interest rate, r_i^* , for each project.

4.1.4 Constraints

To sum up the restrictions mentioned above, we must set two constraints for the MFI. Firstly, a profit constraint implies that the MFI cannot consume its capital base by making losses in the long run. Thus, $\text{Rev}_i^{MFI} \geq 1$ for all individuals.

Secondly, there is a non-negativity constraint on the interest rate. In fact, we will assume that the interest rate is positive, $r_i > 0$. If we allow the interest rate to be zero, the MFIs will be able to lend to all borrowers. To be able to explain important elements of our model such as cross-subsidization already in the base case, we assume that the interest rate is positive. In later sections, where we introduce cost of capital and subsidies to make the model more applicable to reality, the assumption of $r_i > 0$ becomes superfluous. The capital cost implies that the MFIs must charge an even higher interest rate.

The interest rate constraint is also related to the profit constraint since the lender would certainly make a loss from charging a negative interest rate, i.e. giving money away.

4.1.5 Types of borrowers and institutions

As described above, the downside risk of each project is captured by $\underline{\beta}_i$. The lower $\underline{\beta}_i$, the riskier the project is for the MFI to finance. Based on moral hazard as defined in section 3.3, the riskiest borrowers (the borrowers with the lowest $\underline{\beta}_i$) will not get to borrow because of credit rationing. Charging the risky borrowers an interest rate corresponding to their risk level would increase the risk of default in accordance with formula 4.A. When the interest rate is higher than in formula 4.C, the default risk is so high that the project is no longer profitable for the MFI to finance at any interest rate. Hence, borrowers with projects with less than a certain level of repossessable assets will not get to borrow.

As $\underline{\beta}_i$ becomes lower, the interest rate approaches zero.⁸⁰ By observing when the optimal interest rate approaches zero, we identify at what level of risk, i.e. at what $\underline{\beta}_i$, credit rationing is critical.

$$\left. \frac{\partial \text{Rev}_i^{MFI}}{\partial r_i} \right|_{r=0} = 1 - \varepsilon(1 - \underline{\beta}_i).$$

The expression must be non-negative for the MFI not to make a loss from lending to the borrower. Consequently, the following must hold

$$\underline{\beta}_i > 1 - \frac{1}{\varepsilon}.$$

⁸⁰ This negative relation between interest rate and risk only holds when there is no cost of capital. We introduce such costs in section 4.3.

On the other hand, $\underline{\beta}_i \leq 1 - \frac{1}{\epsilon}$ implies that the optimal interest rate charged by a monopolist is negative. Our negativity constraint from 4.1.4 does not allow for such an interest rate. Hence, credit will be rationed and projects with a $\underline{\beta}_i \leq 1 - \frac{1}{\epsilon}$ will not get to borrow. These projects are referred to as unprofitable.⁸¹ Projects with $\underline{\beta}_i > 1 - \frac{1}{\epsilon}$ are referred to as profitable. A profit-maximizing MFI will only lend to profitable borrowers, whereas a client-maximizing MFI will try to maximize its total number of clients.

To separate unprofitable borrowers from profitable borrowers, we introduce $\underline{\beta}^*$ to denote the lowest level of repossessable asset that the profit-maximizing lender will accept. In other words, the lender makes a profit of zero from lending to a borrower with a $\underline{\beta}_i$ of $\underline{\beta}^*$. Hence, the profit constraint is binding for the marginal borrower, i.e. the riskiest player in the group of profitable players.

4.2 Base case

4.2.1 Without credit rationing

If ϵ equals zero a higher interest rate does not increase the probability of default. In this case there is neither credit rationing nor any probability of default on average. A monopolist would charge an interest rate of or in excess of the return on the project and leave no profits for the borrower. Two or more lenders engaging in Bertrand competition would compete for customers by decreasing the interest rate until it reached zero and all profits would be left to the borrower.⁸² However, our model is not applicable when ϵ equals zero since ϵ appears in the denominator, e.g. in formula 4.C.

4.2.2 Introducing credit rationing

We now turn to the case of a positive average propensity for borrowers to default ($\epsilon > 0$), to see what happens when the interest rate affects the probability of default in accordance with the theory of credit rationing, presented in our theoretical section. For credit rationing to be an issue in the first scenario of our model, we must further limit ϵ to $\epsilon \geq 1$. This is because if ϵ is less than one the MFI can lend profitably to all borrowers with $\underline{\beta}_i > 0$, i.e. are all borrowers.⁸³

4.2.3 Monopoly

In many developing countries there is only one single institution providing microfinance. The borrowers will thus face a monopoly market. A profit-maximizing monopolist will obviously only lend to profitable

⁸¹ The borrower is unprofitable to the lender but as stated in section 4.1.3, all projects are profitable to the borrowers.

⁸² See section 4.2.5 for definition of Bertrand competition.

⁸³ See appendix B for formal proof.

borrowers and set the interest rate to maximize its profits. Optimizing the interest rate in the revenue formula 4.B for a monopolist institution, we get

$$\frac{\partial \text{Rev}_i^{MFI}}{\partial r_i} = 1 - \varepsilon - 2\varepsilon r_i + \varepsilon \underline{\beta}_i$$

$$\text{Max Rev}_i^{MFI} \frac{\partial \text{Rev}_i^{MFI}}{\partial r_i} = 0$$

$$r_i^* = \frac{1}{2} \left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right)$$

Comparing with the profit constraint introduced in section 4.1.2, we see that $r_i^* = \frac{1}{2} \left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right)$ will

always be lower than $r_i^* = \frac{1}{\varepsilon} - 1 + \underline{\beta}_i$. Hence, a monopolist will choose an interest rate

$r_i^* = \frac{1}{2} \left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right)$. The revenue is given by

$$\text{Rev}_i^{MFI}(r_i^*) = \frac{1}{2} \left(\frac{\varepsilon}{2} (1 + \underline{\beta}_i^2 - 2\underline{\beta}_i) + \frac{1}{2\varepsilon} + \underline{\beta}_i + 1 \right)$$

The formula is visualized below.

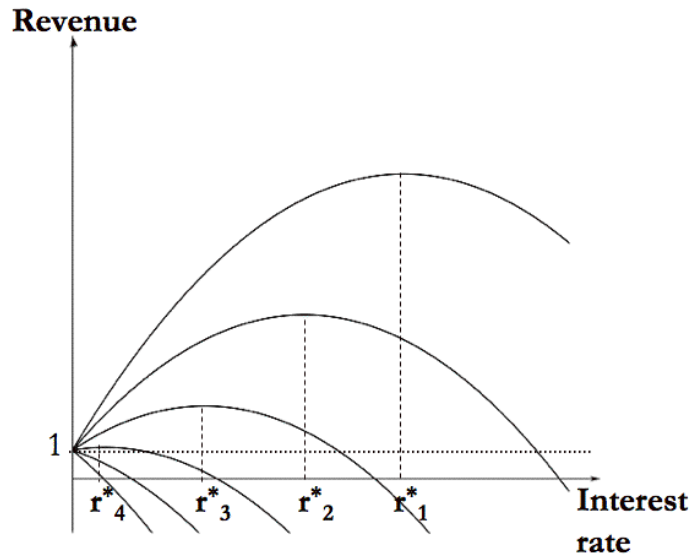


Figure 4.2 The MFI makes a loss below 1. The lender revenue curves of the less risky borrowers (higher $\underline{\beta}_i$) are above the curves of the risky borrowers.

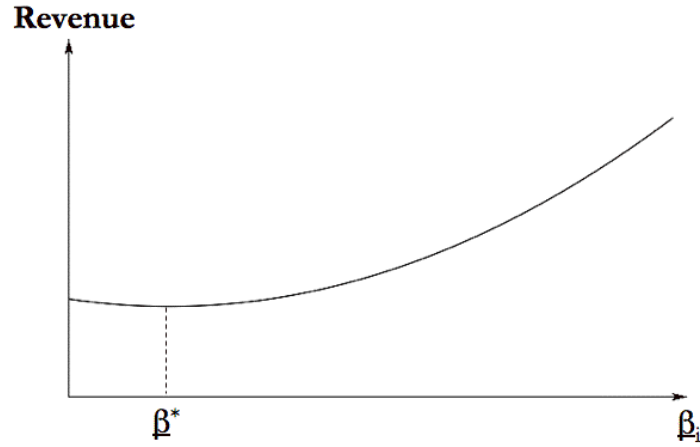


Figure 4.3 The MFI will not lend to borrowers with a $\underline{\beta}_i < \underline{\beta}^*$.

Figure 4.3 shows that the MFI revenue equals one (profit equals zero) at a $\underline{\beta}^*$ of 1/3 for $\epsilon=1.5$. The model is not applicable for values to the left of $\underline{\beta}^*$, since they are based on a negative interest rate. Hence, due to moral hazard which implies credit rationing, a profit-maximizing monopolist will only lend to borrowers with a $\underline{\beta}_i \geq \underline{\beta}^*$.

In case of success, the profitable borrowers will get a profit of $\bar{\beta}_i$ less the face value of the loan (principal plus interest rate), $\bar{\beta}_i - (1 + r_i)$. The interest rate is not as high as it would be without credit rationing. In case of default, the borrower will not make any profit nor loss, since they do not face any downside risk (see section) on option theory). Consequently, the borrower's pay-off is

$$\text{Rev}_i^B = (\bar{\beta}_i - (1 + r_i))(1 - \theta_i).$$

The borrower's profit is above zero but decreasing in the interest rate as long as $\bar{\beta}_i > (1 + r_i)$.

The interest rate charged from profitable borrowers decreases in the risk level of the borrowers. In other words,

- in monopoly, credit rationing causes a negative correlation between interest rate and risk.

4.2.4 Client-maximization

In similarity to a profit-maximizing monopolist, a client-maximizing monopolist will try to maximize its profits from lending to profitable borrowers. The surplus obtained from lending to the profitable borrowers is used to subsidize lending to a group of unprofitable borrowers and thereby increase the number of clients in the MFI's portfolio.⁸⁴ To maximize the number of unprofitable borrowers to lend to before the profit constraint becomes binding, the MFI will choose to lend to the least unprofitable borrowers. The borrowers with the lowest $\underline{\beta}_i$ will still not have access to the credit market.

The client-maximizing monopolist will use the profit incurred from lending to profitable borrowers with a

$$\underline{\beta}_i \geq \underline{\beta}^* \text{ at } r_i^* = \frac{1}{2} \left(\frac{1}{\epsilon} - 1 + \underline{\beta}_i \right) \text{ to cross-subsidize lending to unprofitable borrowers with a } \underline{\beta}_i < \underline{\beta}^*.$$

4.2.5 Introducing competition

We now expand the model to include competition between MFIs. Let us assume that there are at least two MFIs involved in Bertrand competition for projects, i.e. they compete in prices (interest rates).⁸⁵ The MFIs will only compete for the profitable borrowers, since the profit-maximizing MFI is not interested in the unprofitable borrowers. The MFIs underbid each other to capture projects until they have eroded any profits they could have made in the absence of competition. In other words, the revenue will approach one.

As shown in figure 4.1, the MFI revenue is one at both ends of the curve. However, the reasons behind the absence of profit are different in the two cases. The first interest rate identified above, $r_1=0$, is the approximate result of two MFIs competing, in other words the interest rate we were looking for. The other interest rate leaves the MFI with a profit of zero but is a result of non-meaningful behaviour where the MFIs overbid instead of underbid each other.

Consequently, both MFIs will undercut each other until the interest rate approaches zero.⁸⁶ Continued undercutting would then imply losses for the MFIs. Since neither of the MFIs will make any profit, the client-maximizing MFI cannot cross-subsidize. Thus, it will not be able to lend to unprofitable borrowers.

⁸⁴ See Wydick and McIntosh, 2002.

⁸⁵ Since we assume that MFIs compete in prices and not in quantity, we base our model on Bertrand competition as opposed to e.g. Cournot competition. Bertrand competition is a model of price competition between duopoly firms where each firm charges the price that would be charged under perfect competition, i.e. the marginal cost, and makes zero profits. For the model to hold, the firms cannot cooperate and must have the same marginal cost (which has to be constant). The basic version of the model only allows for two firms competing. However, the outcome will be the same in an extended version with more firms. In fact, the model holds for the extreme case of perfect competition. Goods should be homogenous and demand must be linear. The firms compete in price, and choose their respective prices simultaneously. When the price is set, the firms supply the quantity demanded. Consumers buy everything from the cheaper firm. If the price is equal, the consumers buy half at each. In financial markets firms typically set prices, i.e. interest rates, as opposed to quantities. Hence, such markets are often characterized by Bertrand competition.

⁸⁶ In section 4.1.4 we introduced the constraint $r_i > 0$.

Hence, the MFIs will act the same way in competition regardless of whether they are client- or profit-maximizing. They will both lend to a share of the profitable borrowers and make zero profit.

- **Outreach is lower in competition than in the case of a client-maximizing monopolist.**

The profitable borrowers are better off than in monopoly since they now face a much lower interest rate. In case of success, they will get a profit of $\bar{\beta}_i$ minus the face value of the loan (principal plus interest rate), $\bar{\beta}_i - (1 + r_i)$. Since the interest rate is approaching zero, the profit of a profitable borrower in case of success will approach $\bar{\beta}_i - 1$. Consequently, the borrower's profit will be $\text{Rev}_i^B = (\bar{\beta}_i - 1)(1 - \theta_i)$.

The group of unprofitable borrowers that got to borrow because of the cross-subsidization in section 4.2.4 is now worse off, not having access to credit.

4.3 Introducing a cost of capital

An interest rate approaching zero as in the previous section, is far from reality. We have so far assumed that there are neither fixed costs nor costs of capital. Therefore, the competing MFIs could set their interest rates close to zero. In reality, MFIs face a cost of capital, which we call c .⁸⁷ Consequently, the revenue formula is

$$\begin{aligned} \text{Rev}_i^{MFI} &= (1 - \theta_i)(1 + r_i - c) + \theta_i(\bar{\beta}_i - c) \\ &= 1 + r_i - \varepsilon r_i - \varepsilon r_i^2 + \varepsilon r_i \bar{\beta}_i - c \end{aligned}$$

Accordingly, the reasoning on graph 4.2 in section 4.2.3 is no longer accurate. We must now add the cost of capital to the level at which the MFI previously made a profit of zero without capital costs. Now, the MFI will make a loss below the zero-profit line at $(1+c)$.

⁸⁷ The argumentation on cost of capital is also valid for other costs (administration etc).

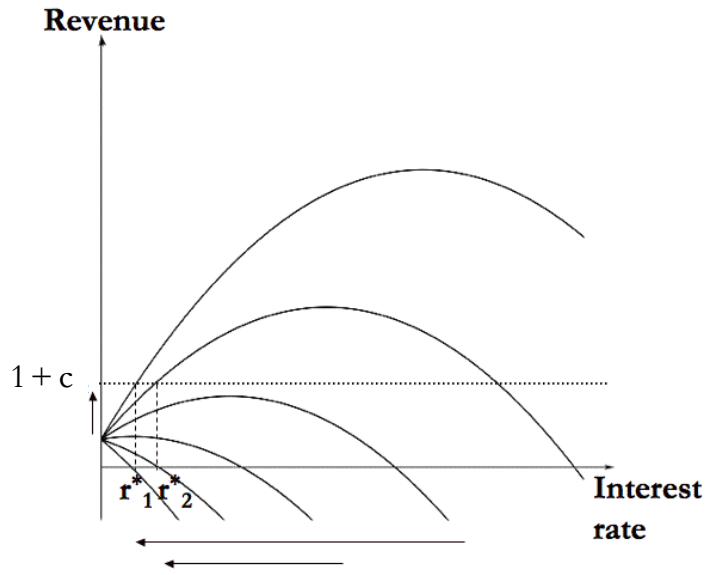


Figure 4.4 The lender makes a loss below the higher zero-profit line.

4.3.1 Monopoly

The cost of capital does not affect the profit-maximization of the monopolist since the first order condition is the same. Following the same procedure as in the base case, we maximize revenue to find the optimal interest rate. Hence, the interest rate charged by the monopolist is negatively correlated to risk regardless of whether we include a cost of capital or not. However, the MFI profit will be slightly lower, implying less cross-subsidization if the MFI is client-maximizing.

The profitable borrowers are in general unaffected by the cost of capital, and credit will still be rationed. However, the MFI can no longer charge a zero interest rate from the marginal borrower, since it has to compensate for the cost of capital. Because of credit rationing, increasing the interest rate charged from the marginal borrower would not increase the MFI revenue. Consequently, the MFI will not lend to borrowers for which the bank revenue curves never reach the horizontal line at $(1+c)$ in figure 4.4. Hence, borrowers which used to belong to the group of profitable borrowers but for which the lender revenue curves have maximums between one and $(1+c)$, will now be considered unprofitable, i.e. have too low $\underline{\beta}_i$ to get to borrow.⁸⁸ Hence,

- increased capital costs cause $\underline{\beta}^*$ to increase and credit to be more rationed.

A profit-maximizing MFI will be worse off because of the decrease in profits caused by the capital cost. Likewise, a client-maximizing MFI will be worse off since it cannot lend to as many borrowers as in the

⁸⁸ See section 4.5 for further discussion on the effects of the risk level.

case of no capital costs due to the increased $\underline{\beta}^*$ as well as the decreased profits used for cross-subsidization.

4.3.2 Competition

The interest rates charged by competitors are affected by the cost of capital. The competitors will still undercut each other until they do not make any profit. However, as figure 4.5 illustrates, the level at which the MFI makes zero profit is higher with capital costs. Since the lender will make a loss charging interest rates resulting in revenues of less than $(1+c)$, he can no longer choose an interest rate of zero. The zero-profit condition of Bertrand competition implies that the lender will charge the interest rates at which the curve of each borrower cuts the zero-profit line.⁸⁹ As shown in figure 4.5, the lender will now charge different interest rates from each borrower.

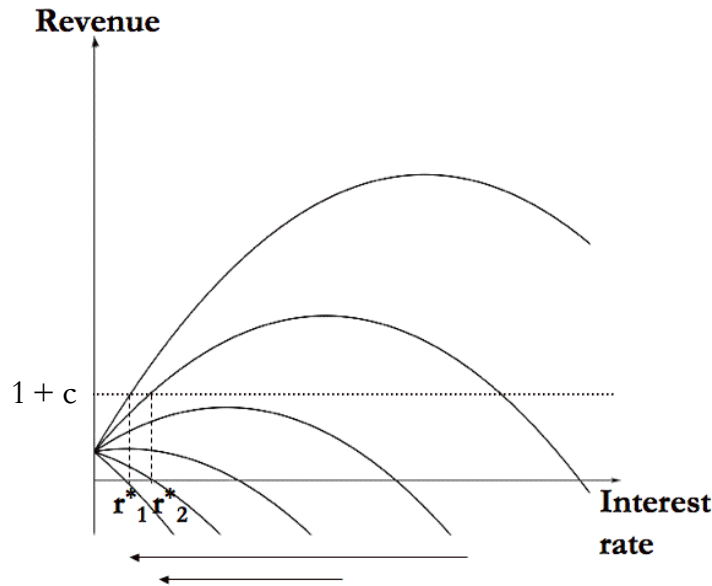


Figure 4.5 With higher capital costs, the MFI charges higher interest rate from riskier borrowers with lower lender revenue curves. The lower $\underline{\beta}_i$ of the borrower the higher the interest rate charged and for sufficiently low $\underline{\beta}_i$ the borrower does not get to borrow.

Moreover, we notice that the more risky a borrower is, the higher interest rate he will have to pay. The lender revenue curves of the less risky borrowers cut the zero-profit line further to the left than those of

⁸⁹ As in section 4.2.5, we assume that the competitors will undercut each other's interest rate until they do not make any profits.

the risky borrowers.⁹⁰ In section 4.2.3 we saw that credit rationing implies that a monopolist charges a higher interest rate from less risky borrowers. Hence, isolating for credit rationing,

- **the interest rate charged by the bank is negatively correlated to risk in monopoly, but positively correlated to risk if we introduce competition and a cost of capital.**

The latter correlation is in line with traditional financial theory on risk and interest rates.

The zero-profit condition implies that the MFIs will charge the following interest rate

$$\text{Rev}_i^{MFI} = 1 + r_i - \varepsilon r_i - \varepsilon r_i^2 + \varepsilon \underline{\beta}_i - c = 1$$

$$r_i^2 - \left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right) r_i - \frac{c}{\varepsilon} = 0$$

$$r_i = \left(\frac{\frac{1}{\varepsilon} - 1 + \underline{\beta}_i}{2} \right) \pm \sqrt{\left(\frac{\frac{1}{\varepsilon} - 1 + \underline{\beta}_i}{2} \right)^2 - \frac{c}{\varepsilon}}$$

In line with the reasoning in section 4.2.5, the lower of the two solutions gives the relevant interest rate.

The profitable borrowers are worse off than without capital costs since they now face a higher interest rate. Since the borrower still does not face any downside risk, his profit will be $\text{Rev}_i^B = (1 - \theta_i)(\bar{\beta}_i - (1 + c))$.

The unprofitable borrowers will still not get to borrow, just as in competition without capital costs. Moreover, profit-maximizing MFIs will be as worse off as they would be in case of competition without capital costs, making a zero-profit. Client-maximizing MFIs will be worse off since they cannot lend to as many borrowers.

4.4 Subsidies

In the previous section we saw that the number of borrowers that get to borrow and the lowest interest rate the MFIs are able to charge without making losses are dependent on the cost of capital. This result has important implications on subsidization of MFIs. Donors and governments often subsidize MFIs by providing funds at a low cost of capital. Since such subsidization simply implies a lower cost of capital, it is covered by the previous section. However, the effects of lump-sum subsidies are not as straight-forward.

⁹⁰ As described in section 4.2.5, the revenue curves cut the zero-profit curve twice, at a high and a low interest rate. We refer to the lower and relevant interest rate, i.e. the cut-off point further to the left.

The analysis on the effects of a non-targeted subsidy is analogous to the analysis on the cost of capital. We therefore apply the reasoning used in the previous section on cost of capital to the case of non-targeted subsidization. The MFI revenue formula can be generalized into

$$\text{Rev}_i^{\text{MFIsub}} = (1 - \theta_i)(1 + r_i - c) + \theta_i(\beta_i - c) + G/n,$$

where cost of capital (c) and a non-targeted lump-sum subsidy (G) affect the scenario in similar ways, except for the costs being subtracted and the subsidy added to the MFI revenue. The MFI lends to a number of n borrowers.

4.4.1 Monopoly

As shown in section 4.3.1, the interest rate charged by a monopolist is not affected by the cost of capital, nor by other costs or subsidies. Hence, if a monopolist is profit-maximizing, the borrowers will not be affected by the subsidy. The interest rate will be the same as in the base case. Only profitable borrowers will get to borrow and the entire subsidy will end up in the hands of the MFI, increasing the total profit by G . However, a profit-maximizing MFI is not likely to receive a non-targeted subsidy that can be used for whatever purpose the MFI desires. Therefore, we will not investigate the case of non-targeted subsidies to profit-maximizing MFIs any further.

On the other hand, if the MFI is client-maximizing, the subsidy will be used to provide credit to a larger number of unprofitable borrowers in addition to those who get to borrow due to the cross-subsidization. Accordingly, the client-maximizing MFI will be better off since the number of borrowers has increased. Likewise, some unprofitable borrowers are better off. The interest rate is still unaffected since the MFI first maximizes the profit received from the profitable borrowers. Consequently, the situation of the profitable borrowers is unchanged. Hence,

- **when there is only a client-maximizing monopolist, the only effect of a non-targeted subsidy is an increase in the breadth of outreach.**

4.4.2 Competition

Introducing subsidies to the competitive setting, we start by allowing only for one subsidized MFI. We then identify the outcomes in a market where two MFIs are subsidized. Finally, we consider targeted subsidies.

A. One subsidized MFI

Let us assume that there are two MFIs of which one is subsidized. Consequently, the subsidized MFI will always be able to undercut the unsubsidized MFI. To maximize its profit doing so, the subsidized MFI will charge the interest rate leaving the MFI with a zero profit in case of no subsidies, i.e. the interest rate charged by the unsubsidized MFI, reduced by an arbitrarily small amount, δ . Thereby the subsidized MFI

captures all the profitable borrowers. Since δ is very small, the interest rate change as well as the subsequent change in the probability of default is negligible. Consequently, the effects of credit rationing are similar to the effects in the case of no subsidies, implying an unchanged $\underline{\beta^*}$.

A client-maximizing MFI will use the arbitrarily small amount δ times the number of profitable borrowers n , $A = \delta \times n$, to undercut the competitor and capture all the profitable borrowers. The MFI will then use the remainder of the subsidy, $G-A$, which is practically the entire subsidy, to fund lending to unprofitable borrowers. Obviously, the subsidy makes the client-maximizing MFI better off since the number of clients is increased.

We conclude that the unsubsidized MFI will not be able to lend profitably to any borrowers, since the subsidized MFI captures all the profitable clients by accepting a minor loss. Therefore,

- **an unsubsidized MFI will be driven out of the market or alternatively prevented from entering the market, due to the existence of a client-maximizing MFI with a non-targeted subsidy.**

B. Two subsidized MFIs

To describe the outcome of two subsidized MFIs, we first return to the cost of capital scenario. If there is a cost of capital but no subsidies, the MFIs will charge the interest rates where the lender revenue curves cut the zero-profit curve in figure 4.5.

Now imagine that there are two subsidized client-maximizing MFIs. Accordingly, they will both be able to lower the interest rate. Further, imagine that one MFI undercuts its competitor by a very small amount δ lending to a specific borrower, as when there was only one subsidized MFI. However, this time the competitor will respond by lowering his interest rate as well. The MFIs will follow the same procedure for all borrowers until there is no subsidy left, i.e. until $G - \delta \times n = 0$. At that point, each borrower will be indifferent to what MFI to borrow from since they both offer the same interest rate.⁹¹

The intuition behind the above is based on a trade-off between interest rate and the number of clients.⁹² If we add the subsidies received by each MFI and divide the total amount $G_a + G_b$ by the number of profitable borrowers n each MFI lends to,

$$\alpha = \frac{G_a + G_b}{n_a + n_b}$$

⁹¹ The interest rate charged will still depend on the borrower's risk. Riskier borrowers will face higher interest rates.

⁹² See Wydick and McIntosh, 2002.

we get an average subsidy per profitable borrower, α . Both MFIs subsidizing each loan with an amount of α is a Nash equilibrium. As explained above, both MFIs will make zero profits in competition and set δ and the number of borrowers n so that $G = \delta \times n$.

If one of the MFIs would like to lower the interest rate offered to some borrowers to undercut the competitor, it would have to increase the interest rate to other borrowers because of the zero-profit condition. Any gain from lowering the interest rate offered to one group of borrowers would be outweighed by the loss from increasing the interest rate offered to another group of borrowers. In fact, the gain would be more than offset since the cost of undercutting per borrower is higher for the new group of borrowers than for the initial set of borrowers. Hence, the MFI will be able to lend to fewer borrowers trying to undercut the competitor. Therefore, given the choices of the opponent, neither of the MFIs can choose an alternative that will make them better off.

We conclude that both MFIs will use the same amount to subsidize each borrower, i.e. the total subsidy divided by the number borrowers that the MFI lends to. Hence, the zero-profit line shifts downward, implying that the MFIs will be able to undercut each other until they reach the zero-profit line shown in figure 4.6.

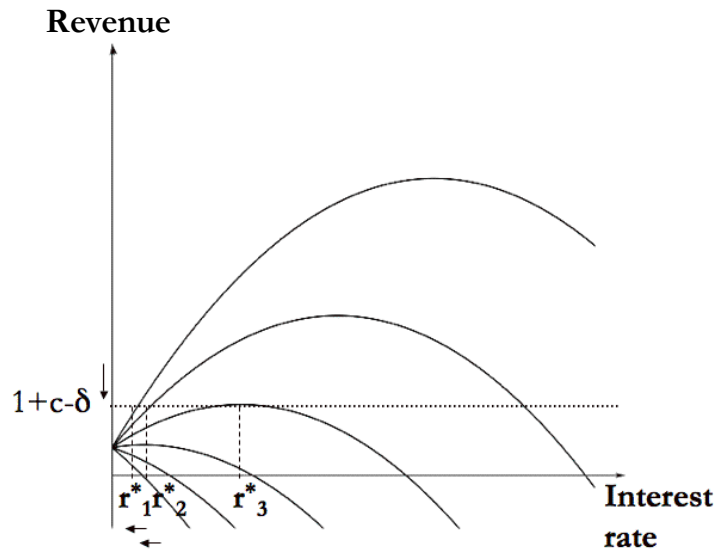


Figure 4.6 The effects of a subsidy are the reverse from those of cost of capital. The zero-profit line falls and the interest rates charged by competitors are lower.

Thus, the MFIs will use the same amount to subsidize lending to each borrower, regardless of the size of their subsidies. The effects of two MFIs receiving lump-sum subsidies are similar to those of per borrower subsidies. In other words,

- **subsidies function as cost of capital reductions.**

However, for the above to hold true and for the MFIs to charge the same interest rate given the borrower risk class, the size of their subsidies must affect the number of client they lend to, n .

$$\alpha = \frac{G_a}{n_a} = \frac{G_b}{n_b}$$

$$\frac{G_a}{G_b} = \frac{n_a}{n_b}$$

Hence, the share of the total amount of borrowers each MFI gets to lend to, n_a/n_b , is equal to the relative size of the subsidies. The MFIs are indifferent to which of the profitable borrowers they get to lend to, and which are captured by the competitor.

Since the MFIs will both use their entire subsidies to fund the undercutting there will be no cross-subsidization and no subsidy left to fund lending to unprofitable borrowers. Therefore, unprofitable borrowers will be worse off and

- **in competition, breadth of outreach will be lower when two client-maximizing MFIs receive non-targeted subsidies, compared to when only one client-maximizing MFI get a non-targeted subsidy.**

Competition reduces the MFI profit to zero as well as implies that the entire subsidies will be used to fund lending to profitable borrowers. The client-maximizing MFIs will be just as bad off as in the case of competition without subsidies, only lending to a share of the profitable borrowers and not to any unprofitable borrowers.

C. Targeted subsidies

So far we have only considered non-targeted subsidies, i.e. subsidies that can be used in whatever way the MFI wishes. If we on the contrary introduce a subsidy that is targeted, e.g. that can only be used to fund lending to a certain group of borrowers such as very poor and risky people, the scenario changes considerably.

Let us assume that there are one unsubsidized and one subsidized MFI as in section 4.4.2 A, but that the subsidy is targeted to be used only for lending to people that otherwise would not get to borrow, i.e. unprofitable borrowers. Since the subsidy cannot be used to fund borrowing to profitable borrowers, the revenue from lending to such borrowers will then be the same as without subsidies. Hence, given that they face the same cost of capital, both MFIs will have to stop the undercutting at the interest rate leaving the

MFI with a zero profit in case of no subsidies. Consequently, they will both only lend to profitable borrowers, making a zero profit. Hence, cross-subsidization is not possible.

However, as opposed to in the previous section, some of the unprofitable borrowers will still get to borrow. The entire subsidy will be used to lend to as many unprofitable borrowers as possible, given that the MFI is client-maximizing.

A client-maximizing MFI will be worse off than in monopoly with a subsidy, but better off than in competition with or without a non-targeted subsidy. $\underline{\beta}^*$ is unchanged and the profitable borrowers will face the same interest rate as in the case of competition without subsidies, whereas some of the unprofitable borrowers are better off. However, fewer of the unprofitable borrowers get to borrow compared to the case of a subsidized, client-maximizing monopolist. The outcome of the competitive scenario when only one client maximizing MFI receives a non-targeted subsidy, is similar to the outcome of a targeted subsidy. In the former case, G-A was used to fund lending to unprofitable borrowers, A being arbitrarily small. In the latter case, the entire subsidy G will be used to fund such lending.

4.5 Effects on the critical level of risk

4.5.1 Market structure

To examine how $\underline{\beta}^*$, separating unprofitable borrowers from profitable borrowers, is affected by the market structure, we consider the lending decision of the MFIs. We showed in sections 4.2.3 and 4.2.5 how MFIs will set their interest rates in monopoly and competition respectively. However, these procedures only concern the decision of what interest rate to charge from a specific individual. Regardless of market structure, the MFI will choose to lend to any borrower for which the profit constraint is fulfilled. Hence, the profit constraint is binding for the marginal borrower, i.e. the riskiest player in the group of profitable players.

Therefore, $\underline{\beta}^*$ depends on the profit constraint and not on the monopoly profit maximization. In other words, $\underline{\beta}^*$ will be the same in monopoly as in competition. Hence, disregarding cross-subsidization,

- **the effects of credit rationing on breadth of outreach is not affected by market structure.**

4.5.2 Cost of capital and subsidies

Turning our attention to the effects of capital costs and subsidization on $\underline{\beta}^*$, we note from the previous section that the profit constraint is binding for the critical borrower, i.e. the riskiest borrower in the group

of profitable borrowers. From the interest rate in the case of competition and cost of capital,

$$r_i = \left(\frac{\frac{1}{\varepsilon} - 1 + \underline{\beta}_i}{2} \right) - \sqrt{\frac{\left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right)^2}{4} - \frac{c}{\varepsilon}},$$

we conclude that an increase in the cost of capital raises the interest rate to cover the higher costs.

Subsidies, on the other hand, have the opposite effect. Figure 4.7 shows that the capital cost shifts the lender profit curve downwards. The interest rate charged by the monopolist for a specific borrower is unchanged, but the cut-off point, i.e. the interest rate at which the lender makes a zero profit, is further to the right. Once again, we see that the increased cost of capital has caused the competitive interest rate to rise. The lowest interest rate charged by the monopolist also increases in the cost of capital. Therefore, $\underline{\beta}^*$ changes.

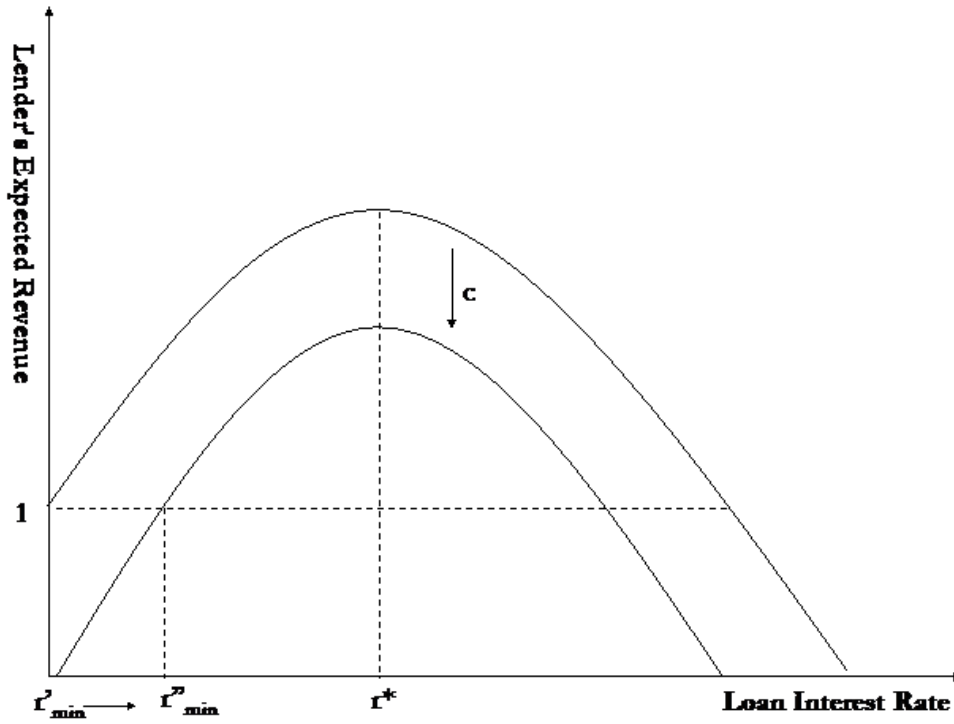


Figure 4.7 The cost of capital shifts the lender profit curve down-wards.

An increase in interest rate implies an increase in the probability of default. Hence, due to credit rationing, the riskiest borrowers in what used to be the profitable group will not be profitable any longer. Increasing

the interest rate charged by the marginal borrower is not viable. Instead, to increase the interest rate, the MFI must raise the risk requirements, i.e. $\underline{\beta}^*$.

To solve for the $\underline{\beta}_i$ for which the lender profit constraint is binding, we turn to the revenue formula in section 4.3.2. Solving for $\underline{\beta}_i$ we get

$$\underline{\beta}_i = \frac{c}{\epsilon r_i} - \frac{1}{\epsilon} + 1 + r_i .$$

We derive the above formula with aspect to capital costs and get $\underline{\beta}'_i = \frac{1}{\epsilon r_i}$.

The derivative is positive as long as the cost of capital is above zero. Hence, $\underline{\beta}^*$ increases in capital costs.

The interest rate at which the profit constraint is binding is higher due to the increased cost of capital. Consequently,

- **increased costs of capital or decreased subsidies raise $\underline{\beta}^*$.**

In other words, the riskiest borrowers in the group of profitable borrowers will now be classified as unprofitable. Increased subsidies imply a lower $\underline{\beta}^*$, i.e. a riskier marginal borrower.

In section 4.5.1, we learnt that $\underline{\beta}^*$ is not affected by the number of players in the market (i.e. monopoly or competition). We therefore conclude that the above is valid in monopoly as well as in competition.

4.5.3 $\underline{\beta}_i$ as collateral

If we relax our assumption that the MFI can only repossess assets financed by the loan, we may include collateral in the model. By adding the amount of collateral per unit borrowed to $\underline{\beta}_i$, the collateral raises the lowest amount the lender will be repaid, given that repossession of collateral is a viable alternative in the legal setting.

The collateral implies a larger downside for the borrower in case of default. The downside raises the incentives of the borrower to exert effort to make the project successful, which is captured in the model through the interest rate function. Looking at the previous sections, we see that

$$r_i^* = f(\underline{\beta}_i) .$$

In monopoly the optimal interest rate is positively correlated to the level of repossessable assets. This means that when β_i increases due to collateral, the optimal interest rate also increases. This is completely logical if we consider that our model only captures the credit rationing effects. Less overall risk in a project means that credit rationing becomes less severe and thus the interest charged will be higher. Hence,

- **in monopoly, borrowers face a higher interest rate if they post collateral due to credit rationing.**

Therefore, there are no incentives for borrowers to post collateral in this framework.

When there are competition and cost of capital on the other hand, the optimal interest rate is negatively related to the level of repossessable assets. Accordingly,

- **in competition, borrowers face lower interest rates if they post collateral.**

Thus, when there is a well-functioning competitive market which ensures that borrowers do not get expropriated by the MFIs, there will be incentives for individuals to pose collaterals and there are better possibilities to reduce credit rationing.

5 Outcomes and implications

This paper outlines how credit rationing affects the relation between interest rate and risk of default in a microfinance setting. In our model we isolated credit rationing from other factors that also affect the choices of MFIs. To understand what happens in reality, all effects must be combined. It is beyond the scope of this paper to combine all the factors, in light of which the following argumentation has to be viewed.

Credit rationing implies that there are some borrowers that are too risky to lend to, regardless of how much they are willing to pay. The most important results of the model concern the outreach of the MFIs and the relation between the interest rate and the risk level of the borrower.

Our model shows that in a monopolistic market, the riskiest borrowers that have access to credit face a lower interest rate than less risky borrowers.⁹³ When the model is expanded to deal with competitive markets and capital costs, high risk projects have to pay higher interest rates than low risk projects.

⁹³ This is not specific to our linear model, but holds true in most credit rationing models, see for example Stiglitz and Weiss, 1981.

However, there are still projects that receive no financing at all, no matter how much interest they are prepared to pay.

The effects of credit rationing on breadth of outreach are not affected by market structure directly. However, outreach is not as strongly affected by credit rationing in the presence of a client-maximizing monopolist as when there is only a profit-maximizing monopolist. In a monopoly with only one client-maximizing MFI, some of the unprofitable borrowers will get to borrow, whereas if there is only one profit-maximizing MFI, credit rationing will have full effect and only profitable borrowers will have access to credit. In fact, outreach is lower in competition than in monopoly with only a client-maximizing monopolist.

Since an increase in the cost of capital raises the interest rate to cover for the higher costs, capital costs cause β^* to increase and credit to be more rationed. When subsidies are introduced they function as cost of capital reductions. Moreover, credit rationing is less palpable if a client-maximizing MFI is subsidized, since the subsidy will then to some extent be used to subsidize lending to unprofitable borrowers. Non-targeted subsidies will not make a profit-maximizing MFI lend to unprofitable borrowers. Thus, subsidizing a profit-maximizing MFI will not reduce credit rationing unless the subsidy is targeted, i.e. can only be used for lending to unprofitable borrowers.

If a client-maximizing MFI in a competitive market receives a non-targeted subsidy, unsubsidized MFIs will be driven out the market. Allowing for two client-maximizing MFIs to receive non-targeted subsidies, both institutions will be able to use the subsidy to undercut the competitor. Consequently, the subsidy will not fund lending to unprofitable borrowers. Outreach will be lower compared to when only one MFI gets a non-targeted subsidy.

The increased interest rate in the case of collateral described in section 4.5.3 is yet another implication of credit rationing. Putting up collateral may be considered beneficial to most borrowers. The collateral implies a lower risk for the bank reflected in a lower interest rate. However, as we showed above, credit rationing effects make it less beneficial for lenders to put up collateral when borrowing from a monopolistic MFI.

One of the most interesting aspects of our model is the relationship between the objectives of MFIs and the nature of the subsidies. Non-targeted subsidies to profit-maximizing MFIs will only end up in the hands of the MFIs and not benefit the borrowers. Hence, to benefit borrowers, non-targeted subsidies should only be given to client-maximizing MFIs. Targeted subsidies will benefit unprofitable borrowers if given to profit-maximizing as well as client-maximizing MFIs. Which is the most appropriate method of subsidization depends on which actor can most efficiently determine where the credit is most needed.

In case of profit-maximizing MFIs and targeted subsidies, the positive incentives created by profit-maximization are expected to improve the execution of microfinance. On the other hand, there are inefficiencies in that the donor of the subsidy has to decide how to target the subsidy. A common way to do this is to limit the subsidy to borrowers under a certain wealth level. This restriction is likely to be a rough and rather inaccurate way of identifying who needs the subsidies. Borrowers can be tempted to appear poorer than they really are to get subsidized loans and MFIs may accept this to get borrowers with lower default ratios and thereby increase their profits.

Nevertheless, client-maximizing MFIs with non-targeted subsidies are also problematic. Most likely, the closer the allocators of subsidies are to the borrowers, the more efficient and informed the decision. However, the absence of profit-maximization implies that many incentives to make efficient choices in execution are missing. One of the most obvious deficiencies is that it is very hard or impossible to tell whether client-maximizing MFIs make losses because their execution is bad or because they are lending to the people who need it the most.

6 Microfinance in Vietnam

The possibility to assess the appropriateness of theoretical models such as the one presented in this paper is typically limited.⁹⁴ In the absence of large unbiased samples, it is not possible to isolate the effects of credit rationing within the industry. Lately, efforts have been made to create more substantial databases. These databases show that microfinance markets most often are competitive and that MFIs are almost always subsidized.⁹⁵ At the moment however, the databases are based on voluntary participation and reporting of statistics. Consequently, the MFIs contributing data are mainly the more successful ones that have nothing to hide, meaning that the databases are severely biased.

Due to the lack of accountable data on microfinance markets, we present an indicative example to illustrate the outcomes of our model. For this purpose, we have chosen the rural financial sector of Vietnam.

Vietnam is one of the fastest growing economies in the world, partly due to the development efforts within the financial market. In ten years, between 1993 and 2002, poverty was heavily reduced.⁹⁶ However, the country still being very poor, the financial sector shows many of the characteristics typical for credit markets in developing countries mentioned in section 2. The legal system is insufficient causing a large

⁹⁴ Jonathan Morduch, personal communication 2005.

⁹⁵ See appendix C for description of the Mix Market database.

⁹⁶ ARCM, 2005.

extent of moral hazard. Being a former French colony, Vietnam has a civil law system.⁹⁷ A large part of the population is too poor to be able to pose any collateral. The Vietnamese MFIs are free to set their own interest rates, unlike in some countries where the institutions are heavily regulated.⁹⁸ We therefore find Vietnam to be an appropriate country to apply to our model.

Even though there are MFIs that target the urban sector, we limit this example to the rural sector. We first describe the market and identify which institutions to refer to as MFIs. Thereafter, we focus on the concepts dealt with in our model and describe credit rationing and moral hazard on the Vietnamese microfinance market. Finally, we comment on the correlation between interest rate and risk.

6.1 The rural financial sector in Vietnam

According to the Vietnam 1997-98 Living Standards Survey, 50 percent of the Vietnamese households are in debt.⁹⁹ Only considering rural households, the figure is even higher (54 percent). The loans can be divided into two groups, the informal financial sector and the formal/semi-formal financial sector.¹⁰⁰

	Loans (%)	Average loan size (1000 VND ¹⁰¹)
Informal financial sector	51	1,752
Moneylender	9.8	2,141
Relatives	24.2	1,861
Ho/Hui	16.8	1,366
Formal/semi-formal financial sector	49	3,209
Private banks and cooperatives	2.2	2,230
Government banks	40.0	3,512
Government programmes and others	7.7	1,547
Total	100	2,480

Table 6.1 Rural household loans and average loan sizes in rural Vietnam 1997-98.¹⁰²

Even though the Vietnamese microfinance market is segmented, separating MFIs from other financial institutions is not a straight forward process. Microfinance schemes are defined as all small-scale formal and quasi-formal financial lending to rural households, directly or through groups. The formal sector consists of financial institutions recognized as credit organizations by law.¹⁰³ The government bank, the

⁹⁷ AusAID, 2000.

⁹⁸ GSO, 2000.

⁹⁹ Ibid.

¹⁰⁰ ARCM, 2005.

¹⁰¹ 1 USD ~ 15,746 VND (2004).

¹⁰² GSO, 2000.

¹⁰³ Note that formal financial institutions are defined differently from in section 2.3, where we separated formal banks from MFIs. Here, MFIs fall in the group of formal or semi-formal institutions.

Vietnam Bank of Agriculture (VBARD), dominates the formal sector, lending to 38 percent of the rural households in Vietnam. The bank lends to poor people, but only if they are credit-worthy, i.e. if the bank can repossess collaterals.¹⁰⁴ The Vietnam Bank for the Poor (VBP) lends to the poor people that do not get to borrow from VBARD. However, many of these loans are once-off loans and the maximum loan limit was 2.5 million VND.¹⁰⁵ The semi-formal sector presented in table 6.1 includes cooperatives and programmes such as group lending initiatives, joint-stock banks and foreign NGO schemes.¹⁰⁶

The pool of borrowers consists of a group that can borrow from the VBARD and a group that cannot.¹⁰⁷ Financial institutions lending to the latter group are often labelled MFIs, which includes private banks and cooperatives, government programmes and the VBP. Since our model does not include collateral, it is not applicable on the VBARD.¹⁰⁸

The MFIs are in general client-maximizing, even though there are tendencies towards an increased focus on sustainability. All the MFIs in the rural financial market in Vietnam are more or less subsidized. Moreover, the subsidies given to NGOs are often targeted to be used only for lending to people below a certain level of poverty. The VBP activities are targeted in the same way.¹⁰⁹

The informal financial sector consists of moneylenders, borrowing from relatives and *Ho/Hui*¹¹⁰, local rotating savings and credit associations.¹¹¹

6.2 Credit rationing on the Vietnamese microfinance market

There is a great excess demand on the Vietnamese rural credit market, implying that the outreach of the MFIs is limited. Only about 50 percent of the 12 million households in rural Vietnam have access to microfinance.¹¹² Since demand outstrips supply, poor households tend to be pushed into market segments where they have no formal sector lending options. The main reason why formal institutions do not lend to poor people is because they are considered to be too risky.¹¹³ However, the interest rates charged by MFIs are not very high. The formal institutions seem to be reluctant to increase their interest rates to compensate for high risk, indicating that there is credit rationing on the Vietnamese credit market.¹¹⁴ In other words, ϵ of our model seems to be large. If the MFIs increased their interest rate, the probability of default would increase so much that the revenue would fall.

¹⁰⁴ McCarty, 2001.

¹⁰⁵ GSO, 2000.

¹⁰⁶ ARCM, 2005.

¹⁰⁷ Economist Intelligence Unit, 1999.

¹⁰⁸ McCarty, 2001.

¹⁰⁹ Ibid.

¹¹⁰ Traditional Vietnamese rotating savings and credit associations (ROSCAs) are called *Ho* in the North and *Hui* in the South. Some of them are created for special purposes such as weddings, funerals or New Year's celebrations.

¹¹¹ ARCM, 2005.

¹¹² There are 15 million households in Vietnam. About 80 percent of these are rural.

¹¹³ GSO, 2000.

¹¹⁴ Economist Intelligence Unit, 1999.

We conclude that a large group of poor people in rural Vietnam does not have access to credit from formal institutions because they are considered to be too risky. In our model, we defined the measure for risk β_i as the share of the loan invested in physical assets that the lender can repossess. Applying that definition to the Vietnamese financial market, we need to consider what the loans are used for. Table 6.2 shows the reasons for taking out microfinance loans in rural Vietnam stated by households in the Vietnam Living Standard Survey 1997-98 mentioned above.

Reasons for taking out loans	Share of households with loans outstanding (%)
Production or construction	66.3
Buy or build a house	10.3
Buy consumer durables	2.9
General consumption and food before harvest	3.3
Others	17.2
Total	100

Table 6.2 Reasons for taking out microfinance loans in rural Vietnam.¹¹⁵

We see that a majority of the borrowers obtaining loans states that they will invest the money in production. The second largest group of borrowers uses the loan to finance buying or building of houses. In both cases, the lender is likely to retain some value (e.g. the house) in case of default. Hence, β_i is substantial. On the other hand, very few loans are given for consumption. In such cases there is rarely any value for the bank to reclaim. Hence, β_i equals zero or approximately zero. Notably, poor people often apply for loans to finance consumption.¹¹⁶ The above indicates that the poor people excluded from the rural credit market are those who apply for loans to finance consumption, i.e. have lower β_i . Consequently, the group excluded from the credit market can be ascribed a β_i below the critical risk level of our model, β^* .

6.3 Moral hazard in Vietnam

Having identified indications of credit rationing, we now turn to the underlying reasons described in the theory section. Our model is based on moral hazard. An increased interest rate implies reduced incentives to repay the loan since the borrower now avoids a higher cost by defaulting. As mentioned above, the Vietnamese legal system is insufficient.¹¹⁷ Since the semi-formal sector falls outside the existing law on credit institutions, there is still no comprehensive legal framework covering microfinance activities in

¹¹⁵ GSO, 2000.

¹¹⁶ Ray, 1998.

¹¹⁷ Havers et al., 2000.

Vietnam.¹¹⁸ Consequently, since monitoring and enforcement are limited, the MFIs are reluctant to lend to poor individuals applying for loans to finance consumption. In other words, moral hazard, implying a substantial ϵ is likely to cause credit rationing in rural Vietnam.

To see how moral hazard and enforcement affect the interest rate charged by financial institutions in Vietnam, we compare the formal and semi-formal institutions to informal lenders.

Informal financial sector			Formal/semi-formal financial sector		
Sector average 3.95%			Sector average 1.26%		
Money lenders	Hoi/Hui	Relatives	Private banks & cooperative	Government banks	Government programmes
4.56%	3.69%	2.63%	1.59%	1.27%	0.87%

Figure 6.1 Monthly interest rates charged by different types of financial institutions in rural Vietnam.¹¹⁹

Figure 6.1 shows the monthly interest rates charged by the different types of institution in 1997-98.¹²⁰ The lenders charging the highest interest rate, moneylenders, are renowned for their efficient and sometimes dubious enforcement methods. Formal financial institutions on the other hand, face severe moral hazard problems in the Vietnamese rural credit markets due to the limited possibilities to enforce repayment. In fact, as mentioned above, formal institutions sometimes cooperate with informal players to mitigate the moral hazard problem.¹²¹ Hence, the interest rates in figure 6.1 seem to be negatively correlated to the extent to which the lender is exposed to moral hazard. The institutions exposed to moral hazard cannot charge high interest rates since that would increase the probability of default to such an extent that their revenue would fall. On the other hand, moneylenders can lend profitably charging interest rates at which a formal institution would make a loss.

6.4 Desired legal and institutional reforms

The above reasoning indicates a need for legal and institutional reforms within the Vietnamese microfinance sector. A survey made by the British Department of International Development (DFID) in 1998 shows that a majority of the managers of 78 Vietnamese MFIs desires legal reform. Specified legal frameworks for different types of MFIs and improved supervision and transparency are some of the desirable changes identified.¹²² Such reforms would improve the informational flow of the credit market and reduce problems of moral hazard and adverse selection. Hence, the reforms could remedy the very causes of credit rationing by reducing moral hazard, i.e. lowering ϵ .

¹¹⁸ ARCM, 2005.

¹¹⁹ McCarty, 2001.

¹²⁰ Ibid.

¹²¹ GSO, 2000.

¹²² DFID, 1998.

In fact, there has been a move towards an improved legal framework in Vietnam since 1996.¹²³ For example, commercial banks now have greater flexibility in deciding on loan guarantee requirements. Moreover, the registration possibilities for non-credit institutions with banking activities and the legal framework for credit cooperatives are improved. Consequently, there has been an overall increase in interest rates in Vietnam.¹²⁴ This might imply a reduction of credit rationing. There are indications that the formal and semi-formal sectors have crowded out the informal sector, implying that moral hazard is less of a problem due to the reforms. Data from the 1992-93 Vietnam Living Standards Survey shows that private money lenders provided 33 percent of loan funds in rural areas, whereas government banks had a 23 percent market share. In the 1997-98 Vietnam Living Standards Survey the corresponding figures were 10 percent and 40 percent respectively.¹²⁵

6.5 Correlation between interest rate and borrower risk

Finally, we focus on the correlation between interest rate and the risk level of the borrower. In section 4.3.2 we showed that in a competitive market with subsidized MFIs, such as the Vietnamese rural credit market, there is a positive correlation between interest rate and risk. However, from figure 6.1 we see that government programmes charge the lowest interest rate of all. Considering that such institutions lend to at least as many poor and risky clients as the private banks and cooperatives, we suspect that there is no strong positive correlation between interest rate and risk. Moreover, the MFIs often charge the same interest rate to customers of different wealth and risk class.¹²⁶ Hence, there are no indications of the positive correlation between interest rate and risk predicted by section 4.3 of our model.

To summarize our analysis of the rural credit market in Vietnam, formal and semi-formal institutions facing moral hazard problems charge substantially lower interest rates than informal institutions with more effective enforcement methods. Moreover, we recognize that a large group of poor people is excluded from the formal and semi-formal credit markets since they are considered to be too risky. Hence, outreach is obviously limited. However, whereas there are marked effects of credit rationing on outreach, we find little support for the interest rate implications predicted by our model. The interest rate seems to depend on other factors.

¹²³ Dao Van Hung, 1999; Havers et al., 2000.

¹²⁴ McCarty, 2001.

¹²⁵ GSO, 2000.

¹²⁶ ARCM, 2005.

7 Conclusion

In this paper, we examined how credit rationing affects microfinance markets in developing countries. We developed a model where credit rationing is isolated from other effects. The focus is upon the outreach of MFIs and the relation between the interest rate and the risk level of the borrower.

In monopoly, we find a negative correlation between the risk level of the borrower and the interest rate charged by the MFI due to credit rationing. In competition, the negative correlation between interest rate and risk level caused by credit rationing identified in monopoly is outweighed because of the zero-profit condition. The interest rate will no longer decrease but rather increase in the level of risk, given that cost of capital is included.

Subsidies mitigate the rationing of credit if a monopolist is client-maximizing. To improve the outreach, the MFI will use the profit made from lending to profitable borrowers to cross-subsidize lending to unprofitable borrowers. However, in competitive markets, subsidies will not improve the outreach of MFIs to the same extent. In such markets, there will be no cross-subsidization since the subsidies are used to undercut the competitor. Hence, in competitive markets, credit rationing will limit the outreach of microfinance even if there are subsidies.

Evidence from microfinance data bases as well as our indicative example suggest that microfinance markets often are characterized by substantial competition between subsidized MFIs. The analysis of the rural credit market in Vietnam shows that institutions facing moral hazard problems are reluctant to charge high interest rates. Hence, borrowers who are considered to be too risky are excluded from the formal credit market.

In summary, credit is rationed and cross-subsidization is limited in microfinance markets. Given the observed level of competition and subsidization in such markets, there are limitations to the extent to which subsidies can mitigate the effects of credit rationing on outreach. To reduce the negative impacts of credit rationing in microfinance markets, the underlying causes must be altered. Improving the institutional framework in general and the legal framework in particular would reduce moral hazard and consequently credit rationing. In light of the findings revealed in our model, it would be profitable to further investigate the impacts of such institutional changes.

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9 Appendices

9.1 Appendix A

Option-like characteristics of loan contracts

The interest rate may function as a screening device for banks to distinguish between good and bad projects.¹²⁷ Lending institutions can rarely identify projects with different risk but the same mean return, R . This means that the potential projects are sorted into a number of groups with similar return profiles and are offered the same interest rate, r , on a loan of size V .

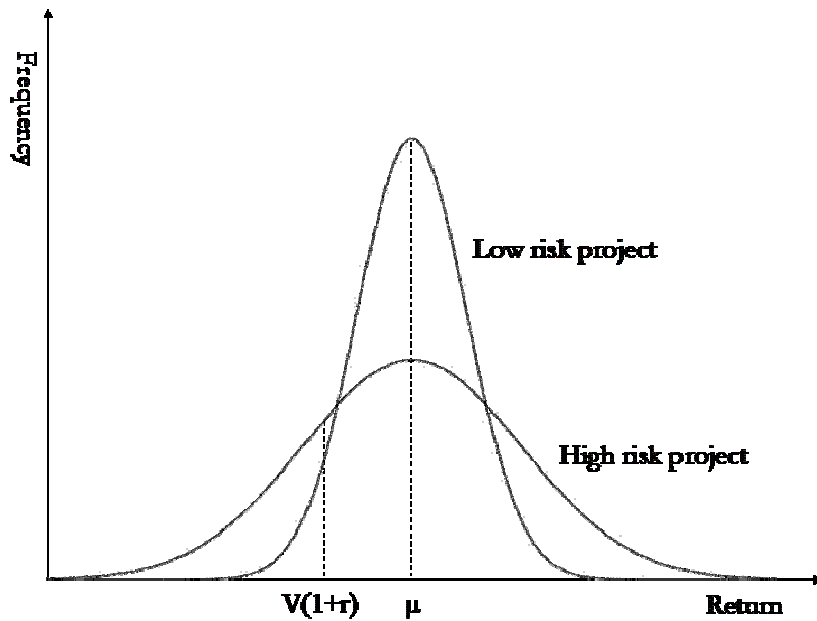


Figure A.1 The density functions of a low risk and a high risk project.

As shown in figure A.1 both projects have the same mean expected return, but differ in variance. The bank owns the rights to the cash flows below the principal and the interest, $V(1+r)$. As can be seen in the graph, the risk of the return R being smaller than $V(1+r)$, i.e. the loan being in default, is greater for the borrower with the highest variance. The borrowers get nothing if the default. The borrower with the highest variance gets the largest profit in case of success. Hence, for a given interest rate, the bank prefers projects with low risk and borrowers prefer projects with high risk. In other words, the risk profiles of lenders and equity holders respectively are determined by the option-like mechanisms of loan contracts.

The lender's position can be described as if he owned the assets in the project and had issued a call option to the entrepreneur/owner, i.e. there is an upward limit to his pay-off.

¹²⁷ The section is based on Becht et al., 2002 and Bodie et al., 2004.

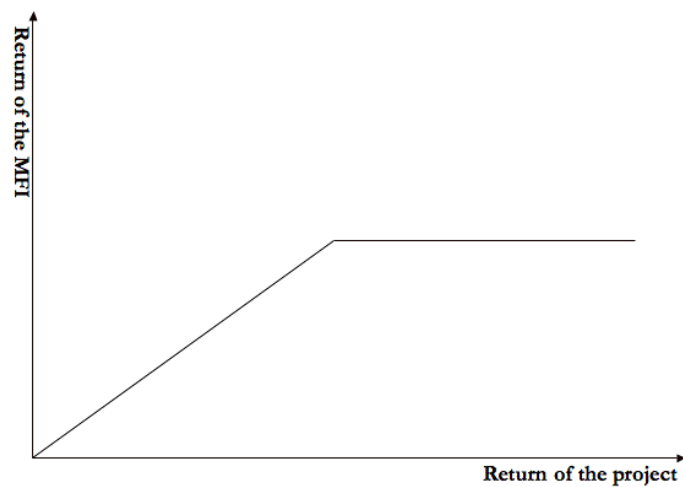


Figure A.2 The lender holds a put option.

The borrower on the other hand, has a call option, i.e. there is a down-ward limit to his pay-off. In other words, the borrower does not face any downward-risk.

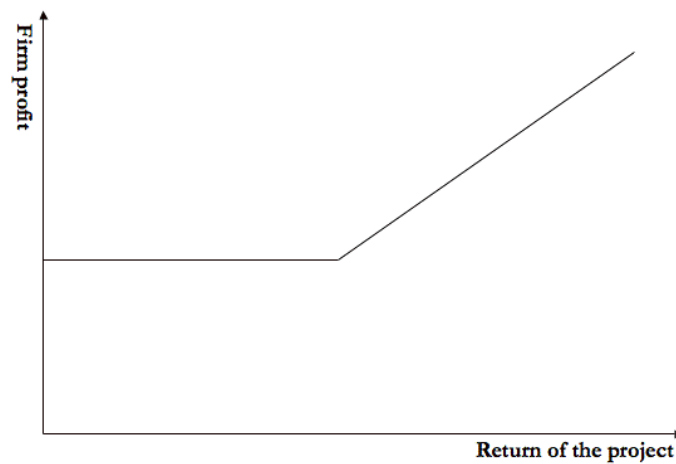


Figure A.3 The borrower holds a call option.

Since the pay-off function of the borrower is convex, his pay-off is increasing in risk. The riskier the project is, the higher interest rate he will be prepared to pay. Hence, at high interest rates, only borrowers investing in very risky projects are prepared to borrow money. Thus, the interest rate a player is prepared to pay reveals his risk class.

9.2 Appendix B

ε must be larger than one

In section 4.2.2 we argue that ε needs to be larger than one based on the calculations presented below. We start in the revenue formula presented in section 4.1.3 and derive an expression for the optimal interest rate at given levels of $\underline{\beta}_i$ and ε .

$$\text{Rev}_i^{\text{MFI}} = 1 + r_i - \varepsilon r_i - \varepsilon^2 r_i + \varepsilon r_i \underline{\beta}_i$$

$$\frac{\partial \text{Rev}_i^{\text{MFI}}}{\partial r_i} = 1 - \varepsilon - 2\varepsilon r_i + \varepsilon \underline{\beta}_i$$

$$\frac{\partial \text{Rev}_i^{\text{MFI}}}{\partial r_i} = 0$$

$$r_i^* = \frac{1}{2} \left(\frac{1}{\varepsilon} - 1 + \underline{\beta}_i \right)$$

This is the interest where the MFI maximizes its revenue. We stated that the MFI will try to capture as many profitable customers as possible but always maintain an interest rate above zero. In the base case of our model the marginal borrower is charged an interest rate of zero. Consequently, the interest rate and the critical level of $\underline{\beta}_i$ given ε is then

$$r_i^* = 0$$

$$\underline{\beta}_i^* = 1 - \frac{1}{\varepsilon}$$

We also know from the definition of $\underline{\beta}_i$ that

$$0 < \underline{\beta}_i < 1$$

Thus

$$1 < 1 - \frac{1}{\varepsilon}$$

$$\varepsilon > 1$$

If $\underline{\beta}^*$ is zero, everybody will have access to the credit market. Hence, $\underline{\beta}^*$ must be larger than zero for there to be credit rationing. In other words, since we want our model to deal with credit rationing, we assume that ε is larger than one.

9.3 Appendix C

The Mix Market

Despite the limited possibilities to assess our model, we here present data from one of the most recognized databases, the Mix Market (MBB, 2005). The database aims at improving the microfinance infrastructure, offering data sourcing, benchmarking and monitoring tools. The objectives are to help increase standardized reporting among MFIs, improve and stimulate MFI performance and transparency and boost public and private investment in microfinance. To reach these goals, the Mix Market standardizes financial reporting across the entire industry, provides a leading benchmarking service and offers a reliable open information marketplace to facilitate the exchange of quality data. The Mix Market database is considered a relatively reliable source of information, often referred to in the most prominent literature within the field.¹²⁸

The data presented in the table below is based on the 10th edition of the MicroBanking Bulletin.¹²⁹ The MFIs contributing with information were invited based on length, quality and depth of previously

¹²⁸ Morduch, 1999; Ghosh et al., 2002.

¹²⁹ MBB, 2005.

reported data. The 60 MFIs participating in the survey are of different size and have different objectives. Some have non-profit status, i.e. client-maximizing in our model, whereas others are profit-maximizing. The data spans all across the globe. Even though the MFIs are chosen to represent different parts of the industry, the criteria on previously reported data stated above implies a bias of the data set. Established, well-functioning MFIs are overrepresented in the sample. Hence, the statistical accuracy is questionable since the sample is far from random.

To relate our model to the real world microfinance market, we describe the risk of different types of MFI portfolios as well as profitability and sustainability documented in the MBB.

Return on Assets (%)				
	2002	2001	2000	1999
For Profit	1,7	0,4	0,4	-1,5
Not for Profit	3,2	2,9	-1,0	-4,4
Financial Self-sufficiency (%)				
	2002	2001	2000	1999
For Profit	111	105	103	99
Not for Profit	121	118	103	97
Portfolio at Risk >30 days (%)				
	2002	2001	2000	1999
For Profit	4,2	4,8	5,4	7,9
Not for Profit	2,9	2,5	3,5	3,4
Average Loan Balance per Borrower (USD)				
	2002	2001	2000	1999
For Profit	630	640	634	767
Not for Profit	276	317	277	270

Table C.1 Profitability, sustainability, risk proxies and loan sizes for the MFIs in the sample.¹³⁰

Firstly, the profit-maximizing MFIs in the data set have riskier portfolios than the non-profit MFIs.¹³¹ Hence, at first glance, the data set seems to contradict a basic characteristic of our framework. Based on credit rationing, our model predicts that MFIs cannot lend profitably to very risky borrowers. The empirical evidence however, implies that the credit rationing might not be as outstanding as we have assumed. Political factors such as interest rate restrictions on client-maximizing institutions have opposing effects to credit rationing. We would therefore need to isolate for such effects. However, such isolation is not feasible due to the lack of data.

Secondly, the implications of competition between MFIs predicted by our model seem to be supported by the empirical evidence. The returns on assets¹³² presented in the table shows that neither the profit-maximizing, nor the client-maximizing MFIs make substantial profits on average. However, there are several possible explanations for the absence of profit in the industry.

¹³⁰ MBB, 2005.

¹³¹ Based on Portfolio at Risk > 30 Days = Outstanding balance, loans overdue > 30 Days / Adjusted Gross Loan Portfolio.

¹³² Return on Assets = Adjusted Net Operating Income, net of taxes / Adjusted Average Total Assets. The values are adjusted for inflation, subsidization and loan loss provision.

Thirdly, the MFIs in the sample seem to be self-sufficient¹³³ on average. However, the surprisingly high self-sufficiency documented might be caused by the doubtful reporting mentioned above rather than true sustainability. For example, subsidized MFIs tend to subtract the subsidies from the cost of capital instead of reporting them separately. Even though the MBB tries to adjust for subsidies, the figures presented above are likely to be slightly exaggerated.¹³⁴ Most MFIs are subsidized in some way and the subsidies are in general non-targeted. Instead of targeting the subsidies, donors choose which MFIs to subsidize according to the objectives of the MFIs.

Finally, the average loan size¹³⁵ is used as an estimate of how poor the borrowers are.¹³⁶ Hence, in accordance with the cross-subsidization element of our model, the empirics show that client-maximizing (non-profit) MFIs tend to lend money to poorer people than profit-maximizing MFIs.

To conclude, microfinance markets seem to be characterized by substantial competition and subsidization.

9.4 Appendix D

One relationship between probability of default and interest rate which offers many attractive features is an arctan function, $f(r_i)$. We want the function to fulfil the following criteria; $f'(r_i) > 0$ and $f''(r_i) > 0$ for $r_i < a$ and $f''(r_i) < 0$ for $r_i > a$. This has the attractive feature that the probability of default can be modelled to always stay between 0 and 1 and that the marginal effect of higher interest is increasing at low interest rates but decreasing as probability approaches 1.

The inclusion of an intercept, c , also has many attractive features since it indicates that the borrower has some level of incentives to take the money as soon as he receives it and run. It should be noted that this is somewhat inconsistent with our concept of β_i however.

One function that fulfils the above criteria is an arccotangent function

$$\theta(r_i) = g(1 - \arccot(h(r_i - a))) + c$$

where a is the inflexion point where the marginal effect of increased interest rate becomes lower than one, c is the intercept and $g < 1$ and $h > 1$ are constants that ensures that the probability of default never becomes larger than one. The resulting relationship is illustrated in figure D.1.

¹³³ Financial self-sufficiency = Adjusted Financial Revenue / Adjusted (Financial Expense + Net Loan Loss Provision Expense + Operating Expense). The values are adjusted for inflation, subsidization and loan loss provision.

¹³⁴ See Murdoch, 1999.

¹³⁵ Average Loan Balance per Borrower = Adjusted Gross Loan Portfolio / Adjusted Number of Active Borrowers. The values are adjusted for inflation, subsidization and loan loss provision.

¹³⁶ Jonathan Morduch, personal communication 2005.

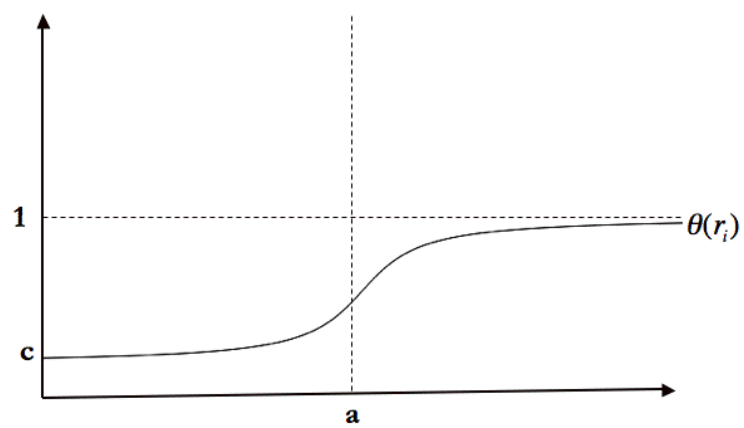


Figure D.1 $\theta(r_i)$ as an Arccotan function.