

Chapter 7

Fragmented Credit Markets

I

Agricultural production takes time. The lag between the start of production and the realization of output ranges from a few months to several years. In this environment, credit transactions serve to finance production and to permit farmers to consume before harvest. Moreover, the agricultural production process depends on a host of external factors, many of which are not under the control of the farmer. When production is risky and insurance markets are incomplete, credit transactions serve a valuable role by permitting people to smooth consumption in the face of a randomly fluctuating stream of income. Where farmers are poorer, these motivations for credit transactions are stronger - liquidity constraints are more likely to be binding so that production and consumption cannot be financed from savings, and the costs (in terms of utility, health, and even survival) of fluctuations in an already low level of consumption are very high.

Seasonal credit transactions, therefore, are found in virtually all poor agricultural economies. The institutional arrangements through which these transactions are effected are varied and often complex. There are formal financial institutions, including banks, credit cooperatives, and group lending schemes. Many financial transactions, however, occur outside the boundaries of the formal financial system. There are specialist moneylenders, informal loans among family and friends, loans tied to purchases, labor transactions, or land rental arrangements, and a variety of informal financial groups. It is commonly the case in rural areas of poor countries

that several of these different institutional forms coexist and interact. The terms and conditions under which credit is transacted may vary substantially across different transactions, depending upon the characteristics of the borrower and lender and the relationship between them. Credit transactions occurring over a short period in a single village might include: extremely informal zero interest loans between friends; formal sector loans backed by documentation and collateral; commercial loans between a moneylender and his clients some of which are backed by collateral; lending from a trader to the farmers who supply him with their harvests backed only by the promise to sell this year's harvest to that trader; consumption loans from an employer to his long-term employees; group loans from a micro finance institution to self-selected groups of borrowers lacking collateral; and a potentially large number of variations on these themes.

An important determinant of the structure and terms of credit contracts available in any particular area is the nature of government regulation and intervention in financial markets in that area. Common policies have included interest rate ceilings, regulations requiring financial institutions to direct a certain proportion of their loans to particular sectors or types of businesses, and subsidized credit programs. There seem to have been two main types of motivations for such interventions. On the one hand, credit (particularly agricultural credit) was conceptualized as a factor of production. As with any other factor of production, an increase in supply of credit would lead to an increase in production and income. On the other hand, informal financial transactions have often been characterized as exploitative and immoral. Government action was deemed necessary, therefore, to raise rural incomes by providing access to a necessary factor of production and to protect borrowers from monopolistic lenders. Over the past few decades, however, there has been an increased consensus on the need for financial market liberalization.

The recommendation that credit markets be liberalized is based on simple economic logic: interest rate ceilings and similar policies lower the supply and raise the demand for credit, leading to administrative rationing and associated rent-seeking behaviour, while discouraging saving mobilization.¹

The argument for the liberalization of financial markets is compelling, yet it also incomplete. A loan involves the exchange of current resources for future resources. It therefore involves a promise. If a loan transaction occurs in a risky environment and if a complete set of markets for contingent commodities does not exist, then the promised transfer of future resources may not be certain. The character of the loan transaction will then be influenced by the risks faced by the parties involved, and by their knowledge of each other and the activities they undertake. Thus the contractual arrangements through which financial transactions occur in the rural areas of poor countries have been influenced by institutional adaptations to the problems of information asymmetries and contract enforcement, as well as by government intervention. The simple model of a smoothly operating market with complete information and perfect contract enforcement which underlies the conventional argument for liberalization, therefore, is potentially misleading. Our goal in this chapter is to develop some basic models of rural credit markets, and to use these models to outline some of the consequences of asymmetric information and imperfect competition on the characteristics of loan transactions within these markets.

The organizing theme of this chapter is information. In separate sections, lessons are drawn from the relevant literature concerning the effects on credit transactions of adverse selection and moral hazard. We are especially interested in the effects of specific information

¹For a classic statement of this argument, see Adams, Graham, and von Pischke (1983).

asymmetries on the structure of the rural credit market. In particular, can monopolists in a particular area, say a village, extract rents using their superior information concerning local borrowers? How is the answer to this question affected by the presence of competition from relatively less well-informed outside lenders?

In each section, contractual mechanisms which can mitigate the difficulties caused by specific information asymmetries are described. We should note that it is artificial to treat separately the issues of adverse selection and moral hazard because most economic environments are characterized by a mixture of the two. For the sake of clarity, in this chapter we write as though a clean distinction can be made between moral hazard and adverse selection.

We will be concerned with four alternative market situations. To provide a benchmark case, first we will examine a competitive market for loans with complete information. Second, (perhaps more realistically) we will develop a model of a rural credit market in competitive equilibrium, but with imperfect information. Here we imagine a situation in which villagers borrow from non-resident commercial lenders, banks or government agencies which compete with one another for borrowers. We assume that the lenders cannot monitor actions of the borrowers which might affect the returns from loans (moral hazard) or that the lenders cannot distinguish between borrowers with different characteristics which might affect returns on loans (adverse selection). Third, as an alternative, we construct a model of a rural credit market dominated by a local monopolistic moneylender who has perfect information concerning the characteristics and activities of village borrowers. Finally, we examine the case of a fragmented national market, in which residents of a village have the option of borrowing from one of a set of relatively

uninformed, competitive non-resident lenders or from a local omniscient moneylender. In this last case the rents which accrue to the local moneylender through his control of local information become apparent.

We focus on rural credit markets to provide a concrete setting for the models, and because of the central importance of such markets to the development process. However, many of the lessons that can be drawn from the models developed below can be applied to firms borrowing in an urban center, sovereign governments in the international credit market, or students borrowing to finance their education.

II

To begin our simplifications, we will assume that all borrowers and lenders are risk-neutral. This eliminates an important motivation for borrowing: the desire to smooth consumption in the face of fluctuating income. We discuss the use of credit markets as a mechanism for coping with risk in chapter 8. For now, we focus exclusively on credit as a source of working capital for productive activities which take time. We suppose that each individual in a village has access to the same amount of land, and can farm this land for a certain fixed cost (which we normalize to 1). The farm yields 0 if there is a harvest failure, and $R > 1$ otherwise. The probability of a successful farming season is $\pi(a)$, where $a \in [0,1]$ is an index of (say) the effort the farmer puts into her land. $\pi(a)$ is strictly increasing and concave. There is a utility cost to the farmers of working; we denote this cost as $D(a)$. $D(a)$ is increasing and strictly convex, so that the marginal utility cost of effort is increasing in effort. We also suppose that the farmers have no

wealth of their own (there is no land market). Therefore, if these farmers are to engage in cultivation, they must borrow the necessary working capital. If a lender offers an interest factor (which is 1 plus the rate of interest) of $i \leq R$, the returns to the farmer and lender are as follows:

	Borrower	Lender
Success	$R - i - D(a)$	i
Failure	$-D(a)$	0

We assume that lenders have access to a risk-free capital market with a return of ρ ($R > \rho \geq 1$). We also assume that if the borrower does not involve herself in farming, she can receive a return of W ($R > W \geq 0$) in alternative employment.²

Therefore the expected utility of a borrower is $U(i,a) = \pi(a)[R-i]-D(a)$ and the expected return of a lender is $\Pi(i,a) = \pi(a)i$. In writing this table, we have made two extremely important assumptions. The first is that the loan contract has limited liability. If the borrower's harvest fails, she has no funds to repay the loan and the lender receives nothing. Second, we have assumed away any problems of enforcement. If the harvest is successful, the borrower has the resources to repay and the loan is repaid. In this model, the borrower cannot renege on her commitment to repay the loan if the project is successful.

Both of these assumptions are oversimplifications of reality. First, faced with a harvest failure, borrowers often request that loans be rescheduled, or make partial repayments of loans. Second, rural financial transactions in many areas are characterized by imperfect formal legal enforcement mechanisms. Why, then, do borrowers repay? Theorists have focused on two

²Now it is clear why we impose the restriction $i \leq R$. If $i > R$, then the borrower receives a negative return in any state of nature. She would do better to take her reservation income of W .

potential mechanisms which can serve to provide repayment incentives. The first is the "self-enforcing contract". The idea is that borrowers repay because they fear losing access to future loans if they ever default. In fact, this is the explanation often provided by borrowers when asked why they repay loans. The second is the creation of social sanctions to punish defaulters. This idea is that defaulters are penalized broadly by the community as a whole, in addition to being denied access to future loans. Theorists (see, for example, Kandori, 1993) have only recently begun to model the process through which the sanctions arise and persist. It is clear that both loss of future access to credit and general social sanctions play an important role in sustaining many rural credit markets. To simplify our analysis and to focus attention on the role of information asymmetries, however, we abstract from problems of enforcement in this chapter.

A. Moral Hazard

1. Competitive Equilibrium with Complete Information

First we assume that there are a large number of competitive lenders. We initially assume that the lenders can observe the borrowers' choice of a . Therefore, they can write contracts which specify both the interest factor i and the effort level a . We define an equilibrium to be a pair (i_1, a_1) such that: (a) $U(i_1, a_1) \geq W$; (b) $\Pi(i_1, a_1) \geq \rho$; and (c) there is no other pair (i, a) which yields a return greater than or equal to ρ to a lender and which a borrower would prefer to (i_1, a_1) .³ If there is an equilibrium with lending, it is characterized by the solution to

³This corresponds to T1 competition in Chan and Thakor (1987).

$$\begin{aligned} \text{Max}_{a,i} \quad & \pi(a)(R-i) - D(a) \\ \text{subject to} \quad & \pi(a)i \geq \rho \\ \text{and} \quad & \pi(a)(R-i) - D(a) \geq W. \end{aligned}$$

There may be no solution to this problem. If there is no (i,a) such that both constraints are satisfied, then there is no lending in equilibrium. For any fixed ρ , however, there is a W low enough so that both constraints may be satisfied.

The equilibrium is depicted in Figure 7.1. The $\Pi(\cdot)=\rho$ contour is downward-sloping and strictly convex (you should be able to show this). The $U(\cdot)=W$ contour is strictly concave (and, given our assumptions on $\pi(\cdot)$ and $D(\cdot)$, will reach a maximum with $0 < a < 1$). As long as there is an interior point in the constraint set there will be lending in equilibrium with terms (i_1, a_1) as at point 1 in Figure 7.1. In this equilibrium, the required input of effort a_1 is set by $\pi'(a_1)R = D'(a_1)$, so that the expected marginal return to additional effort is set equal to its marginal cost. The allocation of effort is efficient. The contractual interest rate i_1 is set so that $\pi(a_1)i_1 = \rho$ and lenders make zero profits. Borrowers achieve an expected utility $U(i_1, a_1) = \pi(a_1)R - D(a_1) - \rho > W$.

2. Competitive Equilibrium with Moral Hazard

Now consider the possibility that a lender cannot observe the input of effort by the borrower, so the lender cannot directly control the borrower's choice of a . The borrower will choose the action that maximizes her utility given the credit contract offered to her. A lender's return from a loan still depends on the choice of a by the borrower, so this is an example of moral hazard. We retain the assumption that the lenders operate in a competitive market. As before, an equilibrium pair of interest charged and effort exerted (i_2, a_2) must satisfy (a) $U(i_2, a_2) \geq W$; (b)

$\Pi(i_2, a_2) \geq \rho$; and (c) there is no other pair (i, a) which yields a return greater than or equal to ρ to a lender and which a borrower would prefer to (i_2, a_2) . Now, however, because the lender cannot monitor the borrower's choice of a , we must add the condition (d) that the lender can only offer contracts such that the borrower wants to choose a_2 , given i_2 . The equilibrium loan contract will be characterized by the solution to:

$$\underset{a, i}{\text{Max}} \quad \pi(a)(R-i) - D(a)$$

$$\text{subject to } \pi(a)i \geq \rho$$

$$\pi(a)(R-i) - D(a) \geq W$$

$$\text{and} \quad \pi(a)(R-i) - D(a) \geq \pi(a')(R-i) - D(a') \quad \forall a' \in [0, 1].$$

The problem is identical to that of section 1, except for the third set of constraints, which are added as a result of moral hazard. The first implication of this analysis is that for a given set of "primitives" [the functions $\pi()$ and $D()$ and the values of R , ρ , and W], if an equilibrium with lending exists in the case of moral hazard, then there must also be an equilibrium with lending in the case of perfect information. The converse is not true. In a competitive situation in which lending would be possible with complete information, the additional incentive compatibility constraints may result in there being no contract (i, a) which satisfies all the constraints, so no equilibrium with lending need exist.

The borrower's utility function is differentiable and strictly concave for all $i \leq R$, so the condition $\pi'(a)(R-i) - D'(a) = 0$ is necessary and sufficient for the third set of constraints in the

problem above.⁴ If a solution (i_2, a_2) does exist, than it satisfies $D'(a_2) = \pi'(a_2)(R-i_2) < \pi'(a_2)R$, which implies $a_2 < a_1$. That is, the effort by farmers will be less in the case of moral hazard than in the complete information equilibrium. This implies $i_2 > i_1$ (by the zero profit constraint), and $EU(a_2, i_2) < EU(a_1, i_1)$. The equilibrium is point 2 in Figure 7.1. Given interest rate i_2 , the farmer maximizes her utility by choosing to commit effort a_2 . The dashed line running from z to a_2 is the set of contracts which satisfy all three constraints; the borrower prefers (i_2, a_2) to any other point in that set.

The consequences of moral hazard in the credit market can be neutralized by the use of collateral when both borrowers and lenders are risk neutral. Suppose that each borrower owns some asset (with value greater than R).⁵ If the project fails, the borrower transfers the collateral pledged for the loan (C) to the lender. The equilibrium with moral hazard is now described by

$$\begin{aligned} \underset{a, i, C}{\text{Max}} \quad & \pi(a)(R-i) - (1-\pi(a))C - D(a) \\ \text{subject to} \quad & \pi(a)i + (1-\pi(a))C \geq \rho \\ & \pi(a)(R-i) - (1-\pi(a))C \geq W \\ \text{and} \quad & \pi(a)(R-i) - (1-\pi(a))C - D(a) \geq \pi(a')(R-i) - (1-\pi(a'))C - D(a') \quad \forall a' \in [0, 1]. \end{aligned}$$

Once again, the first order approach is valid. In equilibrium, $C^* = i^* = \rho$, and $a^* = a_1$. The borrower

⁴At least when $0 < a < 1$. Our assumptions on $\pi()$ and $D()$ ensure that the choice of a will remain in the interior. The assumptions we have made imply that the first order approach we have taken is valid. See Grossman and Hart [1983] and Kreps [1990] for a discussion of the conditions under which the infinite number of inequalities in the third set of constraints can be replaced by a single first order condition.

⁵We are assuming that borrowers and lenders place the same value on these assets, so we are not permitting transactions costs (Bell [1988]) or systematic undervaluation of the collateral (Bhaduri [1983]). We are also assuming that it would be costly to sell the asset in advance of the project, so borrowers still need to borrow in order to finance the project.

absorbs the entire risk of the transaction. The return to the lender no longer depends on the choice of a by the borrower, so moral hazard no longer exists. The loan is now riskless to the lender, so the interest rate lowered (from equilibrium (1)) to the riskless rate. Borrowers are induced to put the optimal level of effort into the project. Lenders make zero profits, and borrowers achieve the same utility as they achieve in the complete information equilibrium (calculate this to make it clear to yourself). This result depends *crucially* on the assumed risk neutrality of both parties. If the borrower were risk averse, the use of collateral could not entirely alleviate the difficulties induced by moral hazard, because she would not be willing to absorb the entire risk of the transaction without some compensation from the lender.

Rural credit transactions are commonly associated with some form of collateral. Items for which there is a secondary market, and which are not themselves subject to moral hazard problems are the most common forms of collateral (see Binswanger and Rosenzweig, 1986). Therefore, jewelry or other household items commonly serve as collateral. In areas with well-developed land markets, land is often pledged in exchange for a loan. Where other assets are not available, a wide variety of items including economic trees and standing crops, livestock, and farm equipment serve as collateral. These assets are less satisfactory as collateral because they are themselves subject to secondary problems of information asymmetries. For example, a farmer might treat a tractor or a bullock pledged as collateral with less care than otherwise; or if there is unobserved (to the lender) variation in the quality of these assets, problems of adverse selection arise. In addition, collateral substitutes have been developed in some areas with poorly developed markets for the assets which conventionally serve as collateral. These include loan guarantees

provided most often by relatives, and *interlinked* transactions in which the terms of an associated transaction in another market (e.g., a labor contract) serve to mitigate the moral hazard associated with the loan transaction (see chapter 9).

3. Equilibrium with a Fully-Informed Monopolist

Suppose that a village has a single resident with enough wealth to act as a moneylender (his wealth is larger than N , the number of residents in the village). The moneylender lives in the village and has the opportunity to costlessly monitor the activities of anyone who borrows from him. He can deposit his wealth at the risk-free rate of ρ , so this is the opportunity cost of his funds. The moneylender will set the interest rate and level of effort to solve:

$$\begin{aligned} \underset{a,i}{\text{Max}} \quad & i\pi(a) \\ \text{subject to} \quad & \pi(a)(R-i) - D(a) \geq W \\ \text{and} \quad & i\pi(a) \geq \rho. \end{aligned}$$

This constraint set is identical to that of the case of perfect competition with complete information, so an equilibrium with lending will exist in the same set of circumstances as in that case. As in the case of a competitive credit market with complete information, this equilibrium is Pareto efficient. Effort is set so that $\pi'(a_3)R = D'(a_3)$ (so $a_3 = a_1$), and the interest rate is set so that the borrower achieves his reservation utility: $\pi(a_3)(R-i_3) - D(a_3) = W$ [See Figure 7.1]. The difference from case 1, of course, is that the farmers are pushed down to their reservation utility.

4. Competition Between an Informed Local Moneylender and Uninformed Outside Lenders

This case may be the most informative. Suppose that there is an active, competitive market for credit from lenders not resident in the village. These lenders may be private urban

lenders, moneylenders from other villages, or formal sector (bank or government) lenders. These lenders all face the same opportunity cost of funds (ρ), and face prohibitive costs of monitoring the actions of borrowers in the village. There is also a resident moneylender (whose opportunity cost of funds is also ρ) who can monitor costlessly the actions of borrowers in the village. The local moneylender can use his informational advantage to collect rents even in the face of competitive (but uninformed) lenders from outside the village. The point is made most simply in the familiar Figure 7.1. Suppose that ρ and W are such that the equilibrium in section 2 permits lending by uninformed outside lenders. The availability of these outside loans raises the reservation utility of local borrowers from W to W_2 . The local moneylender now implements the contract outlined in section 3, replacing W by W_2 . The local moneylender is able to make positive profits ($= i_4\pi(a_4) > i_1\pi(a_1) = i_2\pi(a_2) = 0$). The profits made by the moneylender in this instance reflect the power granted by his superior information concerning the actions of village residents.

B. Adverse Selection

Another type of information asymmetry has received a great deal of attention in the literature on credit markets in developing countries. Contrary to the assumptions of section A, there is a great deal of heterogeneity among farmers in any village. While lenders might have a good idea about the average characteristics of the pool of potential borrowers, they may not have complete information concerning the characteristics of any particular borrower. This may lead to problems of adverse selection. A few simple modifications to the models used in section A permit us to examine the consequences of adverse selection in credit markets.

Suppose that farming requires no effort, but that there are two types of potential borrowers indexed by $t \in \{1, 2\}$. Type 2 borrowers have access to land which is riskier but potentially more lucrative than that used by type 1 borrowers. That is, $\pi(1) > \pi(2)$, but $R(1) < R(2)$. In fact, we suppose that the expected return to farming each type of land is identical ($\pi(t)R(t) = \bar{R} \forall t$).⁶ Also suppose that the reservation utility of the different types of borrowers is constant ($W(t) = W \forall t$). The model is otherwise identical to that of section A. The expected utility of a borrower is $U(i, t) = \pi(t)[R(t) - i]$ and the expected return from a loan at rate i to a type t borrower is $\Pi(i, t) = \pi(t)i$.

1. Competitive Equilibrium with Complete Information

As a benchmark, we first assume that perfectly informed lenders compete to make loans within the village. Lenders can distinguish between the types of borrowers, so they can offer different interest rates to each type. An equilibrium with lending to borrower type t will be an interest rate ($i_1(t)$) such that: (a) $U(i_1(t), t) \geq W$; (b) $\Pi(i_1(t), t) \geq \rho$; and (c) there is no interest rate $i(t)$ which yields a return greater than or equal to ρ to a lender and which a type t borrower would prefer to $i_1(t)$. If there is an equilibrium with lending, it is characterized by solving for each t :

$$\begin{aligned} \underset{i(t)}{\text{Max}} \quad & \pi(t)(R(t) - i(t)) \\ \text{subject to} \quad & i(t)\pi(t) \geq \rho \\ \text{and} \quad & \pi(t)(R(t) - i(t)) \geq W. \end{aligned}$$

There will be lending in equilibrium to both types if $\bar{R} - \rho > W$, otherwise neither type will receive

⁶That is, the distribution of returns for type 2 projects is a *mean-preserving spread* of the distribution of returns for type 1 projects.

loans. If there is lending, $i_1(t) = \rho / \pi(t) \forall t$, and the lender makes zero expected profits.

Substitution of this equilibrium relation into the borrower's utility function shows that

$U(i_1(t), t) = \bar{R} - \rho \forall t$. If there is lending, both types of farmers will borrow, and $i_1(1) < i_1(2)$.

2. Competitive Equilibrium with Adverse Selection

Suppose that the lenders in the competitive credit market cannot differentiate between borrowers of different types, though they know the relative proportions of type 1 and 2 farmers in the village. First note that at any given interest rate i :

$U(i, 1) = \pi(1)(R(1) - i) < \pi(2)(R(2) - i) = U(i, 2)$, but $\Pi(i, 1) = \pi(1)i > \pi(2)i = \Pi(i, 2)$. So safer borrowers achieve a lower expected utility from a given interest rate, but provide higher expected income to the lender. These results follow directly from the limited liability nature of the credit contract, which limits the loss faced by a borrower when her crop fails. Recall that the participation constraint is $\pi(i)(R(i) - i) \geq W$. Obviously, $\partial U(i, t) / \partial i < 0$. Define $i^*(1)$ as the highest interest rate at which type one borrowers are willing to borrow. So $i^*(1)$ is implicitly defined by the equation $\bar{R} - \pi(1)i^*(1) = W$. Define $i^*(2)$ analogously. $i^*(1) < i^*(2)$, so as the interest rate increases, households with safer projects drop out of the pool of borrowers first. For interest rates less than $i^*(1)$, all potential borrowers demand credit. If the interest rate increases past $i^*(1)$, the relatively safe type 1 borrowers stop demanding credit, while type 2 borrowers continue to demand loans. As the safer borrowers drop out of the market, lender income discontinuously falls. Figure 2 illustrates the relationship between the interest rate charged by lenders and the expected income from lending. Lender income rises with increases in the interest rate until $i = i^*(1)$. Suppose $p(1)$ is the proportion of the population of potential borrowers who are type 1.

Then the expected income from a loan at interest $i \leq i^*(1)$ is $E\Pi(i) = p(1)\pi(1)i + [1-p(1)]\pi(2)i$. As i increases past $i^*(1)$, type 1 borrowers drop out of the market and lender income falls. As the interest rate continues to increase, lender income once again increases until $i^*(2)$, at which point type 2 borrowers stop demanding credit and no loans are made. For $i^*(1) < i \leq i^*(2)$, $E\Pi(i) = \pi(2)i$. For $i > i^*(2)$, $E\Pi(i) = 0$.

Lenders cannot distinguish between borrowers of different types. Therefore, the competitive equilibrium with adverse selection is defined as an interest rate i_2 such that (a) $E\Pi(i_2) \geq \rho$; (b) There is no interest rate i for which $E\Pi(i) \geq \rho$ and both $U(i,t) > U(i_2,t)$ and $U(i,t) > W$ for any type t . In other words, an interest rate i is an equilibrium interest rate if lenders do not lose money on average at i , and if there is no other interest rate which any type of borrower would prefer at which lenders would avoid losing money. There are no explicit borrower participation constraints in this definition of equilibrium because these constraints are built into the function $E\Pi(i)$.

As long as $\bar{R} - \rho > W$ (the condition for lending to be possible in the case of complete information), then there will be lending in the equilibrium with adverse selection. If $\rho > E\Pi(i^*(1)) = p_1\pi(1)i^*(1) + (1-p_1)\pi(2)i^*(1)$ (as in Figure 2), then the equilibrium interest rate will be $i_2 = \rho/\pi(2) > \hat{i}$ and only the risky type 2 borrowers will demand loans. If $\rho < E\Pi(i^*(1))$ (as in Figure 3), then the interest rate will be $i_2 = \rho / \{p(1)\pi(1) + [1-p(1)]\pi(2)\}$, which is less than $i^*(1)$ and all potential borrowers will demand loans. It should be clear that \tilde{i} is not an equilibrium. At that interest rate only risky borrowers would demand credit and lenders would make zero profits. But all borrowers prefer i_2 to \tilde{i} and lenders also avoid losing money at i_2 .

Many discussions of the implications of adverse selection for credit markets in less developed countries focus on the possibility of credit rationing. In this simple model credit rationing does not occur. How does this model differ from the celebrated work of Stiglitz and Weiss (1981), which is the theoretical basis of the worry that credit rationing might be pervasive? The essential difference is that current model presumes that lenders have access to an infinitely elastic supply of funds at a cost of ρ . Stiglitz and Weiss show that when the relationship between the expected return to lenders and the interest charged is a nonmonotonic function with an interior local maximum (as in our Figures 2 and 3), then there exist supply of fund schedules which lead to a competitive equilibrium with rationing. Figure 4 (a modified version of their Figure 4) illustrates the Stiglitz-Weiss result. The demand for loans is simply $N_1 + N_2$ for $i \leq i^*(1)$, N_2 for $i^*(1) < i \leq i^*(2)$, and 0 for larger i , where N_i is the number of the i th type of borrower. In the lower left quadrant we show the supply of funds to lenders as a function of the cost of those funds, ρ . We have drawn this schedule so that rationing will occur in equilibrium - you should verify that other supply schedules will lead to equilibria without rationing. The supply of loans schedule in the upper right quadrant is derived by tracing the effect of the interest rate i on the expected return on loans, and hence on the supply of funds to lenders. The competitive equilibrium entails lenders charging $i^*(1)$ and earning an expected return of $E\Pi(i^*(1))$. The demand for loans at $i^*(1)$ exceeds the supply of loanable funds, leading to rationing of credit. An increase in the interest rate would cause type 1 borrowers to drop out of the market, leaving lenders with a riskier portfolio of loans and reducing expected returns to lending. At interest rate i_e loan supply equals loan demand (with only type 2 borrowers in the market), but lenders earn a lower expected return than at $i^*(1)$ - a

lender charging $i^*(1)$ could attract borrowers of all types, and would earn a higher expected return.

In a manner exactly analogous to that discussed in section A, the existence of collateral can eliminate the problem of adverse selection. As in that case, a pledge of collateral equal in value to the repayment owed by the borrower places the entire risk of the transaction on the borrower. The return to the lender no longer depends on the unknown type of the borrower, hence adverse selection no longer exists. Once again, this result depends crucially on the assumed risk-neutrality of the borrower. If the borrower is risk-averse, collateral can mitigate but not eliminate the consequences of adverse selection.

3. Equilibrium with a Fully-Informed Monopolist

Let's return to the case of a village with a monopolistic, omniscient moneylender. He knows which villagers have access to which type of land. As before, we assume that his opportunity cost of funds is ρ . His problem is set an interest rate $i_3(t)$ for each type of borrower to solve:

$$\text{Max}_{i(t)} \quad \pi(t)i(t)$$

$$\text{subject to } \pi(t)(R(t)-i(t)) \geq W$$

$$\text{and } \pi(t)i(t) \geq \rho.$$

As long as $\bar{R}-W \geq \rho$, the equilibrium will involve lending to each type of borrower at interest rates

$$i_3(t) = \frac{\bar{R}-W}{\pi(t)} = i^*(t). \text{ Each type of borrower achieves an expected utility of } W \text{ and the lender earns}$$

an expected return of $\bar{R}-W \geq \rho$ on each loan.

4. Competition Between an Informed Local Moneylender and Uninformed Outside Lenders

Once again, suppose that there is an active, competitive market for credit from lenders not resident in the village. These lenders cannot distinguish between type 1 and type 2 farmers. They compete with a resident moneylender who knows the type of each farmer in the village. All lenders face an opportunity cost of funds equal to ρ . As in the case of moral hazard, the resident moneylender will be able to use his informational advantage to collect rents even in the face of this competitive pressure from uninformed lenders.

There are two cases to consider. First suppose that $E\Pi(i^*(1)) < \rho \leq \bar{R} - W$ (as in Figure 2). The equilibrium with competitive, uninformed lenders would involve lending only to type 2 borrowers, with $i_2 = \rho / \pi(2)$. The local money lender can charge different interest rates to different types of borrowers; denote the interest charged by the local lender by $i_4(t)$. The availability of these outside loans to type 2 borrowers implies that the local money lender cannot charge more than i_2 to type 2 farmers. So $i_4(2) = \rho / \pi(2)$. Type 1 farmers have no access to credit from outside lenders in this case. So the local lender can revert to his case 3 behavior for this type of farmer and set $i_4(1) = (\bar{R} - W) / \pi(1) = \pi^*(1)$. The local lender earns rents on his loans to type 1 borrowers (his return on these loans is $\bar{R} - W > \rho$) because of his superior information.

Alternatively, suppose that $\rho \leq E\Pi(i^*(1))$ (Figure 3). In this case, the equilibrium with competitive uninformed lenders would involve outside lenders setting $i_2 \leq i^*(1)$ and lending to both types of farmers. The local moneylender can lend to type 1 farmers at any interest rate less than or equal to i_2 . Suppose the local lender sets $i_4(1) = i_2$ (or just a bit below). Some (all) of the type 1 borrowers would not borrow from the outside lender, instead borrowing from the local lender.

The outside lenders would be faced with a riskier pool of borrowers at $i=i_2$ than they had in case 2 with no local lender. Their expected return from loans at i_2 would fall below ρ . Outside lenders, therefore, cannot offer loans at interest rate i_2 . All type 1 borrowers will borrow from the local moneylender at $i_4(1)=i_2$, and the outside lenders will lend at \tilde{i} to type 2 borrowers only. The local moneylender will set $i_4(2)=\tilde{i}$. The local lender again earns rents on his loans to type 1 borrowers (his return on these loans is $\pi(1)i_4(1) = \frac{\pi(1)\rho}{p(1)\pi(1) + [1-p(1)]\pi(2)} > \rho$) because of the power provided

to him by his superior information concerning the characteristics of village residents.

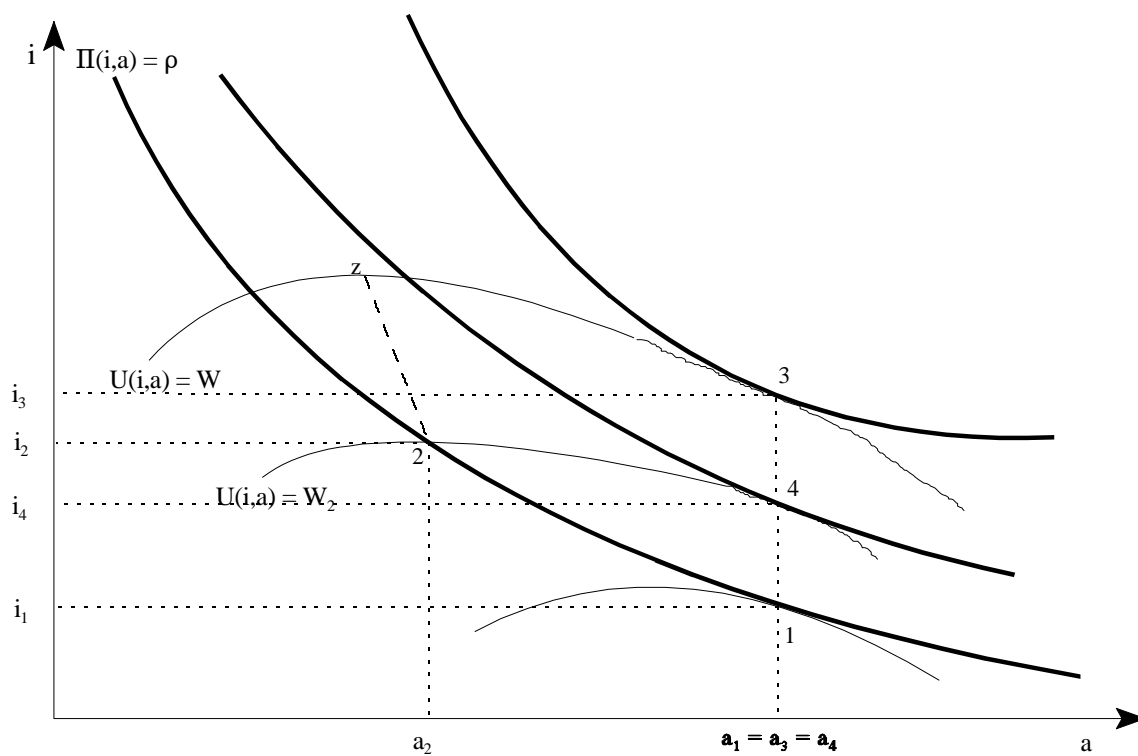


Figure 7.1

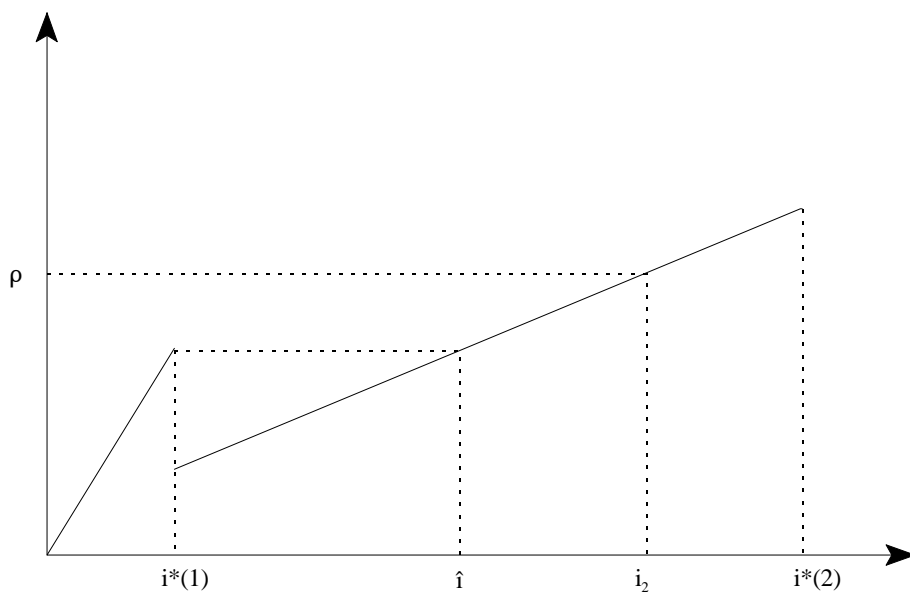


Figure 7.2

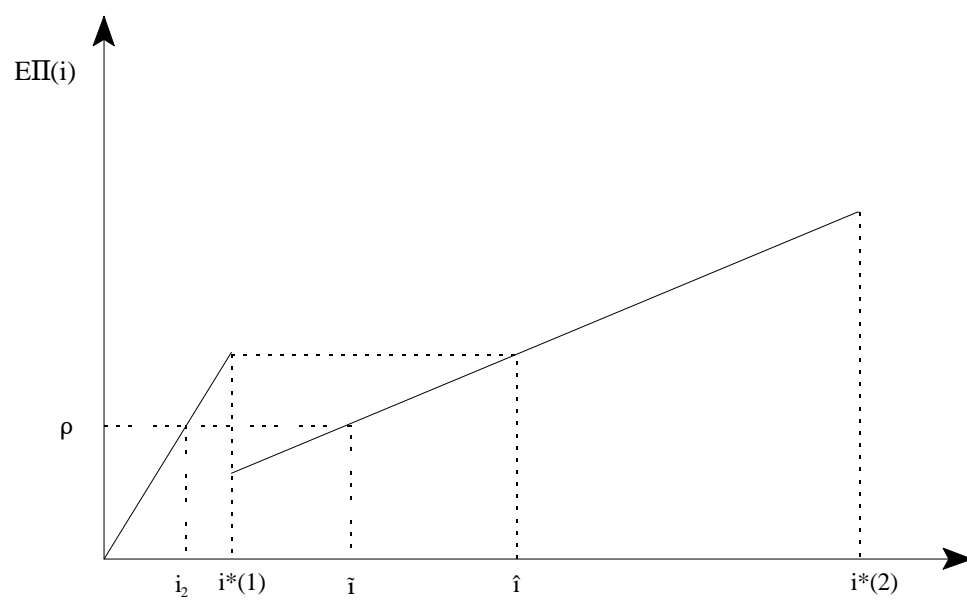


Figure 7.3

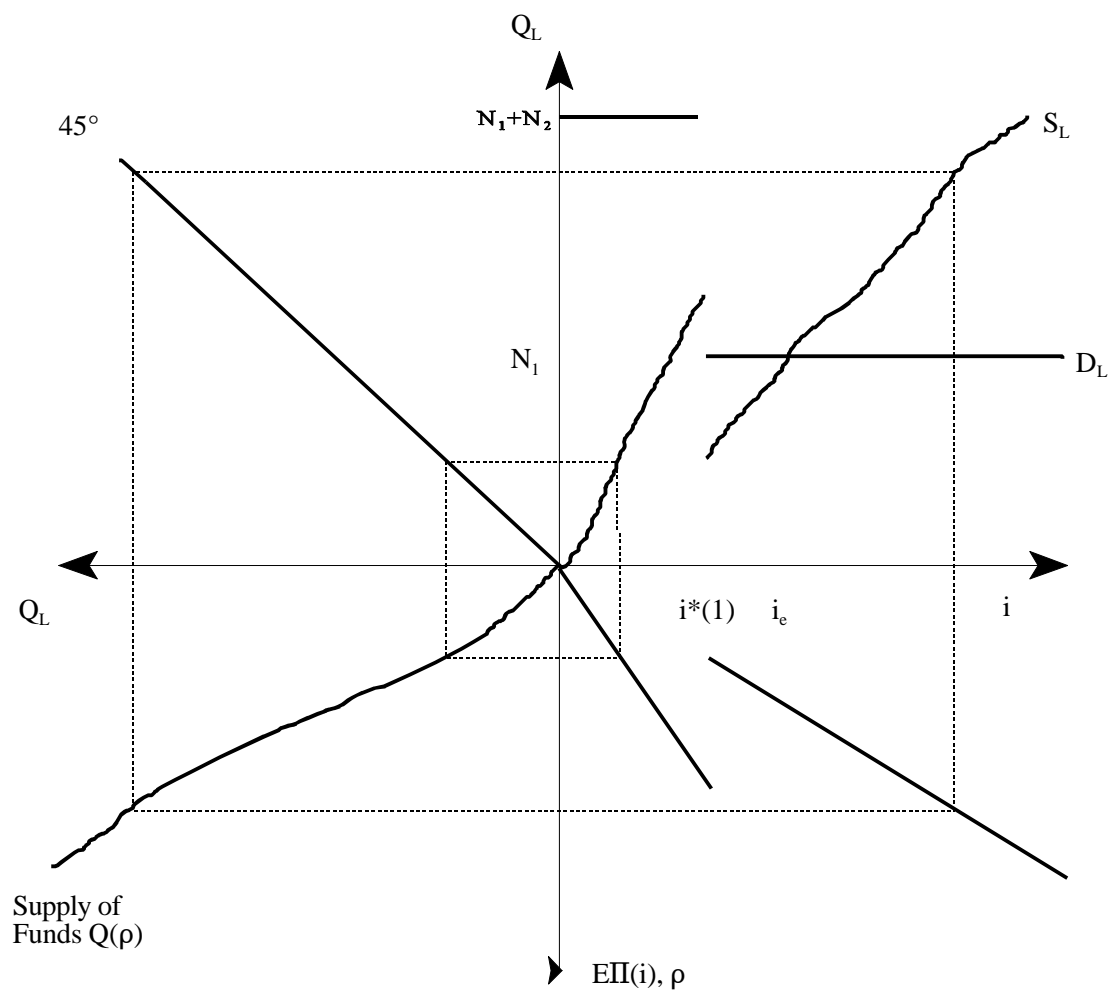


Figure 7.4

References

Adams, D., D. Graham, and J.D. Von Pischke, eds. 1984. *Undermining Rural Development with Cheap Credit*. (Boulder: Westview).

Bell, Clive (1988): *Credit Markets, Contracts, and Interlinked Transactions*. In: *Handbook of Development Economics*. (Eds: Chenery, H; Srinivasan, T.N) North Holland, New York, .

Bhaduri, Amit (1983): *The Economic Structure of Backward Agriculture*. Academic Press, New York.

Bulow, J; Rogoff, K (1989): *A Constant Recontracting Model of Sovereign Debt*. *Jpe* 97(1), 155-178.

Chan, Y.S; Thakor, A (1987): *Collateral and Competitive Equilibria with Moral Hazard and Private Information*. *Journal of Finance* 42(2), 345-363.

Grossman, S; Hart, O (1983): *An Analysis of the Principal-Agent Problem*. *Econometrica* 51(1), 7-45.

Kandori, Michihiro. 1992. "Social Norms and Community Enforcement." *Review of Economic Studies*.

Rogerson, William (1985): *The First Order Approach to Principal-Agent Problems*. *Econometrica* 53, 1357-1367.

Stiglitz, Joseph; Weiss, Andrew (1981): *Credit Rationing in Markets with Incomplete Information*. *American Economic Review* 71(3), 393-410.