19

Credit Markets

19.1. Introduction

Throughout this book, credit markets — or their absence — play an important role. A smoothly functioning credit market can ameliorate the negative effects of inequality. When needed, everyone with access to a profitable activity can then get an upfront loan fto start it up. But when the credit market works badly, the existing distribution of wealth and endowments has a large effect on economic functioning, and can create persistent inefficiencies. There are then fewer ways to rectify the inequality of access caused by the inequality of wealth.

That credit markets are of fundamental importance is no accident. Many economic activities are spread out over time. The inputs are needed now; the output comes later. Three situations are of particular relevance. First, there is the need for *fixed capital*: a new technology or crop is adopted, or a new business is set up, with its attendant need for factory or warehouse space, production processes, machines, and core personnel. Fixed capital credit also plays a central role in the acquisition of *human* capital, as anyone who has had to get a college loan will surely appreciate.

Second, there is the credit required for ongoing production activity, which occurs because of a substantial lag between the outlays required for normal production and sales receipts. Thus, merchants who buy handicrafts from poor producers advance or "put out" sums of money that are used to purchase various materials. When the product is finally produced, these credit advances are deducted from the amount that the merchant pays for his wares. This is the market for *working capital*.

Finally, there is *consumption credit*, often demanded by cash-strapped individuals because of the seasonality of their income, or a sudden downturn in their production, or the price of what they sell, or perhaps because of an increase in their consumption needs caused by illness, death, or even festivities such as a wedding.

Although fixed capital credit is of great importance in determining the overall growth of the economy, working capital and consumption credit are fundamental to our understanding of how an economy supports its poor and disadvantaged. The rural economy exemplifies these needs. At the beginning of a crop cycle, the peasant faces a considerable need for working capital: money to purchase seeds, fertilizers, pesticides,

and so on. These expenditures are bunched up front, and the farmer is often without sufficient funds to finance it. Hence, there is a need to borrow, with the loan repaid after the crop is harvested and sold. The repetitive taking and repayment of loans is an intrinsic feature of life for many, and the ease or difficulty of this process deeply affects the economic productivity and well-being of millions of individuals.

Likewise, for the very poor, seasonality also means a reliance on ongoing *consumption credit*. Farm wages are typically lower in the lean season relative to the harvesting season, when the demand for labor is high. Moreover, there is often a high rate of unemployment in the slack season. A small farmer's harvest might fail, which causes immense temporary hardship that can only be alleviated through loans. Landless laborers, who rely on wages as a means of livelihood, face considerable fluctuations in their earnings from month to month. Credit is required for such people to smooth consumption over time to cover their needs in periods of low income by borrowing against higher expected earnings during times when the going is good. As you would imagine, the presence of uncertainty compounds these needs.

All in all, it seems that moneylending should be an eminently profitable (and socially useful) activity. But several features of the credit market make it a difficult and unwieldy institution. They are all naturally connected to a central problem that makes lenders reluctant to advance money even for profitable projects: the fear of default.

19.2. Who Provides Credit?

First, there are the *formal* or institutional lenders: government or commercial banks, aided by credit bureaus. Often special banks are set up, as in Thailand, the Philippines, and India, and in many other countries, to cater especially to the needs of rural production or the poor. Or existing commercial banks are regulated so that such outreach activities form some minimum part of their portfolio.

The main problem with formal lenders is that they often do not have personal knowledge regarding the characteristics and activities of their clientele. For instance, a bank cannot precisely monitor just how a loan is deployed. The problem is not just production versus consumption: the fear, say, that a loan taken ostensibly for some productive purpose may be squandered to meet the expenses of a wedding. There are other, more subtle reasons for a systematic divergence between what lenders want done with the money and what borrowers want, as we will see in more detail below.

Thus institutional lenders often insist on easily marketable collateral before advancing a loan. For a bank that is interested in making money, this is certainly a reasonable thing to do. For a poor would-be entrepreneur or farmer, however, this usually makes formal credit an infeasible option. They often lack collateral, and the collateral they typically possess is of a very specific kind. A farmer may have a small quantity of land that he is willing to mortgage, but a bank may not find this acceptable as collateral: the cost of selling the land in the event of a default may be too high. Likewise, a landless laborer seeking seasonal consumption credit might pledge his labor as collateral: he will *work* off the loan. However, no bank will accept that labor as collateral.

That brings us to *informal lenders*. But banish from your mind the image of a crafty moneylender, whose sole purpose is to lend money at exorbitant rates of interest to hapless borrowers. A majority of informal lenders in developing countries do *not* pursue usury as their sole occupation. Most of them are wealthy landlords, shopkeepers,

or traders dealing in the marketing of crops. For instance, landlords tend to give credit mostly to their tenants or farm workers, whereas traders might favor clients from whom they also purchase grain. The presence of the production or trade relationship facilitates the credit relationship.

When some types of collateral are unacceptable to formal lenders, the "right" sort of *informal* moneylender may be willing to take it on. A large landowner who has land adjacent to the tiny plot of a poor farmer may well find that plot acceptable as collateral (and indeed, may well be more interested in seizing the plot than in getting the loan back). An employer of rural labor might accept a laborer-borrower's labor power as collateral, in case he fails to repay. A trader-lender can accept a farmer's crop as collateral, especially if the trader is in the business of trading that very crop for a living.[4] It is no surprise, therefore, to find that formal banks cannot effectively reach out to poor borrowers, whereas informal moneylenders — the landlord, the local shopkeeper, the trader — might do a much better job. This interlocking of markets, or the conduct of business in different economic spheres (land, labor, credit, etc.) with the *same* partners, often make the terms of transaction in one market depend on terms and conditions in the other. That is a far cry from the impersonal and independent functioning of markets that characterizes most textbook economics.

There is another reason for the dominance of informal moneylending. Quite apart from the ability to accept collateral in "exotic" forms, the informal moneylender often has much better information regarding the activities and characteristics of his clientele. A trader who advances loans for working capital often has first claim on the farmer-borrower's output; he arrives with his truck at the field on the day of the harvest. A landlord has a better chance of knowing what his tenant is doing with a loan than any commercial bank can hope to have. A shopkeeper deals with her customers on a regular basis, perhaps even daily. Thus, even in countries where government efforts to extend formal credit are strong, the informal credit sector could well flourish.

Another very important response to the imperfection of credit markets is the rise of microfinance organizations. The pioneering organization came out of Bangladesh — the famous Grameen Bank started by Mohammed Yunus, who won the Nobel Peace Prize for his efforts. Microfinance refers to the financing of individuals or small businesses at tiny scales that a large bank would not even touch. They advance loans, often for working capital, but sometimes also to finance a startup business. Among the innovative features of microfinance organizations — again pioneered by Grameen — is the use of frequent repayment schedules involving very small sums of money, a practice that is meant to inculcate disciple and a sense of accomplishment among the borrowers as they see their debt whittled down slowly but steadily. Microfinance organizations have also experimented with *group liability*, a more controversial practice in which groups of individuals is held jointly liable for their debts.

[4]The fact that some agents will accept, say, labor as collateral when others will not, usually means that there is another imperfect market *elsewhere.* After all, why can't the bank accept labor as collateral and sell it if needed to a rural employer? Why can't it accept land and sell that land to a large landowner? There are several answers to these questions. The resale of labor power by a bank may be indistinguishable from slavery and, therefore, illegal. The resale of land may be constrained by informational problems. Finally, if a bank has limited funds that it wishes to disburse to the rural sector, there is no reason to suppose that it will willingly engage in these complex credit transactions with a multitude of small individuals, rather than conclude far easier and safer deals with a relatively small number of large borrowers. In any case, the general point is that imperfections in one market can feed into other markets.

19.3. The Risks of Credit

The previous section highlights two central features of the credit market that make it a difficult and risky institution. First, it is often very hard to monitor exactly what is being done with a loan. Perhaps the borrower's project is intrinsically problematic in a way that the lender cannot fully ascertain. Or perhaps borrowers come in different flavors or *types* (e.g., risky or safe, untrustworthy or reliable), and the lender doesn't know who is whom. Or even if the borrower's "type" is known, the loan may be taken for an ostensibly productive reason, but then diverted to other activities (including immediate consumption) that don't bode well for repayment.

The second feature is that borrowers typically have insufficient *collateral*, compared to what's needed to fully reassure the lender in the event of default. For a bank interested in making money, this is certainly a legitimate worry. For poor borrowers, however, this usually makes formal credit an infeasible option. More generally, inadequate collateral is a special form of *limited liability*. In the event of a default, there is only so much you can do to punish a defaulter. In most parts of the world, there is no debtor's jail: an economic default is not a criminal offense. Limited liability interacts with limited monitoring to create a set of problems that are specific to certain markets, and the credit market is one of them.

19.3.1. An Example. Paula is about to take a loan (at interest rate 10%). There are two projects, A and B. Each needs \$100,000 to start up. Project A has a 5% rate of return and B a 20% rate of return, meaning they will yield gross profits of \$105,000 and \$120,000 respectively. Would Paula and her bank agree in their choice of project? They would. The bank wants its 10% back, and so wants Paula to adopt the more productive project B. Paula is delighted to comply. Everyone is on the same happy page.

Now change matters a little bit, and suppose that A pays off \$140,000 with probability 3/4, and nothing with probability 1/4. That keeps its *expected* return unchanged at \$105,000. Assume that if a project fails, Paula declares bankruptcy and cannot return any money to the lender. Now the bank will have an even stronger preference for project B. Project A not only underperforms on average, it is now risky as well.

What about Paula's expected return? Assuming she is risk-neutral,[5] it is $120,000 - 110,000 = 10,000$ for the safe project, and it is $(3/4)[140,000 - 110,000] + (1/4)0 = 22,500$ for the risky project. Her expected return is higher under the *riskier* project with a *lower* rate of return. Paula and the bank no longer have congruent preferences![6]

What went wrong here? At the heart of it all is *limited liability*. With no collateral (but see below), Paula pays up if all goes well, but if the project fails, she does not repay. That creates a tendency for her to take on too much risk: she benefits from the project if it goes well, but is cushioned on the downside. Or at least that's how a bank might reason about Paula, *whether or not* Paula intends to indulge in such shenanigans.

We make two remarks on this example. First, Paula's limited liability not only creates a problem of potential default, but also exacerbates that problem (in the eyes of the

[5] A similar example can also be constructed even if Paula is risk-averse.

[6] You can (and should) check that the return will have to fall to \$120,000 before Paula begins to agree with the bank. For any successful return above \$120,000, she will want to pursue project A, but at these levels, project A is a really miserable endeavor from any social perspective.

bank) by an intentional distortion of project choice. But such an effect can also be generated even if Paula had just one project. Limited liability could attract the "wrong type" of Paulas; those armed with risky projects.

Adjusting the rate of interest to compensate the lender for this risk seems like an obvious reaction, but like many obvious reactions it is often wrong. The reason is that the interest rate premium itself affects borrower behavior, and it may spark off a higher chance of default. For instance, under the interpretation of many Paula-types, you can easily check that above an interest rate of 20%, *only* those Paulas with risky projects will remain in the credit market, thereby lowering the profits of banks even if the terms of their credit contract look lucrative on paper. More on this in Section 19.4.

Second, we should be careful not to pass moral judgment on these situations. Paula appears to display no social or civic responsibility whatsoever. Perhaps, but that's really not the point. It's not that she is genetically hardwired for irresponsibility. Change the example so that Paula puts up a collateral of $\$x$, which is kept by the lender in the event of a default. Her return is still \$10,000 under the safe project B, because no default occurs and she gets her collateral back. Under A, her expected return is now altered to $(3/4)[140,000 - 110,000] - (1/4)x = 22,500 - x/4$. She will still choose the lousy project A if $22,500 - x/4 > 10,000$, but will switch over to the good project when that inequality is flipped, or equivalently when she can put up collateral of at least $x = 50,000$. When that happens, the conflict between Paula and her bank vanishes.

With enough collateral, the bank would not care about Paula's choices, and indeed Paula would choose the project with the highest expected rate of return. But who can repay in all (or most) contingencies? They are the relatively *rich* borrowers, who can dig into their pockets to repay even if things go badly. A well-heeled Paula, otherwise identical to the poor Paula, would take less risk because her own money is at stake. We see here, then, in stark form, one important reason why banks discriminate against poor borrowers. Of course, such an observation is critically predicated on the assumption that the well-heeled can be made to pay for their profligacy. When they cannot be so made, we are back to a limited liability world: in it, the rich too will take excessive risk, as the financial crisis of 2008 (among others) made very clear to us.

Again, none of this means that there are no unilateral acts of economic honesty. Indeed, whether or not Paula is a responsible person is — after a point — irrelevant. It is enough for the lender to reason in the way that it *thinks* Paula will behave. Paula may be honest, but no bank will bet its money on that hypothesis.

19.3.2. A Typology of Risks. This example illustrates two features of credit markets. There is, first, the issue of what is colorfully referred to as *adverse selection*. A lender may not be sure of the characteristics of the borrower. Some could be inherently risky: they come attached to risky projects. Worse still, as already noted, this mix will generally be affected by the choice of the loan terms. For instance, as the lender raises the interest rate, the risk-composition of borrowers who are willing to enter into that contract could worsen. "Adverse selection" refers to the possibility that if a lender tries to cover itself — say, by charging a higher interest rate to compensate for a potential default — then that itself affects the composition of borrowers in an "adverse" way.

Second, even if a borrower is of known type, the lender may worry about just what the borrower will do once she has the loan. The funds could be diverted to meet other

needs — immediate consumption, medical expenditures, overly risky ventures — that cannot be easily transformed into monetary repayment. Even if no diversion occurs, the borrower may need to exert costly effort to ensure a good outcome. This problem is conceptually different from that of adverse selection. It is not that there are hidden borrower types. Rather, the question is whether a given type of borrower will exert due diligence. This class of problems has an equally colorful name: *moral hazard*.

The example in the previous section can be taken to include both these features. But there is a third risk that the example does not cover, which has both elements of adverse selection and moral hazard, but important enough to deserve its own classification. Recall another borrower, Guillermo, from Section 11.5.1 of Chapter 11, who contemplated a willful default depending on the amount of collateral that he put up. Gilberto was perceived by a bank to be in danger of default, but not because he was *unable* to pay. Rather, the bank surmised that he might be *unwilling* to repay. This is the problem of *strategic default*. Borrowers might deliberately choose (or be perceived by the banks to deliberately choose) not to repay a loan that they are capable of repaying. This sort of worry is especially pertinent in contexts where loan enforcement is weak. International credit arrangements are a case in point. An effective international court of law does not exist, and disgruntled lenders must take recourse to punitive measures that are often limited, such as the threat to advance no further loans, or to cease trading relationships. Either threat might be limited. For instance, trade cessation is vulnerable to objections from other groups in the lending country that gain from trade.

A similar problem plagues many developing countries. Internal courts of law are often weak or absent, and many lenders must rely on the same sorts of punitive mechanisms as in the case of international debt, such as the threat to advance no future loans. The less effective these threats, the more they constrain the operation of credit markets in the first place.

As already noted, morality isn't dead. ("I should repay.") But unless there are strong *economic* reasons for each individual to *consistently* participate in or conform to a particular economic institution, that institution must either adapt or die. A reliance on unilateral acts of generosity cannot undergird a reliable economic institution.

19.4. Adverse Selection and Borrower Risk

19.4.1. Introduction. In this section, we substantially extend and generalize the previous arguments to study project risk in credit markets. At the very outset, we distinguish between observable and unobservable features that might allow a lender to understand her borrower's risk characteristics. Clearly, an entrepreneur looking to expand an existing business is a safer bet than an individual entering the world of business for the first time. A landless laborer in poor health is high risk; a farmer who owns a pump set or has access to assured irrigation is low risk, and so on. So lending risk varies significantly from borrower to borrower, some of it in an observable way, as in the examples I've just chosen. However, to the extent that clients bear different risks that cannot be discerned by the lender, an additional dimension is added to credit market transactions—the interest rate now affects the mix of clients that are attracted, or the mix of projects that are chosen by clients — and therefore the average probability of default. This new dimension might give rise to a situation in which at prevailing rates, some people who want to obtain loans are unable to do so. At the same time,

lenders are unwilling to capitalize on the excess demand and raise interest rates for fear that they will end up increasing default probabilities to an extent that outweighs the higher contractual interest on their loans.

If this last statement sounds surprising, think of the example in Section 19.3.1. There, a risky project is often more attractive from the borrower's point of view, because in the event of project failure the borrower may be protected from repayment. Thus raising the interest rate may shut down the adoption of safe projects even though socially unattractive risky projects may still remain profitable from the point of view of the borrower. We use this idea as a starting point for an explanation of credit rationing.[7]

19.4.2. Risk and Borrower Returns. A borrower, call him Paaji, seeks a loan of B to start up a project, with (possibly risky) returns Y. There is limited liability: Paaji has some collateral $C < B$, but apart from this and whatever the project yields, cannot be made to repay any additional amounts in the event of a project failure.[8] In other words, if the rate of interest charged is r, then Paaji repays the debt if and only if

$$Y + C \geq (1 + r)B. \tag{19.1}$$

Put another way, Paaji loses all this collateral if $Y + C$ falls below $B(1+r)$, but otherwise he gets to keep the difference between Y and $B(1 + r)$, which could still mean a loss for him, but changes to a net gain once Y exceeds $B(1 + r)$. So Paaji's return viewed as a function of Y and r is given by

$$\max\{Y - (1 + r)B, -C\}. \tag{19.2}$$

Figure 19.1 illustrates this net return. It is flat (at $-C$) until Y goes above the full repayment threshold $B(1 + r) - C$, and then rises one for one with Y. On this Figure we can overlay various risky projects that Paaji might have access to. The Figure shows two, each with just two possible and equally likely values of Y: (a_1, b_1) and (a_2, b_2). Under either project, the lower value is too small for loan repayment while the larger value is adequate. Assume projects 1 and 2 have the same average return, so that $(a_1 + b_1)/2 = (a_2 + b_2)/2 = m$, as shown.

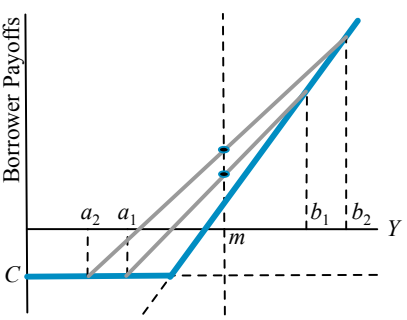


Figure 19.1. Net payoffs to borrower.

For each project, Paaji's expected net return is found by simply connecting the two net returns and taking their midpoint. The oval dots in Figure 19.1 show that *the riskier project yields higher expected net returns* for Paaji. If he could divert funds to this riskier project (moral hazard), he would. If there were many Paajis, each with projects of the same mean but varying risk, the risky Paajis would seek loans more eagerly than the safe Paajis (adverse selection). Other differences could qualify this assessment, but the point is that, *ceteris paribus*, there is a bias in favor of excessive loading on risk.

[7] The analysis that follows draws on Raj (1979) and Stiglitz and Weiss (1981).

[8] In the example in Chapter 11.5.1, the borrower was also threatened with other penalties, such as jail time. These can easily be incorporated with no qualitative change to the analysis.

19.4.3. Risk and Lender Returns. Now we introduce our lender, Raji. She gets all of $Y + C$ — but no more — if Paaji's return Y plus collateral C falls below $B(1+r)$, and $B(1+r)$ otherwise. Therefore Raji's return as a function of Y and r is:

$$\min\{Y + C, B(1+r)\}. \tag{19.3}$$

Figure 19.2 depicts this return. Raji's payoffs climb with Paaji's output Y, and then flatten out at $B(1 + r)$ as $Y + C$ crosses that threshold. We've also overlaid Raji's expected payoffs from the very same pair of projects. Note how the oval dot depicting Raji's expected return slides *down* as we move from the safer to the riskier project. Raji unambiguously prefers the safer project to the riskier project, as long as the two have the same mean returns. Raji's and Paaji's interests have emphatically diverged. Do you see the connection to our example in Section 19.3.1?

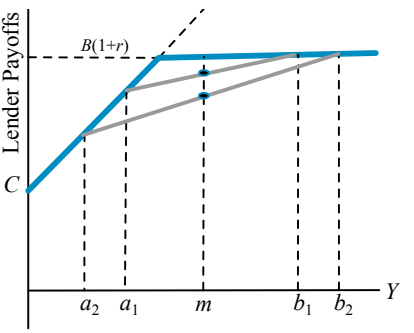


Figure 19.2. Net payoffs to lender.

If Raji raises the interest rate to compensate for default risk, she will also simultaneously worsen the composition of the project pool, as the relatively safe borrowers drop out of the credit market. Figure 19.3 shows this. A higher interest rate $r' > r$ means that the flat portion of Paaji's payoff will stretch out longer, as a higher value of Y is needed for $Y + C$ to exceed $B(1 + r')$. That pulls down both the returns from the safer and riskier projects, but as you can see from the Figure, the borrower's expected return from the safe project is the first to go negative — those projects will drop out of the borrower pool. The pro of a higher interest rate is that Paaji will pay more in the event that he does not default. The con is that the higher interest rate will affect that default risk to begin with. In the end, the "con" wins, as the success probability degrades.

Even if Raji is a monopolist lender, she would rather have excess demand for her loans, in the hope that her borrower pool will contain relatively safe types. Yes, there will be borrowers who would willingly sign a contract with her at even higher interest rates. But she knows that the mix of that borrower pool will be unacceptably risky.

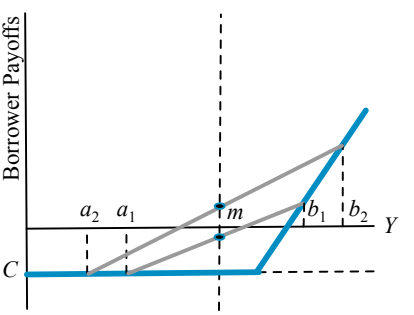


Figure 19.3. A higher interest rate degrades the borrower pool.

Our discussion illustrates an important feature of imperfect credit markets: that they often involve the *rationing* of loans. The textbook view holds that such rationing cannot exist. That is, with a shortage of loanable funds, the interest rate must rise so that the supply of and demand for loans is brought "into equilibrium." But here, the rate of interest has lost its power to equilibriate supply and demand, because its very movements can also serve to contaminate the borrower pool.

In the Appendix to this chapter, we show similar arguments apply to the deliberate *choice* of risk when a borrower can select from a variety of projects with different risk

characteristics. This is a problem not of adverse selection — the borrower pool is given and known — but that of moral hazard, in which borrowers deliberately take on more risk as their collateral comes down, or as the rate of interest is increased.

19.5. Moral Hazard: The Debt Overhang

19.5.1. Introduction. 1982 was the year of the sovereign debt crisis, a situation in which several countries in Latin America faced ballooning loan repayments to international creditors, exacerbated by a global spike in interest rates. Among the many dangers posed by this crisis was, of course, the emergent possibility of default, but a closely related issue was one of a looming *debt overhang*.

Imagine you owe lots of money, and are currently unable to repay. Your creditors are breathing down your neck. You could try and earn more money, but you know that your hard-earned pesos will go into debt service. It stands to reason that you may not want to make the effort to earn that extra peso. Entire countries felt the same way as well. "Oh, here is the IMF telling me to export more. But why export in the first place, if a huge percentage of those revenues will go back to my international creditors?" This is the debt overhang. It reduces the incentive to make costly investments in generating socially valuable returns. It is quintessentially a moral hazard problem.

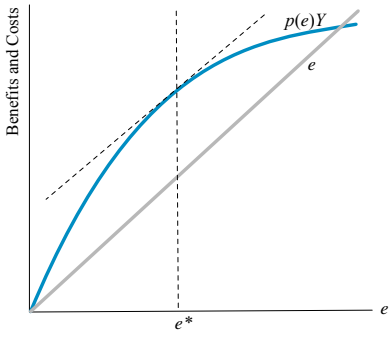


Figure 19.4. Effort under self-financing.

19.5.2. A Simple Model of the Overhang. Mei-Lien is an investor pursuing a project with setup cost B. Output takes either value Y (success) or 0 (failure). The probability of success, p, increases with Mei-Lien's effort into the project; call it e. Panel A of Figure 19.4 draws this probability *times* the success payoff Y as a function $p(e)Y$ of Mei-Lien's investment. We will presume that the function $p(e)$ is concave — as effort is ramped up, the extra gain in success probability flattens out.[9] The cost of investment is in money units, and so depicted by the straight line marked "e".

To begin with, suppose that Mei-Lien is an investor who is completely self-financed, and doesn't need to borrow any money. She will choose effort e to maximize her net profit, which is expected output net of effort cost and startup outlay:

$$p(e)Y - e - B \tag{19.4}$$

In terms of Figure 19.4, Mei-Lien wants to maximize the gap between $p(e)Y$ and e. (The term B is a constant and does not influence her choice.) That will happen at the "first-best" effort choice e^* which solves

$$p'(e^*)Y = 1, \tag{19.5}$$

where p' is the derivative of the success probability function p.

[9] The extension to more complicated success functions is straightforward, but our concavity assumption allows us to use the familiar "marginal cost = marginal benefit" exposition.

Now suppose instead that Mei-Lien must borrow to finance the startup, and takes a loan of B from a bank. Then $R = (1 + r)B$ is her total owed repayment, where r is the interest rate. The bank demands collateral for this loan, so Mei-Lien puts up what she has, which is some amount C presumably smaller than B, the amount of the loan. Now Mei-Lien makes her additional effort investment of e. Supposing that the success output is sufficient to make the repayment in full, and that in no case can Mei-Lien be made to pay up more than her collateral, it is easy to see that her expected *net* payoff is

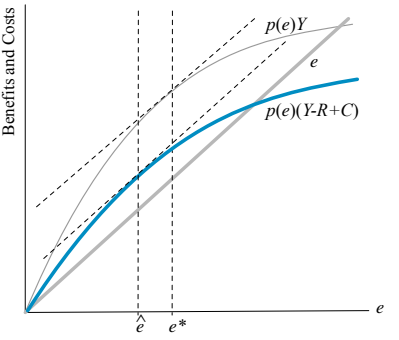


Figure 19.5. Debt and effort.

$$p(e)(Y - R) - (1 - p(e))C - e = p(e)(Y - R + C) - e - C \tag{19.6}$$

conditional on making an investment of e. She will now seek to maximize the expression in (19.6) instead of (19.4). That solution satisfies the condition

$$(Y - R + C)p'(\hat{e}) = 1, \tag{19.7}$$

as Figure 19.5 illustrates (again, you don't have to worry about the last term C in solving the maximization problem). By comparing (19.5) and (19.7) and appealing to Figure 19.5 for appropriate guidance, it is easy to conclude that $\hat{e}$ is smaller than the first best investment e^*. In words: when Mei-Lien is successful, part of her success goes into the pockets of her creditor. But that attenuates Mei-Lien's incentive to invest in the first place. The debt overhang — the looming prospect of *extra* repayment that hangs over a borrower's head — means that the borrower will always work less hard on a project used for debt repayment than one who needed no loan. Or at least she will be *expected* to behave in this way, which affects the terms that a lender will offer her.

19.5.3. The Interest Rate. As in the case of project risk, these considerations lead to an upper bound on the interest rate that can be charged on loans. A bank that charges an interest rate of r on its loan, leading to a demanded repayment of $R = B(1 + r)$, will obtain an expected payoff of

$$\pi = p(e)R + [1 - p(e)]C, \tag{19.8}$$

where the e in this expression is the *bank's* estimate of Mei-Lien's effort, as given by (19.7). A bank that anticipates such a response will realize that the larger its demanded repayment R, the larger is the debt overhang, and the lower will Mei-Lien's effort be.

Figure 19.6 summarizes the situation. The grey line depicts the trade-off we've just described. A higher demand R lowers e, and so this line, which we might call the *borrower's incentive constraint*, is downward-sloping. On the same diagram, we've overlaid some iso-profit curves of the lender, given by (19.8). The bank prefers larger values of R and e, so these iso-profit curves yield greater profits as we move to the northeast in the Figure. The lowest iso-profit curve is drawn for a profit level of $B(1+i)$ for some safe return of i elsewhere, which means that the bank just breaks even by dealing with Mei-Lien. With more lender power, the iso-profit curve would be higher.

If there is competition across different lenders for Mei-Lien, the combination of demanded repayment and Mei-Lien's effort will settle at the point E_c, with repayment demand equal to R_c. If some bank attempts to obtain a larger profit by offering to contract at, say, E, another bank can come in and undercut the first by offering a contract at a point such as E'. Mei-Lien will be only too happy to move to E' as her own payoff is larger there compared to E.[11] In this way, the system moves back to the equilibrium E_c.

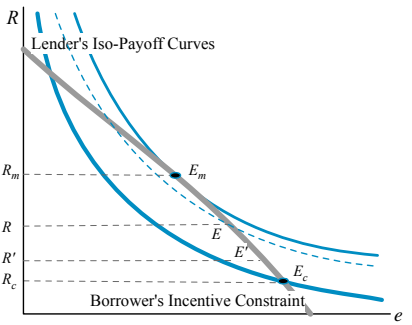


Figure 19.6. Repayment and Effort.

If, on the other hand, the lender enjoys monopoly power, it can freely set the interest rate (and the burden R). But even then, the bank is constrained in what it can do, as it fears that Mei-Lien could cut back on her effort These considerations rein in the monopoly bank. The highest iso-profit curve it can reach is at E_m, with an associated repayment demand of R_m. The repayment demanded is larger than in the case of competition, but it cannot be arbitrarily large.

19.5.4. The Effect of Borrower Collateral. Figure 19.7 studies the effect of changing Mei-Lien's collateral. Suppose that she is poorer, and can post a lower collateral. This has two effects. First, to achieve the same level of profit, the lender's isopayoff curves must shift up. That is because Mei-Lien pays out less in the event of a default, so a larger combination of (R, e) is needed to get to the same expected bank profit as before. Second, the borrower's incentive constraint moves down and to the left: for each stipulated R, Mei-Lien is now perceived as having less to lose (she has less collateral to relinquish) and and is therefore anticipated to reduce her effort. The joint effect of these changes is that the competitive equilibrium point E_c moves up and to the left. So the repayment burden and the interest rate rise.

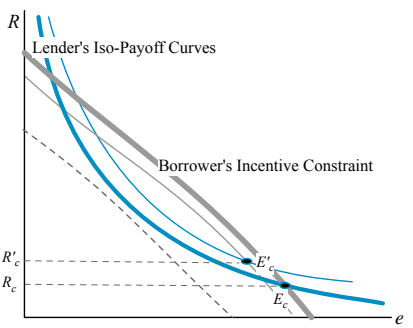


Figure 19.7. Lower collateral.

In this way, poorer borrowers are doubly cursed: apart from being poor to begin with, the terms of trade on the credit market also move against them.[12] It is even possible for the market to break down altogether. In Figure 19.7, that is shown by a situation in which the borrower's incentive constraint shifts down by enough to eliminate any intersection between it and the lender's iso-profit line, evaluated at the lender's outside option. Such borrowers will be entirely excluded from access to the credit market. We have already seen several examples of this double-curse in the book.

[11] As we move downward along the borrower's incentive curve, the repayment burden is lower, The borrower prefers that for any given choice of effort, and *a fortiori* after adjusting for optimal choice.

[12] This is true of any competitive situation in which the lenders are indifferent between lending and their alternative outside option. The double-curse observation may not apply when the lender is a monopolist and earns strictly more than its outside option.

19.5.5. Lender Power and the Social Surplus. As the bank's outside options improve and it acquires greater power, the equilibrium outcome E_c in Figure 19.6 moves up and left towards E_m. As that happens, the repayment burden climbs, and Mei-Lien's effort falls. It is possible to evaluate these changes from the social perspective of lender and borrower *combined*. A natural way to do that is to look at the sum of the payoffs generated to lender and borrower, or the "social surplus":

$$S \equiv \underbrace{p(e)(Y-R) - (1-p(e))C - e}_{\text{Borrower payoff}} + \underbrace{p(e)R + (1-p(e))C}_{\text{Lender payoff}} = p(e)Y - e,$$

where you should understand why social surplus collapses so nicely into the short expression $p(e)Y - e$ (everything else is just a cross-agent transfer). But we already know that this short expression is maximized at $e = e^*$; recall Figure 19.4. Moreover, Figure 19.4 also shows you that with a concave probability success function, the social surplus must decline as Mei-Lien's effort falls below e^*. And finally, we've already noted that as lender power rises, Mei-Lien's effort does indeed fall. We have therefore established the following important observation:

Social surplus declines as lenders acquire more power.

When lenders have power, they earn more profit by increasing the interest rate. The resulting debt burden reduces the borrower's incentive to spend effort, thus sending e below the first-best level e^*. Lenders understand this, but still do it as the higher interest rate gets them some extra money, at the expense of the social surplus.

The observation that equilibria with higher lender power are socially inefficient has broad implications for policy. Any change which reduces interest rates, or improves the bargaining power of the borrower will enhance effort and productivity. The latter involves institutional changes, such as a reallocation of property rights over relevant productive assets from lenders to borrowers, or an improvement in the latter's outside options. Note, however, that such policy interventions do not result in improvements for both parties. Accordingly such policies will tend to be resisted by the losers — in this case the lender — and may not actually be adopted.

19.6. Strategic Default

19.6.1. Introduction. We've already mentioned that strategic default was a central concern in the sovereign debt crisis of the 1980s. By the term "strategic default," I refer to a situation in which borrowers can pay their debt, but *choose* not to. In other words, it is possible to argue that all sovereign debtors could conceivably repay, though that might imply widespread acquisition of their assets by international creditors and widespread dislocation of the economy. Indeed, indebted governments have been threatened to various degrees, typically by countries where their creditors are housed. Even wars, occupations and invasions by lending countries are not ruled out, and historically they have been known to happen. But by and large, the creditor's options are limited in modern international relations, with options ranging from punitive trade measures, to seizure of foreign-held assets, or exclusion from future lending.

Interestingly enough, international debt has a lot in common with informal debt in developing countries. If a laborer or farmer defaults on their loan, it is not as if the legal system comes automatically into play. For one thing, many informal debt arrangements are not codified in the form of a legal contract, and even if they were,

there are limits to what a slow and lumbering legal system can achieve. The threats are therefore eerily reminiscent of international threats: exclusion from future credit, cessation of other economic or social relations, even violence.

To explain the main considerations that are involved in a setting of strategic default, we deliberately consider a model in which risk and effort play no role. Instead, our story emphasizes a third aspect of credit markets: that it is often a *repeated* relationship. Specifically, we study a working capital relationship in which a borrower takes a loan from a lender to finance current production, year after year. But the possibility that the borrower might make off with the principal and interest at any date casts a shadow over the relationship. Absent an institutional structure that legally enforces repayment, the lender must resort to the carrot of *future* loans to ensure that the *current* loan is repaid. Along with the carrot comes a stick: if a loan is not repaid, all of the lender's dealings with the borrower will cease. Whether that threat of cessation is good enough depends on the other options at the borrower's disposal. It is easy enough to augment this deliberately minimal story with other devices to encourage repayment, such as social exclusion or the threat of violence. But let's understand the basics first.

19.6.2. A Repeated Relationship. Assaf is a hardworking rice farmer, whose cultivation depends on working capital — to hire pre-harvest labor, rent a water pump set for irrigation, purchase fertilizer and so on. Instead of tracking all these inputs separately we presume that his rice output Y directly depends on working capital L. That is, $Y = F(L)$. The mnemonic L reminds you that Assaf's working capital comes in the form of a loan L. So $F(L)$ is the "reduced form" of a production function: L is used to purchase inputs that then enter produce Assaf's output. As we did in the last section, we begin by calculating what Assaf could do if he could self-finance his working capital. Then his optimal choice of L is given by maximizing

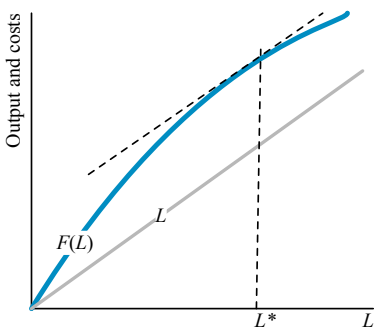


Figure 19.8. Working Capital.

$$F(L) - L,$$

with respect to L (we could additionally account for foregone interest by Assaf, but leave that out here for simplicity). Assaf maximizes the vertical distance between $F(L)$ and L, which means that his optimal investment L^* satisfies the first-order-condition

$$F'(L^*) = 1. \tag{19.9}$$

where F' is the derivative of output with respect to L, and is therefore the marginal product of L. See Figure 19.8 for a graphical illustration.

19.6.3. Borrowing and the No-Default Constraint. But Assaf isn't a self-financing investor, he's a borrower. Meet Aarya, his landlord, who fronts the loan of L every year and asks for a repayment of R in return. Assaf's net payoff from this relationship is $F(L) - R$ (his output net of the repayment burden). Now, if Assaf defaults on the loan, that is the end of the relationship, and he must then make ends meet in some

other way. Aarya certainly won't advance him a cent again. If that default does occur, we summarize matters by saying that *thereafter*, Assaf will only have access to some per-period value of v at every succeeding date. This is his "post-deviation option."

Let's pause to see what such an option might consist of. Maybe Assaf gives up farming and enters the labor market, in which case v is to be interpreted as the income he can expect to earn. Or perhaps he farms without any access to loaned capital, effectively using his own resources as best as he can, in which case v is the (reduced) value of his farming activity. Or perhaps Assaf might find another lender, who lends him $\hat{L}$ and charges $\hat{R}$, in which case $v = F(\hat{L}) - \hat{R}$. See Section 19.7 for more.

We can now calculate the incentive for borrower compliance. If Assaf defaults on the loan, he gets to keep $F(L)$ today — without returning R — and from tomorrow he gets v every period, so his overall lifetime payoff from defaulting is given by

$$F(V) + \delta v + \delta^2 v + \ldots = F(L) + \frac{\delta v}{1-\delta}, \tag{19.10}$$

where $\delta \in (0,1)$ is his discount factor. But if he *does* repay now and later, then:

$$[F(L) - R](1 + \delta + \delta^2 + \ldots) = \frac{F(L) - R}{1-\delta}. \tag{19.11}$$

From expressions (19.10) and (19.11), we can deduce that Assaf will willingly repay his loan if doing so yields a larger payoff than defaulting, or in other words, if:

$$\frac{F(L) - R}{1-\delta} \geq F(L) + \frac{\delta v}{1-\delta}.$$

Rearranging, we get the condition

$$\delta[F(L) - v] \geq R. \tag{19.12}$$

This is Assaf's *no-default constraint*. It is analogous to the incentive constraint in Section 19.5.3, but it is a distinct object that ensures repayment, as opposed to incentivizing effort.

It's easy enough to modify the no-default constraint if Assaf has collateral. For instance, part of his harvest might be seized in the event of default. That would alter equation (19.10), because Assaf would lose his collateral in the event of a default. The no-default constraint would be adjusted to accommodate the presence of collateral, and the rest of the analysis would proceed exactly as it is about to do.

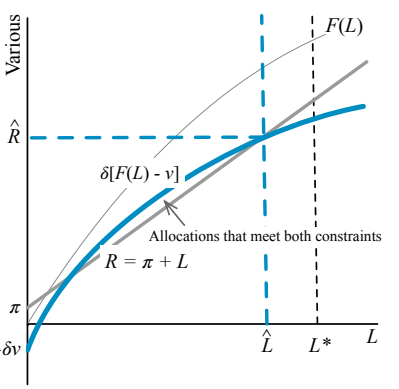


Figure 19.9. No-default equilibrium.

19.6.4. No-Default Equilibrium. An equilibrium between Aarya and Assaf must ensure that the loan-repayment combination provided by Aarya to Assaf incentivizes the latter to repay; i.e., (19.12) holds. At the same time, Aarya must obtain some minimum profit from the activity, which represents her next-best alternative. If we denote this minimum profit by π, then it must be the case that from Aarya's perspective,

$$R - L \geq \pi. \tag{19.13}$$

We combine these two objects in Figure 19.9. The no-default condition for Assaf is shown in blue, while the minimum profit condition for Aarya is depicted in grey (the thin lines are there to remind us of the the original production function and the self-finance cost, as was shown in Figure 19.8). As long as the grey line is *below* the blue line, the no-default constraint holds, so the set of all loan-repayment parameters that satisfy both (19.12) and (19.13) is the area between the blue line on top and the grey line below. Assaf would like to be offered a contract on the corner of this area furthest to the right of the diagram, and indeed, if there is competition between a large number of Aaryas, that is precisely where Assaf will end up: see the loan offering $\hat{L}$ with accompanying repayment $\hat{R}$.[13]

19.6.5. Lender Power and the Social Surplus. A central parameter of this exercise is lender profit, π, which is a measure of the degree of competition across lenders. Figure 19.10 studies this case. If π increases as shown in that diagram, the iso-profit line shifts up and the equilibrium loan size declines: credit rationing becomes more acute. Additionally, the interest rate r implicit in the arrangement also rises; after all, we know that $r = (R/L) - 1$, so r will move in tandem with R/L. But this latter ratio is captured by the slope of the line that connects the equilibrium point to the origin of the graph. As that equilibrium slides to the left, this slope becomes steeper; this swivel is captured in the rotation of dashed angular lines in Figure 19.10.

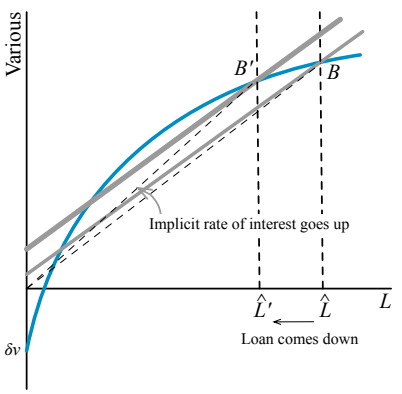


Figure 19.10. Change in lender profit.

It is worth noting (again) that there is a limit to interest rates even if the lender has unlimited power. Continue to mentally slide up the lender iso-profit line in Figure 19.10, and you will see that after a point, there will be no feasible solution to the borrower's no-default constraint. There is a limit to lender profit that simply cannot be pushed further by raising the interest rate, as this will induce a strategic default.

As in the debt overhang of Section 19.5, our exercise has implications for the social surplus. That surplus is the sum of equilibrium payoffs to Assaf and Aarya, which is given by

$$S \equiv \underbrace{Y - R}_{\text{Borrower payoff}} + \underbrace{R - L}_{\text{Lender payoff}} = Y - L = F(L) - L,$$

which shows that overall surplus is just $F(L) - L$, which is intuitive considering that R is only an internal transfer between the two parties. Now we can recall our benchmark case from Section 19.6.2, where Assaf had his own funds. Notice from Figure 19.8 how the social surplus is maximized at L^*, but then steadily falls as the loan size moves away from L^* to the left. But that is precisely what happens when lender profit goes up. We must therefore conclude, just as we did in Section 19.5, that an increase in lender

[13] If the first-best solution L^* along with the repayment $L^* + \pi$ is also part of the feasible set, then the no-default condition is "not binding." But the important case is where it *does* bind, otherwise the default problem would not be a serious one. That's the case we focus on here.

power leads to a fall in social surplus. While the two models are different in terms of the specific imperfection they highlight, they have this common implication.

19.6.6. Outside Options. As a final exercise, I'll focus on a feature that is special to a model of strategic default, which is the outside option v. As already noted, v summarizes what is going to happen to Assaf in the event that he defaults. It includes some options (loan sharks, perhaps, or a change in occupations), and it excludes others (for instance, Aarya might never lend to Assaf again). Figure 19.11 illustrates the effect of *decreasing* Assaf's outside option. That could happen, perhaps because Aarya is more successful in getting other lenders to exclude Assaf, or because some occupational choices are additionally shut off post-default.

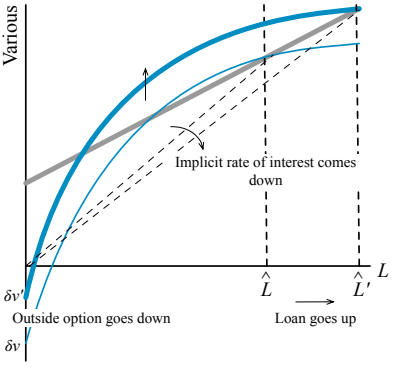


Figure 19.11. Change in outside options.

As you can see from equation (19.12) and Figure 19.11, a fall in the value of the outside option causes the no-default constraint to undergo a parallel *upward* shift, moving the equilibrium point to the right and generating a larger equilibrium loan. By the parallel argument that we used for lender profit (see Figure 19.10), the equilibrium interest rate falls.

This is an interesting finding and I want you to think about it a little. Assaf's outside options are *worse*, but the loan contract gets *better*, and he is consequently better off within the relationship when his outside options worsen. This apparently contradictory finding is easily resolved. A worsening of outside options translates into greater credibility of repayment: Assaf is demonstrably more eager to stay within the relationship, so larger loans can be made to him without fear of default. If lenders are competitive and stay at the same profit level as before, then all the extra surplus from this greater credibility accrues to Assaf, who is therefore better off. Moreover, social surplus $F(L) - L$ also rises, as L now moves closer to the first-best level L^*.

Assaf's improved credibility would, however, be exploited if Aarya were a monopoly lender. She would then push her isoprofit line as high as possible, so that it is tangent to Assaf's no-default locus in Figure 19.11. A fall in the borrower's outside option leads to a parallel shift in that locus, but Aarya would also shift up her iso-profit line to squeeze all that surplus out in the form of less-favorable loan terms. The borrower's greater credibility allows for larger social surplus, just as before. But a monopoly lender will not contribute to an increase in that surplus, instead asking for a higher repayment.[13]

Adverse Selection and Moral Hazard: A Field Experiment in South Africa

Asymmetric information is one of the most important aspects of insurance and credit markets, arguably even more so in developing countries, where a well-developed information market is far from available. There are two main types of information asymmetries:

[13] If you've read this carefully, you will see that the new no-default curve is parallel to the old. So the new tangency of Aarya's iso-profit line occurs at an unchanged loan size. There is no change in social surplus.

Typically, the borrower will have access to more than one moneylender. He may therefore be tempted to default on the loan from the current lender and switch to another source when the current lender refuses to deal with him any further. Indeed, in Section 19.6, it was precisely this fear that forced the lender to offer the borrower some premium or surplus on the loan over and above his opportunities elsewhere. Clearly, the existence of alternative sources of credit strengthens the incentive to default. How do lenders tackle this problem, apart from building repayment incentives into their credit transactions?

One possible answer is that a lender-enforced system of reputations helps to discipline borrowers. If a borrower defaults in his transactions with one lender, this may destroy his reputation in the market and mark him as a bad risk. As a result, *other* lenders may be reluctant to lend to him in the future. Clearly, this requires that information about the borrower's default action be spread throughout the lending community. So a lender must eagerly want to make a default public. Or he would certainly want to profess such eagerness in advance to a borrower.

Is the rapid spread of default information a reasonable postulate for informal credit markets? It depends. In the informationally sophisticated credit markets that prevail in industrialized countries, credit histories are tracked on computer networks: a bank or credit agency can learn about a person's past offenses at the touch of a button, and the ability to learn this information quickly acts as a device to discipline the borrower. At the other extreme, consider traditional village societies with limited mobility. Community networks are very strong in these societies: everyone knows about everyone else. This may not be very pleasant if you are involved in a discreet love affair or don't like gossip, but these networks have social value: they act as credible sanctioning devices in situations where a computerized credit agency is missing. A violation of contractual promise against one party will not go unnoticed by others, who will limit their dealings with the offender as a result. There may even be other forms of social sanctions and censure imposed on the deviant. These threats permit acts of reciprocity and cooperation (including the granting and repayment of loans) that would not be possible otherwise.

As societies develop, mobility increases and traditional ties fall apart. Over time, informal information networks are replaced by the anonymous devices that we see in present-day industrialized societies. However, the replacement may be a long time coming. Hence, there is a large intermediate range of cases where the flow of information slows to a trickle. This is the transitional stage in which many developing countries find themselves. Indeed, it is perfectly reasonable to postulate that information flow follows a U-shaped pattern: both traditional and economically advanced societies have a lot of it, whereas societies in transition do not.

In intermediate or transition societies, a lender who meets a new loan applicant has few ways (or perhaps very costly ways, involving a great deal of time and a lot of painstaking enquiry) of knowing about the applicant's past pattern of behavior in credit relationships. In such a situation, a borrower has no fear of a tainted reputation due to default. What prevents the borrower from periodically defaulting and then switching sources? In addition, if this is going to be the case, why does any lender lend to him in the first place?

To be sure, such a situation is not a rarity. We have already seen that many borrowers are excluded from access to credit and that a history of borrowing is often necessary for loans. The box on informal credit markets in Pakistan underlies these trends. At the same time, informal credit markets *do* function, so we cannot fall back exclusively on the argument that credit markets must *completely* break down in the absence of information.

In the face of limited information about the past behavior of borrowers, lenders have two sorts of reactions. The first possibility is that they check out a new borrower with a great deal of wariness (see the box on Pakistan or studies such as Siamwalla et al. 1993). The lender might expend effort and money to check the credentials of the borrower, to see that he is indeed a good risk.

The phrase "good risk" is significant. A lender wants to know whether a borrower has defaulted in the past simply because this provides a clue as to whether the borrower concerned is an *intrinsically* bad prospect. However, we must conceptually distinguish between borrowers who are intrinsic cheats and borrowers who are opportunists in the sense that the no-default constraint did not hold for them, because the terms of the credit contract did not prevent default. If only variations in the latter are true and there is no variation in the *intrinsic type* of the borrower, a lender gains no information from knowing that a borrower has defaulted in the past; he might as well devise a loan straight away that satisfies the no-default constraint. There is little to gain by checking out the past history of a borrower.

When this is the case, the credit market breaks down entirely. If lenders do not screen borrowers, then any lender who advances a loan will indeed be defaulted upon. We therefore realize that the screening efforts of a lender have enormous (positive) externalities: they prevent default on the loans of *other* lenders. However, externalities, as we well know, are not sufficient cause for someone to exert effort: he will only do so if it benefits *him*. In the present context, this means that intrinsic uncertainty about the types of borrowers, namely, the possibility that some borrowers are more default-prone than others, enables the credit market to function where otherwise it would collapse! The presence of bad types creates careful lenders, who regard past defaults as signals of intrinsically bad risks. To avoid being branded, good risks (who may be opportunists, nevertheless) *do* repay their loans.

We may therefore state the following points. First, the incentive to check out a new borrower actually enables a credit market to function by creating the fear that a default may block of access to future credit. Second, the incentive to screen a fresh borrower depends on the belief that some borrowers are intrinsically bad risks. Combining these two points, we see, paradoxically enough, that the presence of some bad types is essential for the functioning of a credit market under limited information, albeit at some reduced level.

The same is true of what we might call *testing loans*. Lenders may wish to start small and increase the loan size if borrowers return the smaller loans. These small loans serve as indirect tests of the borrower's intrinsic honesty. The point is that even honest borrowers must be subject to these initial testing phases. Taking the argument one step further, we may conclude that the presence of testing loans serves as an incentive for (honest but opportunistic) borrowers to repay, because they know that if they default,

they will be subject to the slow build-up of cooperation that characterizes any new relationship, and this is costly to them.

Observe that in a sense, the market solves one kind of information failure (the lack of information on past defaults) by relying on an *additional* failure of information (lack of knowledge about intrinsic types). Because of the second failure, lenders have some incentive to screen borrowers or provide small test loans at the beginning of a relationship, and the existence of this phase acts as a deterrent to the destruction of an established relationship.[15]

The Cost of Information and the Credit Market: Chambar, Pakistan

As countries begin to develop and industrialize, the traditional rural structure of closely knit, isolated village communities begins to disintegrate. A great deal of mobility is created: people move from village to village, from village to town, and from town to city in response to the growing demands of commerce and trade. Access to markets in distant regions develops and people increasingly enter into transactions with strangers instead of neighbors. At the same time, the introduction of modern inputs into agriculture (e.g., fertilizers, pesticides, pump sets for irrigation, etc.) creates a surge in the need for credit and working capital.

In this environment of relative anonymity, the problem of loan recovery becomes particularly acute. Traditional community pressure can no longer be relied upon nor are there well-developed channels of information flow as in developed countries (e.g., computer networks tracking the credit histories of each individual customer, which banks and credit agencies invariably check before advancing a loan or credit line to a customer). Consequently, a farmer or worker may default on a loan from a moneylender in one town or village and approach another lender in another town for future loans, with very little risk that his past crime will be known in the new place. What prevents such aberrant behavior? How do credit markets deal with the enforcement problem in an environment of considerable mobility and borrower anonymity? A field study by Irfan Aleem of the Chambar region in the Sind district of Pakistan, provided some important clues and insights.

Chambar is a flourishing commercial region. An estimated sixty moneylenders serviced the area at the time of Aleem's study. Of these, fifteen were based in the main town of Chambar, fifteen in the three largest villages, and of the remaining thirty, a majority operated from smaller towns in the vicinity (within a radius of twenty to fifty miles). Obviously, borrowers have potential access to many different lenders and communication across all of them is weak or absent. Making borrowers repay is naturally a precarious task in such an environment.

However, the informal credit market is unusually successful in this respect: of the fourteen moneylenders interviewed by Aleem, twelve reported that less than 5% of their loans were in default.[a] This stands in sharp contrast to the average rate of default of around 30% experienced by formal sector banks and lending agencies, and is all the more remarkable in light of the fact that eleven of the fourteen lenders did not ask for any collateral at all.[b] What explains the low default rates?

It seems that limited information and the associated hazards of lending have prompted moneylenders to build up tight circles of trusted clients, and they are unwilling to lend outside the circle. It is this sharp segmentation of the market that induces most borrowers

[15] For theories that build on this idea, see Ghosh and Ray (1996, 2010), Kranton (1996), and Watson (1996).

to comply with contractual terms: a defaulting borrower, who is removed from the good books of his current lender, will find it extremely difficult to find a new loan source. Thus, apparent competition between lenders and free access to multiple sources is *actually* restricted due to informational limitations, and this restriction, in turn, helps to solve the moral hazard problems that such informational limitations give rise to.

Before taking on a new client, a moneylender usually takes various precautionary measures. It is almost always the case that the lender chooses to deal with the applicant in other markets (e.g., employing him on his farm or purchasing crops from him) for at least two seasons (i.e., for about a year) before advancing a loan, if at all. Such dealings provide some information about the loan applicant's alertness, honesty, and repayment ability. Nine out of the fourteen lenders interviewed were unwilling to give a loan without such previous interaction. Over and above this, lenders also extensively scrutinize a new client. Such scrutiny usually takes the form of traveling to the client's village and conducting interviews with his neighbors and previous business partners to assess his reliability and character. Most lenders also pursue various side businesses, such as trading in crops and retailing, so the considerable amount of time involved in information collection carries a high opportunity cost—on the order of about Rs 20[c] per day spent. It was estimated that on the average, the cost of administering the marginal loan (including the cost of initial screening and possible subsequent cost of chasing an overdue loan) was 6.54% of the loan's value.

If, after the intense screening and period of waiting, the lender agrees to advance a loan (the rejection rate for new loan applicants was around 50%), he usually begins with a small "testing loan." Most reliable information about a trading partner's characteristics can come from the experience of actually dealing with him; no number of enquiries can reveal what actual interaction will tell. Carrying out transactions with the person concerned is, therefore, the ultimate "experiment" that will reveal his characteristics. However, the experiment is risky and hence lenders exercise caution at the beginning. Only when the testing loan is duly repaid does the lender increase his trust in the client and hence increase the loan amount to match the latter's needs.

It is precisely the aforementioned factors—by-products of imperfect information—that help to discipline most borrowers. If a borrower defaults on a loan from his current lender and consequently his access to loans from the same lender is cut off, he can apply for credit from a new moneylender, but then he will have to go through a lengthy waiting period, an intense scrutiny (in the process of which the new lender's suspicion may be aroused and the application rejected), and even after that, a period of tightly rationed credit. The temporary gains from a default can be easily outweighed by these subsequent penalties.

In addition to the administration cost of loans, there are of course capital costs, which include the opportunity cost of the money lent, a premium for bad or unrecoverable debt, and interest lost on loans overdue.[d] The mean capital charge for the fourteen lenders was 38.8% for the marginal loan, whereas for the average loan, the corresponding figure was 27%.

The main reason the marginal cost is greater than the average is that most lenders had to borrow from other informal sector lenders at the margin: typically, 50% of the lender's funds came from his own savings, 30% from institutional sources (either directly from banks, or indirectly from wholesalers, cotton mills, etc., who had access to bank loans), and the remaining 20% from other institutional lenders or clients who used him as a safe deposit (at zero interest) for surplus cash. These figures indicate that moneylenders siphon off a considerable amount of funds from the formal sector, and in this way engage

in arbitrage between the highly segmented formal and informal sector markets (compare with the Philippine case). The overall rural credit market was, in its own peculiar and imperfect way, integrated.

The interest rate charged on average in the sample was 78.7% per annum. However, there was considerable variation—from a low of 18% (still higher than the 12% charged by banks) to a high of 200%. However, in light of the previous text, much of this high rate of interest can be attributed to the high information and administration costs of loans in the informal market. In fact, Aleem estimated that in most cases, the rate of interest was roughly the same as the average cost of funds, which implies that lenders made close to zero economic profits. It appears that the informal credit market in the region is most closely described by a model of "monopolistic competition" (see Hoff and Stiglitz [1998]). The ease of entry into the lending business keeps profits at zero, yet moneylenders enjoy some degree of monopoly power over their established clientele, because their superior information about the characteristics of their long-standing clients gives them an edge over competing lenders in their own market segment.

[a] In the remaining two cases, the highest rate of default is 10%.
[b] Of the other three, the percentages of their total secured loans were 2, 5, and 10%.
[c] In 1981, the exchange rate averaged Rs 9.9 to a dollar.
[d] In a majority of such cases, interest was waived for the period of delay, for the sake of improving the chances of recovering the principal and basic interest.

Appendix: Moral Hazard in Project Choice

19.7.1. Introduction. Next, we study moral hazard in project choice. In contrast to adverse selection, a borrower is not attached to a risky project but rather chooses a project from a set of options. As before, let B denote the setup cost of a project and $C < B$ the borrower's collateral. We are going to assume that there is a whole range of projects that our borrower can choose from. Let use the notation θ to index this range. To each index θ is associated a project: with probability $p(\theta)$ the project is successful, and an output $Y(\theta)$ is produced. With probability $1 - p(\theta)$, the project yields nothing.

It will be convenient to arrange the project index so that higher indices θ are associated with a lower value of $p(\theta)$: that is, the projects increase in risk. Without loss of generality, we can assume that $Y(\theta)$ is increasing in θ. For if $p(\theta)$ and $Y(\theta)$ are both declining, then no-one — neither borrower nor lender — will ever choose such a project. We may as well eliminate such projects from our menu to begin with.

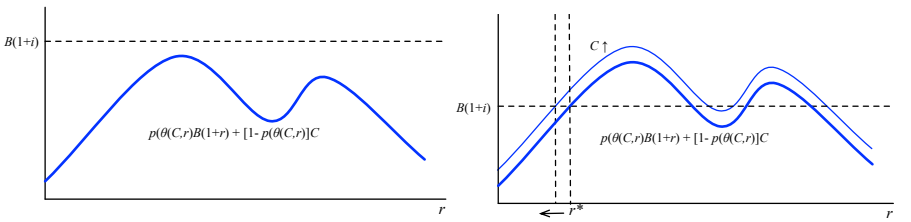
A borrower who puts down collateral C and faces a rate of interest r will choose θ to maximize

$$p(\theta)\,[Y(\theta) - B(1+r)] - [1 - p(\theta)]\,C, \tag{19.14}$$

where of course we can presume that success output exceeds the value $B(1 + r)$, otherwise the borrower would not borrow at all.

19.7.2. Lower Collateral and Higher Interest Induce Risk-Taking. We suppose that a unique maximum choice exists for every value of collateral C and the interest rate r. Call this special choice $\theta(C, r)$, where the arguments inside the function emphasize that the choice depends on both C and r.

Here is the main proposition of this section:



(a) Complete Breakdown **(b)** Functioning Market

Figure 19.12. Equilibrium Interest Rate With Collateral C.

PROPOSITION 19.1. *$\theta(C, r)$ is decreasing in C and increasing in r: lower collateral induces risk-taking, and so do higher interest rates.*

We prove this proposition by the use of a "revealed preference" argument. Define $Z = B(1 + r) - C$, and convince yourself by examining the expression (19.14) that the borrower equivalently chooses θ to maximize

$$p(\theta)[Y(\theta) - Z]$$

Let $Z_1 > Z_2$ and θ_1 and θ_2 be the corresponding maxima. Then by the assumed uniqueness of the maximum,

$$p(\theta_1)[Y(\theta_1) - Z_1] > p(\theta_2)[Y(\theta_2) - Z_1],$$

while

$$p(\theta_2)[Y(\theta_2) - Z_2] > p(\theta_1)[Y(\theta_1) - Z_2].$$

Adding these two inequalities, we can conclude that

$$[p(\theta_1) - p(\theta_2)](Z_1 - Z_2) < 0. \tag{19.15}$$

We can therefore conclude that $p(\theta)$ is decreasing in Z.

Now it is easy to complete the proof of the proposition. Imagine that collateral goes up. Then by the definition of Z, Z comes *down*. It follows from the inequality in (19.15) that the new optimal choice of θ exhibits a higher value of $p(\theta)$ — less riskiness.

Similarly, suppose that r goes up. Then Z goes up. Once again, it follows from the inequality in (19.15) that the new optimal choice of θ exhibits a lower value of $p(\theta)$ — more riskiness.

19.7.3. Competitive Equilibrium. For a person of given collateral C, if

$$\max_r p(\theta(C, r))(1 + r) < 1 + \bar{r}$$

where $\bar{r}$ is the opportunity rate of return to funds, *no* loan will be made to such a person at *any* rate of interest. He will be completely rationed out. This is the case shown in panel A of Figure 19.12.

If, on the other hand, the opposite inequality holds above, then there is scope to lend to such a borrower, and we are Panel B of Figure 19.12. Competition among lenders will drive the interest rate to r, where

$$p(\theta(C, r))B(1 + r) + [1 - p(\theta(C, r))]C = B[1 + \bar{r}].$$

There may be many solutions to this equation (in r), but Figure 19.12 tells us how to pin down the competitive outcome to the *smallest* of the solutions that solve the equation. Anything higher, and a competitive lender can undercut you and make a profit.

Now raise C; then by our previous result $p(\theta)$ goes up. So the wavy line in Figure 19.12 shifts out as shown, and the equilibrium interest rate r must fall. Under competition the interest rate on loans moves inversely with collateral.

With monopolistic lending, matters are not so clear, which makes sense. A monopolistic lender may well take advantage of a highly collateralized (and therefore safe) borrower to push up the interest rate. I leave it to you to examine whether r must rise with C over *some* stretch of collaterals.

Appendix: The Changing Borrower Pool: An Example

Suppose that borrowers come in two equally-sized flavors, indistinguishable by the lender: call them *safe* and *risky*. Each type needs B to invest in a project. The safe type generates a sure return of $Y = m$ ($m > B$). For the risky type, Y takes two values: $M > m$ with probability p, and 0 with probability $1 - p$. Let's assume that our lender lends to just one borrower, and can freely set the interest rate without fear of losing his clients to competing lenders. (The same story works with competitive markets, but it's just simpler to tell it this way.)

The net return to a safe type is $m - (1 + r)B$, so she will want to borrow as long as r is below $r_1 = m/B - 1$. The risky borrower's expected return is $p[M - (1 + r)B]$, so the maximum rate she is willing to pay is $r_2 = M/B - 1$. Because $M > m$, we have $r_2 > r_1$. This is an immediate consequence, but an important one. Observe that the risky type could be a worse borrower, not only in the sense of being risky, but even in the sense that her *expected* output, which is pM, is lower than m. She will be willing to borrow at interest rates between r_1 and r_2, *even when* the safer (and possibly more productive) type has dropped out.

If the lender charges r_1 or below, both types of borrowers will apply for the loan. The lender cannot tell them apart, so effectively he gives the loan at random to one of the applicants. On the other hand, if a rate slightly higher than r_1 is charged, the first type drops out, and the pool of borrowers abruptly worsens — from a mix of safe and risky to just plain risky. (The abruptness is only a consequence of there being just two types: with many types, the pool would worsen more smoothly.) The lender can then go all the way up to r_2 without fear of losing all his borrowers. In short, the lender's choice is then really between the two interest rates r_1 and r_2. Which should he charge?

Suppose the lender charges r_2. His expected profits are then given by

$$\Pi_2 = p(1 + r_2)B - B. \tag{19.16}$$

On the other hand, if the lender charges r_1, he faces both types of borrowers with equal probability. His expected profits are then given by

$$\Pi_1 = \frac{1}{2}r_1 B + \frac{1}{2}[p(1 + r_1)B - B]. \tag{19.17}$$

Faced with these two options, the lender may well charge the lower rate. The lower rate yields a lower return, but yields that return for sure. The higher rate yields a higher

return, but only in the event that the borrower is successful. Using equations (19.16) and (19.17), you can easily check that $\Pi_1 > \Pi_2$ as long as

$$p < \frac{m}{2M - m}. \tag{19.18}$$

This condition is important! It tells us that if the high-risk type is "sufficiently" risky (remember, a lower p means a higher chance of default), then the lender will not raise his interest rate to r_2, thereby attracting the risky type. Instead, he will stick to the lower level r_1 and take the 50-50 chance of getting a safe customer. Raising the interest rate would drive away the good type, and the higher (possible) return cannot compensate for the lowered chance of repayment.