b. Now suppose the bank cannot differentiate between types. Which of the borrower types will it lend to?
c. Suppose that there is another lending option in this community: a moneylender. This moneylender offers loans with a new feature: if you do not pay back your debt to the moneylender, he will smash your kneecaps. The value to the borrower of smashed kneecaps is –$200. The value to the moneylender is zero. In all other ways, the moneylender is identical to the bank. Would the moneylender be willing to lend in the first place, and would anyone enter into such a dangerous contract with the moneylender? Briefly explain your answers.
d. Assuming that neither banks nor moneylenders can distinguish between borrowers' types, are borrowers better off or worse off when kneecapping contracts are available? Explain why and what kind of problem, if any, smashing kneecaps solves.
e. Briefly explain how things might change if borrowers had some positive wealth.
f. This is a typical adverse selection exercise. Briefly explain how the reasoning would differ or stay the same if this had been an exercise focusing on moral hazard.

3 Roots of Microfinance: ROSCAs and Credit Cooperatives

3.1 Introduction

Even without microfinance, poor households' lack of collateral does not mean a complete lack of access to financial intermediation. To the contrary, poor households typically have multiple credit sources in village economies, as well as informal ways to save and insure. In a 1990 survey carried out in rural Indonesia, for example, Mosley (1996a) reports that as many as 70 percent of the households interviewed borrowed from informal lenders, a figure in line with studies of informal economies elsewhere.

An intensive view of informal finance is obtained in the "financial diaries" of poor households in Bangladesh, India, and South Africa collected by Stuart Rutherford, Orlanda Ruthven, and Daryl Collins (described in Collins et al. 2009). The households in the studies were visited every two weeks over a year, and all financial transactions were recorded, whether informal, semi-formal, or formal.[1] Morduch and Rutherford (2003, 5) summarize the activities found in Bangladesh: "On average the Bangladeshi households push or pull through financial services and devices each year a sum of money ($839) equivalent to two-thirds of their annual cash income. In the Bangladesh case, households enter a fresh financial arrangement—with a moneylender, money guard, savings club, or formal provider, among others—on average every two weeks. In Bangladesh, a sample of just forty-two households were found to have used, between them, thirty-three types of service or device during the year: no household used less than four, and a third of them used more than ten." Collins et al. (2009) argue that the households have active financial lives because of their poverty, not despite it.

The devices that are used are typically diverse and overlapping. At one end of the cost spectrum are loans among family, relatives, and

friends. Because these loans are often made reciprocally (you lend to me now and, in return, I'll lend to you at a time when you particularly need some cash), they often do not carry interest charges and are part of broader informal insurance relationships (Ray 1998). At the other end are moneylenders, with long-standing, if not always accurate, reputations as loan sharks. Rotating savings and credit associations (ROSCAs), savings clubs, and credit cooperatives are in the middle. The premise of microfinance is that these mechanisms are far from perfect, constrained by local resources, and, in the case of moneylenders, often very costly. Still, understanding informal mechanisms can provide guidance about how to design workable microfinance contracts.

Like many microfinance models, both ROSCAs and credit cooperatives involve groups. But ROSCAs, which are simpler, are built on informal understandings among friends and acquaintances, while cooperatives typically have a formal constitution and a degree of legal status.[2] Understanding the way these two institutions function thus paves the way for understanding group lending in microfinance (i.e., how groups can help to reduce costs, mobilize funds, improve monitoring, and deploy informal community-based enforcement mechanisms). They also foreshadow limits to group lending in microfinance.

Understanding how ROSCAs hold together sheds light on savings constraints as well. While ROSCAs and credit cooperatives are commonly seen as ways to compensate for the credit market problems described in the last chapter, newer work suggests that they are just as valuable in providing simple ways to save. Indeed, their internal logic may hinge critically on the fact that ROSCAs can provide more effective ways to save than are typically available to low-income households. We introduce ROSCAs in section 3.2 and describe ways that they overcome credit market problems. We then explain why ROSCAs don't fall apart, and, in answering that, we confront savings constraints. (Chapter 6 picks up this theme and describes savings and savings constraints more broadly.)

In turning to nineteenth-century European credit cooperatives in section 3.3, we turn to an early antecedent for microfinance—a concerted attempt to attack poverty in the countryside by creating new financial institutions aimed at low-income families without collateral. The discussion of credit cooperatives shows how these formalized group-based mechanisms have helped overcome the troubles that traditional banks face when lending to poor borrowers. In particular, cooperatives can induce helpful "peer monitoring" among members. These lessons have become part of modern microfinance, and we continue the discussion of related contractual innovations in chapters 4 and 5.

3.2 ROSCAs

One way to avoid the steep costs charged by moneylenders is to borrow from neighbors and friends, but while interest rates may be low (or even zero), social costs and obligations can be considerable. ROSCAs provide an alternative solution, based on pooling resources with a broad group of neighbors and friends. ROSCAs do this in a systematic way, and they can be found nearly universally, from the *tontines* of rural Cameroon to the *hui* organized in Taipei, and the *tanda* and the *polla* of Mexico and Chile, respectively.[3] A few examples illustrate just how important they can be. In the survey which serves as the basis for table 3.1, for example, roughly 40 percent of households with steady access to microfinance through Bank Rakyat Indonesia also participate in ROSCAs. Bouman (1977) reports that ROSCAs in Ethiopia comprised 8–10 percent of GDP in the early 1970s, and 20 percent of all bank deposits in Kerala State, India. Bouman (1995) reports that at least half the rural residents in Cameroon, Côte d'Ivoire, Congo, Liberia, Togo, and Nigeria participated in ROSCAs. Levenson and Besley (1996) find that between 1977 and 1991 roughly one-fifth of the Taiwanese population participated in

Table 3.1
ROSCA Participation in Indonesia

					Frequency (percentage)		
Quintile	Ever a member (%)	Median income per capita per month of participants (rupiah)	Median size of pot (rupiah)	Ratio of median income to median pot (%)	Daily, weekly, or biweekly pots	Monthly or quarterly pots	Other
Bottom	33	40,260	3,000	7.5	38	49	12
Second	44	75,000	3,000	4.0	45	41	14
Third	60	134,150	3,500	2.6	45	52	3
Fourth	71	241,667	5,000	2.1	26	70	4
Fifth	63	600,000	10,000	1.7	24	71	5

Source: Survey of 1,066 households collected by BRI in fall 2000. Calculations are by Jonathan Morduch. The poverty line averaged 90,901 rupiah per capita per month, and at the end of 1999 the exchange rate was 7,855 rupiah per U.S. dollar.

ROSCAs in any given year, and, to their surprise, the data show robustly that participation increased with income.[4]

ROSCAs tend to have simple structures. The basic element is a group of individuals who agree to regularly contribute money to a common "pot" that is allocated to one member of the group each period. Twenty people, say, may agree to contribute $15 each for twenty months, generating a monthly pot of $300. At monthly intervals the group meets to collect dues and allocate the proceeds, with past recipients excluded from getting the pot again until every member has had a turn with the $300 pot (unless it is a "bidding" ROSCA; more on that later). ROSCAs thus successfully take the bits of surplus funds that come into households and translate those bits into a large chunk that can be used to fund a major purchase.

The simplicity has advantages. The life of a ROSCA has a clear beginning and end, accounting is straightforward (one only has to keep track of who has received the pot already and who is in line to do so), and storage of funds is not required since money goes straight from one person's pocket into another's. ROSCAs come in a number of variations, and each has implications for what the ROSCA offers, how it stays together, and who is attracted to join. The main variants involve the way groups determine who gets the pot. The order of receipt may be predetermined and unchanging from cycle to cycle, the order may be chosen randomly at the beginning of each cycle, or, in a third twist, members may be allowed to bid for a given pot, rather than simply waiting their turn (e.g., this is the main form found in Taiwan; see Levenson and Besley 1996, and Calomiris and Rajaraman 1998).[5]

Like moneylenders, ROSCAs are very much local institutions. In Bangladesh, for example, ROSCAs are known as *loteri samities*, and among the ninety-five *samities* investigated by Rutherford (1997), 70 percent were made up of people in the same neighborhood, with the others based on a shared workplace. ROSCA memberships ranged from five members to over one hundred, and the pots ranged from about $25 to $400. The larger ROSCAs in Bangladesh provided enough capital for members to make investments like the purchase of a rickshaw, freeing drivers from having to pay high rental rates. About two-thirds of the ROSCAs had daily collections in amounts as small as 5–25 cents (with less frequent disbursements), and about one-quarter collected payments monthly, which was especially popular with garment workers receiving monthly paychecks.

Gugerty (2007) reports on seventy ROSCAs in western Kenya, close to the Uganda border. Most of the ROSCAs formed as groups of friends and neighbors, and, on average, participants report that other members visit their homes fourteen times per month (for reasons other than a ROSCA meeting). The area is rural, mainly dependent on small-scale subsistence farming, some cash crops (cotton, tobacco, and sugarcane), and local market trade. The average daily agricultural wage is less than $1, so it is noteworthy that the average pot is about $25, usually disbursed monthly (with an average individual contribution of $2). The typical ROSCA cycle lasts for about one year. The pot is roughly one-quarter of average monthly household expenditures, which is adequate to pay primary school fees, or to buy two bags of maize, two iron roofing sheets, or a mattress or blanket (Gugerty 2007).

Related patterns emerge in a survey collected by Bank Rakyat Indonesia (BRI), shown in table 3.1. The survey covers over one thousand households from across the country, and nearly half of the households turned out to include current ROSCA members (with another 7 percent including individuals previously in ROSCAs). As in Taiwan, the probability of having participated rises with income—although the median size of the pots fails to keep up with income so that ROSCAs become increasingly less important as households get richer. As in Bangladesh, richer households favor less frequent collections: the top two richest quintiles strongly favor monthly or quarterly pots, while poorer groups tend to favor daily, weekly, or biweekly pots. (We will draw out the implications of this result in section 5.3, where we describe the relatively unheralded, but critically important, microfinance innovation of weekly and monthly loan repayment schedules).

3.2.1 The Simple Analytics of ROSCAs

To see how ROSCAs work, we give an example of a case where the order in which individuals obtain the pot is predetermined. We follow it in section 3.2.2 with a discussion of why the ROSCA doesn't fall apart. We begin with a group of individuals who voluntarily commit to putting resources into a common pot at regular intervals. At each meeting, every participant adds her share to the pot. The order of who gets the pot is decided at the first meeting by picking names from a hat.

To see one appeal of ROSCAs (and continuing our previous example), suppose that there are twenty individuals who each wish to acquire a

sewing machine that costs $300.[6] (Instead of a sewing machine, the desired good may be a radio or a piece of farm equipment—what really matters is that it is *indivisible*; that is, there is no value in just half a radio or two-thirds of a sewing machine—you need to obtain the whole thing.) As a result, each individual has to wait until she has the $300 fully in hand before making the purchase, and the sooner she can buy it, the better off she is.

Each participant earns $50 each month, but once the sewing machine has been purchased the owner can earn extra income of $20 each month. Everyone needs at minimum $35 to meet basic subsistence needs, so that prior to the purchase of the sewing machine, there is at most only $15 per month left over for saving. If the individual does not join the ROSCA, she can save up the $15 per month and be able to buy the sewing machine after twenty months (assuming, for simplicity, that savings generate no interest.) Her pattern of consumption will thus be $35 per month for twenty months and then $50 + $20 = $70 per month thereafter. Owning the sewing machine allows her to double her consumption!

Now let us consider an individual who joins a ROSCA with twenty neighbors, each of whom is willing and able to contribute $15 each month; her order of receiving the pot is a number between 1 and 20. Before ranks are determined she can a priori end up with any rank with equal probability 1/20, but on average she will be the tenth recipient. If she is indeed the tenth recipient, she will consume $35 for nine periods and get the pot in the tenth. At that point, she can consume $35 + $20 = $55 for the remaining ten periods, at which time the ROSCA cycle has been completed and her obligations are over. From then on, she earns $50 + $20 = $70 each month. By speeding up the expected date of purchasing the sewing machine, the ROSCA is a better bet than saving on one's own. In fact, it's better for everyone except the last person to get the pot, and the last person is no worse off than they would have been when saving up on their own.

Anderson, Baland, and Moene (2009) call this the "early pot motive" for ROSCA participation, but as we describe in section 3.2.2, there are other explanations, including two quite different explanations based on savings motives. One is the "household conflict motive" favored by Anderson, Baland, and Moene (2009); in this explanation, participants—who are often women—seek to get money out of the household and away from their husbands. The other is the "commitment to

savings" motive argued by Gugerty (hinging on the fact that ROSCAs present a clear, public, disciplined way to accumulate funds).

3.2.2 Enforcing Agreements and Facilitating Saving

The existence of ROSCAs can make everyone better off in principle, but how do they work in practice? The ROSCA model that we have just described hinges on three crucial assumptions: first, that all individuals wish to buy an indivisible durable good; second, that they are impatient to do so; and, third, that ROSCA participation is enforced in that all individuals who win the pot earlier keep on turning up and contributing to the pot until every participant has their chance to purchase the durable good.

If the good was not indivisible, participants could start buying pieces of it and reap the returns immediately. Instead, indivisibility means that without a ROSCA, individuals are forced to save until they have payment in full.[7] The role of indivisibility is in line with evidence from two very different contexts. Besley and Levenson (1996), for example, use data for Taiwan to show that ROSCA participants are indeed more likely than others to buy durables like microwave ovens, videocassette recorders, and air conditioners, even after controlling for income and for the endogeneity of participation. In the slums of Nairobi, Anderson and Baland (2002) similarly find that ROSCA participation is associated with making lumpy purchases (in this case, school fees, clothing, rent, and medical costs).

These results are only suggestive. Gugerty (2007) counters that in western Kenya, it is not uncommon to use the pot for more than one item, the most expensive of which takes up no more than two-thirds of the pot on average. Moreover, the expenditures generally favored by ROSCA participants are often divisible. School fees, for example, can be paid in installments; food can be purchased in small quantities; and household items like cups or plates can be purchased individually. Of course, making bulk purchases may cut costs, and the early pot motive for ROSCAs then survives. But Gugerty also shows evidence that in fact most participants do not put an especially high value on getting an early pot; instead, for example, getting the pot during the harvest season is often a bigger prize.

The assumption of impatience also matters to the early pot story; otherwise, households would be content to save up on their own. Assuming impatience is common, economists routinely assume some degree of impatience (i.e., that a given amount of money today is

valued by individuals more than the same amount tomorrow). In practice, though, we suggest that the constraint may not be impatience so much as the absence of an effective way to save, an argument in line with Gugerty's evidence from Kenya and developed formally by Karna Basu (2008a).

To see this, we need to first turn to enforcement issues. In our simple description of the model, we have emphasized the benefits of ROSCA participation versus those of going solo. But enforcement issues arise once the order of who gets the pot is determined. Consider the participant who is very last in line. Why should she stay in the agreement when, after all, she is at least as well off saving up on her own? The ROSCA will not help her get the durable good sooner than she could on her own. In fact, the ROSCA could impose costs since it forces her to save in fixed, regular increments each period when she might instead prefer flexibility in deciding how to accumulate. If the last person refuses to stay in, the whole arrangement unravels since someone always has to be last. One reason why this may work is that in fact ROSCA members do not have better ways to save. The absence of well-established savings institutions for small savings may thus be a key to making ROSCAs work.

The incentive problem with regard to the first participants who win the pot may be even worse. What prevents them from taking the pot and then refusing to make contributions in later periods? The participants who get the pot first are de facto borrowing from the other members of the ROSCA; and they therefore must turn up at subsequent meetings to repay their debt obligations, just like any borrower. Rutherford (2000, 34) notes that the risk of early absconders is the most commonly heard worry of people when presented with the idea of a ROSCA. To work, ROSCAs must rely on potential penalties for not honoring one's obligations.

One possible sanction is to refuse the absconders access to future cycles of the ROSCA, but, as Anderson, Baland, and Moene (2009) argue, this is insufficient; the sanction will not work since the absconder could simply save up on his own and do just as well. Again consider the example of a twenty-member ROSCA with $15 contributions and a $300 pot. Also assume that the order of who gets the pot is unchanged from cycle to cycle—and that once one twenty-period cycle ends, another immediately starts up. Would exclusion from subsequent cycles help the enforcement problem? If the individual stays in the ROSCA, she would have to contribute $15 to the pot for the next nineteen periods until the round ends. In the following period, a new round of the ROSCA commences. Since we have assumed that this individual is again first in line to get the pot, she will make her $15 contribution and again get the allotted $300. Then, again, she is obligated to pay $15 for another nineteen periods, and so forth.

The enforcement problem arises because the individual could do better by reneging. After the first period of the first round, she absconds with a "free" $300, and then, rather than making good on her obligations, she could simply save $15 on her own each period for twenty periods. Twenty periods later, she would have another $300 in hand, just as she would if she had stayed true to the ROSCA rules. Not only that, but she would be able to save flexibly, freed from the rigidity of the ROSCA contribution schedule. The ROSCA will thus fall apart if it is true that, as a ROSCA member in Nairobi said: "You cannot trust people in matters of money. People tend to cheat" (Anderson, Baland, and Moene 2009). The financial diaries reported in Collins et al. (2009) give many examples of intensive ROSCA use in Bangladesh, India, and South Africa—but also tragic stories of failed ROSCAs.

Can the way that the ROSCA is designed affect the ease of enforcement? Specifically, what if we drop the assumption that the order of who gets the pot is unchanged from cycle to cycle? Imagine, instead, that the order was chosen by random lottery at the start of each twenty-period cycle.[8] This would only make the incentive problem worse for the first in line. Rather than staying true and getting the second pot in twenty more periods under the fixed order, she would not expect to get the pot for another thirty periods (since the average lottery number in the next round would be 10). The advantages to reneging are then much greater.

Why then, do we often see assignment by random lottery? First, it seems fairer. Second, it provides the best incentives for the last person in line. She may be number 20 this time, but next time she can expect to be number 10 on average. There is thus a conflict between "fairness" and providing the right incentives for the first in line. One solution used in Kenya is to use a fixed order and to put people known as being most untrustworthy at the end of the line; this is perceived to be most fair (except by those deemed untrustworthy!) and helps address incentive problems (Anderson, Baland, and Moene 2009). To facilitate this, ROSCA managers devote considerable energy to ex ante screening of prospective members. Even if members are poorly acquainted beforehand, requiring recommendations from existing members helps, and

reputations can be allowed to accumulate over time (such that one's order of getting the pot moves forward after maintaining a clean record).

Other ways to keep ROSCAs together include banning problem participants from access to other relationships like trade credit, credit cooperatives, or access to material inputs. ROSCA participants in Kenya also report sometimes using force to obtain goods to be resold from members who fall behind in their obligations (Anderson, Baland, and Moene 2009). Social sanctions may be employed as well, such that those who renege are ostracized within the village or excluded from social and religious events (e.g., Ardener 1964).

Orlanda Ruthven's study of slum-dwellers in Delhi reveals these tensions clearly:

> The dearth of the "right" kind of people to join a RoSCA was a key issue for Delhi respondents. Nasir . . . enjoyed well-run RoSCAs, but two of his neighbors said they didn't have sufficiently trusting relations with anyone in their neighborhood, or even in Delhi, to depend on them to pay their dues. A respondent from another slum said he'd been trying to join a RoSCA for some time and couldn't find one that would have him as a member. Finally, he met a manager of a RoSCA, who told him he could join only if he agreed to take the prize last. Two of his neighbors were excellent RoSCA members, but they had to travel all the way across Delhi to the meetings each month. Neither felt they would find anything suitable closer to home. (Collins et al. 2009, 125)

Imperfect alternative means to save can also explain why ROSCAs stay together. We have assumed up to this point that people who are not in ROSCAs have no constraints in saving; this is why it made sense to argue that absconders would be just as well off without the ROSCA (and often better off). But Rutherford (1997) finds that, when asked, the most commonly cited reason that slum dwellers in Dhaka joined a ROSCA was in fact to save, particularly given their difficulties in saving at home.[9] Daryl Collins's work on ROSCAs and savings clubs in South Africa yields a similar view. She describes a woman who was part of the financial diaries study:

> At the time we knew her, Nomsa was in two different sorts of [saving] clubs . . . Nomsa's membership in the club poses a puzzle. After all, she has an account at the bank in her own name, and is used to transacting there. Why would Nomsa not bank this money for herself, avoiding the bother of the club (she has to attend its meetings) and its undoubted risks (what if the money is stolen from the secretary's house?)? Many South African diary households belonged to clubs of this sort, and their most common answer to this question was that club membership was the surest way to discipline themselves to save for a particular event. "You feel compelled to contribute your payment. If you don't do that, [it] is like you are letting your friends down. So it is better because you make your payment no matter what." (Collins et al. 2009, 113–114)

Anderson and Baland (2002) find, similarly, that women favor ROSCAs since participation helps them get money out of the house (and away from husbands). In this case, the tension is provided by a need for "spousal control" rather than self-control.[10] Nearly all ROSCA participants in their Nairobi sample are women, and this is common globally. Anderson and Baland find an interesting "inverted-U" shaped pattern in their data: women who have little autonomy from their husbands are unlikely to join ROSCAs, as are women with great autonomy (since they do not need the protections that ROSCAs afford). Participation is greatest in the middle, by women who have some autonomy and are looking for additional levers to facilitate household management. We will come back to this issue in chapter 7 on gender.

As far as saving goes, ROSCAs have an important advantage that is missing from other informal mechanisms: the beauty is that ROSCAS do not require a physical place to store money since on the same day that funds are collected, they are distributed again. The public nature and precommitment associated with ROSCA participation also serves as a device to foster discipline and encourage saving in ways that may be otherwise impossible. These advantages follow a logic given by new work in behavioral economics in which commitment devices are superior when self-control is weak (e.g., Thaler 1994; see also section 6.6). Participating in a ROSCA thus provides a secure, structured way to save that would otherwise be missing. Even households that are not particularly impatient may join a ROSCA simply for the help it provides with saving (Basu 2008a).

Gugerty's (2007) analysis of a detailed survey of 1,066 ROSCA members in western Kenya pushes the commitment to saving argument for why individuals form ROSCAs. As one ROSCA participant responded in her survey, "You can't save alone—it is easy to misuse money." Another remarked, "Saving money at home can make you extravagant in using it." And another said, "It is difficult to keep money at home as demands are high." Gugerty analyzes the responses of 308 ROSCA members to the question "What is the most important reason you joined this ROSCA?" She finds that 37 percent reported that it was "difficult to save at home because money got used up in small

household needs." Another 22 percent reported that it was "difficult to save alone, that they 'got the strength to save' by sitting with others." And just 10 percent reported that they joined "as a response to household conflict, fear of theft, or demands by kin."[11]

ROSCAs are so widely observed, and seen in such varying circumstances, that there cannot be one rationale for their existence that universally trumps all others. We see truths in each of the explanations considered here: the early pot motive, the household conflict motive, and the commitment to saving motive. But we have highlighted the latter explanations because they remain underappreciated, and because—as we discuss in chapters 5 and 6—they suggest important angles on microfinance.

3.2.3 Limits to ROSCAs

The ubiquity of ROSCAs attests to their usefulness, but they have limits as well. First, neither the size of the pot nor the size of contributions is flexible within the life of a given ROSCA. Creating a bigger pot can be done by making the contributions larger (which may be difficult for some members) or by recruiting more members. Adding members, though, can lead to management problems and lengthens the life of the ROSCA (and thus lengthens the average time that members must wait to get their next chance at the pot).

Second, and perhaps more important, ROSCAs put locally held funds to good use, but they do not provide a regular way to mobilize funds from outside a given group. So, from the point of view of microfinance, ROSCAs show an interesting precedent for using groups to allocate resources (foreshadowing the practice of group lending), but they fail to present an effective way to move resources across independent communities or to easily expand in size.

One partial way to address the first problem is through a "bidding ROSCA." Here, rather than allocating the pot by a predetermined order, the pot is allocated each period to whoever is willing to pay the most for it. The rest of the participants pocket the proceeds. For those who primarily wish to save, the bidding ROSCA provides a return to saving not available under the other forms—and members do not need to take the pot at a prescribed moment. For those bidding on the pot, the ROSCA provides access to money when it is needed, albeit at a cost. In this way, the bidding ROSCA can help mitigate risk in difficult times (for more on ROSCAs and risk, see Calomiris and Rajaraman 1998).

One problem with this arrangement stems from the information problems discussed in the previous chapter. We expect that risky participants are willing to pay more for the pot than safer participants, so the earliest pots go to the riskiest borrowers. Since risky borrowers are also more likely to default (i.e., stop making contributions), participants who receive the pot later in the cycle may end up getting less from the ROSCA than they put into it. If this is the case, bidding ROSCAs could be a less efficient scheme than random ROSCAs. Research by Klonner and Rai (2008) on bidding ROSCAs in India, mentioned already in section 2.5, backs up these predictions. The authors find that default rates are higher for early borrowers. Since default rates are a proxy for riskiness, this suggests that risky borrowers do, in fact, have a higher willingness to pay. They also examine the effect of a policy shock on defaults, in this case a 1993 Supreme Court decision that put a 30 percent ceiling on ROSCA bids. A bid ceiling makes bidding ROSCAs more like random ROSCAs: multiple participants make the maximum allowable bid, and the person who gets the pot is randomly selected from among the high bidders. Klonner and Rai (2008) examine default patterns before and after the Indian government imposed the ceiling and find that defaults by early bidders were much less pronounced after the ceiling was enforced.

Another time when there may be multiple bidders seeking the pot is during downturns. A bidding war ensues, leading to a result that may be economically efficient but not necessarily equitable since needy, poorer households will easily get outbid. In this light, credit cooperatives present themselves as a more flexible institutional solution—and we turn to this next.

3.3 Credit Cooperatives

ROSCAs show a way to formalize and systematize the use of groups to allocate resources in poor communities, but their simplicity can also be a disadvantage. As described in section 3.2, many use ROSCAs largely as a way to save, rather than as a means to borrow. At the cost of a bit of complexity, the ROSCA structure can be modified to allow some participants to mainly save and others to mainly borrow—and for more than one person to borrow at a time. In this way, the ROSCA transforms into an ASCA (accumulating savings and credit association) as described by Bouman (1995), Rutherford (2000), and Collins et al.

(2009). An ASCA in its most formalized mode is essentially a credit cooperative (or credit union as they are more often called in the Americas—we will use the terms interchangeably). A chief advantage is that savers are no longer required to borrow, and the size of loans can vary with need. A cost is that funds must now be stored, and bookkeeping and management become more complex.

In moving in this direction, we get a step closer to modern microfinance. Indeed, the cooperatives share some of the features of the "village banks" promoted by microfinance NGOs like FINCA, Pro Mujer, and Freedom from Hunger, and credit cooperatives are playing an increasing role in today's microfinance landscape. In 2007, the World Council of Credit Unions (2007) counted 49,134 credit unions serving 177 million members worldwide. Over half of these were operating in Africa and Asia, accounting for 24 percent and 41 percent of the total, respectively. The roots of credit cooperatives, however, are much older. Not unlike the modern microfinance "revolution," a century before microfinance became a global movement, Friedrich Raiffeissen, a village mayor, had spearheaded a similar drive in the German countryside; his aim was to spread new group-based ways to provide financial services to the poor (Banerjee, Besley, and Guinnane 1994; Guinnane 2002; Ghatak and Guinnane 1999). Typical loans in Raiffeisen's cooperatives had ten-year durations and were made for farm investments. Raiffeisen's credit cooperative movement built on a broader movement that started in the 1850s, and by the turn of the century it had spread to Ireland, France, Italy, and Japan (and later to Korea, Taiwan, Canada, the United States, and parts of Latin America; see Adams 1995). In France, the cooperative movement gained traction in 1885, when Louis Milcent created a cooperative bank that would become one of France's largest banks, Crédit Agricole.[12] In Germany, there were over 15,000 institutions operating in 1910, serving 2.5 million people and accounting for 9 percent of the German banking market (Guinnane 2002, 89, table 3); by the early 1900s, nearly one-third of rural households were cooperative members (Adams 1995).

The British too were intrigued, and they fostered credit cooperatives in India, creating a precedent for modern microfinance in South Asia.[13] In the 1890s the government of Madras in South India, then under British rule, looked to the German experiences for solutions in addressing poverty in India, and in 1904 the Cooperative Credit Societies Act established cooperatives along Raiffeisen's basic model. By 1912, over four hundred thousand Indians belonged to the new credit cooperatives, and by 1946 membership exceeded nine million (Bedi, cited in Woolcock 1998). The cooperatives took hold in the state of Bengal, the eastern part of which became East Pakistan at independence in 1947 and is now Bangladesh. The credit cooperatives eventually lost steam in Bangladesh, but the notion of group lending had established itself.[14]

The credit cooperatives function like ROSCAs in that they gather funds from those in a community who are able to save, and those funds are allocated to those who want to invest (or consume) in a lump sum. Unlike ROSCAs, however, credit cooperatives share the following features: First, members do not have to wait their turn in order to borrow, nor do they need to bid for a loan. Second, participants, be they savers or borrowers, are all shareholders in the cooperative. Key decisions about the prevailing interest rates, the maximum loan size, and changes to the constitutional chart of the credit cooperative are taken democratically by all members, on a one-share-one vote basis. Like ROSCA participants, they share a common bond—that is, they live in the same neighborhood, attend the same church, and/or work nearby—and thus social sanctions are available for enforcing contracts (on top of the possibility that a defaulting borrower loses her shares in the credit cooperative). In the subsections that follow we analyze how these various features contribute to the success of credit cooperatives and, in particular, to mobilizing savings, inducing peer monitoring, and addressing risk.

3.3.1 Credit Cooperatives and Savings

In a study of German rural cooperatives during the period 1850–1914, Prinz (2002) analyzes the emergence of credit associations on the Raiffeisen model. The main features of the Raiffeisen model were (a) members should belong to the same local parish; (b) there was unlimited liability in that defaulting members would lose their current assets, as well as suffering social costs;[15] (c) low-income individuals could not be discriminated against and should be given the equal rights when becoming members of the cooperative; (d) the cooperative was not merely a financial intermediary in that it performed other functions such as facilitating the purchase of inputs of production for its members; and, (e) the cooperatives would extend both short-term and long-term loans.

Although Prinz does not have direct evidence on savings, he argues that such savings by participant members were most likely long-term

savings since interest rates were stable, remaining fairly constant (at around 4 percent) for the entire period from 1897 to 1911. This interest rate stability is quite remarkable, the argument goes, especially for credit cooperatives operating in rural areas, and the natural explanation is that members' savings were stable too.

How were members' savings sustained and stable over time in these rural settings? Prinz emphasizes the importance of what he calls "face-to-face" relations and trust-building ties among villagers. Over time, such ties became so strong that even with the advent of strong competition at the turn of century, the Raiffeisen cooperatives continued to enjoy stable levels of savings. In Prinz's words: "Whereas villagers in the 1860s often had no choice but to deposit their saving in the Raiffeisen cooperatives, their grandsons and granddaughters definitely had. It appears that villagers, after leaving their initial suspicion behind, came to regard the Raiffeisen cooperative more and more as an extension of their own businesses" (2002, 15). We formalize this feature of the Raiffeisen cooperatives in appendix 3B. In particular, we show that members of a cooperative will be keen to invest all of their savings in the cooperative when social sanctions are sufficiently high and/or when the opportunity cost of investing elsewhere is high. The reason is that in those cases, the incidence of default falls sharply through the combination of social commitment, unlimited liability, and interest rate stability. And savings are in turn encouraged by a lower probability of default on loans.

3.3.2 Credit Cooperatives and Peer Monitoring

Also inspired by Raiffeisen's cooperatives experience, Banerjee, Besley, and Guinnane (1994) develop a model of credit cooperatives that emphasizes peer monitoring among members. The model yields insights into why a borrower's peers have incentives to monitor and enforce contracts. The insights have been applied to group lending in microfinance as well.

Consider a cooperative with only two members (it's not a realistic assumption but it allows us to show some critical features in a simple way). One of the two has a new investment opportunity and needs to finance it. The borrower's project is risky: the borrower achieves gross income y with probability p, and zero with probability $(1 - p)$, where p is the probability of success. Undertaking the opportunity requires a cost F that can be financed in part by borrowing from an outside lender.

So the project will depend on securing funds from an outside lender and a lender inside the cooperative.

Suppose first that the two cooperative members have zero wealth. Then the loan contract between the borrower and outside lender is simply a standard debt contract that specifies an amount b lent and a gross interest rate R, with $R \cdot b < y$ whenever the project succeeds. This simply says that the outside lender cannot charge a gross interest rate that is greater than the borrower's income—in the case in which the borrower makes profits. When the project fails, the borrower is protected by limited liability and does not repay.

Now consider how a well-designed credit cooperative can improve matters. Consider the case in which the borrower's fellow cooperative member (the "insider") has funds to lend the borrower, making up the difference between the full project cost F and b, the amount that the outsider is willing to lend. Thus one role of the insider is simply to lend an amount $F - b$ to the borrower. The second role of the insider is to act as a guarantor, possibly offering collateral that would secure the loan from the outsider. We'll show why offering the collateral might make sense here, even if the loan goes to the insider's partner. The third role that the insider plays is as a monitor, taking actions to encourage the borrower to work hard and increase the chances for success. A borrower who shirks suffers penalties or social sanctions imposed by his peers, and the chance of being caught shirking increases with monitoring effort.

The questions are: What will determine how much the insider monitors her peer? What will be the effect of offering collateral? How high an interest rate will the insider charge the peer for the "inside loan"?

To simplify matters, we assume that effort by the borrower translates one-for-one into a higher chance of doing well—so we can use one symbol, p, to denote both effort and the probability of success. The question is: How is p determined? The probability that the borrower will succeed is a function of how hard the borrower works. That, in turn, is a function of how much the insider monitors. To capture these elements, the cost of effort is assumed to take the particular form $(1/2)(1/m)\ p^2$, where m denotes the monitoring intensity provided by the insider. The function shows that the cost of effort *decreases* with the extent of monitoring, m. One way to think about this is to consider the relationship the other way round: the cost of shirking *increases* with the extent of monitoring, since more monitoring means that the borrower

is more likely to get caught and punished. The role of p^2 in the cost function means that the cost of effort rises less than proportionally with added effort (since p, which is a probability, must be less than one).

The timing of decisions is as follows. First, the borrower contracts loans with both the inside and the outside lenders. We assume perfect competition among potential outside lenders, so that the contract will guarantee that the outside lender expects to get back the market rate of interest r plus compensation for risk. Second, the inside lender chooses how much to monitor the borrower (picks m). Third, the borrower decides how much effort p to invest in her project. Fourth, project revenues are realized.

Given the sequencing, the borrower chooses effort conditional on knowing how much the insider is going to monitor her. So, for a given monitoring intensity m by the insider, the borrower chooses effort, p, to maximize her expected returns net of costs:

$$p(y - Rb) - (1/2)(1/m)p^2. \tag{3.1}$$

It turns out that the optimal level of effort, p, equals $m(y - Rb)$.[16] We immediately see that a higher monitoring intensity m increases p, as described previously. This is because a higher monitoring intensity m lowers the borrower's marginal cost of effort, leading to higher borrower effort and a higher probability of success. We have taken the interest rate R as given, but we know that it must be higher than the market rate available on alternative, safe investments (like government bonds). This is because the outsider must bear some risk of default.[17]

The problem is that the inside lender has no incentive to invest in peer monitoring. So, what guarantees that m will in fact be positive? To see, we have to modify our assumptions slightly. Suppose that the inside cooperative member has private wealth w that she can use as collateral for the loan contract between the borrower and the outside lender. That is, the insider promises w to the outside lender in case the gross interest rate R is not repaid by the borrower. Furthermore, assume that w is sufficiently large so that the outside lender is always repaid in full.[18] Now, the outside lender faces no risk in making this loan, so he no longer requires a risk premium. Given the assumption of perfect competition, R will then fall to equal r, the market return on safe investments. The falling interest rate, in turn, implies that the borrower's effort rises, since p now equals $m(y - rb)$, which is larger

Clearly, the willingness of the insider to put up collateral is helpful for the borrower. But why should the insider do so? If the project fails, the inside lender loses w. The insider can be compensated by getting a return—effectively an interest rate—in the case that the project is successful. If the insider has strong bargaining power, she will be able to obtain most of the residual return $(y - rb)$, which remains after the borrower has repaid the outside lender. So, the insider under this scenario now has an incentive to put up collateral.

Moreover, the insider now also has an incentive to invest in monitoring in order to increase the probability of success.[19] The monitoring effort, m, that the insider applies in order to elicit higher repayments from the borrower should increase in the amount of collateral w—since more collateral means more to lose when the borrower shirks. Increases in the interest rate charged by the outside lender, however, is apt to have a negative effect on monitoring. This is because the outside lender is paid in priority, so when the interest rate that the outsider receives rises, any additional monitoring that the inside lender applies will increasingly accrue to the outsider.

The model shows ways in which groups can function to increase lending. Here, the insider acts as a guarantor and a monitor, with the incentive given by the fact that the insider is a lender too. In the case of microfinance, fellow group members also act as guarantors and monitors. But in that case, their motivation is fueled by the promise of future access to credit if all group members repay loans.

The Banerjee, Besley, and Guinnane (1994) model is important in demonstrating how monitoring can come about as a function of institutional design. The optimality of monitoring is another matter. We close by noting that it is entirely possible here that insiders will monitor too much and punish borrowers too often relative to outcomes that would emerge if a benevolent social planner were making decisions.

3.4 Summary and Conclusions

In this chapter we have analyzed ROSCAs and credit cooperatives, two precursors to modern microfinance institutions. Credit cooperatives (or credit unions) are also playing an increasingly active role in the microfinance market today.

In the model we described, ROSCAs can help credit-constrained individuals purchase indivisible goods through a simple sharing

arrangement. The idea is beautifully simple, but not very flexible. The approach can be made more complicated, but it will remain limited to intermediating local resources only.

While ROSCAs are commonly cited as indigenous ways that communities use to overcome credit constraints, the closer one looks, the more that ROSCAs seem notable as devices for saving. Indeed we showed that, in principle, one very common form of ROSCA will fall apart if it does not offer a way to save that is more attractive than alternative mechanisms. Given the variety of ROSCAs observed in practice, there is no single explanation of their use that will be universally valid, but recent evidence has stressed the savings side in particular (e.g., Collins et al. 2009; Gugerty 2007; Basu 2008a). The discussion of ROSCAs thus leads toward the broader discussion of savings in chapter 6—as well as providing insight that applies as well to the discussion of group lending in chapter 5.

Credit cooperatives are another way to mobilize local resources, and in section 3.3.1 we cited evidence showing that the German credit cooperatives of the nineteenth century also functioned as important ways to save. The model of the German credit cooperatives in section 3.3.2 turned instead to the nature of the institutional design of cooperatives. The design of cooperatives encourages peer monitoring and guaranteeing the loans of one's neighbors. The level of peer monitoring is not necessarily optimal from a social standpoint, however—which is a lesson that carries over to group lending in microfinance. The analysis raises the question as to whether the 98 percent (plus) loan repayment rates boasted by microlenders might ever be too *high* from a social standpoint. Are too many resources being put into monitoring and enforcement? Are borrowers ever pressured to be too risk-averse rather than seeking the greater profits that can come with risk taking? These are questions that have so far received little attention from the microfinance community.

The discussion of credit cooperatives also introduces practical complications. While the cooperatives add flexibility to what can be achieved through ROSCAs, cooperatives are much more challenging to run. Indeed, in order to borrow, participants must commit to helping run the institution.[20] This is surely appealing for some, but most microfinance programs instead pursue a more traditional bank-client relationship. As Adams (1995, 11) concludes, based on his survey of the modern credit union experience in Latin America:

> Most credit unions in low-income countries are fragile. They typically have thin capital bases, often lack access to funds to meet liquidity shortfalls, have difficulties diversifying their risks, are easily crippled by inflation, and are quickly damaged when their members have economic reverses. Credit unions also face dilemmas as they grow: they lose their informational advantages, they are forced to rely on paid rather than voluntary managers, and they must increasingly count on formal sanctions to enforce contracts . . . Principal-agent problems, transaction costs, and prudential regulation also become increasingly important as credit unions grow.

What does modern microfinance add? As we will see in greater detail in the next chapter, microfinance not only is a device for pooling risk and cross-subsidizing borrowers in order to improve efficiency, but it also increases borrowers' access to outside sources of finance and institutes a professional management structure from the start. Microfinance institutions typically borrow (or otherwise obtain funds) from outside the locality (and often outside the country) to fund borrowers' needs, whereas both ROSCAs and credit unions rely mainly on local savings. A pressing question, taken up in the next chapter, is how to attract outside finance when lending to poor borrowers without collateral.

Appendix 3A: A Simple Model of a Random ROSCA

This appendix shows a rationale for ROSCAs using a mathematical approach that builds on the intuition provided in section 3.2.1. The discussion is directed to readers who are already familiar with the academic economics literature and who are comfortable with using calculus to solve constrained maximization problems.

Consider the following stripped-down version of the model of ROSCAs by Besley, Coate, and Loury (1993). Suppose that there are n individuals who wish to acquire a durable and indivisible good that costs B. These individuals contribute to put resources to a common "pot" that is allocated to one of the members of the group at regular time intervals. At each meeting, every participant adds her share to the pot, and the pot is allocated to one of the members of the group; the order is determined at the first meeting.

Each individual has additive preferences over durable and nondurable consumption: $v(c)$ without the durable good, and $v(c) + \theta$ with it. Suppose that each individual earns an amount y each period, and that she lives for T periods. For simplicity, we suppose that individuals have linear utility $v(c) = c$ whenever $c \geq \underline{c}$, where $\underline{c}$ is the

subsistence level of consumption so that $v(c) = -\infty$ if $c < \underline{c}$. If the individual does not join the ROSCA, she would be solving the following problem:

$$\underset{t}{Max}(T-t)(y+\theta)+tc \tag{3A.1}$$

subject to the following subsistence constraint:

$$c \geq \underline{c}$$

and the budget constraint:

$$t(y-c) \geq B$$

where t is the acquisition date for the durable item, and c is the consumption flow during the accumulation phase. The first term in the maximand refers to the time interval after the durable good has been acquired. The second term refers to the time interval prior to the purchase of the durable good. The budget constraint reminds us that the adequate savings must be accumulated prior to the purchase at date t in order to afford the durable good.

The optimal solution is for the individual to minimize her consumption of the nondurable good in order to cut the time until the purchase of the durable good: that is, to consume $c = \underline{c}$ each period and save $(y - \underline{c})$. After t^*, she can enjoy consumption of her entire income flow (i.e., consume $c = y$) while enjoying the benefits of the durable good as well.

From this we can write the corresponding utility for the individual in "autarky," that is, when she decides not to participate in a ROSCA:

$$U_A = (T-t^*)(y+\theta)+t^*\underline{c} = \left(T-\frac{B}{y-\underline{c}}\right)(y+\theta)+\frac{B}{y-\underline{c}}\underline{c} \tag{3A.2}$$

The first term captures the utility from consuming $y + \theta$ from the date of the durable's purchase until the final period; and the second term captures the utility from consuming $\underline{c}$ until enough is saved up to buy the durable.

Now, consider an individual who joins a ROSCA; her order of receiving the pot is i, which is a number between 1 and n. Before ranks are determined she can a priori end up with any rank i with equal probability $1/n$. If she gets the pot at time $(i/n)t$, her lifetime utility will be

$$u_i = \left(\frac{i}{n}\right)tc+\left[t-\left(\frac{i}{n}\right)t\right](c-\theta)+(T-t)(y+\theta) \tag{3A.3}$$

where the first term refers to the individual's utility before getting the pot, the second term refers to her utility once she has received the pot and thereby acquired the indivisible good but before fulfilling her repayment obligation vis-à-vis the other members of the ROSCA, and the third term refers to her utility once all individuals have purchased the indivisible good so that no further repayment and savings are required.

The corresponding ex ante expected utility (for an individual who does not yet know when she will access the pot), is given by

$$U_R = \frac{1}{n}\sum_{i=1}^{n} u_i \tag{3A.4}$$

or, equivalently,

$$U_R = \left(\frac{n+1}{2n}\right)tc+\left(1-\frac{n+1}{2n}\right)t(c+\theta)+(T-t)(y+\theta) \tag{3A.5}$$

where, as before, t is determined as the time where there is enough accumulated savings for each individual to cover the cost of purchasing the indivisible good, that is,

$$t(y-c) = B \tag{3A.6}$$

This equation also implies that there are enough funds in the pot at each meeting date to purchase one unit of the indivisible good. Using the fact that once again individuals will minimize their initial consumption of the nondurable good in order to speed up the purchase of the durable good, the maximized lifetime utility of an individual joining a ROSCA, is equal to

$$U_R = \frac{B}{y-c}c+\left(1-\frac{n+1}{2n}\right)\frac{B}{y-c}\theta+\left(T-\frac{B}{y-c}\right)(y+\theta) \tag{3A.7}$$

Comparing U_R to U_A, we see that $U_R > U_A$. That is, ROSCA participation provides higher utility to each ROSCA member. The reason is that membership lowers the utility cost of saving up to acquire one unit of the indivisible good. Even if the same saving pattern is maintained as in the absence of a ROSCA, participating in a ROSCA gives each member the possibility of obtaining the pot early.

Appendix 3B: Credit Cooperatives and Savings: A Simple Model

In this appendix we show more formally how credit cooperatives can capture and mobilize long-term savings. As in appendix 3A, the

discussion is directed to readers who are already familiar with the academic economics literature and who are comfortable with using calculus to solve constrained maximization problems. In order to keep the notation consistent with that found in the academic literature, readers should note that we use a different set of symbols here than we do in the main body of the text.

Consider the following stylized model. Suppose that there is a continuum of mass 1 of savers-borrowers in a credit cooperative. Each member has the same initial wealth w that she can invest either in the cooperative or in another bank. Investing inside the cooperative yields a gross interest rate θ, and investing elsewhere involves an opportunity cost δ per unit invested. For simplicity we assume here that the members of the credit cooperative are risk-neutral, and that δ is just a switching cost from the local cooperative to a bank located in the city.[21] Each member has access to a project that yields a return R in case it succeeds and zero if it fails. Success in turn occurs with probability e, where $e \in [\varepsilon, 1]$ and the multiplicative function Ce denotes the borrower's effort cost. Whenever failure occurs, the borrower is forced to default, in which case she loses the wealth that she has invested as savings in the credit cooperative, and, also incurs a nonmonetary cost H of being excluded from the community. Finally, the interest rate r is set so as to enable the cooperative as a whole to purchase capital goods for all the members (which here we take to be exogenously given).

The timing of decisions within the period is as follows: first, borrowers decide how much wealth to invest inside the cooperative. Then, given how much wealth they have invested in the cooperative, borrowers invest in effort.

We reason by backward induction, first taking as given the share of wealth w_i invested inside the cooperative by an individual borrower. The borrower will choose her effort e to

$$\max_{e\in[\varepsilon,1]}\{e(R+\theta w_i - r)+(1-e)(-H)-Ce\} \tag{3B.1}$$

so that, by the first-order conditions:

$$e(w_i)=1 \text{ if } R+\theta w_i - r + H > C \text{ or } e(w_i)=\varepsilon \text{ otherwise} \tag{3B.2}$$

We thus see that the probability of default is reduced (here, to zero) the more savings the borrower has invested in the cooperative and the higher the non-monetary sanction H.

Now, moving back one step, a borrower will choose how much wealth w_i to invest in the cooperative, in order to

$$\max_{w_i \le w}\begin{Bmatrix} e(w_i)(R+\theta w_i - r)+(1-e(w_i))(-H)-Ce(w_i) \\ +(\theta-\delta)(w-w_i) \end{Bmatrix} \tag{3B.3}$$

This very simple model delivers several conclusions: first, given the following "no-default" condition:

$$R+\theta w - r + H > C, \tag{3B.4}$$

namely, in equilibrium all borrowers will invest all their wealth inside the cooperative. Indeed, once she has invested her own wealth, a borrower will find it optimal to invest maximum effort

$$e(w_i)=1 \tag{3B.5}$$

by virtue of the no-default condition, so that each unit invested inside the cooperative yields an expected gross interest rate equal to θ whereas each unit invested outside yields $\theta - \delta$. The no-default condition in turn is more likely to be satisfied when H is large, hence the importance of social sanctions and/or unlimited liability.

It is worth pointing out that in the case where the no-default condition holds, together with the following "commitment" condition:

$$R - r + H < C, \tag{3B.6}$$

investing all her wealth in the cooperative acts as a commitment device for the borrower. That is, without such investment the borrower would find it optimal ex post to minimize effort, whereas investing all her wealth inside the cooperative increases the borrower's cost of defaulting on her loan, to the extent that it becomes optimal for her to invest maximum effort in her project in order to avoid costly default. This, in turn, allows the borrower to minimize the probability of bankruptcy and thereby to take advantage of the better conditions offered by the cooperative in terms of (risk-adjusted) interest rates on savings.

Finally, if the no-default condition does not hold, borrowers will always minimize effort, that is, choose $e = \varepsilon$, which in turn implies that she will default with probability $(1 - \varepsilon)$ and therefore will lose her internal savings also with probability $(1 - \varepsilon)$. Then, whenever

$$\theta\varepsilon < \theta - \delta, \tag{3B.7}$$

the borrower chooses to invest all her savings outside the credit cooperative.

Overall, sufficiently high social sanctions H and/or a high opportunity cost δ of investing elsewhere will encourage internal savings by

the members of a credit cooperative. This, in turn, can explain the success of Raffeisen-style associations in mobilizing long-term savings through their unique combination of social commitment, unlimited liability (defaulting members would lose everything) and interest rate stability.

3.7 Exercises

1. Evaluate the following statement: "Enforcement is a major issue in Rotating Savings and Credit Associations (ROSCAs), yet ROSCAs do not easily fall apart in practice." Explain why.

2. Consider again the problem described in appendix 3A, and show that the expected utility of a participating member of a ROSCA is increasing with the number of members n. What problems may arise from having too many participants in a ROSCA?

3. Consider a village with n symmetric risk neutral borrowers who each live for T periods. At each period, one borrower can earn an amount y, and the level of subsistence consumption is $\underline{c}$, with $y > \underline{c}$. Each borrower has an additive preference for durable and nondurable consumption, as specified in the model in appendix 3A. Assume that if a borrower wants to save on her own in order to buy the durable good, the maximum amount of money that she can save each period is $y - \underline{c} - \varepsilon$, where ε is the cost that she has to incur for saving the money on her own. But if she joins a ROSCA this cost disappears and the maximum she can save is $(y - \underline{c})$.

a. Show that, *ex ante* (that is, before she knows when she will be getting the pot relative to other participants), every saver-borrower is willing to join the ROSCA.

b. In order for a ROSCA to work well, the organizers decide that those members who quit the ROSCA before all of the participants have received the pot will face a punishment P:

i. Show that if $P > B$, then the mechanics of a ROSCA will survive in that no one would want to abscond. Note that, as in Appendix 3A, B is the value of the good to be purchased with the ROSCA pot.

ii. Show that if $P < 1/2\ B$, then the mechanism that holds the ROSCA together collapses.

iii. Again, using the notation from appendix 3A, and considering: $T = 100$, $\theta = \$10$, $y = \$20$, $\underline{c} = \$12$, $\varepsilon = \$3$, $B = \$80$, $P = \$79$ and $n = 78$, can participants borrow from a ROSCA? What about when $n = 120$?

4. Consider 3 villagers who live for 10 periods and have linear, additive utility functions as follows:

$$\text{Villager 1: } U_1 = \sum_{i=1}^{10} 0.6^i c_i^1$$

$$\text{Villager 2: } U_2 = \sum_{i=1}^{10} 0.8^i c_i^2$$

$$\text{Villager 3: } U_3 = \sum_{i=1}^{10} c_i^3$$

Where c_i^n is the consumption (both of durable and nondurable goods) at time i of villager n. And 0.6, 0.8, and 1 are the discount factors of villagers 1, 2, 3, respectively. Note that villager 1 is the most impatient, and villager 3 the least impatient. Assume that at each period, each villager earns $y = \$140$, and the subsistence level of consumption for all of them is $\underline{c} = \$80$, so the maximum amount that each villager can save at each period is $(y - \underline{c})$. A durable good costs $B = \$360$, and if a villager buys it the utility he receives from it equals that of consuming $\theta = \$2500$ each period, for two periods.

Consider a ROSCA, organized as follows. At the first meeting, which takes place at the end of the second period, the pot will go to the member who makes the highest bid, which must be at least $A_1 = \$1000$. Villagers who do not take the pot each get ½ of the bid. At the second meeting, the villager who got the pot in the first meeting is excluded from bidding. The pot will go to the villager who makes the highest bid again in this round, which must be at least $A_2 = \$200$ and will be given to the other participants. At the third meeting, the remaining villager will get the pot, and the ROSCA ends. Meetings occur every two periods, and every villager contributes \$60 every period to the pot.

a. Which villager will get the pot at the first meeting, at the second meeting, and the third meeting?

b. Assume that if the villagers do not turn up to make their contributions after receiving the pot, they will be punished so severely that their utility will be $-\infty$, and that all events occur at the end of the periods. What does this exercise tell us about social sanctions in microfinance operating in close-knit village economies?

5. Relative to Credit Cooperatives, ROSCAs have some disadvantages.
a. Compare the main disadvantages of ROSCAs relative to credit cooperatives.
b. In light of such disadvantages, explain why ROSCAs are so common in nearly all low-income economies these days.

6. ROSCAs often are considered to be predecessors of today's microfinance institutions.
a. In what way have microfinance institutions resolved some of ROSCAs' limitations?
b. Assuming that microfinance institutions resolve the main limitations of ROSCAs, why have ROSCAs survived even in those countries which are thick with microfinance?

7. Consider a village inhabited by 3 risk-neutral individuals: a borrower, an inside lender, and an outside lender. The first two are part of a credit cooperative. The borrower wants to invest in a project that costs $K = \$100$. If she exerts effort, the project will be successful with probability 0.9 and will yield a return of $y = \$240$. Otherwise, the project fails and her return is zero. If she "shirks" (i.e., if she does not put in enough effort), her probability of success is only 0.5. The cost of her effort is $e = \$30$. The inside lender can lend at most $b = \$60$ to be used as investment with a gross interest rate $R = 160\%$. The outside lender will lend the rest of the funds needed to start the project at a gross interest rate of $R = 210\%$. In case of default, the outside lender can seize an amount $\varphi = \$50$ offered as collateral by the inside lender. As she is interested in the result of the project, the inside lender can choose whether to monitor the behavior of the borrower, which would imply a monitoring cost of $P = \$20$. If she monitors, she knows the behavior of the borrower. In the event that misbehavior is discovered, the borrower will then be punished and incur a penalty equivalent to $A = \$9$. Assume that all agents are rational, and that they understand the following time line: lending takes place first; then monitoring decisions are made; choices about effort are made next; and, finally, returns are realized and the borrower decides whether or not to repay.
a. What strategies will the borrower and the inside lender choose and why?
b. Will these strategies change if the inside lender increases the interest rate to $R = 200\%$? Briefly explain your answer.

8. Consider an economy where there is an inside borrower, an inside lender and an outside lender, and assume the three are risk neutral. The inside borrower has a project that yields a return of y with probability p and a return of zero with probability $(1 - p)$ after one period. The project requires an investment of b, which can be borrowed from the outside lender. Since the inside borrower has no wealth, the inside lender offers her the following contract: the inside borrower provides wealth w to the inside lender to be used as collateral, as well as half of her project returns, net of debt payments. The inside lender lends the necessary funds b to the inside borrower and receives either R_b if the project is successful or simply seizes w if the inside borrower's project fails, where R stand for the gross interest rate (principal plus interest). Finally, the inside borrower can choose her level of effort, which changes the probability of her project's success and incurs an effort cost

$$c_e(p) = \frac{kp^2}{2m}$$

where m is the amount of costly monitoring by the inside lender. This monitoring cost is given by

$$c_m(p) = \frac{tm^2}{2}.$$

Assume that w is sufficiently large to eliminate any ex-post moral hazard problems.
a. Interpret the effort and monitoring cost functions.
b. Solve for the equilibrium effort and optimal monitoring effort in this environment, assuming an exogenously given interest rate. Briefly comment on your results.
c. What happens if the inside borrower adopts a new technology that makes effort less costly for every level of p? Comment on what you expect to happen in this case, and, more generally, on what you expect would happen if the inside lender adopts a new technology that makes monitoring cheaper for any level of m.

9. Consider an economy with *ex ante* symmetric, risk neutral individuals of mass 1, living for 2 periods with an additive, linear utility function on consumption goods (both durable and non durable). At the beginning of the first period, a portion f of the economy will luckily receive high income y_1, while the rest of the economy will get a lower income y_0. An agent's level of income is private information. Assume that every individual in this economy wants to buy a durable good,

which costs B and gives extra consumption θ per period. The subsistence level of consumption in this economy is c (i.e., the total consumption on durable and non durable goods must be greater than or equal to c, assume $\theta - B \geq c$). The unlucky individual doesn't have enough money to buy the durable good in the first period, but the lucky one does. However, in the first period there are enough resources in the economy as a whole for each individual to buy the durable good, and there might be a credit market for consumption of durable goods. In the second period, every one will have the same return y, and $y - B > 0$, so everyone's income is high enough to cover subsistence consumption and purchase the durable good.

a. Suppose that ex ante, individuals in this economy can sign a contract to specify that members can lend l_1 and borrow l_0 at the rate R in the end of period 1, where

$$l_0 = B - y_0$$

$$l_1 = \frac{1-f}{f}(B - y_0) = y_1 - B.$$

b. Define the range for R (to be paid in the second period) in which lucky individuals are willing to lend, unlucky individuals are willing to borrow, and everyone is better off from this transaction. (Assume that θ cannot be used for lending.)

10. Is the result in the preceding exercise still true if we allow the discount rate to be positive? What is the lower bound of the discount rate in this particular case?

11. Follow-up from your answer to the previous exercise: what is the upper bound of the discount rate? Briefly explain your answer.

4 Group Lending

4.1 Introduction

Once every week in villages throughout Bangladesh, groups of forty villagers meet together for half an hour or so, joined by a loan officer from a microfinance organization. The loan officer sits in the front of the group (the "center") and begins his business.[1] The large group of villagers is subdivided into eight five-person groups, each with its own chairperson, and the eight chairs, in turn, hand over their group's passbooks to the chairperson of the center, who then passes the books to the loan officer. The loan officer duly records the individual transactions in his ledger, noting weekly installments on loans outstanding, savings deposits, and fees. Quick arithmetic on a calculator ensures that the totals add up correctly, and, if they do not, the loan officer sorts out discrepancies. Before leaving, he may dispense advice and make arrangements for customers to obtain new loans at the branch office. All of this is done in public, making the process more transparent and letting the villagers know who among them is moving forward and who may be running into difficulties.[2]

This scene is repeated over 400,000 times each week in Bangladesh by members and staff of microfinance institutions inspired by Grameen Bank, and versions have been adapted around the world by Grameen-style replicators.[3] Other institutions instead base their methods on the "solidarity group" approach developed by Bolivia's BancoSol or the "village bank" approach operated by microlenders in seventy countries throughout Africa, Latin America, and Asia (including affiliates of FINCA, Pro Mujer, and Freedom from Hunger).[4] For many, this kind of "group lending" has become synonymous with microfinance.[5]

Group lending generally refers to arrangements by individuals without collateral who get together and form groups to obtain loans