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The economics of lending with joint liability: theory and practice [1]

Maitreesh Ghatak [a], Timothy W. Guinnane [b,*]

[a] *Department of Economics, University of Chicago, Chicago, IL 60637, USA*
[b] *Department of Economics, Yale University, New Haven, CT 06520-8269, USA*

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Abstract

Institutions that rely on joint liability to facilitate lending to the poor have a long history and are now a common feature of many developing countries. Economists have proposed several theories of joint-liability lending that stress various aspects of its informational and enforcement advantages over other forms of lending. This paper analyzes how joint-liability lending promotes screening, monitoring, state verification and enforcement of repayment. An empirical section draws on case studies to highlight how joint liability works in practice.

JEL classification: D82; G20; N23; O12
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> To argue that banking cannot be done with the poor because they do not have collateral is the same as arguing that men cannot fly because they do not have wings. — Muhammad Yunus [2]

* Corresponding author. E-mail: timothy.guinnane@yale.edu
[1] This version: May 1999.
[2] Yunus is the founder of the Grameen Bank. The quotation is the epigraph to Wahid (1993).

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1. Introduction

Scholars and development practitioners have in recent years devoted considerable attention to specialized lending institutions that use unconventional methods to lend successfully to poor people. Most of these institutions work in developing countries, but some have been transplanted from poor countries to work with poor people in wealthy countries such as the USA. Considerable evidence now shows that in many circumstances, an unconventional lender such as the Grameen Bank can lend to poor people no ordinary commercial lender would want as a customer and do so with a reasonable degree of financial self-sufficiency and repayment rates that are significantly higher than for comparable loans by conventional lending institutions (see Hossain, 1988; Morduch, 1999). The literature identifies two distinct but complementary reasons for this success. First, many (but not all) of these lending programs ask borrowers to form a group in which all borrowers are jointly liable for each other's loans. These joint-liability lending institutions (which we abbreviate JLLI, and which are often called more loosely ''micro-lenders'') have a long history, and although modern institutions such as the Grameen Bank may be the most famous operating today, credit cooperatives using similar methods date back to the mid-19th century. Second, most micro-lenders engage in intensive monitoring of clients, and rely heavily on the promise of repeat loans for borrowers who perform well. We do not address these efforts systematically in this paper, but that is a matter of focus and not meant as a suggestion that such efforts are unimportant.

This paper provides an economic analysis of joint-liability lending, drawing on and extending recent research, and provides concrete illustrations by discussing actual institutions. The burgeoning literature on JLLIs today suggests several reasons why group lending helps an institution such as the Grameen Bank operate successfully. Many writers mention efforts to reduce transactions costs, which can be relatively large for borrowers who take only small loans. Others highlight ''peer pressure'', ''social capital'', or similar terms that capture the general idea that people with connections of shared locality or other bonds based on kinship and occupation may be able to support credit contracts that would be impossible with conventional banking practices. More recently, economists have applied notions taken from the economics of information and contracts to show how joint liability performs ''...the apparent miracle of giving solvency to a community composed almost entirely of insolvent individuals''. [3] These economic models of JLLIs are efforts to formalize the idea that a well-structured JLLI can deal effectively with the four major problems facing lenders by utilizing the local

[3] Plunkett (1904), quoted in Guinnane (1994). Horace Plunkett was a pioneer in the credit cooperative movement in Ireland at the turn of the 20th century.

information and social capital that exist among borrowers. [4] These problems are: (a) to ascertain what kind of a risk the potential borrower is (*adverse selection*), (b) to make sure she will utilize the loan properly, once made, so that she will be able to repay it (*moral hazard*), (c) to learn how her project really did in case she declares her inability to repay (*auditing costs*) and (d) to find methods to force the borrower to repay the loan if she is reluctant to do so (*enforcement*). [5] JLLIs can do better than conventional bankers *in some social contexts* for two distinct reasons. First, members of a community may know more about one another (that is, each other's types, actions and states, as suggested by points (a)–(c) above) than an outside institution such as a bank. Second, a major source of market failure in credit markets is that a bank cannot apply financial sanctions against poor people who default on a loan, since by definition they are poor. (And in most societies, there are restrictions on the application of non-financial sanctions such as violence.) Poor people's neighbors, on the other hand, may be able to impose powerful non-financial sanctions at low cost. An institution that gives poor people the proper incentives to use information on their neighbors and to apply non-financial sanctions to delinquent borrowers can out-perform a conventional bank. Many studies of JLLIs refer in a general way to ''information problems'' while most economic analyses deliberately focus on one of these four issues. [6]

The literature on micro-finance, like the institutions themselves, is still new. A recent paper by Aghion and Morduch (1998) correctly points out that most studies have focused on the joint-liability aspects of institutions such as the Grameen Bank, and ignored the other program features, such as direct monitoring by the lender, that also promote high repayment rates. Thus far, there is little empirical evidence on the relative importance of joint liability as opposed to other program features. Recent works by Wenner (1995) and Wydick (1999) provide preliminary evidence that joint liability works as thought. In their analysis, variables that proxy for social cohesion and better information flow among group members imply improved repayment rates. [7] But these studies are not conclusive because of difficult econometric problems. [8] Moreover, these studies cannot assess the impor-

[4] The four information and enforcement problems we stress are general and lie at the heart of all theories of financial intermediation. The recent textbook by Freixas and Rochet (1997) provides a clear and comprehensive introduction to the theory of financial intermediation in general.

[5] By ''auditing costs'' in this paper, we mean the costs of state verification (Townsend, 1979) where the relevant state is the return from the borrower's project.

[6] Morduch (1998a) provides an excellent review of microfinance that is complementary to the aims of this paper. In particular, he considers two issues we do not consider, impact analysis and financial sustainability of these programs. See Rashid and Townsend (1994) for a general equilibrium approach to the issue of targeting credit to the poor. For general discussions of credit markets in underdeveloped countries, see Hoff and Stiglitz (1990) or Chap. 14 of the recent textbook by Ray (1998).

[7] See Sections 3.2 and 3.3.

[8] See Morduch (1997) for a discussion of the econometric problems of evaluating the impact of these programs. The main issues are endogenous program placement and self-selection into programs.

tance of joint liability in comparison to, for example, monitoring by the lending institution. In addition, we abstract from the problems associated with inducing the lender, a financial intermediary, to monitor borrowers. In his contribution to this issue, Conning shows that these problems pose a constraint to the expansion of microfinance through increased leverage and other means.

There is also the related but distinct question of whether joint-liability lending, or for that matter any type of micro-finance, really helps the poor. As a logical matter, the Grameen Bank could function very well in terms of repayment rates but have little impact on poverty. This question is also an area of active research. Pitt and Khandker (1998) find, using data from three programs in rural Bangladesh, that borrowing from group-lending schemes increased consumption of poor households. However, Morduch (1998b) has argued that Pitt and Khandker's result reflects program selection effects rather than the impact of borrowing per se. Coleman, in his contribution to this issue, studies the question of program impact in northeast Thailand. The quasi-experimental design of his survey allows him to use more straightforward estimation techniques than either Pitt and Khandker or Morduch to econometrically identify the impact of these programs.

Section 2 below uses simple economic models to show how joint liability can overcome information and enforcement problems. Section 3 discusses various institutional implementations of joint liability to highlight how it works in practice, and illustrates some of the practical problems that arise in the design of these lending programs. In conclusion, we offer some remarks on the key policy question facing supporters of JLLIs today. Our discussion stresses the use of simple economic models to understand broadly how joint liability ameliorates information and enforcement problems. Our discussion does not comprehensively review the entire literature in this active area of research.

2. Theories of joint-liability contracts

In analyzing JLLIs, economists have focused on either the effects of joint liability on the pool and behavior of borrowers, or on the fact that lending to groups as opposed to individuals is a way to reduce transactions costs. While we only discuss the joint-liability aspect of these lending programs, our argument is complementary to the transactions-costs argument. [9] According to the transactions-costs argument, under many circumstances, it is only slightly more expensive to administer a group of n loans than to administer a single loan, so

[9] See Hulme and Mosley (1996a) (Chap. 2).

group lending enables a reduction in transactions costs per loan. [10] If the projects to be funded are *simple* and *similar* in terms of their characteristics, the time path of their returns, and the geographic location of their activities, then coordinating the lender's dealings with these borrowers by putting them together in a group can save on processing, screening and loan collection costs. Put this way, transaction-cost-based theories and joint-liability-based theories can be combined, as we do in Section 2.3 where we show that the bank can avoid the cost of performing a costly audit every time an individual borrower claims she has low output by inducing her partner to undertake liability for her and audit only when the whole group declares inability to repay. [11]

Joint liability alleviates the four main problems faced by formal credit institutions that lend to poor borrowers who cannot offer much in the way of collateral: adverse selection, moral hazard, costly audits and enforcement. We will illustrate these benefits using a simple model of lending. Our model shows how joint liability affects group formation, induces group members to influence the way other members select their projects, helps the lender avoid costly audits, and gives encourages borrowers to repay their loans without the lender imposing costly sanctions. In the rest of this section, we first outline our model, and then take up each of these problems sequentially and use the model to show how joint liability alleviates the four lending problems.

Throughout, we use the following simple set-up: output Y takes two values, high (Y^{H}) and low (Y^{L}) where $Y^{\mathrm{H}} > Y^{\mathrm{L}} \geq 0$. For simplicity, we normalize Y^{L} to zero. Output is high with probability $p \in (0,1)$. Each project requires 1 unit of capital and the lender needs to be paid back an amount $\rho > 1$ per loan, principal plus interest, on average. [12] Borrowers will borrow only if their payoff exceeds the opportunity cost of their labor, $\bar{u}$. The project returns of different borrowers are assumed to be uncorrelated. We assume that all projects are socially profitable in the sense that the expected return from the project is greater than the opportunity costs of the capital and labor employed in the project

$$pY^{\mathrm{H}} > \rho + \bar{u}. \tag{A1}$$

Throughout this paper, we refer to an outside lender as the 'bank'. By this, we mean an individual or an institution who has the resources to lend to a certain

[10] Schaefer-Kehnert (1982) (p. 10) notes that in an early lending scheme in Malawi, repayment rates for individual loans was about the same as for group loans. But the former required much greater effort to collect.

[11] The complementarity of the two approaches is recognized in some policy-oriented studies. See, for example, Fischer (1995) (pp. 14–15).

[12] We will assume that the lender earns zero economic profits, either by design (because it is a not-for-profit organization) or through the forces of economic competition.

group of borrowers either on an individual basis or to a self-formed group. We also assume limited liability, in the sense that the lender can only seize assets that the borrower has specifically pledged as collateral for a loan. Most JLLIs operate in environments where borrowers do not have physical or financial assets to pledge as collateral, meaning that a lender has no recourse in the case of a defaulting borrower. This limited-liability constraint and the borrowers' lack of wealth rules out most instruments used by conventional lenders to contend with information and enforcement and enforcement problems. [13] If a borrower defaults on a loan and has no physical or financial assets, the lender cannot force the borrower to undertake labor services to repay the debt.

A standard loan contract specifies an interest rate r (this is a *gross* interest rate, namely, principal plus the *net* interest rate) which is the amount the borrower must repay to the bank. This can be interpreted as the *individual liability* of the borrower. We model joint liability in the following way: if a borrower is willing and able to repay her own loan but her partner is unwilling or unable to repay her loan, then the former must pay an additional amount c to the bank. The form of joint liability for defaults in actual group-lending programs often takes the form of denying future credit to all group members in case of default by a group member until the loan is repaid. In most cases, intra-group loans are used to ensure timely repayment (Huppi and Feder, 1990). Our static interpretation of joint liability may seem at odds with its institutional implementation. But c can be interpreted as the *net present discounted value* of the cost of sacrificing present consumption in order to pay joint liability for a partner. If these loans from one group member to another are always repaid in the future, in cash or in kind, it may seem that in an intertemporal sense, joint liability does not impose a cost on a borrower who has to cover for her partner. That would indeed be true if credit markets were perfect, but given that these borrowers face borrowing constraints to start with (which after all is the reason for introducing group lending), such sacrifices of present consumption are costly.

2.1. Adverse selection

Adverse selection arises when borrowers have characteristics that are unobservable to the lender but affect the probability of being able to repay the loan. A lender can try to deal with this information problem directly, by trying to assess these characteristics, or indirectly by offering loan terms that only good risks will

[13] Our limited-liability assumption also rules out physical punishment, slavery, or bonded labor as instruments for supporting credit contracts.

accept. The typical method for separating good risks from bad risks is to ask the borrower to pledge collateral. Risky borrowers are likely to fail more often and lose their collateral. If the bank offers two different contracts, one with high interest rates and low collateral and the other with the opposite, risky borrowers will select the former and safe borrowers the latter. But poor people by definition to do not have assets that make useful collateral, meaning that lenders have no effective way to separate good risks from bad. Group lending deals with adverse selection by drawing on local information networks to achieve the equivalent of gathering direct information on borrowers and using differences in loan terms to separate good from bad borrowers.

Several recent papers have examined the effect of joint-liability on the *selection of groups*.[14] Most of these studies use an adverse-selection framework where borrowers know the characteristics of each other's projects relevant to their creditworthiness, but the bank does not. (From now on, we will refer to these characteristics as a borrower's 'type', risky or safe.) While all borrowers prefer to have safe partners (because of lower expected joint-liability payments) safe borrowers value safe partners more than risky borrowers because they repay more often, and as a result more likely to realize the gain of having a safe partner. This implies that in equilibrium, borrowers end up with partners of the same type. As a consequence, the bank can screen borrowers by varying the degree of joint liability. This is because risky borrowers have risky partners and, hence, will prefer a contract with less joint liability than will a safe borrower.

The papers by Ghatak and Van Tassel in this issue formalize this idea and examine various implications of it.[15] Here, we illustrate the main idea using a simple model. Assume borrowers are risk-neutral and of two types, safe (a) and risky (b). With a project of type i, output takes two values, Y_i^{H} and 0, and the probability of high output is p_i, $i = \mathrm{a,b}$. We assume $p_{\mathrm{b}} < p_{\mathrm{a}}$. If the bank does not know a borrower's type, and if standard screening instruments such as collateral are not available, then the bank has to offer loans to all borrowers at the same nominal interest rate. Under such a contract, safe borrowers have to cross-subsidize the risky borrowers because both types of borrowers repay the same amount when they succeed, but safe borrowers succeed more often. The presence of enough risky borrowers can push the equilibrium interest rate high enough to drive the safe borrowers away from the market (as in the lemons model of Akerlof, 1970). Alternatively, the presence of safe borrowers subsidizes some undeserving risky projects. If borrowers know each other's types, a joint-liability contract can restore full efficiency. Under a joint-liability credit contract, a borrower must

[14] See Varian (1990), Aghion and Gollier (1998), Sadoulet (1998), Ghatak (1999), Laffont and N'Guessan (1999).

[15] See also Aghion and Gollier (1998), Ghatak (1999) and Laffont and N'Guessan (1999).

repay her loan r whenever her project yields high returns, and in addition, if her partner's project yields low returns, she must pay an extra amount $c > 0$. The expected payoff of a borrower of type i when her partner is type j from a joint-liability contract is:

$$\mathrm{EU}_{ij}(r,c) = p_i p_j\left(Y_i^{\mathrm{H}} - r\right) + p_i(1-p_j)\left(Y_i^{\mathrm{H}} - r - c\right).$$

The net expected gain of a risky borrower from having a safe partner is $\mathrm{EU}_{\mathrm{ba}}(r,c) - \mathrm{EU}_{\mathrm{bb}}(r,c) = p_{\mathrm{b}}(p_{\mathrm{a}} - p_{\mathrm{b}})c$. Similarly, the net expected loss for a safe borrower of having a risky partner is $\mathrm{EU}_{\mathrm{aa}}(r,c) - \mathrm{EU}_{\mathrm{ab}}(r,c) = p_{\mathrm{a}}(p_{\mathrm{a}} - p_{\mathrm{b}})c$. If $c > 0$, the latter expression is larger than the former since $p_{\mathrm{a}} > p_{\mathrm{b}}$. Hence, a risky borrower will not find it profitable to have a safe partner. A borrower of any type prefers a safer partner, but the safer is the borrower herself, the more she values a safe partner. A risky borrower in theory could pay the safe borrower to accept her as a partner, but the expressions above imply that such payments would have to be so large that the risky borrower would not want to make them. [16] As a result, group formation will display positive assortative matching under a joint-liability contract.

Ghatak (1999) show that this assortative matching property allows the bank to screen borrowers 'by the company they keep' because risky borrowers are less willing than safe borrowers to accept an increase in the extent of joint liability. If the bank offers two contracts, one with high joint liability and low interest rates and the other with low joint liability and high interest rate, safe borrowers will select the former contract and risky borrowers the latter. Thus, the repayment rate and efficiency are higher under joint-liability contracts as compared to conventional individual-liability contracts because the former exploits a useful resource that the latter does not: the information borrowers have about each other.

2.2. Moral hazard

Once a borrower has taken a loan, the project's payoff depends in part on the borrower's actions, including levels of labor and other inputs. Ordinarily, we would expect the borrower to choose these actions such that the marginal benefit of each action equals its marginal cost. That is not necessarily the case with asymmetric information. In the absence of collateral, the lender and borrower do not have the same objectives because the borrower does not fully internalize the

[16] Since we are assuming that borrowers have no assets, such transfers are implausible if interpreted in purely financial terms. What we have in mind is that borrowers within a group might make transfers to each other in forms which are not feasible with an outsider (e.g., free labor services).

cost of project failure. Moreover, the lender cannot stipulate perfectly how the borrower should run the project, in part, because some of the borrower's actions are not costlessly observable.

Theories of peer monitoring are motivated by the fact that group members have an incentive to take remedial action against a partner who mis-uses her loan because of joint liability. [17] With group lending, individual borrowers are made to bear liability for themselves and for others in their group, but the savings in the form of better project choice allows the bank to pass on some benefits to the borrowers in the form of reduced interest rates. Thus, group lending increases welfare and repayment rates. We illustrate this idea with the following simple model.

Output takes two values. Borrowers are risk-neutral, as before. But the borrower's actions determine the probability of success. So output is Y^{H} with probability p and 0 otherwise. Borrowers choose actions, which can be thought of as a level of effort $p \in [0,1]$, for which they incur a disutility cost of $1/2\gamma p^2$ (where $\gamma > 0$). The borrower's choice is unobservable to the bank. Notice that social surplus $pY^{\mathrm{H}} - 1/2\gamma p^2$ is maximized if $p = p^* = Y^{\mathrm{H}}/\gamma$. Let us assume that

$$Y^{\mathrm{H}} < \gamma \tag{A2}$$

so that we have an interior solution. With perfect information, the bank could specify that the borrower choose $p = p^*$ and charge an interest rate $r = \rho/p^*$. But if the choice of p is subject to moral hazard, then taking the interest rate r as given, the borrower chooses p to maximize her private profits:

$$\hat{p}(r) \equiv \arg\max \left\{ p(Y^{\mathrm{H}} - r) - \frac{1}{2}\gamma p^2 \right\} = \frac{Y^{\mathrm{H}} - r}{\gamma}.$$

The interest rate is like a tax on success since it has to be paid only when output is high. Hence, $p^* = \hat{p}(0) > \hat{p}(r)$ and the higher the interest rate, the lower is p. Substituting $p = (Y^{\mathrm{H}} - r)/\gamma$ in the bank's zero-profit condition $pr = \rho$, we get $\gamma p^2 - Y^{\mathrm{H}} p + \rho = 0$. This is a quadratic equation in p which means there are two values of p consistent with equilibrium. We assume that the equilibrium with the higher value of p is chosen (since the bank is indifferent and the borrower is strictly better off), i.e., $p = \frac{Y^{\mathrm{H}} + \sqrt{(Y^{\mathrm{H}})^2 - 4\rho\gamma}}{2\gamma}$.

[17] Stiglitz (1990), Varian (1990), Banerjee et al. (1994), Conning (1996), Madajewicz (1998), Aghion (1999) explore various aspects of the theory of peer monitoring in joint-liability lending.

Under joint liability, when the borrower's project fails her partner is liable for the amount c. If a borrower's partner chooses an action p', then the payoff function of a borrower who chooses an action p is

$$\max_{\{p\}} pY^{\mathrm{H}} - rp - cp(1-p') - \frac{1}{2}\gamma p^2.$$

Suppose the borrower chooses p to maximize her individual payoff taking the partner's action p' as given. Then her best response function is given by:

$$p = \frac{Y^{\mathrm{H}} - r - c}{\gamma} + \frac{c}{\gamma}p'.$$

That is, the safer the partner's project choice, the safer the project choice of a borrower. If a borrower chooses a risky project, this choice reduces the attractiveness of high returns to her partner because of expected joint-liability payments. Thus, the borrower also chooses a more risky project. If borrowers take decisions about project-choice non-cooperatively then in the symmetric Nash equilibrium, $p = p' = (Y^{\mathrm{H}} - r - c)/\gamma - c$. The bank's zero-profit condition under joint liability is:

$$rp + cp(1-p) = \rho.$$

Substituting in the first-order condition, we see that

$$\gamma p^2 - Y^{\mathrm{H}}p + \rho = 0.$$

Hence, a borrower's equilibrium project choice will be the same as with individual liability: mere joint liability does not alleviate moral hazard in this model. This result follows because a borrower does not take into account her action's affect on her partner's choice of action. This similar to the fact that if the borrower internalized the effect of the choice of her action on the interest rate under individual-liability lending (namely, we incorporated the bank's zero profit condition $pr = \rho$ in the borrower's objective function), she would choose the first-best level of p.

If instead borrowers decide on project-choice cooperatively they choose:

$$\tilde{p}(r,c) \equiv \arg\max_{\{p\}} pY^{\mathrm{H}} - rp - cp(1-p) - \frac{1}{2}\gamma p^2 = \frac{Y^{\mathrm{H}} - r - c}{\gamma - 2c}.$$

Substituting this expression in the bank's zero-profit condition, we get:

$$(\gamma - c)p^2 - Y^{\mathrm{H}}p + \rho = 0.$$

This yields (again choosing the higher root),

$$p = \frac{Y^H + \sqrt{(Y^H)^2 - 4\rho(\gamma - c)}}{2(\gamma - c)}.$$

Recall that by Eq. (A2), $\gamma > Y^H$ and since the borrower cannot pay more than what his project yields, it must be the case that $c < \gamma$. For $c \in (0,\gamma)$, the numerator of the expression for the equilibrium value of p under joint liability is higher than the corresponding expression under individual liability, while the denominator of the former expression is lower than that of the latter. The equilibrium value of p and, hence, the repayment rate, is therefore higher under joint-liability lending when borrower's choose p cooperatively compared to individual-liability lending.

The above formulation of joint liability assumes that borrowers can contract on p among themselves: i.e., they can observe each other's actions perfectly and costlessly, as well as enforce any agreement regarding their levels. [18] However, if monitoring is costly, then borrowers must be given incentives to monitor. Suppose that if a borrower chooses a level of monitoring a, then with probability a, she can observe the true action chosen by her partner, and with probability $1 - a$, she receives a completely uninformative signal. If the action undertaken by her partner is different from that agreed on, then she can impose a non-monetary punishment of S (which stands for social sanctions). The cost of monitoring is given by the increasing and convex function $M(a)$. Let $p^D(r,c)$ denote the individual best response of a borrower given that her partner chooses $p = \tilde{p}(r,c)$. Then

$$p^D(r,c) = \frac{Y^H - r - c}{\gamma} + \frac{c}{\gamma}\tilde{p}(r,c) = \left(1 - \frac{c}{\gamma}\right)\tilde{p}(r,c) < \tilde{p}(r,c).$$

Now, the incentive compatibility constraint of a borrower to choose $\tilde{p}$ and not deviate to p^D given that her partner chooses a level of monitoring a and the agreed upon project choice $\tilde{p}$ is given by:

$$\tilde{p}(Y^H - r) - \tilde{p}(1 - \tilde{p})c - \frac{1}{2}\gamma\tilde{p}^2$$

$$\geq p^D(Y^H - r) - p^D(1 - \tilde{p})c - \frac{1}{2}\gamma p^2 - aS.$$

Since monitoring is costly, the minimal level of monitoring consistent with the above constraint will be chosen. This implies that the constraint will be satisfied with equality in equilibrium. Let the corresponding level of a be denoted by

[18] This is the assumption, for example, of the formulation of peer monitoring by Stiglitz (1990).

$\tilde{a}(r,c)$. One must ensure that a borrower has the incentive to undertake the requisite level of monitoring to ensure her partner chooses $p = \tilde{p}$. That is,

$$\tilde{p}(Y^{H} - r) - \tilde{p}(1 - \tilde{p})c - \frac{1}{2}\gamma\tilde{p}^{2} - M(\tilde{a})$$

$$\geq \tilde{p}(Y^{H} - r) - \tilde{p}(1 - p^{D})c - \frac{1}{2}\gamma\tilde{p}^{2}$$

or,

$$\tilde{p}(\tilde{p} - p^{D})c \geq M(\tilde{a}).$$

As long as social sanctions are effective enough (i.e., S is large) or monitoring costs are low enough (i.e., $M(\tilde{a})$ is small), joint-liability lending will improve repayment rates through peer monitoring even when monitoring is costly.

2.3. Costly state verification

Formal lenders sometimes cannot lend to poor borrowers because such lenders cannot easily verify whether borrowers who say they cannot repay are indeed unable to do so. We are assuming that all parties are risk-neutral, which implies that the ideal contract is one in which the borrower pays a fixed fee (such as an interest rate) regardless of what happens. But because of the borrower's limited wealth there may be situations where the borrower cannot pay very much, for example, when her project fails. For the bank to accept partial repayment is like charging a lower interest rate to the borrower, and if the bank applies this lower fee to all states of the world it cannot break even. At the same time, any other option introduces some degree of state contingency in the contract. Since states are costly to verify, a state-contingent contract creates an incentive for the borrower to report those states of the world where her repayment obligations are the least, irrespective of the true state. To solve the twin problems of false reporting and costs of state verification the optimal contract takes the following simple form: as long as the borrower is willing to pay a fixed fee, the bank does not audit, but if she reports that she is unable to pay this fee, the bank audits her and takes away all her returns. This is a standard debt contract. [19] With this kind of contract, if the borrower claims her output was too low to repay, the bank audits her and takes all her output (Townsend, 1979). But if the costs of auditing borrowers are too high, there may be no contract which allows the bank to break even on loans. This problem is especially likely for the kind of borrowers served by JLLIs.

Here, we propose a simple model to show that joint-liability contracts reduce expected audit costs and improve efficiency. [20] The intuition is that if group

[19] Auditing in our discussion means the lender investigates the borrower's condition to see how much wealth is available to seize in lieu of loan repayment.

[20] Prescott (1997) makes a related argument based on the delegated-monitoring model of Diamond (1996).

members face a lower cost of verifying each other's output (say, because they live close to each other's workplaces), then the bank can avoid the cost of performing its own audit every time a borrower claims she has low output by inducing her partner to undertake liability for her. The partner has the incentive to audit a borrower since she is partly liable for her repayment. Only when the whole group announces its inability to repay will the bank have to incur auditing costs. Assume that all projects are identical and the only departure from the first-best is costly output verification: the outside lender has to pay $\gamma > 0$ to verify the return of each individual project. There are no problems of moral hazard, adverse selection or enforcement of contracts. The financial contract specifies three numbers: the transfer from the borrower to the bank when the project succeeds (r), and the probabilities of an audit (λ_H and λ_L), when output is high and low. As before, everyone is risk-neutral and there is a limited-liability constraint. Formally, the optimal contract then solves:

$$\max\ p(Y^H - r) - \bar{u}$$

subject to the following two constraints:

$$Y^H - r \geq \max\{0, (1-\lambda_L)Y^H\}$$

$$\rho \leq p(r - \lambda_{H\gamma}) + (1-p)(-\lambda_{L\gamma}).$$

The first constraint is a ''truth-telling'' constraint which says that given the contract, the borrower will have an incentive to repay the loan when output is high rather than announce that output is low and risk an audit (with probability λ_L) in which she could lose all the output to the bank. The second constraint says the bank should break even on the loan under the contract.

Since there are no risk-sharing issues, the optimal contract has a very simple structure: it minimizes auditing costs by auditing with positive probability $\lambda > 0$ when the borrower claims output is low and the bank takes all output. Otherwise, the borrower pays an interest r in which case, there are no audits. [21] From the two constraints, we get:

$$r = \lambda Y^H$$

$$\lambda = \frac{\rho}{pY^H - (1-p)\gamma}$$

Notice that to ensure $\lambda \leq 1$, we need:

$$pY^H - (1-p)\gamma \geq \rho. \tag{A3}$$

This condition means that the expected return from the project less the expected costs of auditing has to be at least as large as the opportunity cost of capital. This

[21] See Mookerjee and Png (1989) for a general treatment of the problem.

condition also ensures that $pY^H - (1-p)\gamma > 0$ and, hence, $\lambda \geq 0$. Finally, substituting in the borrower's payoff, we see that an optimal contract exists if

$$p(Y^H - r) - \bar{u} \geq 0 \tag{A4}$$

That is, the borrower's expected return net of interest payments has to be as large as the opportunity cost of her labor.

Assume that the borrowers can write side-contracts with each other costlessly and that there is no cost for a borrower to observer her partner's project returns. This means that all members make the same announcement about the state of the world. There are two relevant truth-telling constraints. The first one is like in the previous case which ensures that a borrower has incentives to make truthful announcements when output is high. The second one says that if a borrowers own project yields high returns and her partner's project yields low returns, she has the incentive to report this state truthfully and repay her own loan as well as joint liability for her partner. Clearly, only the second truth-telling constraint,

$$Y^H - 2r \geq \max\{0, (1-\lambda)Y^H\}$$

will bind. The bank's zero-profit condition is now:

$$p^2 r + p(1-p)2r - \lambda(1-p)^2\gamma = \rho.$$

Solving the truth-telling and the zero-profit constraints, we get:

$$r = \lambda\frac{Y^H}{2}$$

$$\lambda = \frac{\rho}{\{pY^H - (1-p)\gamma\} - \frac{1}{2}p\{pY^H - 2(1-p)\gamma\}}.$$

As $[pY^H - (1-p)\gamma] > [pY^H - 2(1-p)\gamma] > (1/2)p[pY^H - 2(1-p)\gamma]$, the equilibrium rate of interest will be lower under joint liability. As long as $[pY^H - (1-p)\gamma] - (1/2)p[pY^H - 2(1-p)\gamma] = (1-(p/2))[pY^H - (1-p)\gamma] + (p/2)(1-p)\gamma \geq \rho$, $\lambda \leq 1$. [22] Audits take place less often under joint liability, so expected audit costs are lower and so is the equilibrium interest rate. Hence, social surplus is always higher under joint-liability contracts. Even if banks would not lend to borrowers under individual-liability contracts due to high audit costs (which happens if Eq. (A4) is not satisfied), a joint-liability contract might make lending possible.

[22] If this condition is not satisfied, then $\lambda = 1$ under joint liability. Then the relevant condition for the interest rate to be lower under joint liability becomes $Y^H/2 < (\rho Y^H)/(pY^H - (1-p)\gamma)$, or $2\rho \geq pY^H - (1-p)\gamma$.

2.4. Enforcement

The final problem, enforcement, arises not from informational asymmetries but from the lender's limited ability to apply sanctions against a delinquent borrower. Even if the borrower's project succeeds so that she is able to repay, she may still refuse to repay if the legal system does not work very well and if the poverty of the borrower restricts the amount of effective sanctions. Besley and Coate (1995) address the question of how joint-liability contracts affect the willingness to repay. They show that group lending has two opposing effects on repayment rates. The advantage of groups is that they allow a member whose project yields very high returns to pay off the loan of a partner whose project does very badly. The disadvantage is that a moderately successful borrower may default on her own repayment because of the burden of having to repay her partner's loan. However, if social ties among members are sufficiently strong, the net effect is positive because by defaulting willfully a borrower incurs sanctions from both the bank and the community. With sufficient social capital, a borrowing group enforces repayment better than would take place with individual liability.

Consider the following simple model that illustrates this point. We now assume borrowers are risk-averse. [23] Suppose the only departure from the first-best stems the fact that borrowers can default intentionally even when they are capable of repaying. The punishment a bank can impose on a delinquent borrowers is limited and consists entirely of never lending to her again. If a borrower's project yields output $Y \geq r$ so that she is able to repay, she will repay only if the benefit of defaulting, the interest cost, is less than the (discounted) net benefit of continued access to credit, $\bar{B}$:

$$u(Y) - u(Y - r) \leq \bar{B}.$$

The term $\bar{B}$ reflects the present value of the net benefit to the borrower from having continued access to loans from the bank. As is well known, infinitely repeated games have many possible equilibria. For simplicity, we are restricting attention to stationary equilibria of the supergame between the borrower and the lender where cooperation is achieved by trigger strategies, namely, both parties revert to the worst subgame perfect equilibrium of the supergame if one of the parties misbehave. In the current context, if the borrower defaults once, the bank never lends to the borrower again, and the borrower never repays if she receives a loan again. We are also assuming that the bank does not pre-commit to future interest rates and hence the benefit from future access to loans viewed from the

[23] The original insight of the Besley–Coate model is that in the absence of strong social sanctions there is a tradeoff between repayment under joint liability and individual liability. This tradeoff does not depend on whether borrowers are risk averse. We assume borrowers are risk averse to make their point in a much simpler model.

current period is independent of the interest rate r. Even if $\bar{B}$ depends on r (it is expected to be decreasing in r) the above argument goes through: for a given r, there will be some critical $Y(r)$ such that borrowers will repay if $Y \geq Y(r)$. [24]

Let $Y(r)$ be the income level that satisfies this condition with strict equality. If there is diminishing marginal utility of income, then for a given r, the borrower will repay only if $Y \geq Y(r)$. If the returns are not very high, repayment is costly because the marginal utility of income is high. Under a joint-liability contract, all group members are considered to be in default unless every loan is repaid and in the event of a default no one gets a loan in the future. A borrower will choose to repay even if her partner defaults (given that she is able to repay, i.e., $Y \geq 2r$) if:

$$u(Y) - u(Y - 2r) \leq \bar{B}.$$

If $Y > Y(2r)$, she will default on both her own and partner's liability. Note further that $Y(2r) > Y(r)$; since paying off both her own and her partner's debts is more onerous than paying off just her own loan, only when income is very high would borrowers want to repay under this contract. Assume for simplicity $Y(r) > 2r$ and that if both members have an income $Y > Y(r)$, then they repay under joint liability. [25] There are two distinct cases.

- One group member is *unable* or *unwilling* to repay (i.e., has an income realization $Y \leq Y(r)$) and the other member is *willing* to repay both her own and her partner's obligation (i.e. has income $Y \geq Y(2r)$). In this case, joint liability is beneficial compared to individual-liability lending.
- One member is unable or unwilling to repay her own debt (i.e., $Y < Y(r)$) and her partner is willing to repay her own debt but not both of their debts (i.e., $Y(r) < Y < Y(2r)$). Now individual liability is better than joint liability.

Depending on which of these cases is more likely to occur (which depends on the probability distribution of output), default may be more or less common with joint liability. However, social sanctions alter the effect of joint liability. Suppose a default by one borrower that hurts the other group member (because she is cut off from loans in the future) elicits some punishment from the community ('social sanctions'). These social sanctions alter the repayment condition under joint liability. Social sanctions reduce the attractiveness of the payoff stream in the case

[24] In this case, $Y(r)$ is a solution of $u(Y) - u(Y - r) = \bar{B}(r)$. A referee noted that default is often motivated by a borrower's desire to take advantage of an investment opportunity that requires more than $Y - r$, which may not arise in the future, that leads to a higher payoff stream and for which the lender is not willing to lend. These considerations can be incorporated in the current formulation if one interprets $f(Y,r) \equiv u(Y) - u(Y - r)$ not as the difference in *one period* utility from defaulting and repaying but the difference in the income streams from taking advantage of an investment opportunity that a capital of Y permits vs. one that a capital of $Y - c$ permits. As long as $f(Y,r)$ is increasing in Y and decreasing in r, our conclusions go through.

[25] That is, we are assuming there are no coordination problems between the borrowers. See Besley and Coate (1995).

when one party defaults intentionally $(r < Y < Y(r))$ and the other party was willing to repay her own loan but not her partner's $(Y(r) < Y < Y(2r))$. In this case, repayment would definitely be higher under joint-liability contracts.

If *repayment decisions* are taken cooperatively, repayment behavior under joint liability is identical to repayment behavior with individual liability. To see this, let the income realization of the two members in a given group be Y_1 and Y_2. If the group maximizes joint welfare, members will always share net income (i.e., net of repayment) so as to equate marginal utilities of consumption. In that case, the crucial variable in the determination of repayment decisions is not individual income, as in the non-cooperative formulation above, but total (or average) income. Accordingly, borrowers will be voluntarily jointly liable for each other's loans regardless of whether the formal terms are joint or individual liability. [26]

Recent work by Diagne (1998) and Aghion (1999) has considered several extensions of the role of joint liability in mitigating the problem of strategic default. Diagne (1998) proposes a peer-pressure model in which borrowers are incompletely informed about their partner's willingness to apply or to tolerate social sanctions. He shows that peer pressure works only because of a potential defaulter's intolerance of passive social sanctions. Aghion (1999) develops a model of strategic default where a borrower's partner(s) can verify her true project return (and impose sanctions if she defaults strategically) at some cost and allows for project returns of group members to be correlated. She examines the issue of optimal design of group-lending programs in terms of optimal group size and monitoring structures.

3. Institutional implementations of joint liability

In Section 2 we used a model of lending to show how joint liability can work in theory. This section uses the history and institutional structure of some joint-liability lending programs to illustrate how joint liability works in practice. We emphasize practical problems that arise in its implementation because a central issue in joint-liability lending today is how to transplant the Grameen Bank and other successful JLLIs to other countries. [27] We begin our discussion with two important institutions that have successfully used joint liability: Germany's historical credit cooperatives and the Grameen Bank today. Between them, these two

[26] In particular, the group will not repay any loan, repay one loan, or repay both loans accordingly as $u((Y_1+Y_1)/2)-u((Y_1+Y_1-r)/2)>\bar{B}$, $u((Y_1+Y_1)/2)-u((Y_1+Y_1-r)/2)\le\bar{B}<u((Y_1+Y_1)/2)-u((Y_1+Y_1-2r)/2)$, or $u((Y_1+Y_1)/2)-u((Y_1+Y_1-2r)/2)\le\bar{B}$.

[27] Adams and von Pischke (1992) is the classic paper on this subject. Most studies at least mention the issue. Studies that emphasize the transplantation of the Grameen Bank include the contributions to Hulme (1990, 1991), Getubig et al. (1993), Todd (1996a) and several of the articles collected in Wahid (1993). Edgcomb et al. (1996) summarize micro-lending efforts in the United States.

institutions provide a basic outline of the various ways joint-liability lending can work. We then turn to discussion of how joint liability has worked in lending programs today.

Ideally, we would like a fine-grained analysis of the factors that contribute to the success or failure of joint-liability lending schemes. One can imagine a regression, where the observations are information on the experience of various JLLIs, the dependent variable a measure of program performance, and the right-hand side variables describe aspects of the social and economic environment, borrower characteristics and program design. Unfortunately, this approach is not possible given the current state of the literature; as we noted in Section 1, the empirical literature does not even yield a clear answer on how important joint-liability is in comparison to the other instruments used by most micro-lenders. The discussion here is intended to illustrate the theoretical discussion of the previous section, and not as any concerted effort to assess the role of joint liability in any particular institution.

3.1. Two examples of successful joint-liability lending

Credit cooperatives were first introduced in Germany during the 1850s. By Wolrd War I, there were about 19,000 such cooperatives and together they had issued some 8% of all German banking liabilities. The German credit cooperatives had parallels and imitators in several European countries in the 19th century and, in some sense, are forerunners of lending schemes that rely on joint liability. [28] We stress the rural cooperatives because they most nearly resembled contemporary institutions in their goals and clientele. Rural cooperatives tended to make long-term loans (often 10 years or more) and financed those loans from local deposits. Most loans were secured by a co-signer. The co-signer did not have to be a member of the cooperative but was held responsible for any loan the borrower did not repay. To apply for a loan, a potential borrower presented himself at the monthly meeting of the management committee and explained the size and terms of the loan he wanted, the purpose for which he intended the loan, and his security. [29] Loans were used for many different purposes, including fertilizer, tools and machinery and livestock for agriculturists, raw materials for artisans, and stock for shopkeepers. Cooperatives as a matter of policy avoided consumption loans.

The German cooperatives made loans of varying sizes and terms, depending on their location and competition with other lenders. But their claim to fame was their

[28] Several studies draw more or less serious parallels to the German credit cooperative movement. See, for example, Schaefer-Kehnert (1982) (p. 15) or Huppi and Feder (1990) (p. 189).

[29] Huppi and Feder (1990) (p. 189) note that in many present-day credit cooperatives, the amount any member can borrow is tied to his or her capital contributions. This was not the norm in the 19th century German institutions.

ability to make and obtain repayment on very small loans from people who had no assets acceptable to a commercial lender. To take one specific example, in April of 1908, two brothers, both laborers, applied to a credit cooperative in the Prussian Rheinland for loans of Marks 100 each. The loans were granted at 5% interest, which is only slightly more than an established business would have paid its bank for a much larger loan. The only security the brothers offered the cooperative was each other as co-signers on the promissory note. [30]

Most credit cooperatives today and in the past are variations on this basic theme. An important feature of the credit cooperatives is that, especially in rural institutions, all of these people lived in a small area, interacted regularly, and had many other ties, both economic (such as employer/employee) and extra-economic (such as kinship or membership in the same social groups). Members in urban credit cooperatives had less tight connections to another, as they could live in different parts of a city and did not necessarily know one another. These weaker member ties probably explain the fact that urban credit cooperatives more nearly resembled commercial lenders in their policies.

Our second example is the most famous group-lending organization today, Bangladesh's Grameen Bank. The Grameen Bank has been imitated in several other countries so the impact of this form of lending goes far beyond Bangladesh. In Bangladesh, the Bank currently lends to about two million people, most of whom are rural, landless women. The Bank operates in 36,000 villages, or about half of all villages in the country. Grameen Bank borrowers organize themselves into self-selected groups of five people (men and women are in different groups, as dictated by social norms in Bangladesh). All group members must be from the same village. After the formation of the group, members receive training from Bank employees and begin weekly meetings. From the outset, each member makes small, weekly savings deposits. Several weeks after the group is formed, two members receive a loan. If the initial borrowers make their required weekly payments and if the group otherwise adheres to the rules of the Grameen Bank, two more members receive loans, and so on. Loans are small and must be repaid in weekly installments over a period of 1 year. If any member of a group defaults, all members are ineligible for Grameen Bank credit in the future (Khandker et al., 1995).

The borrowing groups are combined into larger entities called Centers. Among other responsibilities, these Centers manage two important funds. The first, the Group Fund, is comprised of the compulsory savings deposits already noted, a 5% fee charged on all loans at initiation, and any fines the center chooses to levy on borrowers who violate Grameen rules. Each center manages its own Group Fund and can use it for loans to cover emergency consumption needs, including the

[30] Loan approval in the *Protokollbuch für den Vorstand, Oberdreeser Darlehnskassen-vereine*. An agricultural laborer in this region would earn DM 15–20 per week in the early 20th century.

funeral and wedding obligations that have often been a cause of recourse to money lenders. A second fund, called the Emergency Fund, comes from compulsory surcharges on borrower interest. The Emergency Fund is used to provide insurance coverage for events such as natural disaster or a borrower's death or default. These two funds provide Grameen Bank borrowers a margin of safety against the default of a borrower in their group, since in many cases, either the Group Fund or the Emergency Fund can be used to make good the loss. These funds are the only financial connection between groups within a Center. That is, an individual in one five-person group stands to lose from the misbehavior of someone in another five-person group only through potential losses to the Group or Emergency Funds. Typically, Grameen loans are for small-scale enterprises that require working capital. Examples include grocery shops, tea stalls, sewing machines, and agricultural livestock.

Both the credit cooperatives and the Grameen Bank illustrate the basic joint-liability framework modeled above. Borrowers self-select into groups in which all members are liable for all other members' loans. All borrowers accept the threat that if their group does not fully repay its loans, then all members are cut off from future credit from this lender. Underlying the entire group notion is the idea that these individuals, because of shared location and other ties, know a great deal about one another, can observe each other's day-to-day business activities and the outcome of those activities, and have ways of pressuring each other to repay loans. But there are important differences between the credit cooperative structure and that of the Grameen Bank. In the cooperative, there are two different layers of the group. For loans with co-signers, the first layer consists essentially of one borrower and his co-signer. The second layer consists of the cooperative membership as a whole, who are liable for the cooperative's debts. [31] Notice that within each ''group'', the members have the incentives noted above, although to different degrees. For the first group, the co-signer bears all financial responsibility for the borrower's loan. In the second, much larger group, the failure of any one loan threatens the cooperative's long-term growth and health, and possibly its ability to pay dividends (if it has the policy of doing so). In the Grameen Bank, on the other hand, there is only the one borrowing group. Bank staff combine several borrowing groups into a ''Center'' for meetings, training sessions, etc., but groups within a Center bear no financial responsibility for the loans of other groups.

There are two other important difference between the two institutions. One is the source of loan funds. Some German cooperatives borrowed substantial shares of their loan funds from external financial institutions, but most relied on local funds, a combination of the cooperative's assets (built up from member capital contributions as well as retained earnings), member deposits and deposits of those who were not members. The Grameen Bank and other institutions, on the other

[31] Each member's exposure depends, of course, on how liability in the cooperative is arranged.

hand, obtain most of their lending funds from external institutions. A second difference turns on the longevity of the lending group. In the cooperatives, the first level (borrower and co-signer) exists only for the life of a loan, while the second level, the cooperative membership, is a corporate body that exists independent of any loan. A borrowing group in the Grameen Bank, on the other hand, exists only for the purposes of the loan in question, and while it may be reconstituted for a later loan there is no institutional reason why the members cannot just select other partners (Tohtong, 1988, p. 5).

Accounts of both the cooperatives and the Grameen Bank illustrate concretely the ways they used their structure to achieve screening, monitoring, auditing and enforcement. A few examples will suffice. German cooperatives screened both their members (not all were admitted) and loans (members could be denied loans). To take an example, the Limbach cooperative (Saarland) denied membership to two individuals in 1913, although it did not say why. [32] Cooperatives also ejected members who did not adhere to the rules. [33] These institutions also denied loans to some applicants. The cooperative in Diestedde (Münsterland) denied a fairly small loan to a skilled artisan in 1888. [34] Cooperatives would also approve a loan but demand different co-signers or other security. The cooperative in Leer (Münsterland), for example, agreed to make a loan in March of 1909, but required the borrower to find another co-signer. [35] Auditing of borrowers who could not repay their loans took several forms. Cooperatives sometimes granted a borrower an extension (reflecting the cooperative's ability to see that an extension would allow the borrower to repay the loan in full). For example, in 1892 and 1893, the Leer cooperative granted short (3- to 6-month) extensions to several borrowers. In one case, the reason for the extension is stated; both the borrower and his son have been ill, and in addition, potato prices had been high. Potatoes were an important consumption good, and the cooperative was using its knowledge of the relevant state of the world to alter loan terms. [36] Finally, enforcement of repayment sometimes worked through the legal system, but more often relied on social

[32] The cooperative records were public and often do not state a specific reason for an action that might have been troubling to those in a small village. The cooperative records used here are discussed more fully in Guinnane (1997). The German material discussed here is part of a book manuscript in progress. Guinnane thanks the managements of the several extant *Raiffeisenbanken* for access to this material. The incidents alluded to in the text are reported in Protokollbuch' für den Vorstand, Limbach-Dorfer Spar- und Darlehnskassen-verein, November 2 and December 26, 1913.

[33] For example, a member in Diestedde (Münsterland) was ejected in 1887 because he never paid his capital share. Protokollbuch für den Vorstand, Diestedde-Sünnighausen Spar- und Darlehnskassenverein, June 21, 1887.

[34] Protokollbuch für den Vorstand, Diestedde-Sünnighausen Spar- und Darlehnskassenverein, June 30, 1888.

[35] Protokollbuch für den Vorstand, Leer Spar- und Darlehnskassenverein, October 3, 1909.

[36] Protokollbuch für den Vorstand, Leer Spar- und Darlehnskassenverein, various entries dated 1892 and 1893. The specific case is June 3, 1892.

sanctions of the type discussed above. Co-signers were also required to repay loans for borrower who defaulted. One co-signer in Diestedde was put in this position in 1889. [37] Members who defaulted on loans could be thrown out of the cooperative. Throwing someone out of the cooperative for failure to repay was rare but it did happen. The Oberdrees (Rheinbach) cooperative took this step with a member, for example. [38]

The many accounts of the Grameen Bank suggest similar processes that correspond to our models of screening, monitoring, auditing and enforcement. Two words of caution with these accounts probably apply to other situations as well. First, Todd (1996b), although impressed with the Grameen Bank's accomplishments, notes on the basis of her fieldwork in Bangladesh that in some cases, there are important gaps between what the Bank thinks happens on the ground and what really happens on the ground. She notes, for example, that many loan applications deliberately mis-state the loan's purpose, obviating the Bank's statistics on loan uses. This practice occurs because borrowers either want to use the loan for a forbidden purpose or because the Bank official on location wants to ensure the loan's approval and so puts down an uncontroversial purpose (pp. 23–25). Todd's observation is not at variance with our modeling; as she notes, ''The members all know who is doing what with their loans'' even if the Bank management does not. Second, although most studies are careful to document the full range of activities the Grameen Bank uses to obtain its high repayment rates, the joint-liability lending groups often receive pride of place. As we have noted more generally, there is not as yet clear evidence on how much of the Grameen Bank's success, or that of similar institutions, reflects the effect of joint liability alone. [39]

3.2. Problems with joint liability: group formation and size

The empirical literature on JLLIs devotes considerable attention to the issue of group size. On a priori grounds, group size can have two countervailing effects in joint-liability lending. If project returns are uncorrelated, an increase in group size improves the effectiveness of joint liability because it increases the number of states of the world in which the group as a whole can repay its members loans. On the other hand, joint liability works better than other financial contracts because group members have superior information on one another and can impose non-

[37] Protokollbuch für den Vorstand, Diestedde-Sünnighausen Spar- und Darlehnskassenverein, March 29, 1889.

[38] Protokollbuch für den Vorstand, Oberdreeser Spar- und Darlehnskassenverein, March 19, 1909.

[39] Aghion and Morduch (1998) stress other program elements such as direct monitoring, weekly meetings with borrowers and non-financial threats.

financial sanctions on one another. [40] These advantages are most likely diluted in larger groups. With large groups, there may also be free riding in the provision of some activities which have the character of public goods, such as monitoring and auditing. These considerations would tend to imply small optimal group sizes. Experience has shown that in very large groups, coordination difficulties and free-rider problems in organizational matters overwhelm the informational and enforcement benefits of a group.

In the German cooperatives, the first level of groups has two members and the second a much larger number. Most rural cooperatives had somewhere between 75 and 250 members at the turn of the 20th century. In the Grameen Bank, the group size is set at five persons, a figure arrived at through a process of trial and error. Mosley and Dahal (1985) (p. 202), for example, note in the context of a Nepalese program that there is evidence that in lending groups larger than twenty persons, mutual trust is more meager. Owusu and Tetteh (1982) (pp. 80–81) report that the Ghanian program they studied had groups ranging in size from 10 up to 100 persons. Not surprisingly, ''the very large groups present serious problems of loan supervision and collection''. Even 20 persons is a very large group by the standards of most programs in existence today. Devereux and Fishe (1993) (p. 108) draw on evidence from the Dominican Republic to argue that small groups are essential to joint-liability schemes. The Group Funds of the Grameen Bank are a wise effort to achieve the insurance benefits of pooled risk without robbing the groups of their power to screen, monitor and so forth.

Practitioners have devoted considerable attention to the way in which groups are formed. As we showed in Section 2.1, screening is an important function of group formation, and several studies suggest the importance of practical measures in screening. For example, Wenner (1995) (pp. 270–272) shows that Fundacíon Integral Campesina (FINCA) groups that directly screened members according to their local reputations, or that had adopted a written internal constitution, experienced significantly fewer problems with loan delinquency. [41] Wenner interprets the written constitution as a screening device; individuals selected in or out of groups with written codes, depending on their seriousness about adhering to the expectations of the group. Kevane (1996) (p. 26) notes some extreme examples of ill-formed groups in the Credit with Education lending program in Burkina Faso. [42] Groups seem to have been formed by program officials. Some groups included individuals who had never met one another, and there was confusion over just who bore liability for bad loans.

[40] In addition, if member A repays member B's loan today, member B typically repays A's loan some time in the future.

[41] FINCA is a Costa Rican micro-lender.

[42] Credit with Education is a joint effort of Freedom from Hunger, an NGO, and Réseau des Caisses Populaires.

Another issue raised by joint-liability lending is the degree to which group members know each other and interact on a regular basis. Case studies of JLLIs today suggest a variety of experiences. One study of BancoSol, for example, suggests that some of its lending groups are reconstituted forms of older groups that existed as Roscas (Rotating Savings and Credit Associations) prior to the formation of BancoSol. [43] Roscas are informal credit associations which are an important source of credit in many developing countries. In a typical Rosca, each member agrees to pay periodically a small sum into a common pool and gets to draw one large sum in rotation to purchase some indivisible good (Besley et al., 1993). The survival of a Rosca depends on ensuring payments from all members particularly once a member has his turn. Hence, they tend to form among groups that are socially cohesive as well as are rationed in the credit market. While both group lending and Roscas are group-based informal credit institutions that exploit the information and enforcement advantages of close-knit social networks to overcome credit market failures, they are very different in the source of funds as well as the nature and the (state-contingent) distribution of liability among members. In the current issue, Kovsted and Lyk-Jensen (1999) analyze the efficiency of various types of Roscas when the information about a member's return from investing his draw is private and Handa and Kirton (1999) provide an empirical analysis of the organizational design of Roscas in Jamaica. Thus, the success of BancoSol groups that had earlier been Roscas is no surprise. On the other hand, one third of the BancoSol groups surveyed in this study did not meet at all except for chance encounters unrelated to membership in BancoSol (Mosley, 1996, p. 15). One US effort to replicate the Grameen Bank recognizes the special difficulty of forming a group in a US urban area, and has adapted to those circumstances rather than obviate the point of a group. Chicago's Full Circle Fund has adopted most aspects of the Grameen Bank's system. Balkin (1993), (pp. 241–242) notes that it takes 6 to 8 months for groups to form the Fund, and explains it by noting that ''In a setting where potential members, generally, do not initially know each other... it does seem it would take considerable time for people to perceive just how honest and trustworthy others would be in a linked lending system...'' Some lenders such as the Grameen Bank require that groups participate in a host of activities not strictly related to the credit operation. In Grameen, for example, groups meet regularly to pledge adherence to Grameen's 16 decisions and to receive training. These activities are in part a reflection of Grameen's sense of a larger mission, but they also help to strengthen group solidarity and thus enhance Grameen's ability to lend to the poor. [44]

[43] BancoSol is a very successful lending program in Bolivia. While relying on groups of five to seven borrowers, in imitation of the Grameen Bank, BancoSol differs considerably in that it is willing to lend to people who are more prosperous than the target group served by the Grameen Bank.

[44] In the development practitioner's literature, there is a recognition that ''minimalist'' lenders, those that have no non-credit activities, are sacrificing a mechanism for strengthening groups.

One practice used in Kenya's Jehudi scheme illustrates both the problems in larger groups and a subtle feature of a cooperative's dual group levels. [45] The small borrowing group, the watano, is formed by its members. As in the Grameen bank, these watanos are grouped into larger associations called KIWAs. [46] In the Grameen Bank and most imitators, however, the larger group does not have any liability role. In Kenya all members of a KIWA are liable for all loans to everyone in the KIWA, even people associated with a different watano. Thus, borrowers under this scheme are liable for loans to someone they had no role in choosing for their liability group. According to Mutua (1994) (p. 275), the scheme started following Grameen principles, with each watano responsible for its own loans, but the original policy ''contributed to a lack of cohesion among KIWA members''. Mutua refers to the new system with approval, noting that at the outset there had been some watanos where all clients defaulted, leaving the Juhudi with no mechanism for recovering the loan. Buckley (1996a) (p. 310) notes that some participants in the current Jehudi scheme expressed reservations about this arrangement, even though with the group funds defaults in any one watano are unlikely to cause significant financial losses for borrowers. This unwise aspect of the Jehudi program is to our knowledge unique among Grameen-style lenders. The subtle difference between this arrangement and a credit cooperative is important: in a cooperative, members and loans are screened by elected managers, so no member is guaranteeing loans for someone else without some voice in the matter. In the Kenyan program, the *lending officials* formed the KIWAs.

Another problem that arises with JLLIs is that the institution sometimes keeps the group but abandons the joint liability that makes the groups valuable. Buckley (1996b) documents the abandonment of offers, an account that document this problem. Abandonment of joint liability in the Smallholder Agricultural Credit Administration (SACA) in Malawi. SACA at first lent to individuals formed into groups that undertake joint liability for all loans in a group. These ''farmer's'' clubs had at least 10 members and thus were somewhat larger than those in Grameen and similar lenders, but the operating principle is the same. Buckley notes (p. 349) that these clubs had operated effectively at first. But then in April of 1992 SACA adopted a policy of allowing any individual who had repaid his or her *own* loan access to further credit, even if one or more borrowers in his group was in default. The World Bank opposed this change in policy, Buckley notes, and it is easy to see why: the new policy effectively ended joint liability for loans. Repayment rates have plummeted, although a drought that caused severe shortfalls in maize yields must bear some of the responsibility as well.

[45] The Jehudi Kiberia credit scheme is run by the Kenyan Rural Enterprise Program, a donor-funded NGO. The Jehudi program has been in effect since 1990. Most aspects of the small groups (*watano*) imitate Grameen practice (see Buckley, 1996a).

[46] KIWA is an acronym for *Kikundi Cha Wanabiashara*, ''group of entrepreneurs''.

3.3. Problems with joint liability: social ties

A major obstacle to joint liability as a lending mechanism arises when social ties among possible borrowers are too weak to support feelings of group solidarity. This is a significant problem in efforts to transplant Grameen-style arrangements to wealthier countries. Mondal and Tune (1993) (pp. 224–225) discuss the problems of transplanting joint liability from Bangladesh to rural Arkansas. The Good Faith Fund, formed in 1988, has adopted most aspects of Grameen practice. But as the authors note, significant social and cultural differences mean that joint liability does not work in Arkansas precisely as it does in Bangladesh. Rural Arkansas has much lower population density, meaning that group members are likely to know less about one another, and unlike Bangladesh, within small areas Arkansas has significant racial and religious heterogeneity, a further burden to group formation and solidarity. Wydick (1999) shows for a Guatemalan lending program that groups in which members' business are close together have higher repayment rates, underscoring the role of population density in making joint liability work. But the most important problem for groups in Arkansas may turn on the idea of groups themselves; ''...people in Bangladesh derive more of their identity from membership in groups such as the family than do Americans, who very much express individualism'' (p. 225). Conlin, in his contribution to this issue, discusses a variety of innovations used among micro-lending programs in Canada and the United States. A common theme is a need to rely less on social ties among borrowers than is the case in, for example, Bangladesh. Sometimes the lending scheme can be adapted to take advantage of features of the local environment that will enhance repayment rates. This kind of adaptation has taken place in Malaysia's AIM program. AIM seeks to identify the program with Islamic moral principles, including the spiritual obligation to repay loans. ''Islam is thus used as an additional factor to ensure commitment to AIM and fosters high rates of repayment'' (Hulme, 1990, p. 294).

Joint liability also may not work if the individuals involved are unwilling, for whatever reason, to put pressure on delinquent borrowers and to sanction those who default. The failed experience of German-style credit cooperatives in Ireland in the 19th century provides a case in point. Other cooperatives (such as creameries) had been successful in Ireland, and in 1894 Irish cooperators introduced credit cooperatives modeled very closely on rural German cooperatives. The Irish institutions were with only a few exceptions unsuccessful, as even the Irish leadership acknowledged. The reasons for this failure are doubtless complex, as Guinnane (1994) stresses. Some observers argued that the basic norms of rural society in Ireland worked against the entire basis of the cooperative's functioning:

> It is difficult in a country with no business traditions, and where the natural kindliness of the people renders them easy-going with regard to mutual obligations, to make them realize the necessity of adhering resolutely to the

> rules, so that no mistaken kindness to unthrifty borrowers should be allowed to endanger the interests of the Society [cooperative] and of other members (IAOS, 1902, p. 13).

Suggestions for reforming the Irish cooperatives show that this problem was lethal. Timothy O'Herlihy, the former secretary of a cooperative, advocated increasing the area covered by each Irish cooperative on the grounds that a borrower's neighbors would be unwilling to force him to repay. O'Herlihy saw the need for outsiders who could bear the blame for seemingly harsh decisions (Great Britain, 1914, Q3971–Q3976). This recommendation amounts to throwing away all the information local people have on one another. This problem is not limited to Ireland, of course. Several studies refer to discomfort over the need to penalize those who do not repay their loans. Kevane (1996) (p. 25) reports that in one program in Burkina Faso, ''Women seemed uncomfortable with the idea that persons who failed to repay should be charged a penalty''.

The Irish case illustrates an important point that is second nature to economists but may be lost in the enthusiasm for JLLIs: the mechanism will not work everywhere. The models we outlined in Section 2, like most economic models, presume that a set of parameter values are satisfied. For example, both group lending and individual lending is aided by dynamic incentives, but only to the extent borrowers care about future credit availability and view the lender as preferable to alternatives. More generally, group lending derives its effectiveness from the social ties among potential group members. If those ties are weak, or if they imply an unwillingness to sanction one another (as in the Irish example) the mechanism will not work.

The literature on group lending shies away from discussing the possible negative implications of peer pressure and other aspects of joint liability. One exception is Montgomery et al. (1996) (pp. 154–155), who noted examples of Bangladesh Rural Advancement Committee (BRAC) group members taking aggressive action against defaulters. [47] In some instances, action took the form of seizing the individual's assets, such as livestock or household goods. They note other examples of action that amounts to violence: for example, one group of BRAC borrowers tore down a woman's house because she had not repaid her loan. There are two implications of these aspects of joint liability. First, to create the effects we describe in Section 2, there has to be pressure of this type (or at least the credible threat of pressure, which amounts to the same thing in many circumstances). Second, aggressive action such as tearing down a woman's house may rupture other, more important social ties. In evaluating the impact of

[47] BRAC is an NGO formed in the early 1970s. Originally, it emphasized the health sector, but has since, through its Rural Development Programme, become an important provider of credit for the poor.

group-lending schemes, practitioners must bear in mind the implicit risk to those ties. Montgomery et al. (1996) (pp. 154–155) note that the leadership of both Thana Resource Development and Employment Programme (TRDEP) and BRAC are aware of these risks. [48]

3.4. Problems with joint liability: dynamic incentives

Our model of enforcement through joint-liability schemes relies on the dynamic incentives inherent in the lender's threat to cut off from future loans all members of any group that defaults. For this threat to be meaningful, borrowers must be in a position where this is a serious possibility, and the lender must be willing and able to make this threat real for those who default. Most JLLIs today are either NGOs or private institutions, and for good reason: for political reasons, governments have a difficult time carrying out on threats to impose sanctions on poor borrowers who do not repay their loans. This was part of the cause for the problems in Irish credit cooperatives discussed above. Unlike their German counterparts, the Irish credit cooperatives garnered few deposits. Most of what they lent was a loan to the cooperative from the government. Given the political situation in Ireland at the end of the 19th century, it was not realistic to think that the government would sue poor Irish farmers to recover these monies, making the liability of cooperative members meaningless. The only real threat the government had was to not renew its loans to the cooperatives, which in fact happened, but only after several years of obvious problems in the cooperatives. A similar problem arose in the MMF in Malawi. Borrowers are aware that this is a government program, which made at least some think that they would not be held to strict standards of repayment. Some of the problems in this case might reflect more basic ''misunderstandings concerning the difference between grants and loans'' (Buckley, 1996b, p. 389). A variant on this problem arose in the SACA program in Malawi. [49] In 1991–1992, many SACA borrowing clubs were unable to repay their loans because a drought had devastated maize production in several parts of the country. The government (which effectively ran SACA) announced a policy whereby any borrower who could not repay his loan because of the drought would be granted a repayment moratorium. Just how such borrowers were to be distinguished from others is unclear, and this announcement by itself might harm discipline among borrowers. But once announced, rumor spread to the effect that all loans had been granted an extension. ''Once this belief became ingrained, it was difficult to change, espe-

[48] TRDEP is a project overseen by the Ministry of Youth and Sports in the government of Bangladesh. The credit project began in 1972 and was originally funded by the World Bank.

[49] SACA is a continuation of a program started in the 1960s, and is run by the Ministry of Agriculture. SACA lends to farmers with up to 10 ha of land, in contrast to the MMF, which only lends to individuals with less than 1 ha of land or the equivalent in assets.

cially in an election year'' and repayment rates plummeted to about 21% (Buckley, 1996b, pp. 350–351).

Sometimes the JLLI, for whatever reason, adopts policies that undermine dynamic incentives. For example, if a program's rules stipulate that a particular loan will be the last loan, regardless of how the borrower behaves with it, then the lender forsakes all benefit from dynamic incentives. Mosley and Dahal's study of a program in Nepal reports examples where some borrowers refuse to make their payments, even when able to do so. Withholding payments ''seems to be particularly common among farmers who are taking out what they believe will be their last loan'' from the program. [50] This Nepalese program is not unique in this regard; Bangladesh's TRDEP, for example, limits any single person to four loans in total. Neither Grameen nor the other Bangladeshi lender (BRAC) has a policy like this (Montgomery et al., 1996, pp. 107–110). This aspect of dynamic incentives has the paradoxical implication that joint-liability schemes are undermined if the lender tries to establish rules whereby borrowers cannot treat the lender as a permanent source of credit. Buckley (1996b) (pp. 359–360) notes disapprovingly that in the Malawi SACA scheme, the vast majority of borrowers had received several loans from the program. He is right to worry that this feature of the program makes it difficult to extend assistance to new borrowers, but potential access to repeat loans is crucial to enforcing repayment. A related problem arises when a lender is so weak that borrowers suspect it might not exist in the future to provide loans. Westley and Shaffer (1996) study loan delinquency rates among 55 Latin American credit unions in the early 1990s. They find that credit unions with a low rate of return on assets in the previous year had higher delinquency rates, and attribute this result to borrower suspicion that the credit union may soon go out of business and thus be unavailable for future loans.

In other cases, competition among JLLIs leads them to undermine repayment incentives for *each other's* borrowers. Malawi, for example, has two different programs, SACA and a newer replicate the Grameen Bank called the Mudzi Fund. Buckley (1996b) (pp. 387–388) found that many borrowers who were participants in the Mudzi Fund had been dropped from earlier participation in the SACA program for not repaying a loan. To the extent that, these two program continue to exist side-by-side, they run a real danger of undermining one another. The threat to exclude a defaulter from one program is less effective if individuals can simply move to another. This situation seems likely to become more common with time, as several countries now have similar programs that operate in the same geographic area. In Bangladesh, for example, the Grameen Bank, BRAC and TRDEP increasingly operate in the same areas. Those who advocate increased competition as a mechanism for improving credit delivery to poor people must bear in mind

[50] Mosley and Dahal (1985) (p. 202). Emphasis in original.

that such competition could well undermine the very basis of joint-liability lending schemes. [51]

Attempts to replicate the Grameen Bank in the United States illustrate a perverse aspect of the success of joint-liability lending in developing countries. The dynamic incentives depend heavily on the alternative sources of credit being very expensive or non-existent. The Grameen Bank works in part because alternative credit sources in rural Bangladesh are either very expensive or non-existent. One problem for Irish credit cooperatives was that alternative credit sources were not bad enough to make the end of cooperative credit a powerful threat. Similarly, access to credit in countries such as the United States is not impossible, even for poor people, and poses a challenge to joint-liability lending in wealthy countries. This line of argument also implies that the Grameen Bank may undermine itself: if it can improve conditions for the rural poor, it may also improve access to alternative forms of credit.

Dynamic incentives are important and perhaps under-appreciated aspect of successful institutions such as the Grameen Bank. But to some extent these incentives do not, we should be clear, require group lending at all. [52] The Grameen Bank and other lenders sometimes condition future loans not on lending-group behavior but on individual behavior. The repayment incentives we discuss are stronger with group lending, for the reasons shown above, but the possibility of future credit will under some circumstances improve borrower incentives with individual lending. Similarly, the efforts of some micro-lenders to construct buildings and other visible signs of permanence are to some extent innovations that signal to borrowers that the institution will exist in the future and thus encourage borrowers to adopt a longer planning horizon. The brick-and-mortar institution building has a stronger incentive effect with group lending, but works with individual lending, as well.

4. Conclusions

This paper outlines the economic logic of joint-liability lending using a simple model that illustrates the way joint liability can mitigate some problems that arise in lending to poor people. The central issue in such credit markets is twofold: the lender does not know much about the borrower (asymmetric information), and effective, commonly used contractual arrangements for contending with asymmetric information do not work because the borrowers are too poor for the lender to

[51] Salloum (1995) (p. 97) is one such advocate of competition. He is of course correct that competition among lenders that do not rely on these dynamic incentives ordinarily improves the welfare of borrowers.

[52] We thank a referee for this observation.

use financial sanctions to achieve repayment of loans. We show that joint liability can achieve better screening to contend with adverse selection, encourages peer monitoring to reduce moral hazard, gives group members incentives to enforce the repayment of loans, and reduces the lender's audit costs for cases where some group members claim not to be able to repay.

Our empirical discussion has focused on problems of institutional implementation. The focus has been to tie the theory to actual practice and not to provide recommendations to practitioners. Given the underdeveloped state of the empirical literature, we do not claim that joint-liability lending is the most important feature of successful micro-lenders such as the Grameen Bank. There is clear evidence that joint-liability improves repayment, but these institutions use other instruments as well, and no study yet tries to apportion the reasons for success. We have also avoided the entire issue of sustainability. Whether the Grameen Bank and similar joint-liability programs will ever be completely self-sustaining is not clear, as Morduch argues in this issue. Conning's analysis in the current issue suggests that sustainability could indeed be difficult to achieve in many circumstances. Efforts to replicate the Grameen Bank and other successful JLLIs face difficult problems of adapting the system to local conditions without destroying the incentives that make joint liability work. We cited examples of apparently slight modifications of the rules that robbed group lending of the joint-liability aspect that accounts for the high repayment rates. The case studies we located only rarely mention the potential social costs of joint liability. These schemes draw on close ties among members to achieve the benefits we noted. When things go wrong, such as when an entire group is denied future loans, bitterness and recrimination among group members may have far-reaching consequences for village life. This risk is inherent in the system and needs to be viewed as a potential cost.

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