Group Lending Without Joint Liability

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Abstract

This paper contrasts individual liability lending with and without groups to joint liability lending. By doing so, we shed light on an apparent shift away from joint liability lending towards individual liability lending. We show that individual lending with or without groups may constitute a welfare improvement so long as borrowers have sufficient social capital to sustain mutual insurance. Secondly, we explore how a purely mechanical argument in favour of the use of groups - namely lower transaction costs - may actually be used explicitly by lenders to encourage the creation of social capital.

1 Introduction

While joint liability lending by microfinance institutions (MFIs) continues to attract attention as a key vehicle of lending to the poor, recently some MFIs have moved away from explicit joint liability towards individual lending. The most prominent such institutions are Grameen Bank of Bangladesh and BancoSol of Bolivia. However, interestingly, Grameen and others have chosen to retain the regular group meetings that traditionally went hand-in-hand with joint liability lending. Now it should be pointed out that in the absence of good panel data on lending methods, from the various anecdotes about some high profile MFIs it is not clear whether there in fact has been a significant overall decline in joint liability among MFIs worldwide. Indeed, existing evidence suggests that joint liability continues to be widely used.

For example, de Quidt et al. (2012) use a sample of 715 MFIs from the MIX Market (Microfinance Information Exchange) database for 2009, and estimate that 54% of loans are made under “solidarity group” lending as opposed to “individual” lending. Interestingly, when measured by value of loans the figure is only 18%, reflecting the fact that group loans are typically smaller as they are given out to poorer borrowers.

Nevertheless, these phenomena raise the question of the costs and benefits of using joint liability, and the choice between group loans with and without (explicit) joint liability. In this paper we study three issues raised by this apparent shift, in the context of the limited enforcement or “ex-post moral hazard” framework introduced by Besley and Coate (1995), where joint liability increases repayment rates by inducing borrowers to repay on behalf of their unsuccessful partners. Firstly, we analyze how by leveraging the borrowers social capital, individual liability lending (henceforth, IL) can mimic or even improve on the repayment performance and borrower welfare of explicit joint liability (EJ). When this occurs, we term it “implicit joint liability” (IJ). Secondly, we analyze a purely operational argument for the use of group lending under IL, that it may simply reduce the lender’s transactions costs. Finally, we show how the two may be closely related: despite the costs, group lending may contribute to the creation of social capital, and therefore, may induce IJ.

Our analysis is motivated by two influential recent empirical studies. Giné and Karlan (2011) found that removing the joint liability clause, but retaining the group meetings, of a random subset of borrowing groups of Green Bank in the Philippines had no meaningful effect on repayment rates. In our model, this outcome arises when the newly individually liable groups have sufficient social capital to continue to assist one another with repayments, as under EJ. Indeed, both Giné and Karlan (2011) and Feigenberg et al. (2011) find evidence for intra-group transfers to help a borrower repay her loan even without explicit joint liability. Secondly, Feigenberg

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2 An earlier study Cull et al. (2009) puts this number at 51% using 2002/04 data involving 315 institutions. The year 2009 is one for which the largest cross-section of lending methodologies is available. Solidarity group loans defined by MIX as those for which “some aspect of loan consideration depends on the group, including credit analysis, liability, guarantee, collateral, and loan size and conditions.” Individual loans are “made to individuals, and any guarantee or collateral required comes from that individual.” We excluded 154 “village banks” for which lending methodology is unclear. See http://www.mixmarket.org/about/faqs/glossary.

3 It could even be that without the group, borrowers would be less able to interact. Indeed, in some conservative societies, social norms may prevent women from attending social gatherings (for instance under the Purdah customs in some parts of India and the Middle East). Then externally mandated borrowing groups can be a valuable vehicle for social interaction. See, for instance Sanyal (2009), Anderson et al. (2002), Kabeer (2005).

4 In table IX of Giné and Karlan (2011) we see that conversion to individual liability caused
et al. (2011) randomly varied the meeting frequency of individually liable borrowing groups of the Village Welfare Society in India. They found that groups who met more frequently had subsequently higher repayment rates. In particular, they present evidence suggesting that this is due to improved informal insurance among these groups due to higher social capital. We argue that more frequent group meetings give borrowers a stronger incentive to build social capital, and that this is then leveraged to generate IJ. Grameen Bank states that Grameen II is designed to “lean on solidarity groups: small informal groups consisting of co-opted members coming from the same background and trusting each other.” The emphasis on trust suggests that the group continues to play an important role in Grameen’s lending methodology beyond simply moderating the lender’s transaction costs.

A main conclusion of our analysis is that it is premature to write off EJ as a valuable contractual tool. Thus far we have one high quality randomized study of contractual form (Giné and Karlan (2011)) in which EJ seems not to play an important role. However in our theoretical analysis there are always parameter regions over which EJ is the most efficient of the simple contracts we analyze. A recent randomized control trial by Attanasio et al. (2011) finds stronger consumption and business creation impacts under EJ (albeit no significant difference in repayment rates - note that in their context mandatory group meetings are not used under either IL or EJ). Carpena et al. (2010) analyze an episode in which a lender switched from IL to EJ and found a significant improvement in repayment performance. For the same reasons, Banerjee (2012) stresses the need for more empirical work in the vein of Giné and Karlan (2011) before concluding that EJ is no longer relevant.

It is instructive to briefly look at the types of contracts currently used by MFIs. As mentioned, from the MIX dataset, 54% of borrowers were borrowing under what are classified as solidarity group loans. Although the solidarity group loans might not correspond exactly to pure EJ, this is the best measure we have. Our concept of IJ is most relevant to the “individual” category; the MIX Market notes that “loans based on consideration of the sole borrower, but disbursed through and recollected a decrease, significant at 10%, in side-loans between borrowers, although no significant effect on borrowers “voluntarily [helping others] repay loans”. Note that one challenge of interpreting these results in the light of our analysis is that group composition changed in Giné and Karlan (2011)’s experiment, while our model analyzes contract choice for a given level of social capital. Converted centers tended to take in members that were less well-known by existing members, presumably because individual liability made doing so less risky.

from group mechanisms, are still considered individual loans.” A notable example is the Indian MFI Bandhan, which is one of the top MFIs in India, and is listed as having 3.6m outstanding loans in 2011, all classified as “individual”. Bandhan does not use joint liability but disburses the majority of its loans through borrowing groups. Unfortunately, we do not have data on the method of disbursement of the full sample of loans classified as individual, but it seems likely that many institutions are indeed using groups to disburse individual loans. This paper highlights how this may improve welfare through two channels: first of all, borrowers with sufficient social capital can mutually insure one another and secondly, attending costly group meetings may give borrowers incentives to invest in social capital.

Much of the existing theoretical work has sought to show how explicit joint liability improves repayment rates (see Ghatak and Guinnane (1999) for a review). In the model of Besley and Coate (1995), joint liability gives borrowers an incentive to repay on behalf of their partner when the partner is unable to repay her own loan. If borrowers can threaten social sanctions against one another, this effect is strengthened further. However, there are two problems with EJ. Firstly, since repaying on behalf of a partner will be costly, incentive compatibility requires the lender to use large sanctions and/or charge lower interest rates, relative to individual liability. Secondly, when a borrower is unsuccessful, sometimes EJ induces the successful partner to bail them out, but sometimes it has a perverse effect, inducing them to default completely, while under IL they would have repaid. Rai and Sjöström (2004) and Bhole and Ogden (2010) approach these issues from a mechanism design perspective - designing cross-reporting mechanisms or stochastic dynamic incentives that minimize the sanctions used by the lender. Meanwhile Allen (2012) shows how partial EJ, whereby borrowers are liable only for a fraction of their partner’s repayment, can improve repayment performance by optimally trading off risk-sharing with the perverse effect on strategic default. In contrast, we focus on how simple group lending with no joint liability can achieve some of these effects.

Also, in the light of the Grameen Bank of Bangladesh abandoning explicit joint liability and switching to the Grameen II model, the theoretical literature on microfinance has started focusing on aspects other than joint liability, such as sequential lending (e.g., Chowdhury (2005)), frequent repayment (Jain and Mansuri (2003),

\[6\] This issue is the focus of the analysis in Rai and Sjöström (2010). Because of this, de Quadt et al. (2012) show that with a for-profit monopolist lender borrowers are better off under EJ than IL lending, because the lender must typically charge lower interest rates under EJ.
Fischer and Ghatak (2010), exploring more general mechanisms than joint liability (e.g., Laffont and Rey (2003); Rai and Sjöström (2004); Rai and Sjöström (2010)), and exploring market and general equilibrium (Ahlin and Jiang (2008); McIntosh and Wydick (2005) and de Quidt et al. (2012)).

The paper is structured as follows: in section 2 we present the basic model where in principle lending may take place with or without group meetings. We introduce our concept of implicit joint liability and show when it will occur and be welfare improving. Section 3 then introduces a simple formulation of repayment meeting costs that may favor group or individual meetings. Section 4 the presence of meeting costs can give borrowers incentives to invest in social capital, and shows when this is welfare improving. Section 5 discusses the results and concludes.

2 Model

We model a lending environment characterized by costly state verification and limited liability. Borrowers are risk neutral, have zero outside option, no capital and are subject to limited liability. They have access to a stochastic production technology that requires 1 unit of capital per period with expected output $\bar{R}$, and therefore must borrow 1 per period to invest (we assume no savings for simplicity). There are three possible output realizations, $R \in \{R_h, R_m, 0\}$, $R_h \geq R_m > 0$ which occur with positive probabilities $p_h, p_m$ and $1 - p_h - p_m$ respectively. We define

$$
\begin{align*}
p &\equiv p_h + p_m \\
\Delta &\equiv p_h - p_m \\
\bar{R} &\equiv p_h R_h + p_m R_m.
\end{align*}
$$

We assume that output is not observable to the lender and hence the only relevant state variable from his perspective is whether or not a loan is repaid. Since output is non-contractible, the lender uses dynamic repayment incentives, as in Bolton and Scharfstein (1990). We assume that if a borrower’s loan contract is terminated following a default, she can never borrow again. Under IL, a borrower’s contract is renewed if she repays and terminated otherwise. Under EJ, both contracts are renewed if and only if both loans are repaid.

Now we introduce the notion of social capital used in the paper (the following discussion is based on de Quidt et al. (2012)). We assume that pairs of individuals
in the village share some pair-specific social capital worth $S$ in discounted lifetime utility, that either can credibly threaten to destroy (after which $S = 0$). If the threat is to terminate a friendship, $S$ represents the value of that friendship in excess of that generated by the borrowing relationship. We assume that each individual has a large number, say, $n$ friends or candidate borrowing partners, each worth $S$, valued jointly at $nS$. Thus each friendship that breaks up represents a loss of $S$.

One way to conceptualize $S$ is as the net present value of lifetime payoffs in a repeated “social game” played alongside the borrowing relationship, similar to the multi-market contract literature, such as Spagnolo (1999), who models agents interacting simultaneously in a social and business context, using one to support cooperation in the other. As an illustration, suppose the borrowers play the following “coordination” stage-game each period: if both play $A$, both receive $s$. If one plays $A$ and the other, $B$, both receive $-1$. If both play $B$, both receive $0$. Clearly, both $(A, A)$ and $(B, B)$ are Nash equilibria in the stage-game. If players expect to play $(A, A)$ forever, their expected payoff is $S \equiv \frac{s}{1-\delta}$. However, switching to $(B, B)$ forever as a social sanction is always a credible threat, and can be used to support the repayment rule.

We assume a single lender with opportunity cost of funds equal to $\rho > 1$. In the first period, the lender enters the community, observes $S$ and commits to a contract to all potential borrowers. The contract specifies a gross interest rate, $r$ and EJ or IL. We assume the lender to be a non-profit who offers the borrower welfare maximizing contract, subject to a zero-profit constraint.

In this section we ignore the role of groups altogether - being in a group or not has no effect on the information or cost structure faced by borrowers and lenders. Although borrower output is unobservable to the lender, we assume it is observable to a subset of other borrowers. As a result, they are able to write informal side contracts to guarantee one another’s repayments, conditional on the output realizations. For simplicity we assume an artificial limit on the size of such arrangements of two borrowers. EJ borrowers will naturally side contract with their partner, with whom they are already bound by the EJ clause. Specifically, we assume that once the loan contract has been fixed, pairs of borrowers can agree a “repayment rule” which specifies each member’s repayment in each possible state $Y \in \{R_h, R_m, 0\} \times \{R_h, R_m, 0\}$. Then in each period, they observe the state and make their repayments in a simultaneous-

7We abstract from other organizational issues related to non-profits, see e.g. Glaeser and Shleifer (2001).
move “repayment game”. Deviations from the agreed repayment rule are punished by a social sanction \( S \). The repayment rule, social sanction and liability structure of the borrowing contract thus determine the payoffs of the repayment game and beliefs about the other borrower’s strategy. To summarize, once the lender has entered and committed to the contract, the timings each period are:

1. Borrowers form pairs, and agree on a repayment rule.

2. Loans are disbursed, borrowers observe the state and simultaneously make repayments (the repayment game).

3. Conditional on repayments, contracts are renewed or terminated and social sanctions carried out. If an IL borrower’s partner is terminated, she rematches with a new partner.

We restrict attention to repayment rules that are stationary (depending only on the state) and symmetric (do not depend on the identity of the borrower). This enables us to focus on the stationary value function of a representative borrower. Stationarity also rules out repayment rules that depend on repayment histories, such as reciprocal arrangements. In addition, we assume that the borrowers choose the repayment rule to maximize joint welfare. This means that they will never use social sanctions to enforce repayment unless the value to an individual borrower of retaining her contract, \( \delta V \), exceeds the cost of repayment, \( r \), forming one of our key constraints. By welfare maximization, social sanctions are never used on the equilibrium path.

Given repayment probability \( \pi \), the zero-profit interest rate is:

\[
r = \frac{\rho}{\pi}.
\]

By symmetry, each borrower \( i \) pays \( \pi r = \rho \) per period in expectation.

There are two interesting cases that arise endogenously and determine the feasibility of borrowers guaranteeing one another’s loans. In Case A \( R_m \geq 2r \) and hence a successful borrower can always afford to repay both loans. In Case B we have \( R_h \geq 2r > R_m \geq r \), thus it is not feasible for a borrower with output \( R_m \) to repay both loans. Consider Case A. If borrowers agree to guarantee one another’s loans, they will repay in every state except \((0,0)\), so the repayment probability is
\[ \pi = 1 - (1 - p)^2 = p(2 - p), \] in which case \( r = \frac{\rho}{p(2-p)} \). Therefore Case A applies if \( R_m \geq \frac{2\rho}{p(2-p)}. \)

**Definition 1** Case A applies when \( R_m \geq \frac{2\rho}{p(2-p)}. \) Case B applies when \( R_m < \frac{2\rho}{p(2-p)}. \)

Logically, the highest possible interest rate (lowest possible repayment rate) consistent with the lender earning zero profits occurs when borrowers only repay when both are successful, i.e. with probability \( p^2 \), yielding \( r = \frac{\rho}{p^2}. \) In practice, this is never observed since this is dominated by a simple IL contract that involves \( r = \frac{\rho}{p} \) which is lower. Still, to ensure \( R_m \geq r \) and \( R_h \geq 2r \) for the values of \( r \) that might be relevant on or off the equilibrium path and consistent with the zero-profit condition, we make the following assumptions:

**Assumption 1** \( R_m \geq \frac{\rho}{p^2}. \)

**Assumption 2** \( R_h \geq \frac{2\rho}{p^2}. \)

We can now write down the value function \( V \) for the representative borrower. Assume that borrower i’s loan is repaid with probability \( \pi \) (this also implies that her loan contract is renewed with probability \( \pi \)). Recall that her expected repayment is \( \rho \). Hence, her welfare is:

\[
V = \bar{R} - \rho + \delta \pi V
= \frac{\bar{R} - \rho}{1 - \delta \pi} \quad (2)
\]

For any borrower to be willing to repay her loan, it must be that the value of access to future loans exceeds the interest rate, or \( \delta V \geq r \). If this condition does not hold, all borrowers, IL or EJ, will default immediately. We refer to this condition as Incentive Condition 1 (IC1), and it must hold under any contract for the borrowers to be willing to repay their loans. Using (2) and \( r = \frac{\rho}{\pi} \) we can derive IC1 explicitly:

\[
\rho \leq \delta \pi \bar{R} \quad (IC1)
\]

To ensure IC1 always holds, we make the following assumption:

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8Note that \( S \) is not included hence these represent the utility of access to microfinance. Total borrower welfare including social capital with \( n \) potential partners is \( W = V + nS \). We assume that \( n \) is sufficiently large that we can ignore the possibility of borrowers running out of partners.
Assumption 3 $\delta p^2 \bar{R} > \rho$.

This condition ensures that IC1 is (strictly) satisfied even when a borrower's loan is repaid only when both partners are successful ($\pi = p^2$), analogous to Assumption 1.

2.1 Individual Liability

Suppose first of all that the borrower does not reach a repayment guarantee arrangement with a partner. IC1 implies she should always repay when successful, so her repayment probability is $p$.

Now consider when IL borrowers can agree a repayment guarantee arrangement. When this occurs, we term it implicit joint liability (IJ). When IC1 holds, joint welfare is maximized by repaying both loans whenever possible. We assume that borrowers agree to repay their own loan whenever they are successful, and also repay their unsuccessful partner’s loan if possible.

Repayment of a borrower’s own loan is incentive compatible by IC1. For a borrower to willingly repay on behalf of her partner, it must be that the threat of social sanction for failing to do so outweighs the cost of the extra repayment, or $r \leq \delta S$.

This gives us a constraint which we term IJ Incentive Constraint 2, or IJ IC2:

$$\rho \leq \delta \pi_{IJ} S.$$  \hfill (IJ IC2)

IJ IC2 is tighter than IC1 for $S \leq \bar{R}$. The condition implies a threshold value of $S$, $\hat{S}_{IJ}$, such that IJ IC2 holds for $S \geq \hat{S}_{IJ}$:

$$\hat{S}_{k} \equiv \frac{\rho}{\delta \pi_{IJ}}, k \in \{A, B\},$$

where $k$ denotes the relevant case. Borrowers who can agree to an incentive compatible loan guarantee arrangement will do so since this increases joint welfare. Therefore IJ applies for $S \geq \hat{S}_{IJ}$.

Assume $S \geq \hat{S}_{IJ}$. In Case A, a successful borrower can always afford to repay both loans, so both loans are repaid with probability $\pi_{IJ}^{A} = 1 - (1 - p)^2 = p(2 - p)$. In Case B, both loans are repaid whenever both are successful, and in states

9This rule seems the most reasonable and maximizes joint welfare, there are of course other rules that achieve the same welfare.
(R_h, 0), (0, R_h). In state (R_m, 0), borrower 1 cannot afford to repay borrower 2’s loan, so she repays her own loan, while borrower 2 defaults and is replaced in the next period with a new partner. Therefore \( \pi_{IJ}^I = p^2 + 2p_h(1-p) + p_m(1-p) = p + p_h(1-p) \).

The lender observes whether Case A or Case B applies, and the value of \( S \) in the community, and offers an individual liability contract at the appropriate zero profit interest rate. Borrower welfare is:

\[
V_{IL}^I_k(S) = \begin{cases} 
R - \rho \frac{1 - \delta p}{1 - \delta \pi_k} & S < \hat{S}_{IJ_k}^I \\
R - \rho \frac{1 - \delta p}{1 - \delta \pi_k} & S \geq \hat{S}_{IJ_k}^I, \ k \in \{A, B\}. 
\end{cases}
\]

2.2 Explicit Joint Liability

Under EJ, just as under IL, IC1 implies that the joint welfare is maximized by ensuring both loans are repaid whenever possible. As identified by Besley and Coate (1995), the lender’s sanction on borrower \( i \) when \( j \) defaults implies that \( i \) has an incentive to guarantee \( j \)’s loan repayments, even without the threat of social sanctions. However, EJ also implies that borrowers have no incentive to repay if their partner’s loan is not being repaid.

We therefore need to consider \( i \)’s incentive to repay when \( j \) is repaying, and \( i \)’s incentive to repay both loans when \( j \) is not repaying. The first is easy - if \( j \) is repaying, IC1 implies that \( i \) will repay as well. Therefore both loans are repaid whenever both borrowers are successful.

When borrower \( i \) is successful and \( j \) is unsuccessful, we must consider \( i \)’s incentive and ability to repay on \( j \)’s behalf. \( i \) will be willing to make this loan guarantee payment provided the threat of termination of her contract, plus social sanction for failing to do so, exceeds the cost of repaying two loans, or \( 2r \leq \delta (V^{EJ} + S) \). We refer to this condition as EJ IC2. Rearranging, we obtain:

\[
\rho \leq \frac{\delta \pi^{EJ} [\hat{R} + (1 - \delta \pi^{EJ})S]}{2 - \delta \pi^{EJ}} \tag{EJ IC2}
\]

EJ IC2 is tighter than IC1 for \( S < \hat{R} \). We can derive a threshold, \( \hat{S}^{EJ} \), such that EJ IC2 holds for \( S \geq \hat{S}^{EJ} \):

\[
\hat{S}_{k}^{EJ} = \max \left\{ 0, \frac{\rho}{\delta \pi_k^{EJ}} - \frac{\delta \pi_k^{EJ} \hat{R} - \rho}{\delta \pi_k^{EJ} (1 - \delta \pi_k^{EJ})} \right\}, \ k \in \{A, B\}.
\]
Provided $S \geq \hat{S}^{EJ}$, borrowers are willing to guarantee one another’s repayments. The repayment rule will then specify that $i$ repays on $j$’s behalf whenever $i$ can afford to and $j$ is unsuccessful, since this maximizes $\pi^{EJ}$. Next we must check in which states such a guarantee is possible.

Suppose $S \geq \hat{S}^{EJ}$. In Case A, both loans are repaid whenever at least one borrower earns at least $R_m$. Thus the repayment probability is $\pi^{EJ}_A = p(2 - p)$. In Case B, $R_m$ is not sufficient to repay both loans. Therefore both loans are repaid in all states except $(0,0), (R_m,0), (0,R_m)$, otherwise both borrowers default. The associated probability is $\pi^{EJ}_B = p^2 + 2ph(1 - p) = p + \Delta(1 - p)$.

If $S < \hat{S}^{EJ}$, borrowers will not guarantee one another. They will therefore only repay when both are successful, so $\pi^{EJ} = p^2$. Borrower welfare is:

$$V^{EJ}_k(S) = \begin{cases} \bar{R} - \rho, & S < \hat{S}^{EJ}_k, \ k \in \{A,B\} \\ \frac{R-p}{1-\delta^2}, & S \geq \hat{S}^{EJ}_k \end{cases}$$

Note that $\hat{S}^{EJ}_A \leq \hat{S}^{EJ}_B$. This is because the interest rate is lower in Case A, and $V$ is higher (due to the higher renewal probability), so the threat of termination is more potent.

Let us define $V(S) \equiv \max\{V^{EJ}(S), V^{IJ}(S)\}$ as the maximum borrower welfare from access to credit. Observe that the repayment probability and borrower welfare from access to credit, $V(S)$, are stepwise increasing in $S$.

### 2.3 Comparing contracts

In this section we compare borrower welfare under each contractual form. Firstly we give a lemma that orders the $S$ thresholds, $\hat{S}^{IJ}$ and $\hat{S}^{EJ}$.

**Lemma 1** $\hat{S}^{IJ}_A > \hat{S}^{EJ}_A$. Suppose $p_h \geq p_m$. Then $\hat{S}^{IJ}_B > \hat{S}^{EJ}_B$.

**Proof.** See appendix.

The intuition for Lemma 1 is that under EJ, if a borrower fails to repay on behalf of her unsuccessful partner, she stands to lose her access to credit and social capital, while in an IJ arrangement, only her social capital would be lost. A slight complication arises because in Case B the interest payment is lower under IJ, offsetting this effect.
By assumption, the lender is a non-profit who offers the borrower welfare-maximizing contract. This turns out to depend on the Case (A/B), the sign of $\Delta$, and $S$. We summarize all the results thus far in the following proposition.

**Proposition 1** The contracts offered in equilibrium are as follows:

- **Case A:** IL is offered at $r = \frac{\rho}{p}$ for $S < \hat{S}_{EJ}^A$, otherwise EJ is offered at $r = \frac{\rho}{\pi_{EJ}^A}$.

- **Case B, $\Delta > 0$:** IL is offered at $r = \frac{\rho}{p}$ for $S < \hat{S}_{EJ}^A$, EJ is offered at $r = \frac{\rho}{\pi_{EJ}^B}$ for $S \in [\hat{S}_{EJ}^B, \hat{S}_{IJ}^B]$, IL is offered at $r = \frac{\rho}{\pi_{IJ}^B}$ for $S \geq \hat{S}_{IJ}^B$.

- **Case B, $\Delta \leq 0$:** IL is offered at $r = \frac{\rho}{p}$ for $S < \hat{S}_{IJ}^B$, IL is offered at $r = \frac{\rho}{\pi_{IJ}^B}$ otherwise.

Whenever EJ is offered, or IL is offered and $S \geq \hat{S}_{IJ}^B$, borrowers agree to guarantee one another’s repayments whenever they can afford to do so.

**Proof.** See appendix. ■

The result is summarized in Table 1, which gives the equilibrium contract and repayment probability $\pi$ in alternate rows. Borrower welfare is not shown, but is easily computed as $V = \frac{pR - \rho}{1 - \delta \pi}$, strictly increasing in $\pi$.

This shows that IL, EJ and IJ have costs and benefits and each one can be chosen under some circumstances. For example, IJ will be chosen when $S$ is high and when the distribution of returns is such that EJ is not costless (namely, for moderate levels of output, a borrower can pay back her own loan but not both loans). However, IJ is associated with a tighter incentive constraint, and therefore, there are circumstances when EJ will be preferred: for moderate levels of $S$ and distribution of returns such that EJ is costless.

<table>
<thead>
<tr>
<th>$S &lt; \hat{S}_{EJ}^A$</th>
<th>Case A</th>
<th>Case B, $\Delta &gt; 0$</th>
<th>Case B, $\Delta \leq 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL (no IJ)</td>
<td>IL (no IJ)</td>
<td></td>
<td>IL (no IJ)</td>
</tr>
<tr>
<td>$S \in [\hat{S}<em>{EJ}^B, \hat{S}</em>{IJ}^B]$</td>
<td>EJ $p(2 - p)$</td>
<td>EJ $p + \Delta(2 - p)$</td>
<td></td>
</tr>
<tr>
<td>$S \geq \hat{S}_{IJ}^B$</td>
<td>EJ $p(2 - p)$</td>
<td>IL (with IJ) $p + p_h(1 - p)$</td>
<td>IL (with IJ) $p + p_h(1 - p)$</td>
</tr>
</tbody>
</table>

Table 1: Equilibrium contracts and repayment probabilities
2.4 A remark on loan size

For simplicity, our core model assumes loans of a fixed size. However we can allow for variable loan size as a simple extension. To keep things simple, we assume that borrowers require a loan of size $L$, which we think of as a borrower type rather than a result of some optimization by the lender (for example, minimum productive scale is larger in rich than in poor countries). The relation between loan size and productivity is linear, that is, with a loan of size $L$, output is $LR_h$ with probability $p_h$, $LR_m$ with probability $p_m$, and 0 otherwise. Therefore we can simply scale $\bar{R}$ and $r$ by $L$, so borrower welfare is now equal to $LV$. However, borrowers’ social capital is derived from relationships external to the production function and therefore is assumed not to depend on $L$. Thus for a given amount of social capital $S$, borrowers are less willing to guarantee one another’s loans as the loan size increases.\footnote{Formally, the IJ IC2 is $Lr \leq \delta S$ and the EJ IC2 is $Lr \leq \delta (LV + S)$. Both are tighter as $L$ increases. Replacing $R$ with $L\bar{R}$, we observe that $\hat{S}^{EJ}(L) = L\hat{S}^{EJ}$ and $\hat{S}^{IJ}(L) = L\hat{S}^{IJ}$.
}

Thus we have the following observation:

**Observation 1** $\hat{S}^{EJ}(L)$ and $\hat{S}^{IJ}(L)$ are increasing in loan size, $L$. For a given $S$, the lender is more likely to offer IL as loan sizes increase, and borrowers are less likely to guarantee one another’s repayments. The repayment probability is thus stepwise decreasing in $L$.

This proposition summarizes a simple intuition for the stylized fact that IL loans tend to be larger. When loan sizes are small, the borrowers’ social capital can be tapped to smooth out occasional small imbalances in income. As loan sizes and incomes increase, this becomes less feasible. As borrowers become unwilling to guarantee one another’s loans, EJ becomes unattractive as it induces the borrowers to default unless both are successful.\footnote{Baland et al. (2010) obtain a result that gives the same negative correlation between the use of IL and loan size. Our above result is different in a nuanced way. In their model the poorest borrowers need the largest loan. Hence, their model generates a positive correlation between loan size and poverty.}

2.5 Discussion

The analysis so far illustrates how EJ can be a double-edged sword. In Case B, EJ enables borrower $i$’s loan to be repaid in a state where individually she would default $(0, R_h)$. However, this comes at the cost of inducing her to default in a state where...
individually she would repay \((R_m, 0)\). The relative probability of these two states determines whether EJ can perform better or worse than IL.

Since there are no information frictions within the village, borrowers can always find a partner with whom to agree a loan guarantee arrangement, whether under IL or EJ contracts. Borrowers form partnerships that optimally leverage their social capital to maximize their joint repayment probability. Thus when social capital is sufficiently high to generate implicit joint liability, IL lending can dominate EJ: borrower \(i\) no longer defaults in state \((R_m, 0)\). This does not however mean there is no role for EJ. In particular, for intermediate levels of social capital, EJ can dominate IL - social capital is high enough for repayment guarantees under EJ but not under IL.

The results of Giné and Karlan (2011) are consistent with our Case A. Here, IL and EJ lending can achieve the same repayment probability, provided \(S\) is sufficiently high. This does not imply that those same borrowers would repay as frequently were they fully separated from one another. Giné and Karlan (2011) additionally find that borrowers with weak social ties are more likely to default after switching to IL lending - this is consistent with these borrowers having \(\hat{S}_{EJ} \leq S < \hat{S}_{IJ}\), so they are unable to support implicit joint liability.

Our model is distinct from Rai and Sjöström (2010), where borrowers are assumed to have sufficient social capital to support incentive-compatible loan guarantees through a side-contract between borrowers. This hinges on a message game played in the borrowing group. They show that for borrowers to guarantee one another under IL, the lender must increase the punishment for default to induce borrowers to truthfully report their output. However, the guarantee makes such punishment less likely, and if the lender minimizes the sanctions used against the borrowers, expected sanctions and borrower welfare are the same with and without such side-contracting. That is not the case in our model because the sanction is the denial of future credit, which is more valuable with mutual insurance due to the higher future renewal probability.\(^{12}\) Also, distinct from Rai and Sjöström (2010), we assume that members of a group or village observe each others output realizations and repayment behavior. Hence, in our context, group meetings do not play an

\(^{12}\)To show this formally, we convexify the lender’s sanction by assuming renewal with probability \(\lambda \geq 0\) after default. Assume \(S\) is large, such that IJ IC2 holds. Since contracts are renewed with probability \(\pi + \lambda(1 - \pi)\), \(V = \frac{L(R - \rho)}{1 - \delta(\pi + \lambda(1 - \pi))}\). Now we can write IC1 as \(\delta V - r \geq \delta AV\), or \(\lambda \leq \frac{\delta R - \rho}{\delta \pi R - \delta \lambda}\). The optimal \(\lambda\) is the one that satisfies this condition with equality. Call this \(\lambda^*\) and note that it increases in \(\pi\). Since \(V\) increases in \(\lambda\) and \(\pi\), borrowers are strictly better off with IJ.

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informational role.

So far, we have ignored the use of groups. Group meetings generate costs that differ from those under individual repayment. In the next section we show that this may induce the lender to prefer one or the other. We then proceed to show that by interacting with the benefits from social capital, group meetings may induce the creation of social capital. This is consistent with the results of a field experiment by Feigenberg et al. [2011].

3 Meeting Costs

In this section we lay out a simple operational argument for the use of groups - holding group repayment meetings help the lender keep costs down. Then in the next section we explore how the use of groups might create social capital, and thus generate implicit joint liability. Since we wish to focus on the interplay between meeting costs and social capital when the lender does not use EJ, we assume Case B applies and suppress the A, B notation (so $\pi_{IJ} = p + p_h(1 - p)$), and we assume $\Delta \leq 0$, so the lender will never use EJ.

A common justification for the use of group meetings by lenders is that it minimizes transaction costs. Meeting with several borrowers simultaneously is less time-consuming than meeting with each individually. However, group meetings might be costly for the borrowers, as they take longer and are less convenient than individual meetings. We term IL lending to groups ILG and IL lending to individuals ILI.

We assume that loan repayment meetings have two components each of which takes a certain amount of time that we measure in utility or value units. For simplicity, we assume that the value of time is the same for borrowers and loan officers (this may not be too unrealistic as many MFIs deliberately hire loan officers from the communities that they lend to). Also, for simplicity, we assume that the cost of borrower time is non-monetary (otherwise we would have to amend all the various limited liability conditions and address what happens when a borrower has zero income). However, more time spent in meetings by the loan officer increases monetary lending costs, for example because more staff must be hired.

Each meeting consists of a standard and a nonstandard component. The standard component includes travel to the meeting location (which we assume to be the same for borrower and loan officer for simplicity), setting up the meeting, any discussions
or advice sessions that take place at the meeting, reminding borrowers of the MFI’s policies, and so on. This takes a fixed amount of time worth $\gamma_s$ symmetrically to each borrower and to the loan officer irrespective of the number of borrowers in the group. For instance, in an individual meeting the total cost to the single borrower and the loan officer of the standard part is $2\gamma_s$, while a group meeting with two borrowers and one officer costs $3\gamma_s$ in total. Secondly there is a nonstandard component that must be carried out once for each borrower: collecting and recording repayments and attendance, reporting back on productive activities, rounding up missing borrowers, and so on. This costs $\gamma_n$ per borrower, so the total cost of this part of a meeting with one borrower is $2\gamma_n$ (a cost of $\gamma_n$ faced by the borrower and by the loan officer), while for a meeting with two borrowers it is $6\gamma_n$ (a cost of $2\gamma_n$ faced by each of the borrowers and the loan officer).

Putting these together, we can consider the costs of individual and group meetings. An individual meeting costs $\gamma_s + \gamma_n$ to the borrower and to the loan officer, taking the total cost of lending per borrower to $\rho + \gamma_s + \gamma_n$. The total meeting cost per borrower is $\frac{3}{2}(\gamma_s + 2\gamma_n)$.

A group meeting of two borrowers costs $\gamma_s + 2\gamma_n$ to each borrower and to the loan officer. However, the loan officer only needs to hold one meeting so the total cost of lending per borrower is $\rho + \frac{3}{2}(\gamma_s + 2\gamma_n)$. The total meeting cost per borrower is $2(\gamma_s + \gamma_n)$.

Accounting for these costs, per-period expected utility for borrowers under ILI is $\overline{R} - \rho - 2(\gamma_s + \gamma_n)$. Under ILG, the per-period utility is $\overline{R} - \rho - \frac{3}{2}(\gamma_s + 2\gamma_n)$.

**Observation 2** Suppose $S = 0$. The lender uses ILG if and only if $\gamma_n < \frac{2\gamma_s}{2}$.

**Proof.** $S = 0$ implies IJ is not possible so $\pi = p$. ILG is used if and only if total meeting costs per borrower under ILG are smaller than those under ILI, which reduces to the condition in the observation.

The intuition is straightforward. When a large part of repayment meetings is repetitious ($\frac{\gamma_s}{\gamma_n}$ is large), it is economical to hold group meetings. Since all costs are passed on to the borrowers through the interest rate, this makes them better off. However, the more time is spent on individual concerns, the more costly it is to the borrowers to have to attend repayment meetings in groups. In our model,

\[\text{We need to adapt Assumptions 1, 2 and 3 to reflect the additional costs. We assume } R_m \geq \frac{\rho + \frac{3}{2}(\gamma_s + 2\gamma_n)}{p^2}, R_h \geq 2\rho + \frac{3}{2}(\gamma_s + 2\gamma_n), \delta p^2 (\overline{R} - \max \{2(\gamma_s + \gamma_n), \frac{3}{2}(\gamma_s + 2\gamma_n)\}) \geq \rho.\]
the needs of borrowers are homogeneous, but the same intuition carries over to situations where borrowers might different financing needs, term requirements and so forth. Traditional microfinance loans are generally standardized and so \( \frac{\gamma_s}{\gamma_n} \) will be relatively large.

Now consider borrowers’ incentives to form loan-guarantee arrangements. First we observe that for a given \( \gamma_n, \gamma_s \), half of the total meeting cost per borrower is borne by the lender under ILI, while only a third is borne by the lender under ILG. Since the lender passes on all costs through the interest rate, inspecting the value functions suggests that it is innocuous upon whom the cost of meetings falls. In fact this is not the case. Consider once again IJ IC2: \( r \leq \delta S \). The only benefit a borrower receives from bailing out her partner is the avoidance of a social sanction, while the cost depends on the interest payment she must make. Therefore a lending arrangement in which the lender bears a greater share of the costs, and thus must charge a higher interest rate, tightens IJ IC2.

**Proposition 2** Borrowers are more likely to engage in IJ under group lending than individual lending, as \( \hat{S}_{IJG} < \hat{S}_{IJI} \).

**Proof.** Borrowers are willing to guarantee their partner’s repayments provided \( r \leq \delta S \). Plugging in for the interest rates under ILG and ILI, we obtain

\[
\hat{S}_{IJG} = \frac{\rho + \frac{1}{2}(\gamma_s + 2\gamma_n)}{\delta \pi + \delta J} < \frac{\rho + \gamma_s + \gamma_n}{\delta \pi + J} = \hat{S}_{IJI}.
\]

The implication of this result is that there is a trade-off between minimizing total meeting costs, and minimizing those costs borne by the lender. It may not be optimal to minimize total costs as shown by the following corollary, the proof of which is straightforward and given in the appendix.

**Corollary 1** Suppose \( S \in [\hat{S}_{IJG}, \hat{S}_{IJI}] \). Group lending may be welfare improving, even if \( \gamma_n > \frac{\gamma_s}{2} \).

### 4 Social capital creation

Now we show how groups can actually generate social capital that is then used to sustain IJ. This analysis is inspired by the findings of Feigenberg et al. (2011). Suppose initially that borrowers do not have enough social capital to sustain IJ - for simplicity we assume that initially they have no social capital and creating it is costly. For example, borrowers must invest time and effort in getting to know and
understand one another, extend trust that might not be reciprocated, and so forth. Suppose that for a pair to generate social capital worth $S$, each must make a discrete non-monetary investment that costs them $\eta$.

Social capital has a direct benefit ($S$) and an indirect benefit, by enabling the formation of a guarantee arrangement. However this may not be sufficient to induce them to make the investment. Suppose the lender offers ILI and $S$ is sufficiently large to sustain IJ. If the borrowers prefer to invest in social capital, each time their partner defaults they must invest in social capital with their new partner. Assume that the lender does not observe the investment and adjust the interest rate. We obtain the following result.

Lemma 2 Borrowers will not invest in social capital under ILI if:

$$\eta - S > G_1.$$  

where

$$G_1 \equiv \frac{p_n(1-p)\left[\delta\left(\bar{R} - \frac{\rho}{\pi\tau}\right) - \frac{1+\delta\pi\sigma}{\pi}\left(\gamma_s + \gamma_n\right)\right]}{(1-\delta)(1-\delta(p + \Delta(1-p)))}$$

is increasing in the welfare gain from the guarantee arrangement sustained by the created social capital.

Proof. See Appendix. □

If $S + G_1$ is low relative to the cost of investing in social capital, borrowers are unwilling to do so.

Now assume that under ILG, the per-meeting cost to borrowers is decreasing in $S$. Attending group meetings is a chore unless the other group members are friends, in which case it can be a social occasion. By forcing the borrowers to meet together, the lender might give them an incentive to create social capital, benefiting them.

For simplicity, we assume that the cost of group meetings to borrowers is $\gamma_s + 2\gamma_n$ when $S = 0$, but when $S > 0$ it is $(1 - \sigma)(\gamma_s + 2\gamma_n)$, for some $\sigma > 0$. The larger is $\sigma$, the smaller the disutility of group meetings, and when $\sigma > 1$, borrowers actually derive positive utility from group meetings that is increasing in the length of the meeting. We can now check when social capital will be created in groups.

14This means that we need to adjust IC1 to reflect that investment. We assume that IC1 holds throughout.
Lemma 3  Borrowers invest in social capital under ILG if:

\[ \eta - S \leq G_2. \]  \hspace{1cm} (4)

where

\[ G_2 \equiv \frac{p_h(1 - p)\left[\delta \left(R - \frac{\rho}{\pi IJ}\right) - \frac{1 + 2\delta\pi IJ}{2\pi IJ}(\gamma_s + 2\gamma_n)\right] + \sigma(1 - \delta p)(\gamma_s + 2\gamma_n)}{(1 - \delta p)(1 - \delta(p + \Delta(1 - p)))} \]

is increasing in the combined gain from the loan guarantee arrangement and the reduction in meeting costs.

Proof. See Appendix. \(\blacksquare\)

Now, creating social capital generates a loan guarantee benefit and a reduction in meeting costs: if \(S + G_2\) is sufficiently large to offset the cost of social capital creation, \(\eta\), borrowers will invest.

Lemmas 2 and 3 suggest that there may exist an interval, \((G_1, G_2]\) for \(\eta - S\) over which groups create social capital but individual borrowers do not. The condition for this to be the case is derived in the next proposition, which follows from straightforward comparison of (3) and (4):

Proposition 3  If the following condition holds:

\[ \sigma > \frac{p_h(1 - p)(\delta\pi IJ\gamma_n - \frac{\gamma_s}{2})}{4\pi IJ(1 - \delta p)(\gamma_s + 2\gamma_n)} \]  \hspace{1cm} (5)

then there exists a non-empty interval for \(\eta - S\) over which both (3) and (4) are satisfied. If \(\eta - S\) lies in this interval, groups create social capital, and individual lending does not.

This is a key result, as it shows that when creating social capital sufficiently offsets the cost to borrowers of attending group meetings, borrowing groups may create social capital and guarantee one another’s loans, while individual borrowers may not do so. Importantly, (5) always holds for sufficiently large \(\sigma\). However it does not yet establish that this is necessarily welfare-improving. In other words, observing that groups are bonding and creating social capital does not tell the observer that group lending is the welfare-maximizing lending methodology. The following proposition addresses this question.
Proposition 4  Suppose condition (5) is satisfied and $\eta - S \in (G_1, G_2)$. The lender will use groups and thus create social capital if doing so makes borrowers better off. This is the case if the following condition holds:

$$\eta - S \leq G_3$$  \hspace{1cm} (6)

where

$$G_3 \equiv \frac{\delta p h (1 - p) (\bar{R} - \rho) + 2(1 - \delta \pi^{IJ})(\gamma_s + \gamma_n) - \frac{1}{2}(1 - \delta p)(\gamma_s + 2\gamma_n)(3 - 2\sigma)}{(1 - \delta p)(1 - \delta(p + \Delta(1 - p)))}.$$  

Proof. Total borrower welfare when groups are not used is:

$$V^{ILI}_{IL} = \frac{\bar{R} - \rho - 2(\gamma_s + \gamma_n)}{1 - \delta p}$$

and when groups are used it is:

$$U^{IJG}_{1} = \frac{\bar{R} - \rho - \frac{1}{2}(\gamma_s + 2\gamma_n)(3 - 2\sigma) + (1 - \delta(p + \Delta(1 - p))) (S - \eta)}{1 - \delta \pi^{IJ}}.$$  

The result follows from comparison of these value functions. ■

If $\eta - S > G_3$, then using groups to create social capital is actually welfare-reducing. Given the group contract, borrowers are better off incurring the cost $\eta$ to create $S$. However, that investment is very costly; they would be better off under the individual contract that did not induce them to make this investment. Note that (6) is always satisfied for sufficiently large $\sigma$.

The expressions $G_1, G_2$ and $G_3$ are somewhat unwieldy. The following proposition establishes a sufficient condition under which $G_1 < G_2 < G_3$.

Proposition 5  Suppose total meeting costs per borrower are lower under ILG than ILI, i.e. $\gamma_n < \frac{\gamma_s}{2}$. Then $G_1 < G_2 < G_3$, so: a) there always exists an interval for $\eta - S$ over which groups create social capital and individuals do not; b) use of groups to create social capital is always welfare improving; and thus c) borrower welfare is always strictly higher under ILG than ILI, for all values of $\eta - S$.

Proof. See appendix. ■

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These value functions are derived in the proofs of Lemmas 2 and 3.
Thus, the cost-based argument for use of groups carries over when we allow for social capital creation, which further strengthens the case for use of groups even under IL lending. However, Corollary 1 and Propositions 4.1 and 4 establish conditions under which, even when group lending is very costly in terms of borrower and loan officer time, it may be more effective than individual lending at sustaining implicit joint liability and creating social capital.

For intermediate values of $S$ our conclusions are further strengthened. Corollary 1 shows that for a given level of meeting costs, IJ is easier to sustain under group lending. Since the borrowers’ incentive to create social capital depends on the IJ it sustains, there will be cases under which individual lending cannot create social capital (doing so would not create IJ), while groups can.

4.1 Meeting frequency and social capital creation

Feigenberg et al. (2011) find that groups that meet more frequently have better long-run repayment performance, which they attribute to higher social capital and informal insurance within the group. We do not model repayment frequency, but nevertheless our model is able to capture some of this intuition. Consider more frequent meetings as an increase in $\gamma_s$ or $\gamma_n$. For a given level of welfare, the more time spent in group meetings, the greater the benefit to social interaction within those meetings, captured by $\sigma$. However, more frequent meetings require more of the loan officer’s time as well, leading to higher costs and a higher interest rate, reducing the incentive to invest in $S$ (which increases the repayment and renewal probability). The net incentive effect is positive if $\sigma$ is sufficiently large, as shown by the following proposition.

**Proposition 6** Increases in $\gamma_s$ or $\gamma_n$ make borrowers under group lending more willing to invest in social capital (by relaxing (4)) if and only if the following condition holds:

$$\sigma > \frac{p_h(1-p)(1 + 2\delta \pi^{IJ})}{2\pi^{IJ}(1 - \delta p)}.$$  \hfill (7)

**Proof.** Immediate from inspection of (4).

**Corollary 2** Suppose (7) holds. Then there exists a threshold at which increases in the costs $\gamma_s$ or $\gamma_n$ cause group borrowers to switch to creating social capital, and this is welfare-improving.
Proposition derives a condition on $\sigma$ under which groups are better able to create social capital than individual borrowers. Proposition 6 simply focuses on group lending and asks when higher meeting costs actually lead to more social capital creation. As meeting costs increase, two things occur. Firstly, the lender must charge a higher interest rate, which reduces borrower welfare and tightens IJ IC2. Secondly, the cost to borrowers of being in a group with a stranger increase: by creating social capital the cost to borrowers of time spent in meetings decreases by $\sigma(\gamma_s + 2\gamma_n)$. If $\sigma$ is sufficiently large, the second effect dominates and higher meeting costs increase the borrowers’ incentive to invest in $S$.

Feigenberg et al. (2011) show that the improvement in repayment performance associated with higher meeting frequency approximately offset the increase in the lender’s cost. This implies that among contracts with group meetings the total surplus was increasing in meeting frequency in their experiment. In our model, all surplus accrues to the borrower, so condition (7) is necessary for there to exist a region over which total surplus is increasing in the meeting frequency.

If the lender holds the interest rate fixed, as in Feigenberg et al. (2011), borrowers will be more willing to create social capital for a given increase in the meeting frequency (the extra cost is not passed on through a higher interest rate). However, a parallel condition must then hold for the increase in repayment frequency to offset the lender’s costs.

5 Conclusion

Anecdotal evidence suggests that there has been a move away from explicit joint liability towards individual liability by some prominent institutions. Most of these institutions have retained the use of groups to facilitate credit disbursal. The key question now is whether groups do more than just facilitate the lender’s operations. The interest in this question has been strengthened by two recent field experiments. Giné and Karlan (2011) found that removing the joint liability clause, but retaining the group meetings, of a random subset of borrowing groups of Green Bank in the Philippines had no meaningful effect on repayment rates, although borrowers with weak social ties to other borrowers were more likely to drop out.

In this paper we have shown that this outcome may result when the newly individually liable groups have sufficient social capital to continue to guarantee one
another’s repayments, as under EJ, which we call implicit joint liability (IJ). We show that this may even lead to higher repayment rates and borrower welfare. However this first result does not depend upon the use of groups, provided borrowers are able to side contract on loan repayments outside of repayment meetings.

We next show that when individual and group repayment meetings are costly, mutual insurance or IJ are easier to sustain under group lending, because IJ depends crucially on the interest rate, which in turn depends on the share of total meeting costs borne by the lender. Group meeting reduces the lender’s share of meeting costs, enhancing IJ.

The second experimental paper highlighting the role of groups is Feigenberg et al. (2011). They find that varying meeting frequency for a subset of individually liable borrowing groups seemed to have persistent positive effects on repayment rates. They suggest that this is due to improved informal insurance among these groups due to higher social capital.

We analyze situations under which microcredit might induce borrowers to create social capital, which in turn enables them to sustain IJ. We derive conditions under which group lending is more likely than individual lending to create social capital, and show when this is indeed welfare increasing. Finally, in response to Feigenberg et al. (2011), we derive conditions under which more frequent meetings, modeled here as an increase in the amount of time borrowers and loan officers must spend in loan repayment meetings, increases borrowers’ incentive to invest in social capital. Hence, we provide a theoretical foundation for Feigenberg et al. (2011)’s observation.

References


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A Appendix

Proof of Lemma 1

Proof. It is immediate that \( \hat{S}^E_J < \hat{S}^I_J \) since \( \pi^E_A = \pi^I_A \) and \( \delta \pi^E_A \bar{R} - \rho > 0 \) by Assumption 3.

Therefore consider Case B. It is obvious that if \( \hat{S}^E_J = 0 \), \( \hat{S}^I_J > \hat{S}^E_J \), since \( \hat{S}^I_J > 0 \). Suppose therefore that \( \hat{S}^I_J > 0 \). It is straightforward to check that Assumptions 1, 2 and 3 imply that \( \delta p \geq \frac{1}{2} \). Given this, and \( p_h \geq p_m \), it follows that \( \pi^I_J \geq p \geq \frac{1}{2} \) and \( \pi^E_J \geq p \geq \frac{1}{2} \). Also recall that \( \pi^E_J \) can be written as \( p^2 + 2p_h(1-p) \).

We have:

\[
\hat{S}^I_J - \hat{S}^E_J = \frac{\delta \pi^E_J \bar{R} - \rho}{\delta \pi^E_J (1 - \delta \pi^E_B)} + \rho \frac{\delta \pi^I_J}{\delta \pi^E_B} - \frac{\rho}{\delta \pi^E_J} = \frac{\pi^I_J (\delta \pi^E_J \bar{R} - \rho) - p_m(1-p)(1-\delta \pi^E_B)(\delta \pi^I_J)}{\delta \pi^E_J \pi^E_B (1 - \delta \pi^E_B)} \\
\geq \frac{(\delta \pi^E_J \bar{R} - \rho) - p_m(1-p)\rho}{2\delta \pi^I_J \pi^E_J (1 - \delta \pi^E_B)} \\
= \frac{\delta p^2 \bar{R} - \rho + p_h(1-p)(2\delta \bar{R} - \rho) + (p_h - p_m)(1-p)\rho}{2\delta \pi^I_J \pi^E_J (1 - \delta \pi^E_B)} \\
> 0
\]

which follows from \( 2\delta \bar{R} - \rho > 0 \) by Assumption 3. ■

Proof of Proposition 1

To compare IL and EJ, we consider first Case A, then Case B with \( p_h > p_m \), and lastly Case B with \( p_h \leq p_m \).

In Case A, borrower repayment guarantees under IL offer no advantage over EJ, so provided \( S \geq \hat{S}^E_J \), EJ is the borrower welfare-maximizing contract (with indifference for \( S \geq \hat{S}^I_J \)). For \( S < \hat{S}^E_J \), borrower will not mutually guarantee under EJ and also default unless their partner is successful, so IL is preferred to EJ:

\[
V^E_J(S) - V^I_L(S) = \begin{cases} 
\frac{\delta p(1-p)(\bar{R} - \rho)}{(1-\delta p)(1-\delta p^2)} & S < \hat{S}^E_J \\
\frac{\delta p(1-p)(\bar{R} - \rho)}{(1-\delta p)(1-\delta p(2-p))} & S \in [\hat{S}^E_J, \hat{S}^I_J] \\
0 & S \geq \hat{S}^I_J
\end{cases}
\]

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In Case B, with $p_h > p_m$, EJ dominates IL when borrowers guarantee one another under EJ but not under IL, for $S \in [\hat{S}^E_B, \hat{S}^I_B)$, so EJ is preferred in this region. However, once IJ is possible, for $S \geq \hat{S}^I_B$, it dominates EJ. This is because borrower 1 repays her own loan in state $(R_m, 0)$, while she would default under EJ. We have:

$$V^E_B(S) - V^I_B(S) = \begin{cases} 
- \delta p (1-p) (\bar{R} - \rho) \\
(1-\delta p)(1-\delta^2 p^2) 
\end{cases} S < \hat{S}^E_B$$

$$S \in [\hat{S}^E_B, \hat{S}^I_B)$$

$$\begin{cases} 
- \delta p_m (1-p) (\bar{R} - \rho) \\
(1-\delta p_m(1-p))(1-\delta(p+\triangle(1-p))) 
\end{cases} S \geq \hat{S}^I_B$$

Lastly, in Case B with $p_h \leq p_m$, EJ is always dominated by IL. This is because under EJ the highest possible repayment probability is $p + \triangle(1-p)$, which is weakly smaller than $p$, the lowest possible repayment probability under IL. Therefore we do not need to know the ordering of $\hat{S}^E_B$ and $\hat{S}^I_B$ for this case - EJ will never be used.

**Proof of Corollary 1**

Suppose total meeting costs are higher under ILG: $\frac{3}{2}(\gamma_s + 2\gamma_n) > 2(\gamma_s + \gamma_n)$ or $2\gamma_n > \gamma_s$. Suppose also that $S \in [\hat{S}^I_G, \hat{S}^I_I)$. Then group lending sustains IJ but individual lending does not. Welfare is higher under group lending if:

$$\frac{\bar{R} - \rho - \frac{3}{2}(\gamma_s + 2\gamma_n)}{1-\delta(p+p_h(1-p))} > \frac{\bar{R} - \rho - 2(\gamma_s + \gamma_n)}{1-\delta p}$$

Taking the limit as $\gamma_s \to 2\gamma_n$, it is clear that this condition holds strictly, while $\hat{S}^I_G > \hat{S}^I_I$ continues to hold, thus the corollary follows for a non-trivial interval of costs by a standard open set argument.

**Proof of Lemma 2**

We check for a one-shot deviation from a hypothetical equilibrium in which the borrowers do invest and are charged $r = \frac{\rho + \gamma_s + \gamma_n}{\pi^I}$. If she prefers to deviate from this equilibrium, we also know she prefers not to deviate from an equilibrium in which she does not invest (and is therefore charged $r = \frac{\rho + \gamma_s + \gamma_n}{\pi^I}$), because $\frac{\partial^2 V}{\partial r \partial \pi} < 0$; she benefits more from the increase in repayment probability when interest rates are low.

Consider a borrower who invests in social capital and whose loan is repaid with probability $\pi^I$. However, her partner defaults and is replaced with probability
following which she must invest again (but keeps the social capital $S$ with the original partner). Her total utility including social capital is $U$, defined as:

$$U_1^{IJ} = S - \eta + W_1^{IJ}$$

$$W_1^{IJ} = (\bar{R} - \rho - 2(\gamma_s + \gamma_n)) + \delta(p + \Delta(1-p))W_1^{IJ} + \delta p_m(1-p)U_1^{IJ}$$

Note that although she repays with probability $\pi_{IJ}$, with probability $p + \Delta(1-p)$ she earns $W_1^{IJ}$ next period, and with probability $p_m(1-p)$ she earns $U_1^{IJ}$ next period. Substituting, we can write $U$ as:

$$U_1^{IJ} = S - \eta + \left(\frac{(\bar{R} - \rho - 2(\gamma_s + \gamma_n)) + \delta p_m(1-p)(S - \eta)}{1 - \delta \pi_{IJ}}\right)$$

Now we check for a one-shot deviation. In this context, a deviation is to defer investing in social capital by one period, i.e. to have one period with a repayment probability of $p$, then invest next period. She prefers to deviate if:

$$U_1^{IJ} < \left(\bar{R} - \rho \frac{p + \gamma_s + \gamma_n}{\pi_{IJ}} - (\gamma_s + \gamma_n)\right) + \delta p U_1^{IJ}.$$

Note that the lender’s cost of individual meetings $(\gamma_s + \gamma_n)$ appears in the numerator of the interest rate, while the borrower’s cost appears separately. Substituting for $U_1^{IJ}$ and rearranging yields condition (3).

For completeness, we can double check that this condition implies she would not want to deviate from a no-investment equilibrium. Doing so would create a phase of IJ that would last until her partner was replaced. The equilibrium utility is:

$$V_{ILI}^{IJ} = \frac{(\bar{R} - \rho - 2(\gamma_s + \gamma_n))}{1 - \delta p}.$$
Substituting and rearranging, we obtain:

\[ U_2^{IJI} = S - \eta + \frac{\left( \bar{R} - \pi^{IJ} \frac{\rho + \gamma_s + \gamma_m}{\rho} - \left( \gamma_s + \gamma_m \right) \right)}{1 - \delta(p + \Delta(1 - p))} + \frac{\delta p_m(1 - p)}{1 - \delta(p + \Delta(1 - p))} V^{II}^{I} \]

She will not deviate if \( U_2^{IJI} \leq V^{II}^{I} \) or:

\[ ph(1 - p) \left[ \delta \left( \bar{R} - \frac{\rho}{p} \right) - \frac{1 + \delta p(\gamma_s + \gamma_m)}{p} \right] \frac{1}{(1 - \delta p)(1 - \delta(p + \Delta(1 - p)))} < \eta - S. \]

This condition is implied by (3).

**Proof of Lemma 3**

Hypothesize an equilibrium in which borrowers invest in social capital, and check that no borrower prefers to defer investing by one period. We define the value functions analogously to those in the proof of Lemma 2:

\[ U_1^{IJI} = S - \eta + W_1^{IJI} \]

\[ W_1^{IJI} = \left( \bar{R} - \rho - \frac{1}{2} (\gamma_s + 2\gamma_n)(3 - 2\sigma) \right) + \delta(p + \Delta(1 - p)) W_1^{IJI} + \delta p_m(1 - p) U_1^{IJI}. \]

Where the possession of social capital reduces the borrowers’ cost of group meetings by \( \sigma(\gamma_s + 2\gamma_n) \). The appropriate substitutions yield:

\[ U_1^{IJI} = \frac{\bar{R} - \rho - \frac{1}{2} (\gamma_s + 2\gamma_n)(3 - 2\sigma) + (1 - \delta(p + \Delta(1 - p)))(S - \eta)}{1 - \delta \pi^{IJ}}. \]

There will be no deviation if \( U_1^{IJI} \geq \left( \bar{R} - p^{\frac{\rho + \frac{1}{2}(\gamma_s + 2\gamma_n)}{\pi^{IJ}}} - (\gamma_s + 2\gamma_n) \right) + \delta p U_1^{IJI}. \)

Simplifying yields condition (4).

**A.1 Proof of Proposition 5**

First, observe that if \( \gamma_n < \frac{\gamma_s}{2} \), condition (5) is satisfied for all \( \sigma \geq 0 \), hence \( G_1 < G_2 \).

From the proof of Lemma 3, \( \eta - S \leq G_2 \) if and only if \( U_1^{IJI} \geq \left( \bar{R} - p^{\frac{\rho + \frac{1}{2}(\gamma_s + 2\gamma_n)}{\pi^{IJ}}} - (\gamma_s + 2\gamma_n) \right) \frac{1 - \delta p}{1 - \delta p}. \)

Call the RHS of this condition \( B \). From the proof of Proposition 4, \( \eta - S < G_3 \) if
and only if $U_1^{ILG} > V^{ILL}$. Finally, note that $B - V^{ILL} = \frac{p_n(1-p)(p+\gamma_n)+p(\gamma_n^2-\gamma_n)}{\pi(1-\delta p)}$, which is strictly positive if $\gamma_n < \frac{\gamma_s}{2}$. Thus, $\eta - S \leq G_2$ implies $\eta - S < G_3$, or $G_2 < G_3$.

Claims a) and b) follow immediately from $G_1 < G_2 < G_3$. Claim c), that borrower welfare is always higher under ILG, follows from Observation 2.