

Moral Hazard and Peer Monitoring in a Laboratory Microfinance Experiment*

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Abstract

This paper reports the results from a laboratory microfinance experiment of group lending in the presence of moral hazard and (costly) peer monitoring. We compare peer monitoring treatments in which credit is provided to members of the group to individual lending treatments with lender monitoring. We find that if the cost of peer monitoring is lower than the cost of lender monitoring, peer monitoring results in higher loan frequencies, higher monitoring and higher repayment rates compared to lender monitoring. In the absence of monitoring cost differences, however, lending, monitoring and repayment behaviour is mostly similar across group and individual lending schemes. Within group lending, contrary to theoretical predictions, simultaneous and sequential lending rules provide equivalent empirical performance.

JEL Classification: G21, C92, O2.

Key words: Group Lending, Monitoring, Moral Hazard, Laboratory Experiment, Credit, Development

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1. Introduction

The last few decades have witnessed the development of innovative and highly successful mechanisms for the provision of credit to the poor. The most common of these is group-lending. Rather than use individual lending rules where the bank (or the lender) makes a loan to an individual who is solely responsible for its repayment, in group lending the bank makes a loan to an individual who is a member of a group and the group is jointly liable for each member's loans. If the group as a whole is unable to repay the loan because some members default on their repayment, all members of the group become ineligible for future credit. The Grameen Bank in Bangladesh, the well known microfinance institution (MFI), which was the pioneer of such group lending programs, reports that as of 2008, only 2.08% of its loans are overdue (see www.grameen-info.org). The success of the Grameen Bank has led policy makers and Non-Government Organisations around the world to introduce similar schemes.¹ While it is true that in recent years, several MFIs have moved on from group based lending programs, group lending continues to be the most commonly used mechanism in the context of credit provision by MFIs. Indeed the current trend towards individual lending programs makes a systematic study of the performance of lenders and borrowers in individual and group lending programs topical and important from an academic and a policy point of view.

The aim of this paper is to examine lending, monitoring and repayment behaviour in group and individual lending schemes, using experimental methods. We report the results from a laboratory experiment of group lending in the presence of moral hazard and (costly) peer monitoring.² We find

¹ As of 2007, microfinance institutions were serving around 150 million people around the world (Gine et al. (2010)). The 2006 Nobel Prize for Peace to microfinance pioneer Muhammed Yunus also put the success of microfinance in the world spotlight. 2005 was designated by the United Nations as the year of microfinance. While microfinance programs are most widespread in less developed countries they are by no means confined to them. These programs have been introduced in transition economies such as Bosnia and Russia and in developed countries such as Australia, Canada and the US (see Conlin (1999), Armendariz de Aghion and Morduch (2000), Armendariz de Aghion and Morduch (2005) and Fry et al. (2006)). Micro-lending is increasingly moving from non-profit towards a profit-making enterprise, with large banks such as Citigroup now backing such loans (Bellman (2006)).

² We focus on informational asymmetries due to moral hazard rather than those due to adverse selection. In particular we restrict attention to exogenously formed groups and leave the issue of endogenous group formation (positive assortative matching) for future research. Ghatak (2000), Van Tassel (1999), and Armendariz de Aghion and Gollier (2000) discuss theoretical models on how group lending solves the problem of adverse selection.

that simultaneous and sequential credit provision to group members leads to similar results. Compared to individual lending, however, group lending leads to greater loan frequencies, higher monitoring and improved repayment rates if peer monitoring is less costly than lender monitoring.

This importance of monitoring costs on credit market performance in our experiment is consistent with perceived advantages of group lending in practice. The success of group lending programs arises, in part, because they can better address the enforcement and informational problems that generally plague formal sector credit in developing countries.³ Group lending programs typically help solve the enforcement problem through peer monitoring. Stiglitz (1990) and Varian (1990) argue that since group members are likely to have better information compared to an outsider like, the bank, peer monitoring is relatively cheaper compared to bank monitoring, leading to greater monitoring and hence greater repayment. Banerjee, Besley and Guinnane (1994) argue that explanations based on peer monitoring are better at explaining the success of group lending programs than alternative explanations.⁴

Most empirical studies on the determinants of repayment use data from institutions with similar lending rules, hence there is relatively little variation to estimate the efficacy of a particular mechanism. Thus, lacking well designed experiments, they are forced to rely on variation in the economic environment to identify the parameter of interest, and often times they employ instruments that are hard to justify. Also, variation that does exist in the field is endogenous, which makes it difficult to unambiguously determine causality (Morduch (1999), Armendariz de Aghion and Morduch (2005)).

³ Armendariz de Aghion and Morduch (2000), Armendariz de Aghion and Morduch (2005), Chowdhury (2005), Che (2002), Rai and Sjostrom (2004) and Bhole and Ogden (2010) discuss different aspects of microfinance programs..

⁴ Peer monitoring and peer enforcement have been observed to deter free riding in several experiments relating to other social dilemma situations, such as common pool resource environments and the voluntary provision of public goods. See Fehr and Gächter (2000), Barr (2001), Masclet et al. (2003), Walker and Halloran (2004), and Carpenter, Bowles and Gintis (2006) for experimental evidence.

Our laboratory study complements the rapidly growing body of research that can broadly be characterized as field experiments in microfinance.⁵ The laboratory approach that we use in this paper can address issues in different ways compared to field experiments. It is difficult to vary specific properties of institutions in the field due to problems of replicability, data accessibility and comparability (see for example Bolnik (1988) and Hulme (2000)). Furthermore some relevant variables, such as actual monitoring costs, and the decision making process of lenders remain unobserved. The laboratory approach, on the other hand, can help control for specific parameters and observe both lender and borrower behaviour under alternative lending contracts. In our case it can help in isolating and clarifying the impact of different design features, by implementing an environment that is carefully aligned with the theoretical models relating to moral hazard and peer monitoring in microfinance programs.

Of course, the laboratory approach has some drawbacks. For example, while the laboratory experiment included human subject behaviour, the subjects are making decisions for relatively low stakes. In field experiments, by contrast, participants are often the actual borrowers who are involved in microfinance programs. This advantage of field experiments however comes at the cost of some loss of experimental control. For example, spillovers from one village to another or from the treatment group to the control group could create noise in the data. Since groups are self-formed in the field the benefits of peer monitoring could also be over-estimated due to assortative matching. It might therefore be difficult to separate out the effects of peer monitoring and group selection using field data. This is not a problem in our laboratory experiment, which features strictly random assignment.

Few laboratory experiments examine the impact of specific design features on the performance of microfinance models. Abbink, Irlenbusch and Renner (2006) and Seddiki and Ayedi (2005) examine

⁵ The Gine et al. (2010), Fischer (2008), Kono (2006), Cassar, Crowley and Wydick (2007) papers report “artefactual” field experiments which place non-student subjects in stylized microfinance environments similar to controlled laboratory studies. The Field and Pande (2008), Banerjee et al. (2009), Gine and Karlan (2009) and Karlan and Zinman (2009) papers on the other hand describe randomized interventions for actual microfinance programs.

the role of group selection in the context of group lending. Both experiments are designed as investment games where each group member invests in a risky project whose outcome is known only to the individual and they find that self-selected groups have a greater willingness to contribute. Neither of these papers analyse the role of peer monitoring.

Our experimental design is motivated by theoretical models of microfinance and in these models the agents are assumed to be pay-off maximisers. Considerable experimental evidence has accumulated in recent years to suggest that individuals do not necessarily act as pay-off maximisers, and that other social preferences often influence behaviour (Sobel (2005)). Our experiment provides evidence that reciprocal motivations significantly affect behaviour in the individual lending treatments, which are modelled as two-person games. Subjects however exhibit little reciprocal behaviour in the group lending treatments, when a fellow borrower is monitoring and can also compensate the lender for non-repayment of loans. This suggests that the group lending environment diffused the borrower's perceived responsibility to be reciprocal, analogous to free-riding on reciprocal motivations of fellow borrowers in the group lending treatments.

2. Theoretical Framework

Overview

Consider a scenario where two borrowers require one unit of capital (say \$1) each for investing in a particular project. The bank, which provides this capital in the form of a loan, can either make the loan to an individual (individual lending) or it can loan to the borrowers as a group (group lending). In the case of group lending the borrowers are jointly responsible for the repayment of the loan. Borrowers can invest in two different types of projects: one project has a large verifiable income and no non-verifiable private benefit (project *S*), while the other has a large non-verifiable private benefit and no verifiable income (project *R*). The bank prefers the first project, where it can recoup its investment, but

the borrowers prefer the second one. In the absence of monitoring, the borrowers will choose to invest in the second project and the bank, knowing this, will choose not to make the loan.

Let us briefly describe the theoretical framework, which forms the basis of our experimental design and hypotheses. The framework closely follows Chowdhury (2005) and Ghatak and Guinnane (1999). Suppose that there are two borrowers: B_1 and B_2 . If Project S is chosen, the return is H (verifiable by monitoring) and if project R is chosen, then the return is b (not verifiable) with $b < H$. The \$1 cost of each project is financed by a loan from the bank (or a lender) since the borrowers do not have any funds of their own. When the two borrowers (B_1 and B_2) borrow together as a group, each borrower receives \$1 from the lender. The amount to be repaid is $r(>1)$ in the case of individual lending or $2r$ in the case of group lending. We assume that this interest rate r is fixed exogenously.

In the case of individual lending, if the borrower chooses project S the return to the bank is r ; otherwise it is 0. The return to the borrower is $H - r$ if the borrower chooses project S , and is b if the borrower chooses project R . We assume that $H - r < b$ so that borrowers prefer project R . Banks on the other hand prefer project S . In the case of group lending, if both borrowers choose project S , the return to each borrower is $H - r$ and the return to the bank is $2r$. If both borrowers choose project R , the return to each borrower is b and the return to the bank is 0. Finally if one borrower chooses project R and the other chooses project S , then due to joint liability the return to the borrower choosing project S is 0 while that of the borrower choosing project R is b and the return to the bank is H . We assume that $H \leq 2r$. In the case of group lending it is therefore in the interest of both the bank and the borrowers to ensure that the other member of the group chooses project S .

An informational asymmetry arises because each borrower knows the type of his own project, but the lender or the other borrower in the group can find out the borrower's project choice only with costly monitoring. The monitoring process works as follows: Borrower B_i can, by spending an amount

$c(m_i)$ in monitoring costs, obtain information about the project chosen by the other borrower in his group (B_j) with probability $m_i \in [0,1]$. This information can be used by B_i to ensure that B_j chooses project S . One could think of different ways in which monitoring works in practice: information acquired by the borrowers about each other's project choice may be passed on to the lender who then uses this information to force the borrowers to choose project S . Alternatively, through monitoring the borrowers can use some form of social sanctions or peer punishment to ensure that the other borrower chooses project S . The bank (lender) can also acquire this same information by spending an amount $\lambda c(m)$. We assume that $\lambda \geq 1$ in order to capture the notion that peer monitoring is less expensive than monitoring by the bank. We assume for simplicity a quadratic monitoring cost function $c(m_i) = \frac{m_i^2}{2}$, and this quadratic function is implemented in the experiment.

In practice peer monitoring is usually less costly than direct lender monitoring; indeed, this cost advantage is regarded as one of the main benefits of peer monitoring. Hermes and Lensink (2007) argue that the higher observed repayment rates in group lending with peer monitoring compared to individual lending with lender monitoring is driven by the greater effectiveness of screening, monitoring and enforcement within the group. This could be due to the closer geographical proximity and close social ties between the group members, which translate to lower monitoring costs in the case of group lending with peer monitoring compared to individual lending with lender monitoring. Our experimental design also compares credit market performance when direct lender monitoring and peer monitoring involve the same monitoring cost ($\lambda = 1$). This allows us to examine the relative effectiveness of group lending with peer monitoring and individual lending with lender monitoring, holding monitoring costs constant.

Individual Lending

First consider individual lending (with bank monitoring). There are three stages to the game.

Stage 1: Bank chooses whether or not to lend \$1 to the borrower. If the bank chooses not to lend, then the \$1 can be put into alternative use, which yields $\bar{r} < 1$.

Stage 2: Bank chooses the level of monitoring, conditional on deciding to lend.

Stage 3: Borrower chooses either project R or project S .

It is straightforward to solve for the sub-game perfect Nash equilibrium of the game by backward induction. If the bank lends, it chooses m to maximise $mr - \frac{\lambda m^2}{2} - 1$, which gives $m^* = r/\lambda$.

Therefore the expected return to the bank is $\frac{r^2}{2\lambda} - 1$, so the bank will provide the loan if and only if

$\frac{r^2}{2\lambda} - 1 > \bar{r}$; i.e., if $r^2 > 2\lambda(\bar{r} + 1)$. This gives rise to the first proposition:

Proposition 1: If the costs of monitoring relative to the return are sufficiently low, i.e., $\lambda < \frac{r^2}{2(\bar{r} + 1)}$,

then individual lending is feasible, and the efficient (full monitoring/lending) equilibrium exists; for monitoring costs above this threshold the unique equilibrium has no lending.

We consider two specifications for the monitoring cost structure in the experiment. In the individual lending high cost treatment (Treatment 1) we set $\lambda > \frac{r^2}{2(\bar{r} + 1)}$. In the individual lending low cost

treatment (Treatment 2) we set $\lambda < \frac{r^2}{2(\bar{r} + 1)}$.

Group Lending: Simultaneous

The sequence of events in group lending is as follows:

Stage 1: Bank chooses whether or not to lend \$2 to the group. There is joint liability, so that if one borrower fails to meet his obligations, then if the other borrower has verifiable income he must pay back the bank for both borrowers. If the bank chooses not to lend, then the \$2 can be put into alternative use, which yields $\bar{r} < 1$ per dollar.

Stage 2: The borrowers simultaneously choose the level of peer monitoring, m_i .

Stage 3: Both borrowers choose either project R or project S .

Note that here both monitoring and lending is simultaneous. Again the sub-game perfect Nash equilibrium is solved by backward induction. Borrower B_i will choose monitoring m_i to maximize

$$m_i \left[m_j (H - r) + (1 - m_j) b \right] + (1 - m_i) \left[m_j \times 0 + (1 - m_j) b \right] - \frac{m_i^2}{2}$$

The first order condition is: $m_j (H - r) - m_i = 0$. Likewise the first order condition for borrower B_j is: $m_i (H - r) - m_j = 0$. Clearly $m_i^* = m_j^* = 0$ is a Nash equilibrium. We call this the *inefficient (zero-monitoring/zero-lending) equilibrium*. In this case there is a strategic complementarity between the monitoring levels of the two borrowers. A borrower knows that if the other borrower monitors and he does not, then he will end up with a payoff of 0. If however the other borrower does not monitor then he has no incentive to monitor as well. Hence joint liability and peer monitoring would not solve the moral hazard problem.

Remember however that $m \in [0, 1]$. Now consider B_i 's reaction function $m_i = m_j (H - r)$. If $H - r > 1$, there exists a $m_j = \bar{m}_j < 1$ such that the best response is $m_i = 1$ for $m_j > \bar{m}_j$. So B_i 's complete reaction function can be written as:

$$m_i = \begin{cases} m_j (H - r), & \text{if } m_j \leq \bar{m}_j \\ 1, & \text{if } m_j > \bar{m}_j \end{cases}$$

In this case the corner solution $m_i^{**} = m_j^{**} = 1$ is also a Nash equilibrium (and the derivative of the borrowers' value function is strictly positive). We can call this the *efficient (monitoring/lending) equilibrium*. Figure 1 presents the reaction functions for $H - r = 1.75$. It is important to note that the reaction functions are upward sloping. We will return to this issue when we discuss the empirical results.

The lender will choose to lend if her expected payoff from lending exceeds that from not lending. The lender will therefore choose to lend if (see Appendix A for a derivation of this condition):

$$m^{**2} (r - H) + m^{**} H > 1 + \bar{r}$$

The bank's payoffs in these two monitoring game equilibria determine whether it will lend. For the inefficient (0,0) case, the expected payoff to the bank is $-2 < 2\bar{r}$ and group lending is not feasible. The payoff to both borrowers in this case is 0. On the other hand, for the efficient (1,1) case, the payoff to the bank is $2r - 2 > 2\bar{r}$ and the payoff to both borrowers is $H - r - \frac{1}{2}$. Clearly $m_i^{**} = m_j^{**} = 1$ is the payoff-dominant equilibrium. Although this also makes it a focal point equilibrium (Schelling (1980), p. 291), previous experimental evidence indicates that this is not a sufficient condition for "behavioural" equilibrium selection (e.g., Van Huyck, Battalio and Beil (1990)).

Proposition 2: If $H - r > 1$ and agents coordinate on the payoff-dominant Nash equilibrium, then under a simultaneous group lending scheme lenders choose to make loans, borrowers choose a high level of monitoring and repayment rates are high leading to an efficient (monitoring/lending) equilibrium. However, an inefficient zero-monitoring equilibrium with no lending also exists.

Group Lending: Sequential

An alternative to simultaneous lending is to lend sequentially to group members with the order chosen randomly. Here initially only one (randomly chosen) member of the group receives a loan. Depending on whether this loan is repaid, the bank decides whether or not to lend to the other member of the group. This incorporates dynamic incentives, which have become increasingly popular among researchers and practitioners in microfinance.⁶ The sequence of events is as follows:

Stage 1: Bank chooses whether or not to lend \$1 to one of the members of the group. The other dollar can be put into alternative use, which yields $\bar{r} < 1$ if the actual project choice of the first randomly chosen borrower is project R and the second borrower does not receive the loan.

Stage 2: The borrowers simultaneously choose their levels of monitoring m_i .

⁶ Dynamic incentives mean that banks make future loan accessibility contingent on full repayment of the current loan to prevent strategic default. Ray (1998) argues that this kind of sequential lending minimizes the contagion effect associated with individual default. Sequential lending can also minimize the potential of coordination failure. Chowdhury (2005) and Aniket (2006) argue that in a simultaneous group lending scheme with joint liability and costly monitoring, peer monitoring by borrowers alone is insufficient and that sequential lending that incorporates dynamic incentives is essential to improve repayment rates.

Stage 3: One of the borrowers is chosen at random (with probability α) to receive the first loan, if the bank lends. This borrower, B_i , decides whether to invest in R or S . If B_i invests in project R , then he earns b and neither B_j (the second borrower) nor the bank receives anything. The game stops here.

Note that if the bank chooses not to lend to either borrower, then the \$2 can be put into alternative use, which yields $\bar{r} < 1$ per dollar.

Stage 4: The game moves to round 2 only if B_i (the first borrower) invests in project S in round 1. The bank lends \$1 to B_j who invests in either project R or project S (of course if B_i was successful in her monitoring, then B_j has to invest in project S).

If B_i (the first borrower) invests in project S in round 1, we assume that the bank collects the entire output H and holds on to it. If B_j (the second borrower) also invests in project S , the bank collects r from B_j and returns $H - r$ to B_i . The earnings of each borrower then are $H - r$ and the bank's earnings are $2(r - 1)$. If B_j invests in project R , the bank collects 0 from B_j and retains the entire output of B_i , which is H . So B_i earns 0, B_j earns b , and the bank's earnings are $H - 2$. Finally if B_i invests in project R in round 1, then B_j does not receive a loan (the bank puts the second dollar to alternative use): Earnings of B_i are b , earnings of B_j are 0, and the bank's earnings are $-1 + \bar{r}$. This happens irrespective of the project chosen by B_j .

The reaction functions for the two borrowers are symmetric and are given by (see Appendix B for a derivation of the reaction functions):

$$\begin{aligned} m_i &= m_j [H - r - (1 - \alpha)b] + (1 - \alpha)b \\ m_j &= m_i [H - r - (1 - \alpha)b] + (1 - \alpha)b \end{aligned}$$

Solving out and simplifying we get

$$\bar{m}_i = \frac{(1-\alpha)b}{1-[H-r-(1-\alpha)b]} = \bar{m}_j = \bar{m}$$

Thus a unique and positive level of monitoring exists as long as $\alpha < 1 - \left(\frac{H-r-1}{b}\right)$,⁷ although an interior solution is not defined if $1+[H-r-(1-\alpha)b]=0$ or $1-[H-r-(1-\alpha)b]=0$. This positive level of monitoring occurs because even if borrower B_j does not monitor, B_i has an incentive to monitor. To see this, suppose that B_j receives the loan in round 1 (remember that the order of receiving the loan is determined randomly). If B_i does not monitor, B_j will invest in project R and then B_i will receive a payoff of 0. By choosing a positive level of monitoring, B_i can increase the probability that B_j invests in project S . In this case the game continues onto the second round and B_i gets the loan. Moreover, given that B_i is going to monitor, B_j has an even greater incentive to monitor due to the strategic complementarity of monitoring. So the sequential nature of the lending scheme and the simultaneous choice of the level of monitoring (before a borrower knows whether he is the first or the second borrower) leads the *efficient (monitoring/lending) equilibrium* to be unique, as long as the equilibrium monitoring levels are sufficient to provide positive net returns to the lender.

Proposition 3: If $\alpha < 1 - \left(\frac{H-r-1}{b}\right)$ and $\bar{m}[\bar{m}(2r-H) + (H-\bar{r}-1)] > \bar{r} + 1$, then under sequential group lending, a unique Nash equilibrium exists in which lenders choose to make loans, borrowers choose a high level of monitoring and repayment rates are high leading to an efficient (monitoring/lending) equilibrium. The symmetric monitoring rates in this case are given by $\bar{m}_i = \text{Min}\left(1, \frac{(1-\alpha)b}{1-[H-r-(1-\alpha)b]}\right) = \bar{m}_j = \bar{m}$. An interior solution to the monitoring rate is not defined if $1+[H-r-(1-\alpha)b]=0$ or if $1-[H-r-(1-\alpha)b]=0$.

⁷ This condition, derived from the need for the denominator immediately above to be positive, simply requires that the borrowers are sufficiently uncertain about the order in which they would be chosen to be the first and second borrower.

The first expression in the *if* statement ensures that monitoring is positive, and the second expression ensures that the lender chooses to make loans (see Appendix C for a derivation of this condition). For the parameter values that we have chosen, $H = 4; b = 2.5; r = 2.25; \bar{r} = 0.75; \alpha = 0.5$ (see Table 1), we have a corner solution: optimally each borrower would like to choose $\bar{m} > 1$, but recall that monitoring is restricted in the interval $[0,1]$. Hence in equilibrium each borrower will choose the maximum permissible level of monitoring which is equal to 1 in our framework. At this corner solution, the derivative of the borrowers' value function is strictly positive. The lender's payoff is $2r - 2 = 2.5$, which exceeds the $2\bar{r} = 1.5$ payoff from not lending.

In Figure 2 we present the best response of Borrower B_i to alternative monitoring rates chosen by Borrower B_j for the experiment parameters. These reaction functions indicate the choice of monitoring rate that maximizes a borrower's payoffs given the monitoring rate chosen by the other borrower. Since monitoring decisions are made *before* each borrower knows whether he is the first or the second borrower, and each knows that they will be randomly chosen to be the first or the second borrower with probability 0.5, the relevant line is shown with triangle labels. Irrespective of whether one is the first or the second borrower, the optimal response of each borrower is to choose a level of monitoring higher than that chosen by the other borrower. Consequently, for the experiment parameters both borrowers have a strictly dominant strategy to choose the maximum level of monitoring. Thus the efficient (monitoring/lending) equilibrium is unique. The sequential nature of the lending scheme and the simultaneous choice of the level of monitoring lead each borrower to choose the maximum permissible level of monitoring, and knowing this the lender will choose to make the loan.

3. Experimental Design

We designed four treatments to examine the equilibrium predictions described in Propositions 1 – 3. Treatments 1 and 2 were individual lending treatments, with 12 subjects randomly divided into groups

of two with each group consisting of one borrower and one lender. These two treatments differ in the lender's monitoring costs: higher in Treatment 1 compared to Treatment 2. Treatments 3 and 4 were group lending treatments, with the 12 subjects randomly divided into groups of three with each group consisting of two borrowers and one lender. Treatment 3 is the simultaneous group lending treatment and Treatment 4 is the sequential group lending treatment. The role of each subject (as a borrower or as a lender) was determined randomly and remained the same throughout all 40 periods of each session. At the end of every period participants were randomly re-matched. Subjects participated in one session only.

The two projects available to borrowers, S and R , each cost \$1, to be financed by a loan from the lender. In the individual lending treatments, the lender chose whether or not to invest \$1 into this loan. If the lender decided to make the loan she could monitor the project choice of the borrower by choosing to pay a monitoring cost (C). In the group lending (simultaneous: treatment 3, and sequential: treatment 4) treatments, the lender chose whether or not to invest \$2 into the loan (\$1 to each borrower). In this case the lender could choose to make the loan to both borrowers or to neither. If the lender chose not to make loans, she earned \$1.50 (or \$0.75 in the individual lending treatment) for the period. In the group lending treatments, if the borrower received the loan, he could monitor the project choice of the other borrower in the group by choosing to pay a monitoring cost (C). Both borrowers could monitor each other. If a borrower incurred a cost C on monitoring, there was a chance of m that the other borrower would be required to choose project S . Otherwise the other borrower could choose either project R or project S . Monitoring decisions were made simultaneously. In the sequential group lending treatment, the borrowers were randomly determined to be the first or the second borrower in the group to receive the loan. In this case if the first (randomly chosen) borrower's actual project choice was R , then the lender's second dollar was automatically allocated to her savings account where she earned \$0.75 for this dollar. The theoretical predictions and the parameter values used are summarized in Table 1 (Panel A and Panel B respectively). These parameter values were chosen to satisfy the

parameter restrictions in Propositions 1 – 3 and implement a test of the theoretical model. These parameters imply specific earnings of the borrowers and the lender, shown in Table 1, Panels C – E.

We used the strategy method to elicit decisions from the borrowers.⁸ The use of this method implies that the borrowers and lenders made decisions simultaneously and borrowers made their decision before they knew whether or not they had received the loan. In the case of sequential lending, the borrowers made monitoring decisions before they knew whether they were the first or the second borrower in their group to receive a loan. They did, however, know whether they were the first or the second borrower to receive the loan at the time of making their project choice.

Our choice of random re-matching of subjects aligns the experimental environment with the theoretical model, which does not feature reputation formation. In practice, this makes the environment most relevant for microfinance in urban slums, where groups are usually formed exogenously (see Karlan (2007) for an example). Social capital and long term relationships between borrowers, which may be important for the success of group based lending programs in rural areas, are virtually non-existent in urban slums, implying that a significant monitoring cost differential between lender and peer monitoring is unlikely in such an environment. One of the advantages of our experimental design is that it enables us to examine explicitly the implications of changing the cost differential between lender and peer monitoring treatments. A second feature of our design is that the lending decision is a choice variable. This allows us to examine lender behaviour, which might be difficult to do in the field.

We conducted a total of 29 sessions in Australia and India across these treatments with 12 subjects in each session, with 5 sessions in Treatment 2 and 8 in the other three treatments. The 348 subjects who participated in these sessions were graduate and undergraduate students at Monash University and University of Melbourne, Australia and Jadavpur University, Kolkata, India. We conducted sessions in two countries to examine whether subjects in India, exhibit behavioural

⁸ The strategy method simultaneously asks all players for strategies (decisions at every information set) rather than observing each player's choices only at those information sets that arise in the course of a play of a game. This allows us to observe subjects' entire strategies, rather than just the moves that occur in the game.

differences from those in Australia. Such cultural differences are not included in any theoretical microfinance models, so it is reassuring that our data reveal only minor differences in behaviour. We discuss this at the end of the results section. All subjects were inexperienced in that they had not participated in a similar experiment. Subjects earned payments in experimental dollars, which were converted to local currency at a fixed and announced exchange rate. On average they earned AUD 25 – 35 or its purchasing power equivalent.⁹ The z-tree software (Fischbacher (2007)) was used to conduct the experiment. Each session lasted approximately 2 hours, including instruction time. The instructions (included for the simultaneous lending treatment in Appendix D) used the borrowing and lending terminology employed in this description.

4. Hypotheses to be tested

The experiments were designed to test the following theoretical hypotheses, which follow from propositions 1 – 3:

Hypothesis 1 (H1) lending: The lending rate is

- a. strictly lower for individual lending with high cost monitoring (Treatment 1) compared to the other three treatments;
- b. at least as high in the sequential group lending treatment (Treatment 4) compared to the simultaneous group lending treatment (Treatment 3); and
- c. at least as high in individual lending with low cost monitoring (Treatment 2) compared to group lending (Treatments 3 and 4).

Hypothesis 2 (H2) monitoring: The monitoring rate

- a. is strictly lower for individual lending with high cost monitoring (Treatment 1) compared to the other three treatments;
- b. at least as high in the sequential group lending treatment (Treatment 4) compared to the simultaneous group lending treatment (Treatment 3); and
- c. at least as high in individual lending with low cost monitoring (Treatment 2) compared to group lending (Treatments 3 and 4).

Hypothesis 3 (H3) repayment: The repayment rate is

- a. is strictly lower for individual lending with high cost monitoring (Treatment 1) compared to the other three treatments;
- b. at least as high in the sequential group lending treatment (Treatment 4) compared to the simultaneous group lending treatment (Treatment 3); and

⁹ At the time of the experiment, 4 Australian dollars were worth about 3 U.S. dollars.

- c. at least as high in individual lending with low cost monitoring (Treatment 2) compared to group lending (Treatments 3 and 4).

Part (a) of each hypothesis concerns the change in monitoring cost, holding constant the aspect of individual lending with lender monitoring.¹⁰ Part (b) compares the two forms of group lending. Part (c) evaluates the impact of group lending compared to individual lending with lender monitoring, holding monitoring cost constant. In summary, for all three performance measures the treatments are ordered as $\text{Treatment 2} \geq \text{Treatment 4} \geq \text{Treatment 3} > \text{Treatment 1}$. The weak inequalities in parts (b) and (c) of these hypotheses follow from the theoretical predictions and parameter choices, which imply that the efficient (lend/monitor) equilibrium is unique in the sequential lending and individual lending with low cost monitoring treatments, but both efficient and inefficient (no loan) equilibria exist in the simultaneous lending case. Thus, theoretically outcomes could be less efficient in the simultaneous compared to sequential group lending treatment, and the experimental results reveal whether this behavioural difference arises empirically.

5. Results

We present our results in the next three subsections, with each subsection addressing a specific aspect of the program performance: lending, monitoring, and repayment. In each case we present conservative non-parametric Mann-Whitney rank sum tests for treatment differences which require minimal statistical assumptions and are based on only one independent summary statistic value per session. We also report estimates from multivariate parametric regression models which can identify the contribution of different factors on lender and borrower behaviour. Our results are summarized in Table 6 below.

Lending

¹⁰ Strictly speaking in Hypotheses 2 and 3, Part (a) does not derive from an equilibrium prediction. This is because in equilibrium there should be no lending in the individual lending high cost treatment (Treatment 1). Since monitoring and repayment is conditional on lending, they are not defined in equilibrium for this treatment. We nevertheless include Part (a) in these two hypotheses because in the experiment we see positive lending rate in Treatment 1, so monitoring rates and repayment rates are defined empirically, although they should be low off the equilibrium path.

Figure 3 presents the average proportion of lenders making loans in the different periods, by treatment. Clearly the average proportion of lenders making loans is substantially lower at every period for treatment 1 (individual lending high cost) but there is very little difference in the early periods between treatments 2 (individual lending low cost), 3 and 4 (group lending). However the lending rate in the last 5 periods is significantly lower in treatment 2 compared to the group lending treatments (Table 2, Panel A). This suggests that over time lending rates are modestly lower in individual lending compared to group lending even holding monitoring costs constant. Differences in monitoring costs across the different monitoring regimes exacerbate the differences in lending rates between individual and group lending programs, as the individual lending high cost treatment has by far the lowest lending rate.¹¹

Subjects participated in the experiment for 40 periods, allowing us to examine their behaviour over time more systematically using panel regressions. Table 3 presents two econometric models of the lenders' loan decisions. These panel regressions incorporate a random effects error structure, with the subject (lender) representing the random effect. The dependent variable is 1 if the lender chooses to lend. We present the results from two different specifications. Specification 1 includes a dummy for group lending, and specification 2 replaces this with separate dummies for the two group lending treatments. Both specifications include a dummy for the individual lending with low cost treatment, and the reference category is always individual lending with high cost.

The configuration of sign and significance of $\frac{1}{t}$, $\frac{1}{t} \times INDVLOWCOST$ and $\frac{1}{t} \times GROUP$ indicate that lending decreased over time in the two individual lending treatments, but increased over time in the two group lending treatments. The null hypothesis that lending rates are not different

¹¹ We also conducted a “direct” test of observed behavior against the theoretical predictions in Table 1, Panel A. Using the Wilcoxon matched-pairs signed-ranks test we always reject the null hypothesis that on average subjects' behaviour is consistent with theory. This is not too surprising because the theoretical predictions have a boundary value (either 0 or 1), so deviations from the predictions can only go in one direction. Behaviour, however, often moves towards theoretical predictions in the later periods. For example, in average lending rates move towards 0 percent in the case of Treatment 1 and towards 100 percent for Treatments 3 and 4.

between the group lending and individual lending with low cost treatment is rejected.¹² The probability of lending in period t is significantly lower if the lender received negative earnings in period $t-1$, which provides some simple evidence of a reinforcement-type learning.¹³ The results from Specification 2 additionally show that there are only marginally statistically significant treatment differences between the two group lending treatments ($\chi^2(2) = 4.79$ with a p -value = 0.0931). In summary (see Table 6), we find support for hypothesis 1(a), but not for 1(b) and 1(c).

Monitoring

Figure 4 presents the average level of monitoring across periods. Monitoring rates are significantly lower in the high cost treatment (Treatment 1) compared to the low cost treatments (Treatments 2, 3 and 4). Controlling for monitoring costs however, there is little difference in monitoring rates between individual and group lending (Table 2, Panel B). Monitoring rates in Treatment 2 are significantly higher compared to those in treatments 3 and 4 in the first 5 periods, but this difference disappears over time. The average monitoring rate is however always significantly lower for the individual lending high cost treatment.

The monitoring decision is made by the lender in the individual treatments and by a peer borrower in the group lending treatments.¹⁴ The level of monitoring chosen is restricted in the range $[0,1]$ and is estimated using a tobit model.

Consider first the level of monitoring chosen (by the lender) in the individual lending treatments. Table 4, Panel A, presents the random effects tobit regression results and the Hausman-

¹² The relevant test here is $\frac{1}{t} \times GROUP = \frac{1}{t} \times INDVLOWCOST$ and $GROUP = INDVLOWCOST$; i.e., both the slope and the intercept are different. The test statistics (distributed as $\chi^2(2)$ under the null hypothesis) are shown in the lower section of Table 3.

¹³ Most of the demographic control variables are not statistically significant in a consistent manner. Though we control for them in the regressions, we do not discuss them in the text. Details are available on request.

¹⁴ The propensity to make the loan is significantly lower in the individual lending treatments (particularly in the high cost treatment), implying that the data on the level of monitoring is often not observed in the case of treatment 1. The panel in this case is therefore unbalanced: the observed number of monitoring choices varies from 2 (i.e., in only 2 of the possible 40 cases, did the lender choose to make the loan) to 37.

Taylor estimates for error component models. The treatment dummy is positive and statistically significant, indicating that monitoring rates are significantly higher in the low monitoring cost case. Monitoring rates fall over time in both treatments. The level of monitoring in period $t - 1$ has a positive and statistically significant impact on the level of monitoring in period t .

As mentioned above in the case of group lending (with peer monitoring), the payoff for an individual borrower depends both on her level of monitoring and also on the level of monitoring of her partner. Subjects could construct expectations for the level of monitoring of the other member of the group in different ways. Here we consider the following two simple alternatives: (1) *Cournot expectations*: each subject expects the monitoring level of the other member of the group to be the same as that in the previous period (Lagged Monitoring of the Other Borrower); (2) *Fictitious play*: each subject expects the monitoring level of the other member of the group to be the average observed over all the previous periods (Average Lagged Monitoring of the Other Borrower). Hence each subject is assumed to have a long memory as opposed to the Cournot expectations case where each subject has a short memory.

The results presented in Table 4, Panel B show that monitoring increased over time and is modestly higher with sequential lending (with both specifications of expectation formation). This is consistent with Hypothesis 2(b). The positive and significant coefficient estimate of the other borrower's lagged monitoring level (in the Cournot expectations version) or its counterpart lagged average other borrower's monitoring (in the fictitious play version) is consistent with the upwardly-sloped reaction functions of the theoretical model. Note that the coefficient estimate on a borrower's own monitoring in the previous period is also positive, and is substantially larger than the reaction to the other borrower's monitoring level.

Table 4, Panel C compares the level of monitoring chosen across the lender and peer monitoring treatments, holding the cost of monitoring constant (Treatments 2, 3 and 4). We present the results for two different specifications: in specification 1 we include a group lending treatment dummy as defined

above while in specification 2 we include separate dummies for the sequential and simultaneous lending treatments and the corresponding time interaction terms. The reference category in both cases is the individual lending low cost treatment. While specification 1 in the random effects tobit regression indicates a significantly different (upward) time trend for group lending, overall the null hypothesis of no difference in monitoring rates between the group lending treatments and the individual lending low cost treatment cannot be rejected. In summary, we find support for hypothesis 2(a) and 2(b), but not for 2(c) since monitoring is slightly higher in sequential compared to individual lending (see Table 6).

Repayment Rate

The repayment rate is not a direct choice variable but is the result of a combination of the *ex ante* project choice by the borrower, the level of monitoring chosen by the borrower or lender, and the success of the monitoring process: repayment occurs if the borrower chooses project *S* or if the borrower chooses project *R* and monitoring is successful. Panel C of Table 2 shows that repayment rates, like the other performance measures, are not significantly different across the two group lending treatments. Repayment rates are significantly lower in the individual lending high cost treatment compared to all three low monitoring cost treatments. The average proportion of subjects (*ex ante*) choosing project *R* is significantly lower, however, in both the individual lending treatments compared to the group lending treatments (Panel D of Table 2).

Table 5 presents the random effect probit regression results for repayment (columns 1 and 2) and *ex ante* choice of project *R* (columns 3 and 4). The explanatory variables are the same as in Table 4 and as before we present the results from two alternative specifications. The repayment rates (Table 5, column 1) are not significantly different in the group lending treatments compared to the individual lending low cost treatment indicating that over all, group lending and individual lending with low cost treatments have similar effects on repayment. Column 2 indicates that the probability of repayment is lower for simultaneous group lending than for low cost individual lending.

Recall that the earnings of the borrower are greater if he chooses project R , but the earnings of the lender are lower if the borrowers choose project R . Columns 3 and 4 indicate that the borrowers are less likely to choose project R in the two individual lending treatments. Table 4 earlier showed that borrowers in these group lending treatments are also more likely to choose a high level of monitoring to be able to switch the other borrower's project choice to S . In consequence the actual project choices are likely to be project S and the earnings of the lenders are positive and outcomes move toward an efficient (monitoring/lending) equilibrium. On the other hand in Treatment 1 monitoring rates are lower and even though borrowers are more likely to choose project S (i.e., are less likely to choose project R compared to the theoretical prediction), lenders choose not to make the loan. Outcomes in this treatment frequently correspond to the inefficient (low monitoring/no lending) equilibrium. Finally, holding monitoring cost constant the repayment rates are significantly higher in the individual lending treatment compared to the simultaneous group lending treatment. Since monitoring rates are not different across these treatments (Table 4, Panel C), the difference is driven by the fact that borrowers are significantly more likely to (*ex ante*) choose project R in this group lending treatment compared to the individual lending treatment. In summary as reported in Table 6, we find support for all parts of hypothesis 3.

One possible explanation for the lower rate of choice of project R in the two individual lending treatments could be that reciprocal motivations are triggered more in a two person game (Treatments 1 and 2) than a three person game (Treatments 3 and 4). Individual lending in the experiment shares some parallels with the trust game (e.g., McCabe, Rigdon and Smith (2003)). When the lender trusts the borrower with the loan, the borrower is more likely to choose the verifiable project. Subjects appear to be less likely to exhibit reciprocal behaviour when a fellow borrower is monitoring and can also compensate the lender for any bad outcomes. In other words, it is possible that the group lending environment reduced the borrower's perceived responsibility to be reciprocal. This makes the framework presented in Section 2, which is based on standard non-reciprocal preferences, a better

approximation to behaviour when moving to groups larger than one (individual) borrower. This suggests that such simplified preferences may also prove to be useful approximations for larger borrower groups that are sometimes employed in practice.

The theoretical model also does not include cultural differences, so it is reassuring that the data provide little evidence of cultural differences in behaviour. The Jadavpur University dummy variable is generally not statistically significant. The only exception is monitoring in the individual lending model (Table 5, panel A), where the Jadavpur University dummy is positive and statistically significant. However it is interesting to note that if we restrict the sample to those born in South Asia (whether residing in Australia or India: twenty of the 240 subjects participating in the sessions conducted in Australia were born in South Asia), the Jadavpur University dummy is no longer statistically significant.

6. Implications of our Results and some Concluding Comments

Our experiment examines several aspects of group lending programs. The first is the argument that sequential lending is crucial to the success of group lending schemes. We examine the empirical validity of theoretical predictions regarding the added benefits of sequential lending by comparing its performance to simultaneous lending in the presence of moral hazard and costly peer monitoring, holding constant important factors such as monitoring costs. The second issue is whether peer monitoring indeed does better than active lender monitoring. The lender is often an outsider who often has less information compared to peers about the borrowers. Borrowers usually live near each other and are more likely to have closer social ties. The third issue is the relative benefits of individual and group lending. Over the years there has been a discernible shift from group lending to individual lending in microfinance programs, and a number of theoretical reasons have been advanced to explain this shift. First, clients often dislike tensions caused by group lending. Second, low quality clients can free-ride

on high quality clients leading to an increase in default rates. Third, group lending can be more costly for the clients as they often end up repaying the loans of their peers. Theoretically the results are mixed.

Our laboratory experiment is able to address each of these issues, through random assignment to group and individual lending treatments, and random assignment to specific lending groups. We compare treatments when credit is provided to members of the group (sequentially or simultaneously) who can then monitor each other, to a framework in which loans are given to individuals who are monitored by the lenders directly. Our results show that when monitoring costs are lower for peer monitoring than lender monitoring, group lending performs better compared to individual lending, reflected in higher loan frequencies and repayment rates. This occurs even though repayment rates with individual lending considerably exceed the theoretical prediction, which might reflect social preferences such as reciprocity. However if we hold the cost of monitoring constant across the different monitoring regimes, then the performance of individual and group lending schemes are equivalent. Our findings therefore suggest an alternative reason for the emerging popularity of individual lending schemes, partially corroborating the observations of Gine and Karlan (2009) and Kono (2006).¹⁵

Much of the success of microcredit programs has been attributed to self-selected groups and social ties in rural communities. However successful application of these programs in other scenarios and economies requires more than just strong social ties. In urban contexts of developing and transitional economies, for example, it might be more difficult to form self-selected borrowing groups. The optimal design of microcredit programs may need to look beyond the issue of self-selection and even look beyond group lending. Indeed, expansion of microcredit and microfinance schemes to urban slums in developing countries could require a different approach. Social capital and long term

¹⁵ In Gine and Karlan (2009), the existing field centers with group liability loans were converted to individual liability loans. Lenders therefore had prior information about the borrowers' characteristics from the group lending field sessions and this could be used in the individual lending sessions at no extra cost. As a result the monitoring costs did not necessarily change substantially as they moved from group lending to individual lending. Furthermore, participants had some experience with group lending before switching to individual lending. This suggests that monitoring costs in that field experiment might have been very similar under individual lending (with active lender monitoring), compared to group lending (with peer monitoring). Our laboratory experiment results are consistent with that interpretation.

relationships between borrowers, are however virtually non-existent in urban slums. This suggests that a significant cost differential between lender and peer monitoring is unlikely. Experiments such as this one can exogenously manipulate monitoring costs and forms of individual and group lending. If our results are robust to other environments, they indicate that individual lending programs might do as well in urban areas as group lending programs.

Appendix A. Condition for the lender choosing to lend in the Simultaneous Lending Model

Recall that the lender's returns are:

$2r-2$ with probability $m_i m_j$; $H-2$ with probability $m_i(1-m_j)$; $H-2$ with probability $m_j(1-m_i)$; and -2 with probability $(1-m_i)(1-m_j)$.

So the lender's expected earnings are:

$$m_i m_j (2r-2) + m_i (1-m_j) (H-2) + m_j (1-m_i) (H-2) + (1-m_i) (1-m_j) (-2).$$

The lender will choose to lend as long as:

$$m_i m_j (2r-2) + m_i (1-m_j) (H-2) + m_j (1-m_i) (H-2) + (1-m_i) (1-m_j) (-2) > 2\bar{r}.$$

Since borrowers are symmetric and in equilibrium $m_i^* = m_j^* = m^*$, the lender will lend if

$m^{*2} (2r-2H) + 2m^* H > 2(1+\bar{r})$, which simplifies to the condition in the text:

$$m^{*2} (r-H) + m^* H > 1+\bar{r}.$$

Appendix B: Derivation of Reaction Functions in the Sequential Lending Treatment

To obtain the reaction functions note that borrower B_i earns:

- $H-r$ with probability $m_i m_j$ if both borrowers choose project S (i.e., if both borrowers B_i and B_j are successful in the monitoring process).
- 0 with if probability $\alpha(1-m_i)m_j$ (if B_i is the first borrower and B_j is successful in the monitoring process but B_i is not) or with probability $(1-\alpha)(1-m_i)$ (if B_i is the second borrower and is not successful in the monitoring process).
- b with probability $\alpha(1-m_j)$ (if B_i is the first borrower and B_j is not successful in the monitoring process) or with probability $(1-\alpha)(1-m_j)m_i$ (if B_i is the second borrower and is successful in the monitoring process but B_j is not).

Appendix C: Condition for the lender choosing to make loans in Sequential Lending Treatment

Recall the lender earns:

$2r-2$ with probability $m_i m_j$ (i.e., both borrowers are successful in monitoring); $H-2$ with probability $(1-m_i)m_j$ (i.e., only the second borrower is successful in monitoring); and $(-1+\bar{r})$ with probability $(1-m_j)$ (i.e., the second borrower is not successful in monitoring).

So the expected return to the lender by choosing to lend is:

$$m_i m_j (2r-2) + (1-m_i) m_j (H-2) + (1-m_j) (-1+\bar{r}).$$

The lender will choose to lend as long as $m_i m_j (2r-2) + (1-m_i) m_j (H-2) + (1-m_j) (-1+\bar{r}) > 2\bar{r}$.

Since the borrowers are symmetric and in equilibrium $\bar{m}_i = \bar{m}_j = \bar{m}$, the lender will lend if:

$$\bar{m}^2 (2r-2) + (1-\bar{m}) \bar{m} (H-2) + (1-\bar{m}) (-1+\bar{r}) > 2\bar{r}.$$

This simplifies to the condition shown in Proposition 3.

Table 1: Theoretical Predictions, Parameter Values and Earnings in the Different Treatments

Panel A: Theoretical Predictions for Chosen Parameters				
Criterion	Treatment 1	Treatment 2	Treatment 3: inefficient equilibrium/efficient equilibrium	Treatment 4
Make Loan	No	Yes	No/Yes	Yes
Monitoring Rate	0	1	0/1	1
(Ex ante) Project Choice	R	R	R/R	R

Panel B: Parameter Values				
Parameter	Treatment 1	Treatment 2	Treatment 3	Treatment 4
H	4	4	4	4
b	2.5	2.5	2.5	2.5
r	2.25	2.25	2.25	2.25
λ	4.5	1	1	1
\bar{r}	0.75	0.75	0.75	0.75
α	-	-	-	0.5

Panel C: Earnings, Treatment 3				
Actual project choice of borrower 1	Actual project choice of borrower 2	Earnings of borrower 1	Earnings of borrower 2	Earnings of lender
S	S	$\$1.75 - C_1$	$\$1.75 - C_2$	$\$2.50$
S	R	$\$0.00 - C_1$	$\$2.50 - C_2$	$\$2.00$
R	S	$\$2.50 - C_1$	$\$0.00 - C_2$	$\$2.00$
R	R	$\$2.50 - C_1$	$\$2.50 - C_2$	$-\$2.00$
No loan is provided		$\$0.00$	$\$0.00$	$\$1.50$

Panel D: Earnings, Treatment 4				
Actual project choice of the first borrower	Actual project choice of the second borrower	Earnings of first borrower	Earnings of second borrower	Earnings of lender
S	S	$\$1.75 - C_1$	$\$1.75 - C_2$	$\$2.50$
S	R	$\$0.00 - C_1$	$\$2.50 - C_2$	$\$2.00$
R	S	$\$2.50 - C_1$	$\$0.00 - C_2$	$-\$0.25$
R	R	$\$2.50 - C_1$	$\$0.00 - C_2$	$-\$0.25$
No loan is provided		$\$0.00$	$\$0.00$	$\$1.50$

Panel E: Earnings, Treatments 1 and 2		
Actual project choice of borrower	Earnings of borrower	Earnings of lender
S	$\$1.75$	$\$1.25 - C$
R	$\$2.50$	$-\$1.00 - C$
No loan is provided		$\$0.75$

Note:

Treatment 1: High Cost Individual Lending; Treatment 2: Low Cost Individual Lending; Treatment 3: Simultaneous Group Lending; Treatment 4: Sequential Group Lending. C_1 and C_2 denote the monitoring costs incurred by borrowers 1 and 2 in Treatments 3 and 4, and this cost depends on monitoring $m \in [0,1]$ and is given by $c(m) = m^2/2$. C denotes the monitoring cost incurred by the lender, and this cost depends on monitoring $m \in [0,1]$ and is given by $c(m) = \lambda m^2/2$; $\lambda = 4.5$ in Treatment 1 and $\lambda = 1$ in Treatment 2. S denotes the verifiable project choice, and R denotes the non-verifiable project choice.

Table 2: Selected Descriptive Statistics

	Full Sample	First 5 periods	Last 5 periods
Panel A. Average Proportion Making Loans			
Individual Lending High Cost Treatment (Treatment 1)	0.474	0.588	0.303
Individual Lending Low Cost Treatment (Treatment 2)	0.685	0.800	0.620
Simultaneous Lending Treatment (Treatment 3)	0.812	0.756	0.801
Sequential Lending Treatment (Treatment 4)	0.737	0.700	0.789
Group Lending Treatments (Treatments 3 and 4)	0.775	0.728	0.795
Rank sum Test			
Individual Lending High Cost (T1) = Individual Lending Low Cost (T2)	-2.342**	-2.432**	-2.580***
Individual Lending Low Cost (T2) = Group Lending (T3 & T4)	-1.405	0.705	-1.910*
Individual Lending High Cost (T1) = Group Lending (T3& T4)	-3.124***	-1.965**	-3.381***
Simultaneous Lending (T3) = Sequential Lending (T4)	0.684	0.582	-0.318
Panel B. Average Level of Monitoring			
Individual Lending High Cost Treatment (Treatment 1)	0.343	0.423	0.268
Individual Lending Low Cost Treatment (Treatment 2)	0.588	0.629	0.614
Simultaneous Lending Treatment (Treatment 3)	0.575	0.528	0.663
Sequential Lending Treatment (Treatment 4)	0.643	0.500	0.709
Group Lending Treatments (Treatments 3 and 4)	0.607	0.514	0.686
Rank sum Test			
Individual Lending High Cost (T1) = Individual Lending Low Cost (T2)	-2.928***	-2.928***	-2.928***
Individual Lending Low Cost (T2) = Group Lending (T3 & T4)	-0.330	2.064**	-1.404
Individual Lending High Cost (T1) = Group Lending (T3& T4)	-3.613***	-1.408	-3.735***
Simultaneous Lending (T3) = Sequential Lending (T4)	-0.840	0.000	-1.105
Panel C. Average Repayment Rates			
Individual Lending High Cost Treatment (Treatment 1)	0.583	0.624	0.420
Individual Lending Low Cost Treatment (Treatment 2)	0.726	0.692	0.710
Simultaneous Lending Treatment (Treatment 3)	0.654	0.632	0.720
Sequential Lending Treatment (Treatment 4)	0.689	0.643	0.752
Group Lending Treatments (Treatments 3 and 4)	0.671	0.637	0.736
Rank sum Test			
Individual Lending High Cost (T1) = Individual Lending Low Cost (T2)	-2.928***	-1.761*	-2.650***
Individual Lending Low Cost (T2) = Group Lending (T3 & T4)	1.156	1.404	-0.911
Individual Lending High Cost (T1) = Group Lending (T3& T4)	-2.481**	-0.092	-3.402***
Simultaneous Lending (T3) = Sequential Lending (T4)	-0.525	-0.420	0.211
Panel D. Average Proportion Choosing the Non-Verifiable Project R			
Individual Lending High Cost Treatment (Treatment 1)	0.629	0.667	0.662
Individual Lending Low Cost Treatment (Treatment 2)	0.7001	0.807	0.693
Simultaneous Lending Treatment (Treatment 3)	0.798	0.722	0.872
Sequential Lending Treatment (Treatment 4)	0.795	0.691	0.846
Group Lending Treatments (Treatments 3 and 4)	0.797	0.706	0.859
Rank sum Test			
Individual Lending High Cost (T1) = Individual Lending Low Cost (T2)	-1.171	-1.848*	-0.220
Individual Lending Low Cost (T2) = Group Lending (T3 & T4)	-2.065**	1.865*	-1.987**
Individual Lending High Cost (T1) = Group Lending (T3& T4)	-3.185***	-0.675	-2.670***
Simultaneous Lending (T3) = Sequential Lending (T4)	0.053	0.053	0.792

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Random Effect Probit Regressions for Making Loans

	Specification 1	Specification 2
1/t	1.912*** (0.347)	1.910*** (0.347)
1/t × GROUP	-2.436*** (0.491)	
1/t × INDVLOWCOST	0.245 (0.622)	0.245 (0.622)
1/t × GROUP_SIMUL		-1.621** (0.681)
1/t × GROUP_SEQUEN		-2.939*** (0.564)
Group Lending Treatment (Dummy)	1.186*** (0.183)	
Simultaneous Lending Treatment (Dummy)		1.265*** (0.222)
Sequential Lending Treatment (Dummy)		1.086*** (0.217)
Individual Lending Low Cost Treatment (Dummy)	0.834*** (0.256)	0.826*** (0.255)
Negative Earnings in Previous Period (Dummy)	-0.358*** (0.053)	-0.355*** (0.053)
Session at Jadavpur University (Dummy)	-0.266 (0.184)	-0.261 (0.183)
Constant	5.362** (2.399)	5.330** (2.389)
Number of observations	5282	5282
Number of individuals	138	138
Treatment Effects (Joint Significance): $\chi^2(2)$		
Group Lending	54.52***	
Individual Lending Low Cost	11.66***	11.54***
Simultaneous Lending		33.47***
Sequential Lending		42.26***
Group Lending = Individual Lending Low Cost	18.78***	
Sequential Lending = Simultaneous Lending		4.79*
Sequential Lending = Individual Lending Low Cost		21.83***
Simultaneous Lending = Individual Lending Low Cost		6.65**

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Regressions control for: proportion of correct answers in quiz, age and age squared, gender, whether subject is Business/Economics/Commerce major, location of residence when aged 15, year at university and previous experience in terms of participation in economic experiments.

Table 4: Level of Monitoring Chosen.
Panel A: Individual Lending (Lender Monitoring)

	Random Effect Tobit Regression	Hausman-Taylor Estimation for Error Component Models [†]
1/t	0.187** (0.083)	0.171** (0.076)
1/t × INDVLOWCOST	-0.132 (0.116)	-0.128 (0.106)
Individual Lending Low Cost Treatment (Dummy)	0.166*** (0.039)	0.128* (0.066)
Lagged Monitoring	0.441*** (0.034)	0.306*** (0.029)
Session at Jadavpur University (Dummy)	0.085** (0.034)	0.116** (0.052)
Constant	0.150 (0.351)	4.238 (3.262)
Number of observations	1239	1239
Number of individuals	77	77
Treatment Effect (Joint Significance): $\chi^2(2)$		
Individual Lending Low Cost	18.71***	4.56

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%;

Regressions control for: proportion of correct answers in quiz, age and age squared, gender, whether subject is Business/Economics/Commerce major, location of residence when aged 15, year at university and previous experience in terms of participation in economic experiments.

[†]IV estimates to account for the possibility that the lagged dependent variable (lagged level of monitoring) can be correlated with the time invariant component of the error term (the unobserved individual level random effect). Ignoring this could result in biased estimates.

**Table 4 (continued): Level of Monitoring Chosen.
Panel B: Group Lending (Peer Monitoring)**

	Cournot Beliefs		Fictitious Play Beliefs	
	Random Effects Tobit Regression	Hausman-Taylor Estimation for Error Component Models [†]	Random Effects Tobit Regression	Hausman-Taylor Estimation for Error Component Models [†]
1/t	0.006 (0.081)	-0.010 (0.062)	0.005 (0.081)	-0.007 (0.062)
1/t × GROUP_SEQUEN	-0.291*** (0.110)	-0.304*** (0.085)	-0.278** (0.111)	-0.287*** (0.086)
Sequential Lending Treatment (Dummy)	0.054* (0.029)	0.058** (0.024)	0.053* (0.030)	0.060** (0.024)
Lagged Own Monitoring	0.504*** (0.022)	0.349*** (0.016)	0.496*** (0.022)	0.340*** (0.016)
Lagged Monitoring of the Other Borrower	0.131*** (0.018)	0.104*** (0.014)		
Average Lagged Monitoring of the Other Borrower			0.268*** (0.056)	0.244*** (0.043)
Session at Jadavpur University (Dummy)	-0.049 (0.032)	-0.045 (0.028)	-0.051 (0.033)	-0.057** (0.029)
Constant	-0.296 (0.944)	-0.562 (2.231)	-0.392 (0.960)	-3.026 (2.311)
Number of observations	3530	3530	3530	3530
Number of individuals	120	120	120	120
Treatment Effect (Joint Significance):				
$\chi^2(2)$				
Sequential Lending	8.07**	14.82***	7.30**	13.53***

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Regressions control for: proportion of correct answers in quiz, age and age squared, gender, whether subject is Business/Economics/Commerce major, location of residence when aged 15, year at university and previous experience in terms of participation in economic experiments.

[†]: See explanation in Table 4 panel A.

Table 4 (continued): Level of Monitoring Chosen.
Panel C: Comparing Peer Monitoring and Lender Monitoring with Low Cost

	Random Effects Tobit Regression		Hausman-Taylor Estimation for Error Component Models [†]	
	Specification 1	Specification 2	Specification 1	Specification 2
	1/t	0.068 (0.111)	0.068 (0.111)	0.016 (0.093)
1/t × GROUP	-0.260** (0.123)		-0.221** (0.103)	
Group Lending Treatment (Dummy)	0.031 (0.042)		0.105* (0.059)	
1/t × GROUP_SIMUL		-0.103 (0.133)		-0.071 (0.107)
1/t × GROUP_SEQUEN		-0.435*** (0.135)		-0.410*** (0.110)
Simultaneous Lending Treatment (Dummy)		0.001 (0.046)		0.046 (0.060)
Sequential Lending Treatment (Dummy)		0.054 (0.043)		0.097* (0.055)
Lagged Own Monitoring	0.515*** (0.020)	0.510*** (0.020)	0.356*** (0.015)	0.353*** (0.0159)
Session at Jadavpur University (Dummy)	-0.047 (0.029)	-0.050* (0.029)	-0.009 (0.032)	-0.021 (0.031)
Constant	0.483 (0.690)	0.473 (0.689)	13.184** (5.895)	8.627 (5.427)
Number of observations	4191	4191	4191	4191
Number of individuals	150	150	150	150
Treatment Effects (Joint Significance): $\chi^2(2)$				
Group Lending	4.45		7.13**	
Simultaneous Group Lending		0.65		0.93
Sequential Group Lending		10.44***		15.67***
Sequential Lending = Simultaneous Lending		10.93***		17.14***

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Regressions control for: proportion of correct answers in quiz, age and age squared, gender, whether subject is Business/Economics/Commerce major, location of residence when aged 15, year at university and previous experience in terms of participation in economic experiments.

[†]: See explanation in Table 4 panel A.

Table 5: Random Effect Probit Regressions for Repayment and Choice of Non-Verifiable Project (R)

	Repayment		Choice of Project R	
	Specification 1	Specification 2	Specification 1	Specification 2
1/t	-0.056 (0.227)	-0.057 (0.227)	0.372** (0.189)	0.372** (0.189)
1/t × GROUP	-0.113 (0.265)		-1.309*** (0.225)	
1/t × INDVLOWCOST	-0.251 (0.335)	-0.251 (0.334)	0.347 (0.330)	0.347 (0.330)
1/t × GROUP_SIMUL		0.020 (0.300)		-1.400*** (0.261)
1/t × GROUP_SEQUEN		-0.242 (0.297)		-1.233*** (0.251)
Group Lending Treatment (Dummy)	0.214** (0.084)		0.813*** (0.145)	
Simultaneous Lending Treatment (Dummy)		0.118 (0.093)		0.901*** (0.169)
Sequential Lending Treatment (Dummy)		0.306*** (0.092)		0.736*** (0.163)
Individual Lending Low Cost Treatment (Dummy)	0.491*** (0.140)	0.511*** (0.138)	0.456* (0.260)	0.437* (0.260)
Session at Jadavpur University (Dummy)	-0.082 (0.079)	-0.099 (0.078)	-0.257* (0.147)	-0.239 (0.148)
Constant	-0.268 (1.576)	-0.407 (1.553)	1.084 (3.038)	1.177 (3.035)
Number of observations	5330	5330	7732	7732
Number of individuals	198	198	198	198
Treatment Effects (Joint Significance): $\chi^2(2)$				
Group Lending	6.87**		53.29***	
Individual Lending Low Cost	12.44***	13.80***	4.77*	4.47
Simultaneous Lending		1.95		47.97***
Sequential Lending		11.30***		37.63***
Group Lending = Individual Lending Low Cost	4.55		31.51***	
Sequential Lending = Simultaneous Lending		5.23*		1.27
Sequential Lending = Individual Lending Low Cost		2.58		24.96***
Simultaneous Lending = Individual Lending Low Cost		8.10***		29.73***

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Regressions control for: proportion of correct answers in quiz, age and age squared, gender, whether subject is Business/Economics/Commerce major, location of residence when aged 15, year at university and previous experience in terms of participation in economic experiments.

Table 6: Summary of Results

Hypotheses	Description	Results	Implications
H1: Lending			
1a	$T1 < \text{Min}\{T2, T3, T4\}$	Supported	Lending rate is lowest in T1.
1b	$T3 \leq T4$	Not supported	Lending rate is modestly higher in T3 compared to T4.
1c	$T2 \geq \text{Max}\{T3, T4\}$	Not supported	Lending rate is higher in T3 and T4 compared to T2.
H2: Monitoring			
2a	$T1 < \text{Min}\{T2, T3, T4\}$	Supported	Monitoring rate is lowest in T1.
2b	$T3 \leq T4$	Supported	Monitoring rate is higher in T4 compared to T3.
2c	$T2 \geq \text{Max}\{T3, T4\}$	Not supported	Monitoring rate is slightly higher in T4 compared to T2.
H3: Repayment			
3a	$T1 < \text{Min}\{T2, T3, T4\}$	Supported	Repayment rate is lowest in T1.
3b	$T3 \leq T4$	Supported	Repayment rate is slightly higher in T4 compared to T3.
3c	$T2 \geq \text{Max}\{T3, T4\}$	Supported	Repayment rate is lower in T3 compared to T2, but no different in T4.

T1: Individual Lending with High cost Lender Monitoring Treatment

T2: Individual Lending with Low cost Lender Monitoring Treatment

T3: Group Lending with Peer Monitoring: Simultaneous Lending Treatment

T4: Group Lending with Peer Monitoring: Sequential Lending Treatment

Figure 1: Reaction Functions in Simultaneous lending. Note that reaction functions intersect in two places (at $(0, 0)$ and at $(1, 1)$), which leads to multiple equilibria.

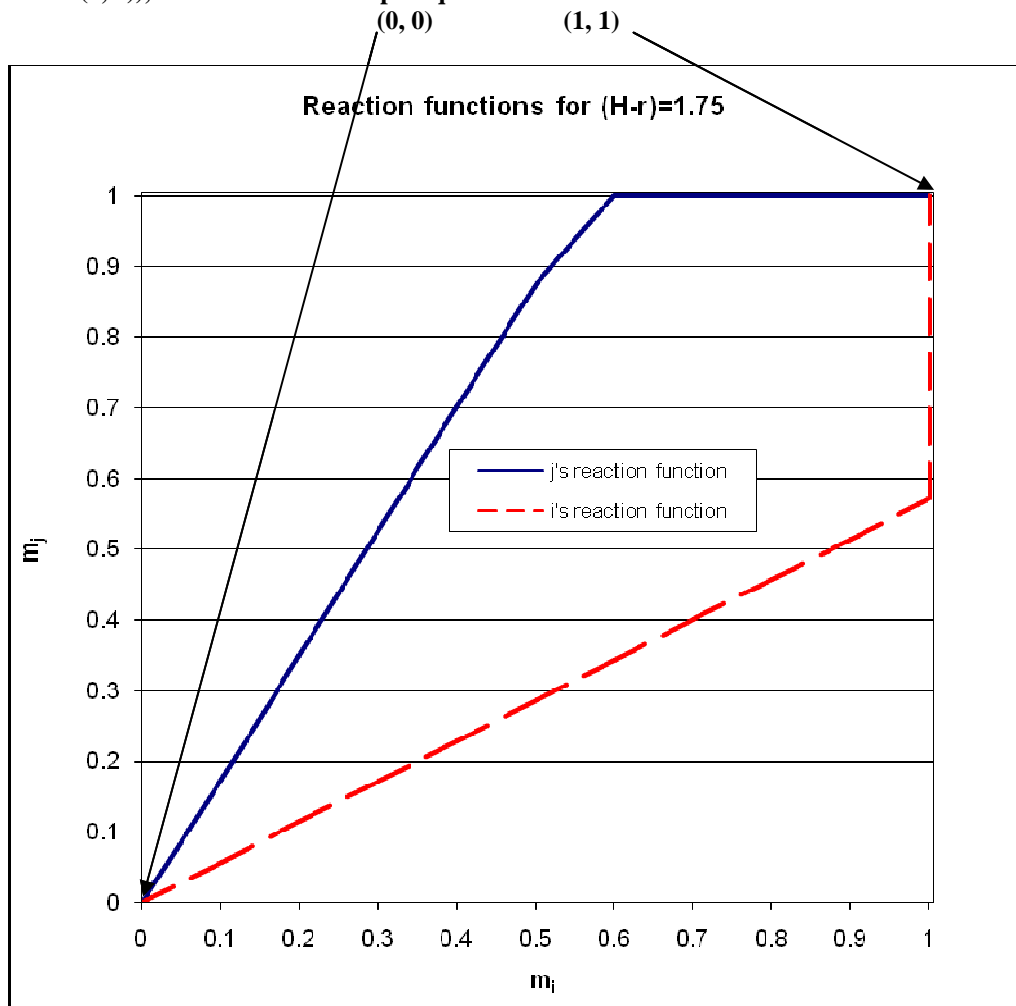


Figure 2: Reaction Functions of Borrower B_i in the Sequential Lending Treatment

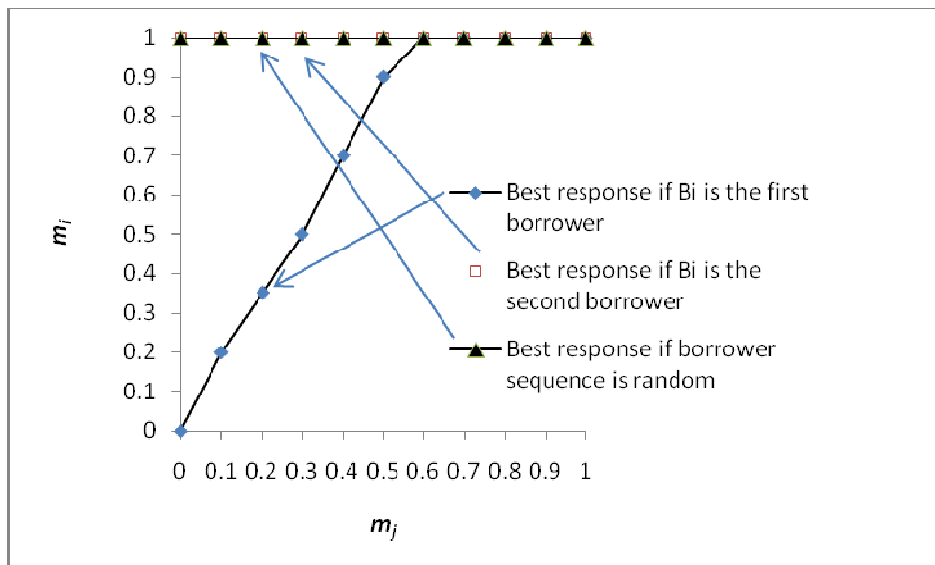


Figure 3: Average Proportion Making Loan, by treatment

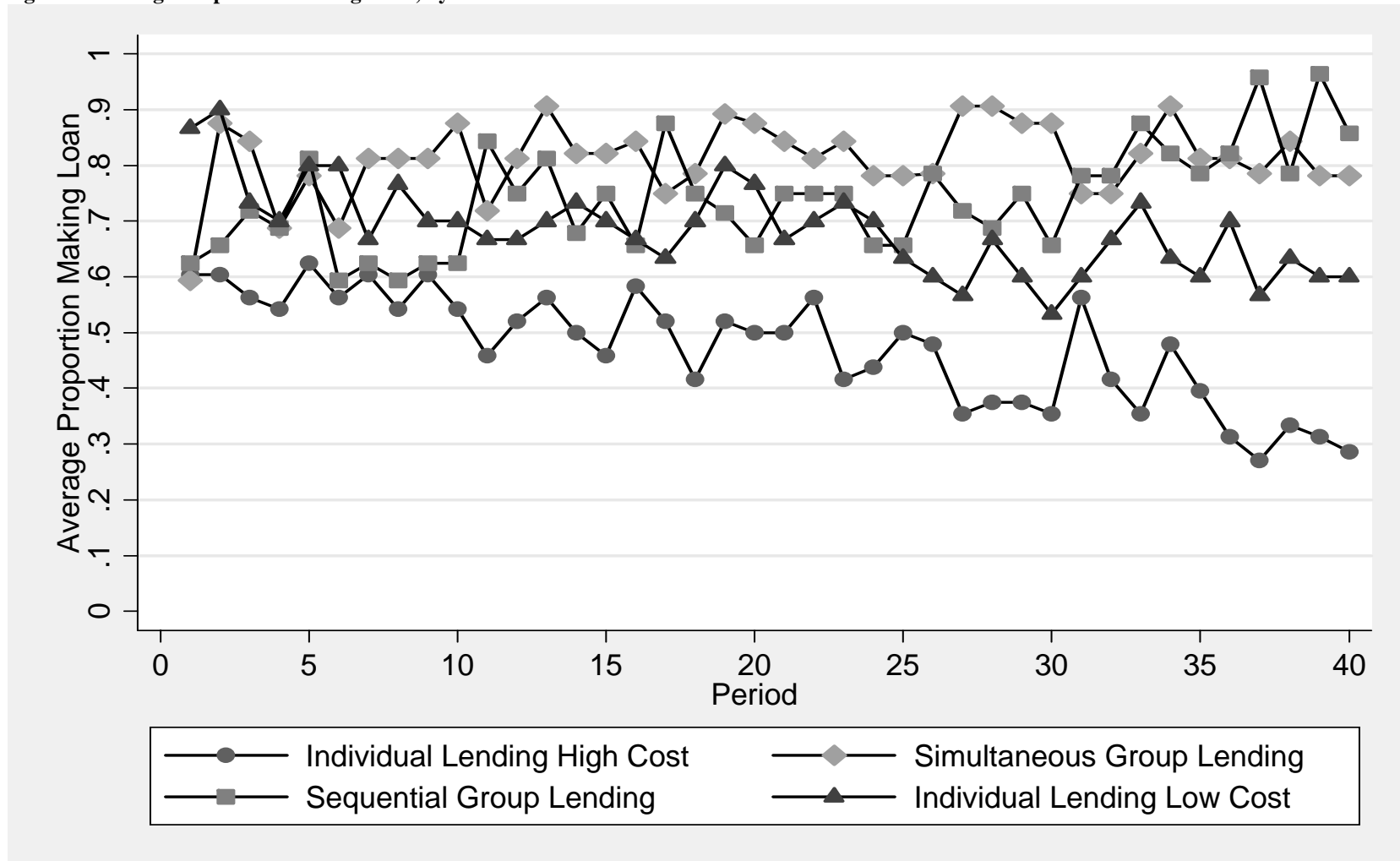
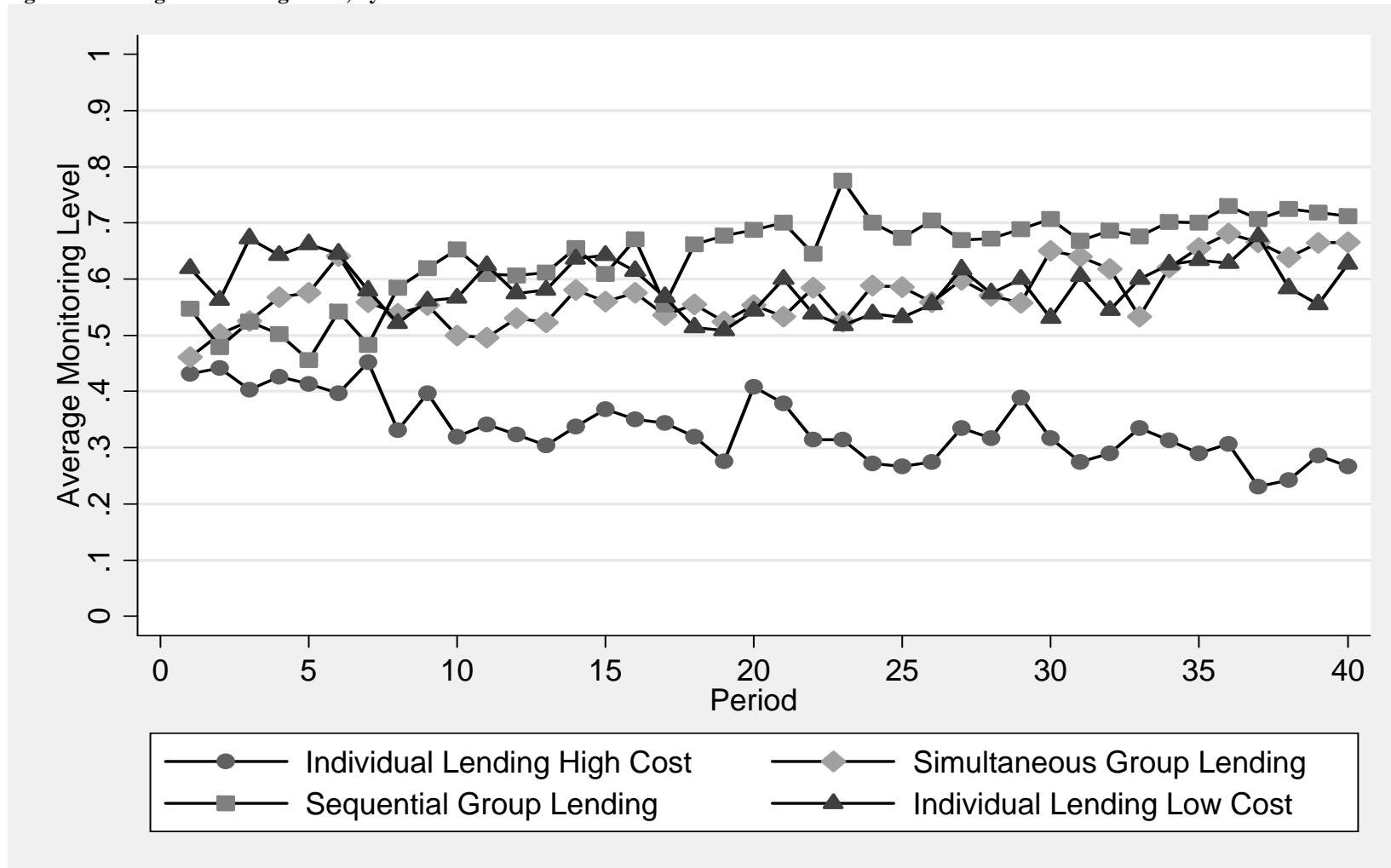


Figure 4: Average Monitoring Level, by Treatment



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Appendix D: Instructions (Simultaneous Lending Treatment)

General:

This is an experiment in the economics of decision-making. The instructions are simple and if you follow them carefully and make good decisions you will earn money that will be paid to you privately in cash at the end of the experimental session. Your earnings will be in experimental dollars and they will be converted into real dollars at the following rate: 1 Experimental Dollar = ____ Real Dollars. Notice that you earn more money by earning more experimental dollars.

After we finish reading the instructions and before we start the experiment, we would like you to answer a set of questions relating to these instructions. You will be paid in cash (at the end of the experiment, in addition to your earnings from the actual experiment) at the rate of \$0.50 for each correct answer.

In today's experiment, you will be randomly divided into groups and each group will have three members. Each group consists of one lender and two borrowers. Your role—either borrower or lender—is determined randomly and will remain unchanged throughout the experiment. At the end of every period, participants will be randomly re-matched and so the other people in your group will typically change each period. You will make decisions for 40 periods.

Decision Making:

Two projects are available to each borrower every period: project S and project R. The cost of each project is \$1 and it is to be financed by a loan from the lender.

Every period the lender can choose whether or not to invest her \$2 into making loans to the borrowers. She must either make the loan to both borrowers or to neither borrower, and she cannot make a loan to a single borrower. If the lender chooses not to invest in the loans to the borrowers, she earns \$1.50 for the period.

If the borrowers receive the loans, they can monitor the project choice of the other borrower in their group by choosing to pay a monitoring cost (C). Both borrowers can monitor each other. If borrower X incurs a cost C on monitoring, there is a chance of M that the other borrower Y will automatically be required to choose project S. Otherwise the other borrower can choose either project S or project R. Choices will be made simultaneously and the borrowers will not know whether the lender chooses to make the loans or not before making their choice of project. All decisions will be revealed after both the lender and the borrowers have made their decisions. Borrowers pay their selected monitoring costs whenever the lender makes the loan, regardless of whether or not the monitoring is successful.

The monitoring chances work in the following way. Suppose borrower X chooses $M = 20\%$. In this case, imagine an urn (or the bingo cage the experimenter is holding) containing 10 total balls: 2 white balls and 8 red balls. One ball is drawn from this imaginary urn, and if we draw a white ball then a borrower Y choice of R is switched to S; if we draw a red ball then a borrower Y choice of R remains R. If borrower Y chose S, then this choice of S is implemented regardless of the ball draw. Remember, borrower Y also makes monitoring choices in the same way to possibly switch borrower X choices from R to S.

To take another example, suppose borrower Y chooses $M = 70\%$. In this case you should imagine an urn containing 7 white balls and 3 red balls. Again, a drawn white ball switches a borrower X choice of R to S, but a drawn red ball means that a borrower X choice of R remains R. Therefore, a higher choice of M, which is more costly as shown in the table below, increases the chances that the other borrower's choice of R is switched to S. A different ball draw, from a different imaginary urn, is conducted for every different group and borrower for every different period in the experiment. In other words, the random draws are all independent.

The relationship between C and M is as follows:

Monitoring Cost (C)	M	Interpretation of M percentage:
\$0.000	0%	Switch a borrower choice of R to S 0 out of 10 times
\$0.005	10%	Switch a borrower choice of R to S 1 out of 10 times on average
\$0.020	20%	Switch a borrower choice of R to S 2 out of 10 times on average
\$0.045	30%	Switch a borrower choice of R to S 3 out of 10 times on average
\$0.080	40%	Switch a borrower choice of R to S 4 out of 10 times on average
\$0.125	50%	Switch a borrower choice of R to S 5 out of 10 times on average
\$0.180	60%	Switch a borrower choice of R to S 6 out of 10 times on average
\$0.245	70%	Switch a borrower choice of R to S 7 out of 10 times on average
\$0.320	80%	Switch a borrower choice of R to S 8 out of 10 times on average
\$0.405	90%	Switch a borrower choice of R to S 9 out of 10 times on average
\$0.500	100%	Switch a borrower choice of R to S 10 out of 10 times

Earnings:

If they receive the loan, the earnings of the borrowers depend on the project choices made by the two borrowers and on the monitoring costs the two borrowers choose to incur. If the lender decides to make the loan, her earnings depend on the actual project choices made by the two borrowers. If she chooses not to invest in the loans to the borrowers, her money is allocated to a savings account and she earns \$1.50 for the period.

The earnings of the two borrowers and the lender in the different project scenarios are as follows. Here C_1 and C_2 denote the monitoring costs incurred by borrower 1 and 2 respectively.

Actual project choice of borrower 1	Actual project choice of borrower 2	Earnings of borrower 1	Earnings of borrower 2	Earnings of lender
S	S	$\$1.75 - C_1$	$\$1.75 - C_2$	\$2.50
S	R	$\$0.00 - C_1$	$\$2.50 - C_2$	\$2.00
R	S	$\$2.50 - C_1$	$\$0.00 - C_2$	\$2.00
R	R	$\$2.50 - C_1$	$\$2.50 - C_2$	-\$2.00
No loan is provided		\$0.00	\$0.00	\$1.50

Each borrower can increase the chances of the other choosing project S by investing in monitoring. Monitoring choices will have to be made simultaneously and before each borrower knows whether the lender actually makes the loan.

Examples:

Consider the following examples, which were chosen randomly and are not meant to suggest any particular decisions.

Example # 1:

1. Lender makes the loan.
2. Borrower 1 chooses project S and monitoring M of 70%. Monitoring cost $C_1 = \$0.245$.
3. Borrower 2 chooses project R and monitoring M of 30%. Monitoring cost $C_2 = \$0.045$
4. Monitoring results: Borrower 1's monitoring is unsuccessful and so borrower 2's actual project is project R. Borrower 2's monitoring is also unsuccessful, but borrower 1 already chose project S, and so his actual choice remains project S.
5. Earnings: Use the second row of the previous table to determine borrower 1's earning = $$(0.00 - 0.245) = -\$ 0.245$; borrower 2's earning = $$(2.50 - 0.045) = \2.445 ; and lender earning = $\$2.00$

Example # 2:

1. Lender makes the loan.
2. Borrower 1 chooses project R and monitoring M of 80%. Monitoring cost $C_1 = \$0.320$.
3. Borrower 2 chooses project S and monitoring M of 50%. Monitoring cost $C_2 = \$0.125$.
4. Monitoring results: Borrower 1's monitoring is successful, but borrower 2 already chose project S and so his actual project choice remains project S. Borrower 2's monitoring is also successful and this switches borrower 1's actual project choice to S.
5. Earnings: Use the first row of the previous table to determine borrower 1's earning = $$(1.75 - 0.320) = \1.430 ; borrower 2's earning = $$(1.75 - 0.125) = \1.625 ; and lender earning = $\$2.50$.

Summary of Decisions to be taken:

Lender:

1. In every period choose how you want to invest your \$2, using a decision screen shown in Figure 1.

Borrowers:

1. Indicate how much you wish to invest in monitoring the other borrower to possibly switch him or her to project S, as shown in Figure 2, in case you receive the loans.
2. Decide whether you want to invest in project S or project R, using a decision screen shown in Figure 3. Remember that if the other borrower chooses to incur a monitoring cost (shown as *other's C* on the figure), there is a chance of M that your project choice will be switched to S, even if you had actually chosen R.

Remember that choices are made simultaneously and the borrowers do not know whether the lender chose to invest in the loans or not before making their choices of a project. Once both the lender and the borrowers have made their decisions, the information shown in Figure 4 will be provided to all of the participants in the group:

- Borrower's project choices
- Did the lender choose to make the loan
- Borrower's monitoring level, if the lender chose to make the loan
- Actual projects chosen by the borrower, if the lender chose to make the loan
- Lender earnings

- Borrower earnings
- Your cumulative earnings over the experiment

Attached to these instructions is a record sheet where you are required to record your earnings and other details from every period.

Are there any questions before we start the experiment?

Period

1 of 40

Remaining time [sec]: 24

Participant ID: 9

Please choose how you want to invest your \$2 this period:

- Make \$2 loan to borrowers (\$1 to each borrower)
- Allocate to savings account (total earnings from savings account = \$1.50)

OK

Figure 1: Lender's loan decision screen

Period

1 of 40

Remaining time [sec]: 5

Participant ID: 1

If you and the other borrower in your group receive the loans from the lender,
how much do you wish to invest in monitoring to check whether the other borrower chooses project S?
(The other borrower may choose either project S or R, regardless of your monitoring level.)

Please indicate your level of monitoring:

- 0% at cost of \$ 0.0000 (switch a borrower choice of R to S 0 out of 10 times)
- 10% at cost of \$ 0.0050 (switch a borrower choice of R to S 1 out of 10 times on average)
- 20% at cost of 0.0200 (switch a borrower choice of R to S 2 out of 10 times on average)
- 30% at cost of 0.0450 (switch a borrower choice of R to S 3 out of 10 times on average)
- 40% at cost of 0.0800 (switch a borrower choice of R to S 4 out of 10 times on average)
- 50% at cost of 0.1250 (switch a borrower choice of R to S 5 out of 10 times on average)
- 60% at cost of 0.1800 (switch a borrower choice of R to S 6 out of 10 times on average)
- 70% at cost of 0.2450 (switch a borrower choice of R to S 7 out of 10 times on average)
- 80% at cost of 0.3200 (switch a borrower choice of R to S 8 out of 10 times on average)
- 90% at cost of 0.4050 (switch a borrower choice of R to S 9 out of 10 times on average)
- 100% at cost of 0.5000 (switch a borrower choice of R to S 10 out of 10 times)

OK

Figure 2: Borrower's monitoring decision screen

Period: 1 of 2 Remaining time [sec]: 28

Participant ID: 1

If you receive the \$1 loan from the lender, the other borrower may be able to monitor your project choice.
 If the other borrower expends a cost C on monitoring, there is a chance of M that you will automatically be required to choose project S. (See the instructions table for the relationship between C and M)
 Otherwise, you can choose either project S or project R.

If you are able to choose either project, which project do you choose?

Project S
 Project R

If the other borrower's actual choice is **Project S**

	<u>My Earnings</u>	<u>Other Borrower Earnings</u>	<u>Lender Earnings</u>
If your actual choice is Project S	\$ 1.75 - C	\$ 1.75 - other'sC	\$ 2.50
If your actual choice is Project R	\$ 2.50 - C	\$ 0.00 - other'sC	\$ 2.00

If the other borrower's actual choice is **Project R**

	<u>My Earnings</u>	<u>Other Borrower Earnings</u>	<u>Lender Earnings</u>
If your actual choice is Project S	\$ 0.00 - C	\$ 2.50 - other'sC	\$ 2.00
If your actual choice is Project R	\$ 2.50 - C	\$ 2.50 - other'sC	\$ -2.00

Figure 3: Borrower's project decision screen

Period 1 of 2 Remaining time [sec]: 37

Participant ID: 3

Borrower 1's project choice:	R
Borrower 2's project choice:	R
Did lender make loan?	Yes
Borrower 1's monitoring level:	50 %
Borrower 2's monitoring level:	50 %
Borrower 1's actual project chosen:	S
Borrower 2's actual project chosen:	R
Borrower 1's earnings:	-0.1250
Borrower 2's earnings:	2.3750
Your earnings:	2.0000
Your cumulative earnings	22.0000

OK

Figure 4: Example output screen

Quiz

Participant ID: _____

Total Number of Correct Answers:

Earnings: Total Number of Correct Answers \times \$0.50 =

Record Sheet

Participant ID: _____

Period	Your Project Choice (circle one)	Other Borrower's Project Choice	Did Lender Make Loan? (circle one)	Your Monitoring Level	Other Borrower's Monitoring Level	Your Actual Project (circle one)	Other Borrower's Actual Project	Lender Earnings	Other Borrower's Earnings	Your Earnings	Your Cumulative Earnings
1	S R	S R	Yes No			S R NA	S R NA				
2	S R	S R	Yes No			S R NA	S R NA				
3	S R	S R	Yes No			S R NA	S R NA				
4	S R	S R	Yes No			S R NA	S R NA				
5	S R	S R	Yes No			S R NA	S R NA				
6	S R	S R	Yes No			S R NA	S R NA				
7	S R	S R	Yes No			S R NA	S R NA				
8	S R	S R	Yes No			S R NA	S R NA				
9	S R	S R	Yes No			S R NA	S R NA				
10	S R	S R	Yes No			S R NA	S R NA				
11	S R	S R	Yes No			S R NA	S R NA				
12	S R	S R	Yes No			S R NA	S R NA				
13	S R	S R	Yes No			S R NA	S R NA				
14	S R	S R	Yes No			S R NA	S R NA				

Period	Your Project Choice (circle one)	Other Borrower's Project Choice	Did Lender Make Loan? (circle one)	Your Monitoring Level	Other Borrower's Monitoring Level	Your Actual Project (circle one)	Other Borrower's Actual Project	Lender Earnings	Other Borrower's Earnings	Your Earnings	Your Cumulative Earnings
15	S R	S R	Yes No			S R NA	S R NA				
16	S R	S R	Yes No			S R NA	S R NA				
17	S R	S R	Yes No			S R NA	S R NA				
18	S R	S R	Yes No			S R NA	S R NA				
19	S R	S R	Yes No			S R NA	S R NA				
20	S R	S R	Yes No			S R NA	S R NA				
21	S R	S R	Yes No			S R NA	S R NA				
22	S R	S R	Yes No			S R NA	S R NA				
23	S R	S R	Yes No			S R NA	S R NA				
24	S R	S R	Yes No			S R NA	S R NA				
25	S R	S R	Yes No			S R NA	S R NA				
26	S R	S R	Yes No			S R NA	S R NA				
27	S R	S R	Yes No			S R NA	S R NA				
28	S R	S R	Yes No			S R NA	S R NA				
29	S R	S R	Yes No			S R NA	S R NA				
30	S R	S R	Yes No			S R NA	S R NA				

Period	Your Project Choice (circle one)	Other Borrower's Project Choice	Did Lender Make Loan? (circle one)	Your Monitoring Level	Other Borrower's Monitoring Level	Your Actual Project (circle one)	Other Borrower's Actual Project	Lender Earnings	Other Borrower's Earnings	Your Earnings	Your Cumulative Earnings
31	S R	S R	Yes No			S R NA	S R NA				
32	S R	S R	Yes No			S R NA	S R NA				
33	S R	S R	Yes No			S R NA	S R NA				
34	S R	S R	Yes No			S R NA	S R NA				
35	S R	S R	Yes No			S R NA	S R NA				
36	S R	S R	Yes No			S R NA	S R NA				
37	S R	S R	Yes No			S R NA	S R NA				
38	S R	S R	Yes No			S R NA	S R NA				
39	S R	S R	Yes No			S R NA	S R NA				
40	S R	S R	Yes No			S R NA	S R NA				