Open access • Journal Article • DOI:10.1016/J.JEBO.2012.02.003

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Published on: 01 Apr 2012 - Journal of Economic Behavior and Organization (North-Holland)

Topics: Loan, Microfinance and Moral hazard

Moral Hazard and Peer Monitoring in a Laboratory Microfinance Experiment*

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Revised: November 2011

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

* We have benefited from comments by Dyuti Banerjee, Shyamal Chowdhury, Roland Hodler, Jeorg Oechssler, Kunal Sengupta, Tom Wilkening, Chikako Yamauchi, participants at seminars and workshops at Monash University, University of Melbourne, the Australian National University, the University of Adelaide, University of Sydney, Jadavpur University, Kolkata, the Indian Statistical Institute, Delhi, participants at ESA International meetings, NEUDC Conference, the Econometric Society Australasian Meetings, the Econometric Society World Congress and two anonymous referees for their comments and suggestions. We would like to thank Gautam Gupta for his assistance in organizing the sessions at Jadavpur University, Kolkata. Tania Dey, Simon Hone, Vinod Mishra and Roman Sheremeta provided excellent research assistance. The usual caveat applies.

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1. Introduction

The last few decades have witnessed the development of innovative and highly successful microfinance 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) that 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 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. (2008)). 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, and 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 peer monitoring is 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, the 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)). Microfinance loans present a complex economic environment, and the literature does not yet provide a unified approach to analyse contracts and borrower and lender behavior. Experiments, grounded in careful theory, have an important role to play in this respect.

Few laboratory experiments examine the impact of specific design features on the performance

[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 Gaechter (2000), Barr (2001), Masclet et al. (2003), Walker and Halloran (2004), and Carpenter, Bowles and Gintis (2006) for experimental evidence.

of microfinance models. Abbink, Irlenbusch and Renner (2006) and Seddiki and Ayedi (2005) examine 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 both find that self-selected groups have a greater willingness to contribute. Neither of these papers analyse the role of peer monitoring.

This paper contributes to the recent debate on joint versus individual liability in microfinance. In recent years, programs like Grameen II and Banco Sol have adopted individual liability, where each loan recipient is individually responsible for repayment of her loans. Gine and Karlan (2009) use data from a controlled field experiment in Philippines and argue that converting existing borrowers to individual liability does not affect repayment rates; and even when groups are initially formed under individual liability, repayment rates are no lower. The role of a group in such a scenario is simply to act as a mediator. On the other hand, programs like Self Help groups in India continue to rely on joint liability where members are jointly responsible for loan repayment. As many micro lenders switch or consider switching from group to individual-liability loans, it is important to understand the mechanisms determining outcomes in the different scenarios. Achieving this goal is particularly challenging as it can be affected by information, monitoring, and project choice.[5] We find that in the environment that we consider, the results depend on the cost of monitoring. If the cost of monitoring under an individual liability program is no different to that under a joint liability program, then the two provide almost equivalent performance. If however, the cost under peer monitoring is lower, compared

[5] Field experiments while feasible are difficult to implement and sometimes come at the cost of some loss of experimental control. For example, spill overs 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. That said, in recent years there have been a number of innovative field experiments dealing with different aspects of microfinance. Gine et al. (2010), Fischer (2008), Kono (2006), Cassar, Crowley and Wydick (2007) report "artefactual" field experiments which place non-student subjects in stylized microfinance environments similar to controlled laboratory studies. Field and Pande (2008), Banerjee et al. (2009), Gine and Karlan (2009), Karlan and Zinman (2010), Feigenberg, Field and Pande (2011) on the other hand describe randomized interventions for actual microfinance programs. Our paper complements this rapidly growing literature by directly testing some of the theoretical predictions relating to individual and group lending and the cost of monitoring, which is difficult to do in the field.

to the cost of lender monitoring, then joint liability dominates. We also document differences in group and individual lending treatments that could be attributed to group-based responsibility and trust.

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. Both the borrowers and the lenders are assumed to be risk-neutral and aim to maximise their profits. 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 therefore the bank is better off if both borrowers choose project *S*, and each borrower has an incentive to ensure that the other borrower chooses project *S* so that the bank has an incentive to lend.

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 $c(m_i) = m_i^2 / 2$, 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., $\lambda < \frac{r^2}{2\left(\bar{r}+1\right)}$, then individual lending is feasible, and the efficient (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 first the *individual lending high cost* treatment we set $\lambda > \frac{r^2}{2\left(\bar{r}+1\right)}$. In the second, the *individual lending low cost* treatment we set $\lambda < \frac{r^2}{2\left(\bar{r}+1\right)}$.

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

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

The first order condition is: $m_j\left(H-r\right)-m_i=0$. Likewise the first order condition for borrower B_j is: $m_i\left(H-r\right)-m_j=0$. 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 $m_j = \hat{m}_j < 1$ such that the best response is $m_i = 1$ for $m_j > \hat{m}_j$. So B_i's complete reaction function can be written as:

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

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 in 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 $H - r - 1/2$. 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.

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*).

[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.

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):

$$m_i = m_j\left[H-r-(1-\alpha)b\right]+(1-\alpha)b$$
$$m_j = m_i\left[H-r-(1-\alpha)b\right]+(1-\alpha)b$$

Solving out and simplifying we get

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

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 $1+\left[H-r-(1-\alpha)b\right]=0$ or $1-\left[H-r-(1-\alpha)b\right]=0$. 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

[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.

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.[8]

***Proposition* 3**: If $\alpha < 1 - \left(\frac{H - r - 1}{b}\right)$ and $\bar{m}\left[\bar{m}\left(2r - H\right) + \left(H - \bar{r} - 1\right)\right] > \bar{r} + 1$, 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 $\bar{m}_i = Min\left(1, \frac{\left(1-\alpha\right)b}{1 - \left[H - r - \left(1-\alpha\right)b\right]}\right) = \bar{m}_j = \bar{m}$. An interior solution to the monitoring rate is not defined if $1 + \left[H - r - \left(1-\alpha\right)b\right] = 0$ or if $1 - \left[H - r - \left(1-\alpha\right)b\right] = 0$.

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.

[8] In field settings, groups are often self-selected. In such a situation one could think of the monitoring costs as screening costs that the group members have to incur prior to group formation. By incurring this cost, borrowers are able to ensure that other members of the group will not make choices that are detrimental to the group. Possibly incurring a higher screening cost prior to group formation gives borrowers greater leverage in affecting the project choice of other members of the group. In the lab we replicate this idea by making borrowers incur the monitoring cost before they know the order in which they receive the loan.

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 expected payoffs given the monitoring rate chosen by the other borrower. For example, if B_i knew he was the first borrower and believed that B_j would monitor at level $m_j = 0.1$, his expected payoff would be maximized at a monitoring level of $m_i = 0.2$. 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. Two treatments 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 the *individual lending high cost* treatment compared to the *individual lending low cost* treatment. The other two treatments were group lending treatments, with the 12 subjects randomly divided into groups of three with each group consisting of two borrowers and one lender. One is the *simultaneous group lending* treatment and the other 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 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.[9] 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 more 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. A significant monitoring cost differential between lender and peer monitoring could still exist in such an urban environment, since fellow borrowers live in the same community, but peer monitoring costs are likely to vary significantly between urban and rural settings. 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. Twenty of the 29 sessions were conducted in Australia and the remaining in India. 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. All subjects were

[9] 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.

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. At the end of the session subjects were paid the amount they had accumulated over the 40 periods and on average they earned AUD 25 – 35 or its purchasing power equivalent.[10] 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 group 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 the *individual lending high cost* treatment compared to the other three treatments;
b. at least as high in the *sequential group lending* treatment compared to the *simultaneous group lending* treatment; and
c. at least as high in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment.

Hypothesis 2 (H2) monitoring: The monitoring rate

a. is strictly lower for *individual lending high cost* treatment compared to the other three treatments;
b. at least as high in the *sequential group lending* treatment compared to the *simultaneous group lending* treatment;
c. at least as high in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment.

Hypothesis 3 (H3) repayment: The repayment rate is

a. is strictly lower for *individual lending high cost* treatment compared to the other three treatments;
b. at least as high in the *sequential group lending* treatment compared to the *simultaneous group lending* treatment;
c. at least as high in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment.

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

Part a of each hypothesis concerns the change in monitoring cost, holding constant the aspect of individual lending with lender monitoring;[11] Part b compares the two forms of group lending; Part c compares the outcomes under simultaneous group lending to individual lending with lender monitoring, holding monitoring cost constant. In summary, for all three performance measures the treatments are ordered as: *individual lending low cost* treatment = *sequential group lending* treatment ≥ *simultaneous group lending* treatment > *individual lending high cost* treatment. The weak inequality in parts b and c of these hypotheses follow from the theoretical predictions and parameter choices, which imply that the efficient (monitoring/lending) equilibrium is unique in the *sequential group lending* and *individual lending low cost* treatments, but both efficient and inefficient (zero-monitoring/zero-lending) equilibria exist in the *simultaneous group lending* case. Thus, theoretically outcomes could be less efficient in the *simultaneous group lending* treatment compared to *sequential group lending* treatment and the *individual lending low cost* treatment. The experimental results will 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 that 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 that can identify the contribution of different factors on lender and borrower behaviour. Our results are summarized in Table 6 below.

Lending

Figure 3 presents the average proportion of lenders making loans in the different periods, by treatment.

[11] 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. 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 the *individual lending high cost* treatment, so monitoring rates and repayment rates are defined empirically, although they should be low off the equilibrium path.

Clearly the average proportion of lenders making loans is substantially lower at every period for the *individual lending high cost* treatment but there is very little difference in the early periods between the *individual lending low cost* and group lending treatments. However the lending rate in the last 5 periods is significantly lower in the *individual lending low cost* treatment 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 (though the differences are not statistically significant using a non-parametric ranksum test using session level averages as the unit of observation). 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.

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, where the subject (lender) represents the random effect and the standard errors are clustered at the session level to account for potential session level unobserved heterogeneity. 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 low cost* treatment, and the reference category is always the *individual lending high cost* treatment.

The configuration of sign and significance of $1/t$, $1/t \times INDVLOWCOST$ and $1/t \times GROUP$ indicate that lending decreased over time in the two individual lending treatments, but increased over time in the two group lending treatments, relative to the reference category (*individual lending high cost* treatment). Lending rates are significantly higher in the group lending treatments compared to the

individual lending low cost treatment.[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 reinforcement-type learning.[13] The results from Specification 2 additionally show that there are statistically significant treatment differences between the two group lending treatments $\left(\chi^2(2) = 31.24; p - value = 0.00\right)$, but this difference is minor during the late periods (see figure 3). The probability of lending is lower in the sessions conducted in Jadavpur. In summary (see Table 6), we find support for hypothesis 1a (lending rate is the lowest in the *individual lending high cost* treatment) and 1b (lending rate is no higher in the *simultaneous group lending* treatment compared to the *sequential group lending* treatment), but not for 1c (because the lending rate is lower in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment).

Monitoring

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

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.

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[12] The relevant test here is $1/t \times GROUP = 1/t \times INDVLOWCOST$ 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 the *individual lending high*

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-Taylor estimates for error component models. The *individual lending low cost* treatment dummy is positive and statistically significant. Monitoring rates fall over time in both treatments and the sign and significance of the *individual lending low cost* treatment dummy and the interaction term with $1/t$ indicates that monitoring rates are significantly lower in the *individual lending high cost* treatment. Additionally the level of monitoring in period $t-1$ has a positive and statistically significant relationship with 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 2b. 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

cost treatment. 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.

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. 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* group lending treatments and the corresponding time interaction terms. The reference category in both cases is the individual lending low cost treatment. Specification 2 in the random effects tobit regression indicates a significantly different (upward) time trend for group lending, and overall the null hypothesis of no difference in monitoring rates between the *sequential group lending* treatment and the *individual lending low cost* treatment is rejected**.** The results do not indicate any evidence that the monitoring rate is different for the *simultaneous group lending* and the *individual lending low cost* treatments, consistent with hypothesis 2c. Finally combining the results in Panels A, B and C we find support for Hypothesis 2a (monitoring rate is the lowest in the *individual lending high cost* treatment).

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 random effect probit regression results (with the subject representing the random effect and the standard errors clustered at the session level) for repayment (columns 1 and 2) and ex ante choice of project *R* (columns 3 and 4). The explanatory variables are similar to the ones in Table 3 and as before we present the results from two alternative specifications. The repayment rates are significantly lower in the *individual lending high cost* treatment compared to all other treatments (providing support for Hypothesis 3a). The results in Specification 2 provide support for Hypotheses 3b and 3c (repayment rates are at least as high in the *sequential group lending* and *individual lending low cost* treatments compared to the *simultaneous group lending* treatment).

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*. The non-parametric tests reported in Panel D of Table 2 and the tests of joint significance reported in columns 3 and 4 of Table 5 indicate that the borrowers are less likely to choose project *R* in the two individual lending treatments.[15] 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*. Consequently, 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 the *individual lending high cost* treatment 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

[15] The corresponding value of the $\chi^2(2)$ statistic is 59.32 (*p-value* = 0.00).

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.

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 the two person individual lending game than the three person group lending game. Lending in the experiment shares some parallels with the first move in the trust game (e.g., McCabe, Rigdon and Smith (2003)), and repayment and choice of the verifiable project is analogous to reciprocal trustworthiness. In the group lending treatments, a pair of borrowers may reciprocate the lender's decision, but results from previous trust game experiments have shown that less reciprocity is exhibited by groups (Song (2009)) or by individual representatives deciding for groups (Song (2008)). In our group lending environment, subjects appear to be less likely to exhibit reciprocal behaviour when a fellow borrower is monitoring, and this may have reduced the borrower's perceived responsibility to be reciprocal to the lender.

These social preference and reciprocity concerns are not included in theoretical models of microfinance, such as the one motivating our experiment that assumes agents are own monetary payoff maximisers. Our results add to the considerable experimental evidence (both in the lab and in the field) that has accumulated in recent years indicating that individuals do not necessarily act as payoff maximisers, and that other social preferences often influence behaviour (Sobel (2005)). Specifically, it suggests that reciprocal motivations affect behaviour more in the individual lending treatments than in the group lending treatments. If additional evidence accumulates to indicate that this finding is robust, it may be appropriate to extend theoretical models of microfinance to include social preferences to improve their descriptive accuracy. Although observing social preferences in the laboratory does not guarantee that they exist in the field, we see no reason why such social influences would not appear in actual microfinance relationships.

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 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 of participants 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. This is 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).[16]

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 relationships between borrowers are virtually non-existent in urban slums. This suggests that a significant cost differential between lender and peer monitoring is unlikely. Experiments such as this 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 can perform at least as well as group lending programs.

[16] In the first experiment reported in Gine and Karlan (2009), as the existing field centers with group liability loans were converted to individual liability loans, lenders had prior information about the borrowers' characteristics from the group lending field sessions, which could be used in the individual lending sessions at no extra cost. As a result the monitoring costs did not 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 similar under individual lending (with active lender monitoring), compared to group lending (with peer monitoring). Our laboratory experiment results are consistent with that interpretation.

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 $m_i\left(1-m_j\right)$; $H-2$ with probability $m_j\left(1-m_i\right)$; and -2 with probability $\left(1-m_i\right)\left(1-m_j\right)$.
So the lender's expected earnings are:
$m_i m_j\left(2r-2\right)+m_i\left(1-m_j\right)\left(H-2\right)+m_j\left(1-m_i\right)\left(H-2\right)+\left(1-m_i\right)\left(1-m_j\right)\left(-2\right)$.
The lender will choose to lend as long as:
$m_i m_j\left(2r-2\right)+m_i\left(1-m_j\right)\left(H-2\right)+m_j\left(1-m_i\right)\left(H-2\right)+\left(1-m_i\right)\left(1-m_j\right)\left(-2\right)>2\bar{r}$.
Since borrowers are symmetric and in equilibrium $m_i^{**}=m_j^{**}=m^{**}$, the lender will lend if $m^{**2}\left(2r-2H\right)+2m^{**}H>2\left(1+\bar{r}\right)$, which simplifies to the condition in the text: $m^{**2}\left(r-H\right)+m^{**}H>1+\bar{r}$.

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 $\alpha\left(1-m_i\right)m_j$ (if B_i is the first borrower and B_j is successful in the monitoring process but B_i is not) or with probability $\left(1-\alpha\right)\left(1-m_i\right)$ (if B_i is the second borrower and is not successful in the monitoring process).
- b with probability $\alpha\left(1-m_j\right)$ (if B_i is the first borrower and B_j is not successful in the monitoring process) or with probability $\left(1-\alpha\right)\left(1-m_j\right)m_i$ (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 $\left(1-m_i\right)m_j$ (i.e., only the second borrower is successful in monitoring); and $\left(-1+\bar{r}\right)$ with probability $\left(1-m_j\right)$ (i.e., the second borrower is not successful in monitoring).
So the expected return to the lender by choosing to lend is:
$m_i m_j\left(2r-2\right)+\left(1-m_i\right)m_j\left(H-2\right)+\left(1-m_j\right)\left(-1+\bar{r}\right)$.
The lender will choose to lend as long as $m_i m_j\left(2r-2\right)+\left(1-m_i\right)m_j\left(H-2\right)+\left(1-m_j\right)\left(-1+\bar{r}\right)>2\bar{r}$.
Since the borrowers are symmetric and in equilibrium $\bar{m}_i=\bar{m}_j=\bar{m}$, the lender will lend if:
$\bar{m}^2\left(2r-2\right)+\left(1-\bar{m}\right)\bar{m}\left(H-2\right)+\left(1-\bar{m}\right)\left(-1+\bar{r}\right)>2\bar{r}$.
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	Individual Lending High Cost Treatment	Individual Lending Low Cost Treatment	Simultaneous Group Lending Treatment: inefficient equilibrium/efficient equilibrium	Sequential Group Lending Treatment
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	Individual Lending High Cost Treatment	Individual Lending Low Cost Treatment	Simultaneous Group Lending Treatment	Sequential Group Lending Treatment
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, Simultaneous Group Lending Treatment

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, Sequential Group Lending Treatment

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, Individual Lending

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	\$0.00	\$0.75

Note:

C_1 and C_2 denote the monitoring costs incurred by borrowers 1 and 2 in the simultaneous and sequential group lending treatments respectively 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 the individual lending high cost treatment and $\lambda = 1$ in the individual lending low cost treatment. 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	0.474	0.588	0.303
Individual Lending Low Cost Treatment	0.685	0.800	0.620
Simultaneous Group Lending Treatment	0.812	0.756	0.801
Sequential Group Lending Treatment	0.737	0.700	0.788
Group Lending Treatments	0.775	0.728	0.795
Rank sum Test			
Individual Lending High Cost = Individual Lending Low Cost	-2.342**	-2.432**	-2.580***
Individual Lending Low Cost = Group Lending	-1.405	0.705	-1.910*
Individual Lending High Cost = Group Lending	-3.124***	-1.965**	-3.381***
Simultaneous Group Lending = Sequential Group Lending	0.684	0.582	-0.318
Simultaneous Group Lending = Individual Lending Low Cost	1.464	-0.294	1.690*
Sequential Group Lending = Individual Lending Low Cost	1.026	-0.955	1.690*
Panel B. Average Level of Monitoring			
Individual Lending High Cost Treatment	0.342	0.423	0.268
Individual Lending Low Cost Treatment	0.588	0.629	0.614
Simultaneous Group Lending Treatment	0.575	0.528	0.663
Sequential Group Lending Treatment	0.643	0.500	0.709
Group Lending Treatments	0.607	0.514	0.686
Rank sum Test			
Individual Lending High Cost = Individual Lending Low Cost	-2.928***	-2.928***	-2.928***
Individual Lending Low Cost = Group Lending	-0.330	2.064**	-1.404
Individual Lending High Cost = Group Lending	-3.613***	-1.408	-3.735***
Simultaneous Group Lending = Sequential Group Lending	-0.840	0.000	-1.105
Simultaneous Group Lending = Individual Lending Low Cost	-0.146	-1.610	0.878
Sequential Group Lending = Individual Lending Low Cost	0.732	-2.049**	1.610
Panel C. Average Repayment Rates			
Individual Lending High Cost Treatment	0.591	0.624	0.420
Individual Lending Low Cost Treatment	0.727	0.692	0.710
Simultaneous Group Lending Treatment	0.658	0.632	0.720
Sequential Group Lending Treatment	0.710	0.643	0.752
Group Lending Treatments	0.683	0.637	0.736
Rank sum Test			
Individual Lending High Cost = Individual Lending Low Cost	-2.928***	-1.761*	-2.650***
Individual Lending Low Cost = Group Lending	1.156	1.404	-0.911
Individual Lending High Cost = Group Lending	-2.481**	-0.092	-3.402***
Simultaneous Group Lending = Sequential Group Lending	-0.525	-0.420	0.211
Simultaneous Group Lending = Individual Lending Low Cost	-1.317	-1.319	0.295
Sequential Group Lending = Individual Lending Low Cost	-0.732	-1.171	1.319
Panel D. Average Proportion Choosing the Non-Verifiable Project R			
Individual Lending High Cost Treatment	0.629	0.667	0.662
Individual Lending Low Cost Treatment	0.701	0.807	0.693
Simultaneous Group Lending Treatment	0.798	0.722	0.872
Sequential Group Lending Treatment	0.795	0.691	0.846
Group Lending Treatments	0.797	0.706	0.859
Rank sum Test			
Individual Lending High Cost = Individual Lending Low Cost	-1.171	-1.848*	-0.220
Individual Lending Low Cost = Group Lending	-2.065**	1.865*	-1.987**
Individual Lending High Cost = Group Lending	-3.185***	-0.675	-2.670***
Simultaneous Group Lending = Sequential Group Lending	0.053	0.053	0.792
Simultaneous Group Lending = Individual Lending Low Cost	1.610	-1.255	1.908*
Sequential Group Lending = Individual Lending Low Cost	2.049**	-2.075*	1.610

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

Table 3: Random Effect Probit Regressions for Making Loans

	Specification 1	Specification 2
1/t	1.894***	1.939***
	(0.471)	(0.470)
1/t × GROUP	-2.416***	
	(0.717)	
1/t × INDVLOWCOST	0.224	0.221
	(0.792)	(0.813)
1/t × GROUP_SIMUL		-1.670**
		(0.828)
1/t × GROUP_SEQUEN		-2.969***
		(0.856)
Group Lending Treatment (Dummy)	0.857***	
	(0.084)	
Simultaneous Lending Treatment (Dummy)		1.419***
		(0.124)
Sequential Lending Treatment (Dummy)		1.069***
		(0.109)
Individual Lending Low Cost Treatment (Dummy)	0.315***	0.483***
	(0.104)	(0.094)
Negative Earnings in Previous Period (Dummy)	-0.358***	-0.361***
	(0.075)	(0.073)
Session at Jadavpur University (Dummy)	-0.448***	-0.465***
	(0.069)	(0.055)
Constant	6.646***	3.973***
	(0.992)	(0.678)
Number of observations	5282	5282
Number of individuals	138	138
Treatment Effects (Joint Significance): $\chi^2(2)$		
Group Lending = Individual Lending High Cost	155.07***	
Individual Lending Low Cost = Individual Lending High Cost	16.64***	105.34***
Simultaneous Lending =Individual Lending High Cost		217.99***
Sequential Lending = Individual Lending High Cost		142.47***
Group Lending = Individual Lending Low Cost	19.28***	
Sequential Lending = Simultaneous Lending		31.24***
Sequential Lending = Individual Lending Low Cost		71.69***
Simultaneous Lending = Individual Lending Low Cost		18.60**

Standard errors (clustered at the session level) are 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**	0.171**
	(0.083)	(0.076)
1/t × INDVLOWCOST	-0.132	-0.128
	(0.116)	(0.106)
Individual Lending Low Cost Treatment (Dummy)	0.251***	0.244***
	(0.035)	(0.053)
Lagged Monitoring	0.441***	0.306***
	(0.034)	(0.029)
Session at Jadavpur University (Dummy)	0.085**	0.116**
	(0.034)	(0.052)
Constant	0.150	4.238
	(0.351)	(3.262)
Number of observations	1239	1239
Number of individuals	77	77
Treatment Effect (Joint Significance): $\chi^2(2)$		
Individual Lending Low Cost = Individual Lending High Cost	53.36***	21.27***

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	-0.010	0.005	-0.007
	(0.081)	(0.062)	(0.081)	(0.062)
1/t ×GROUP_SEQUEN	-0.291***	-0.304***	-0.278**	-0.287***
	(0.110)	(0.085)	(0.111)	(0.086)
Sequential Lending Treatment (Dummy)	0.054*	0.058**	0.053*	0.060**
	(0.029)	(0.024)	(0.030)	(0.024)
Lagged Own Monitoring	0.504***	0.349***	0.496***	0.340***
	(0.022)	(0.016)	(0.022)	(0.016)
Lagged Monitoring of the Other Borrower	0.131***	0.104***		
	(0.018)	(0.014)		
Average Lagged Monitoring of the Other Borrower			0.268***	0.244***
			(0.056)	(0.043)
Session at Jadavpur University (Dummy)	-0.049	-0.045	-0.051	-0.057**
	(0.032)	(0.028)	(0.033)	(0.029)
Constant	-0.296	-0.562	-0.392	-3.026
	(0.944)	(2.231)	(0.960)	(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 = Simultaneous 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	0.068	0.018	0.027
	(0.111)	(0.111)	(0.092)	(0.090)
1/t × GROUP	-0.260**		-0.223**	
	(0.123)		(0.102)	
Group Lending Treatment (Dummy)	0.078**		0.108**	
	(0.035)		(0.044)	
1/t × GROUP_SIMUL		-0.103		-0.073
		(0.133)		(0.107)
1/t × GROUP_SEQUEN		-0.435***		-0.413***
		(0.135)		(0.109)
Simultaneous Lending Treatment (Dummy)		0.051		0.062
		(0.038)		(0.046)
Sequential Lending Treatment (Dummy)		0.104***		0.112***
		(0.037)		(0.042)
Lagged Own Monitoring	0.515***	0.510***	0.357***	0.354***
	(0.020)	(0.020)	(0.015)	(0.015)
Session at Jadavpur University (Dummy)	-0.047	-0.050*	0.007	-0.012
	(0.029)	(0.029)	(0.038)	(0.037)
Constant	0.437	0.423	12.196*	7.633
	(0.692)	(0.692)	(6.254)	(5.866)
Number of observations	4191	4191	4191	4191
Number of individuals	150	150	150	150
Treatment Effects (Joint Significance): $\chi^2(2)$				
Group Lending = Individual Lending Low Cost	7.00**		9.32**	
Simultaneous Lending = Individual Lending Low Cost		1.93		2.04
Sequential Lending = Individual Lending Low Cost		13.63***		18.23***
Sequential Lending = Simultaneous Lending		10.93***		17.26***

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	-0.057	0.369	0.379
	(0.266)	(0.265)	(0.361)	(0.365)
1/t × GROUP	-0.113		-1.314***	
	(0.317)		(0.412)	
1/t × INDVLOWCOST	-0.251	-0.250	0.329	0.334
	(0.349)	(0.349)	(0.487)	(0.489)
1/t × GROUP_SIMUL		0.020		-1.404***
		(0.372)		(0.484)
1/t × GROUP_SEQUEN		-0.242		-1.245***
		(0.345)		(0.438)
Group Lending Treatment (Dummy)	0.217***		0.996***	
	(0.084)		(0.136)	
Simultaneous Lending Treatment (Dummy)		0.120		1.017***
		(0.129)		(0.101)
Sequential Lending Treatment (Dummy)		0.305***		0.677***
		(0.083)		(0.081)
Individual Lending Low Cost Treatment (Dummy)	0.409***	0.410***	0.175*	0.549***
	(0.100)	(0.099)	(0.101)	(0.071)
Session at Jadavpur University (Dummy)	-0.082	-0.100	-0.022	-0.110**
	(0.095)	(0.097)	(0.060)	(0.053)
Constant	-0.272	-0.392	4.681***	-0.520
	(1.547)	(1.460)	(1.629)	(1.148)
Number of observations	5330	5330	7732	7732
Number of individuals	198	198	198	198
Treatment Effects (Joint Significance): $\chi^2(2)$				
Group Lending = Individual Lending High Cost	7.86**		54.44***	
Individual Lending Low Cost = Individual Lending High Cost	23.11***	23.18***	7.18**	117.37***
Simultaneous Lending = Individual Lending High Cost		1.28		114.26***
Sequential Lending = Individual Lending High Cost		13.71***		86.43***
Group Lending = Individual Lending Low Cost	3.33		59.32***	
Sequential Lending = Simultaneous Lending		1.83		19.79***
Simultaneous Lending = Individual Lending Low Cost		4.63*		20.68***
Sequential Lending = Individual Lending Low Cost		1.06		16.20***

Standard errors (clustered at the session level) are 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	ILHC < Min{ILLC, SIM, SEQ}	Supported	Lending rate is the lowest in the *individual lending high cost* treatment.
1b	SIM ≤ SEQ	Supported	Lending rate is modestly higher in *sequential group lending* treatment compared to *simultaneous group lending* treatment.
1c	SIM ≤ ILLC	Not supported	Lending rate is lower in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment.
H2: Monitoring			
2a	ILHC < Min{ILLC, SIM, SEQ}	Supported	Monitoring rate is lowest in the *individual lending high cost* treatment.
2b	SIM ≤ SEQ	Supported	Monitoring rate is modestly higher in late periods in *sequential group lending* treatment compared to *simultaneous group lending* treatment.
2c	SIM ≤ ILLC	Supported	Monitoring rate is not significantly different in the *individual lending low cost* treatment compared to the *simultaneous group lending* treatment.
H3: Repayment			
3a	ILHC < Min{ILLC, SIM, SEQ}	Supported	Repayment rate is lowest in the *individual lending high cost* treatment.
3b	SIM ≤ SEQ	Supported	Repayment rate is equivalent in the *sequential* and *simultaneous group lending* treatments.
3c	SIM ≤ ILLC	Supported	Repayment rate is not lower in the *individual lending low cost* and the *simultaneous group lending* treatments.

ILHC: Individual Lending High Cost Treatment
ILLC: Individual Lending Low Cost Treatment
SIM: Simultaneous Group Treatment
SEQ: Sequential Group Lending Treatment
[+] All results are consistent across the conservative non-parametric tests and the multivariate regressions.

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.

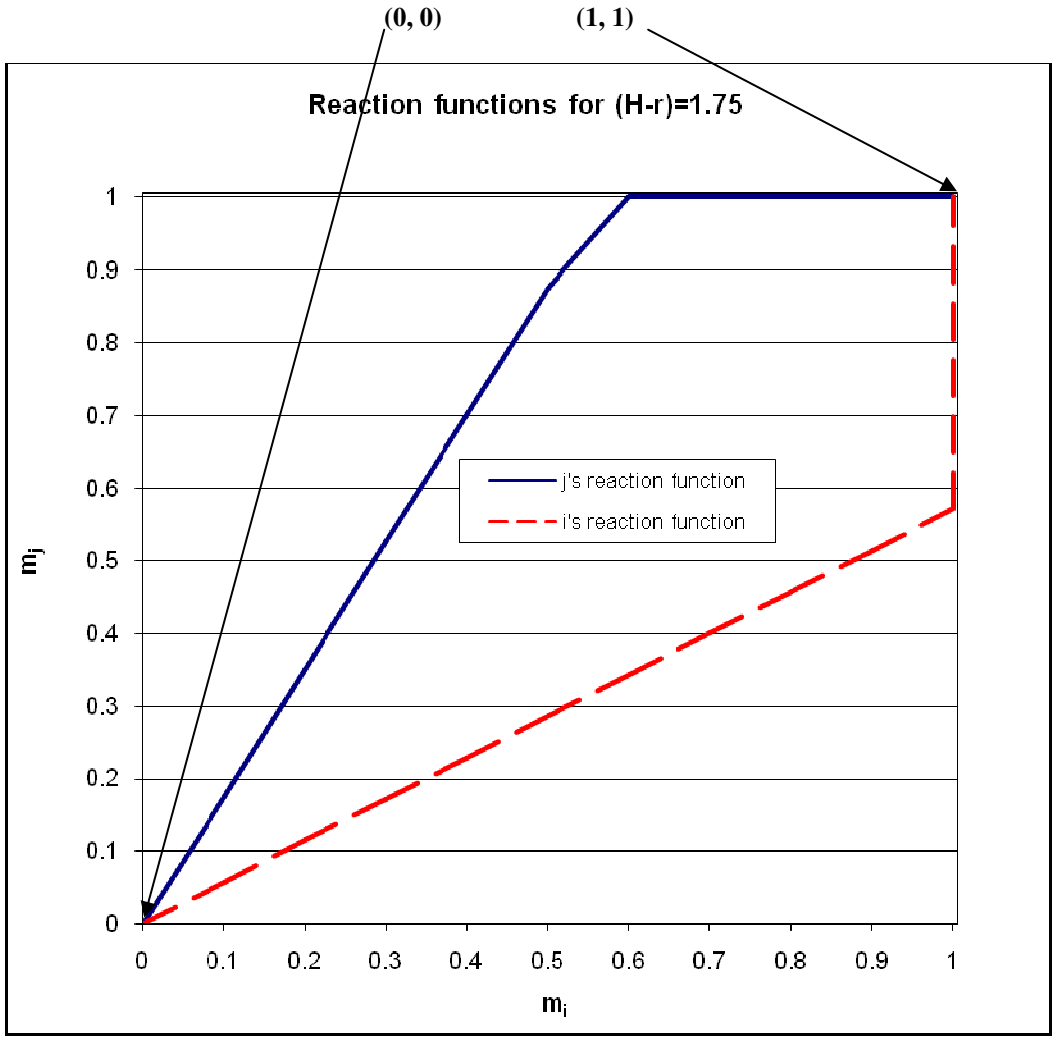


Figure 2: Reaction Functions of Borrower B_i in the Sequential Lending Treatment

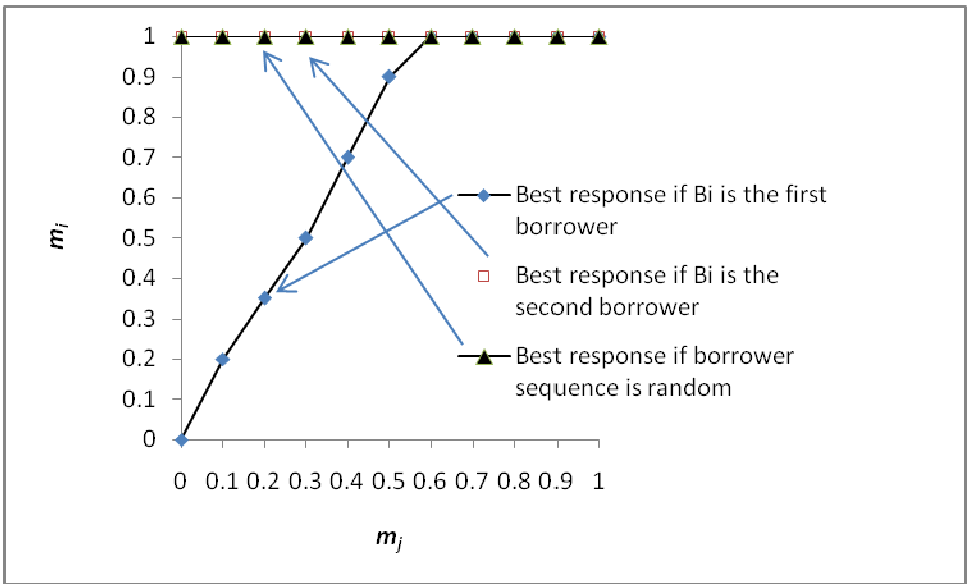


Figure 3: Average Proportion Making Loan, by treatment

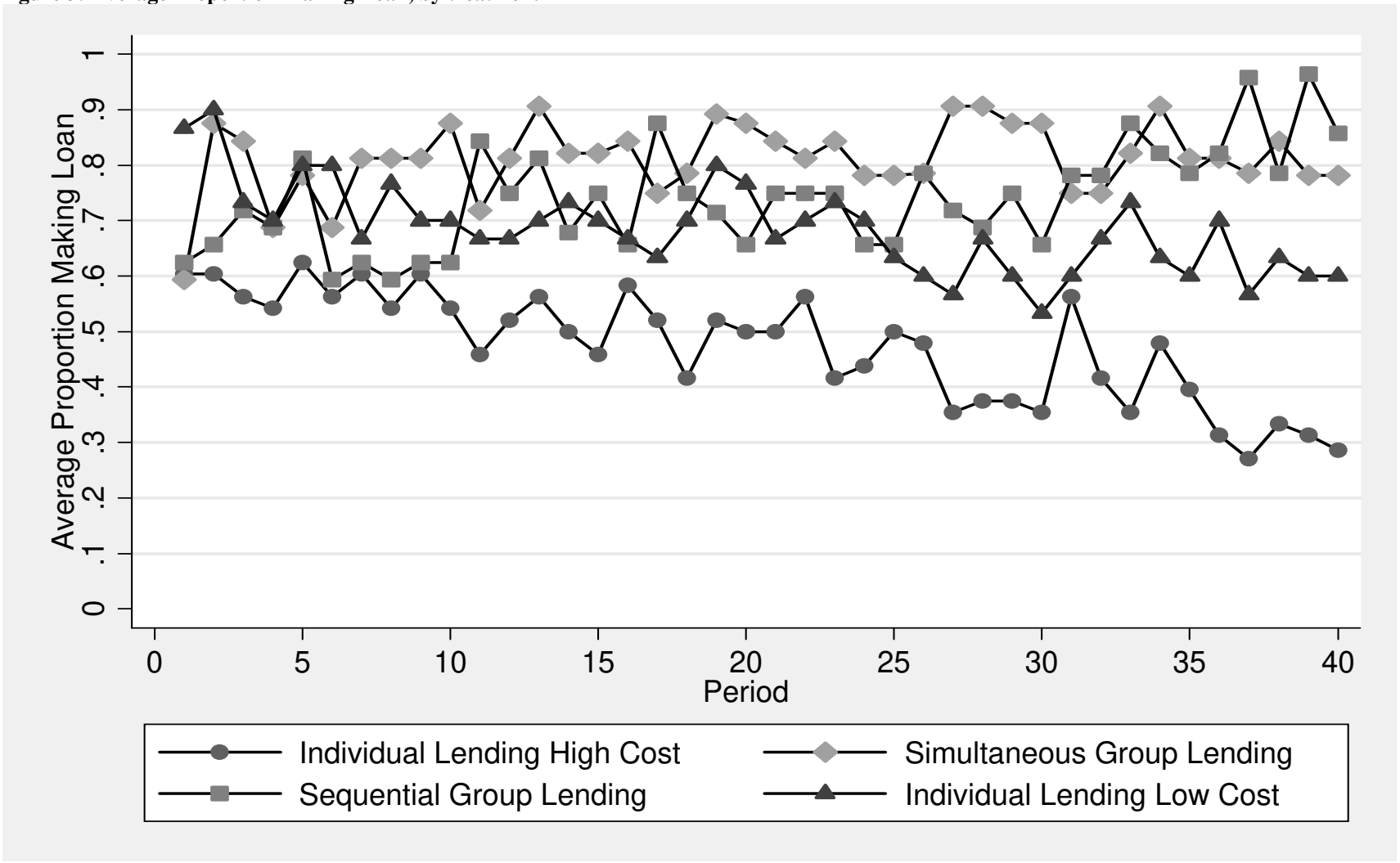
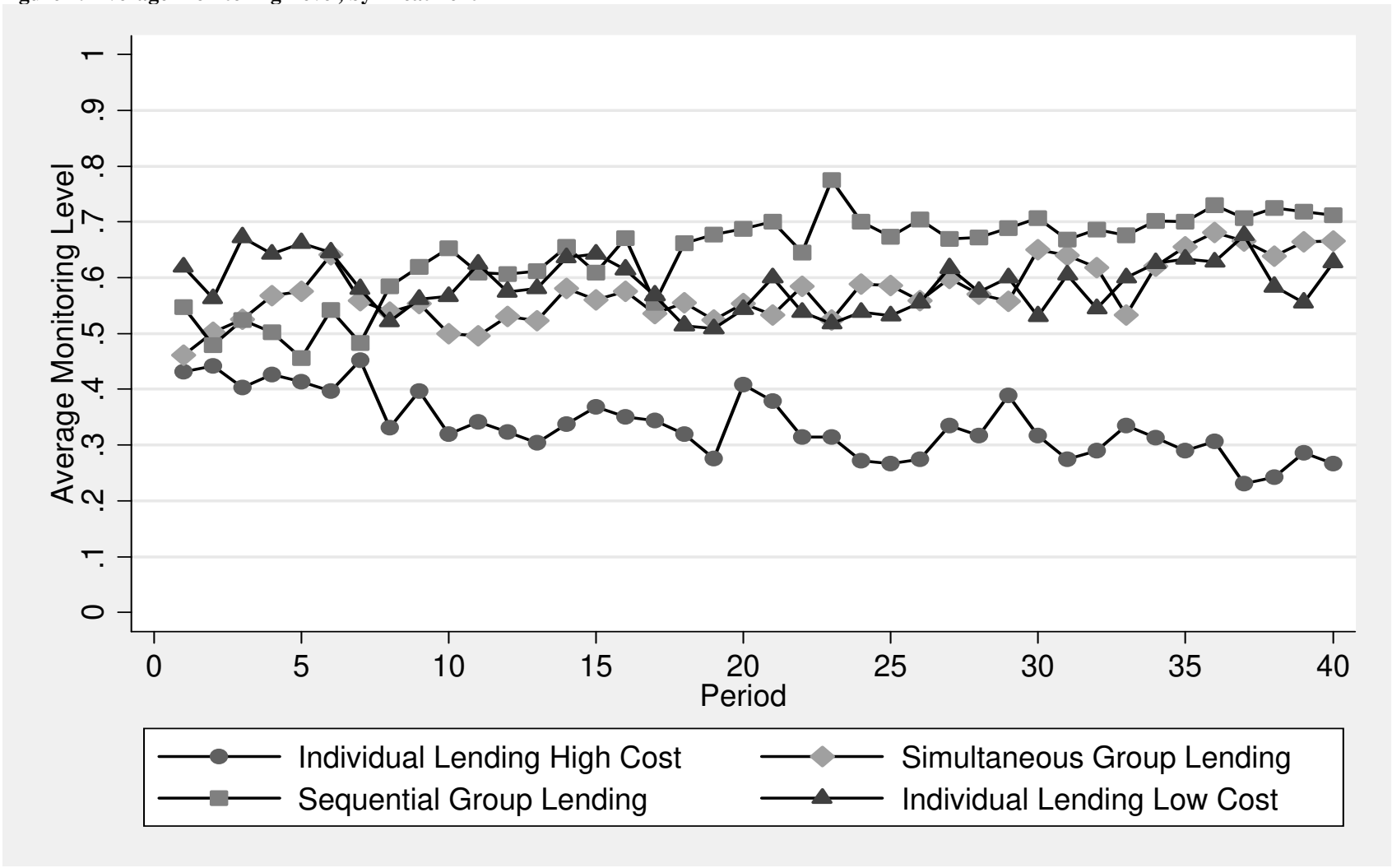


Figure 4: Average Monitoring Level, by Treatment



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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?

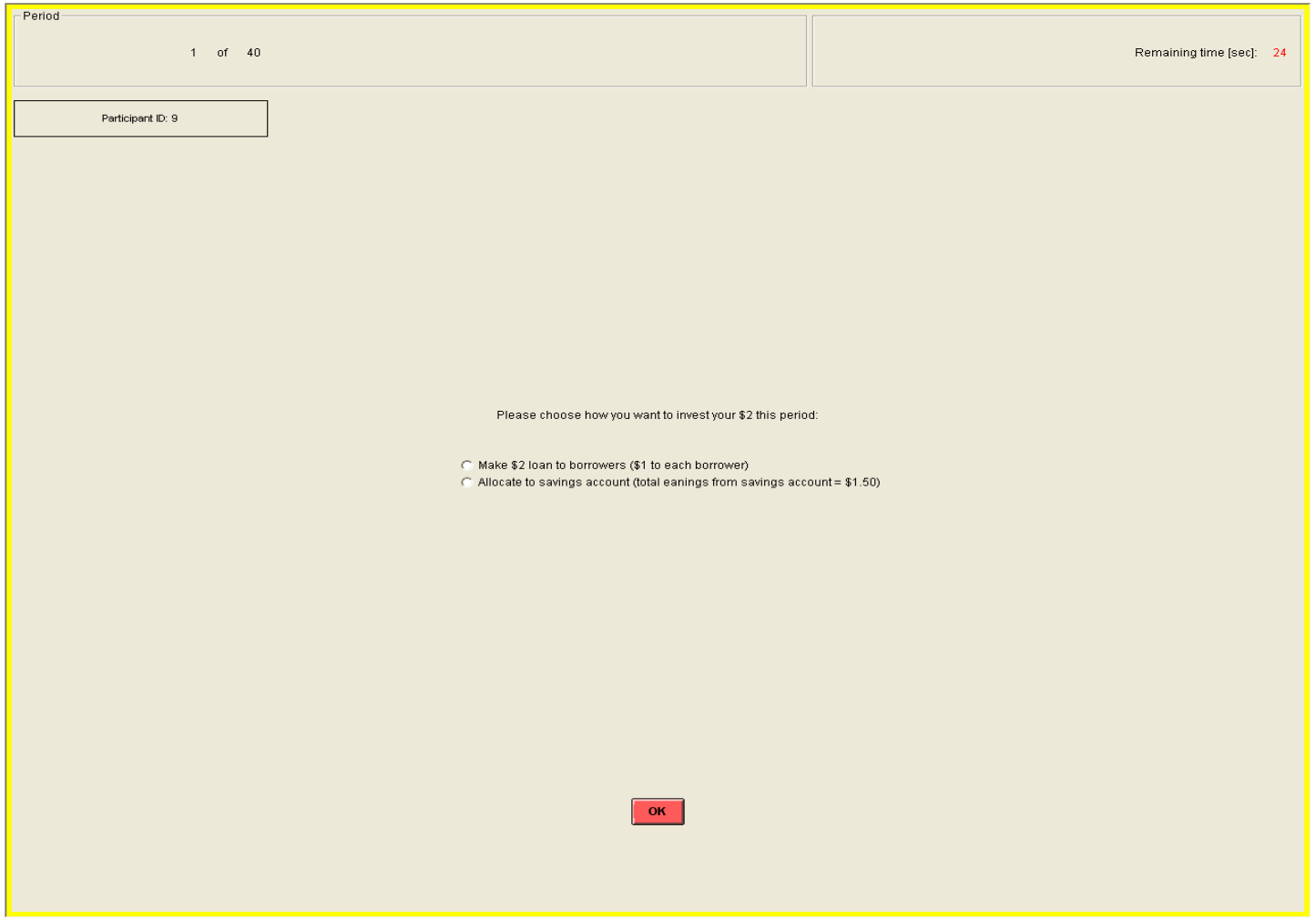

Figure 1: Lender's loan decision screen

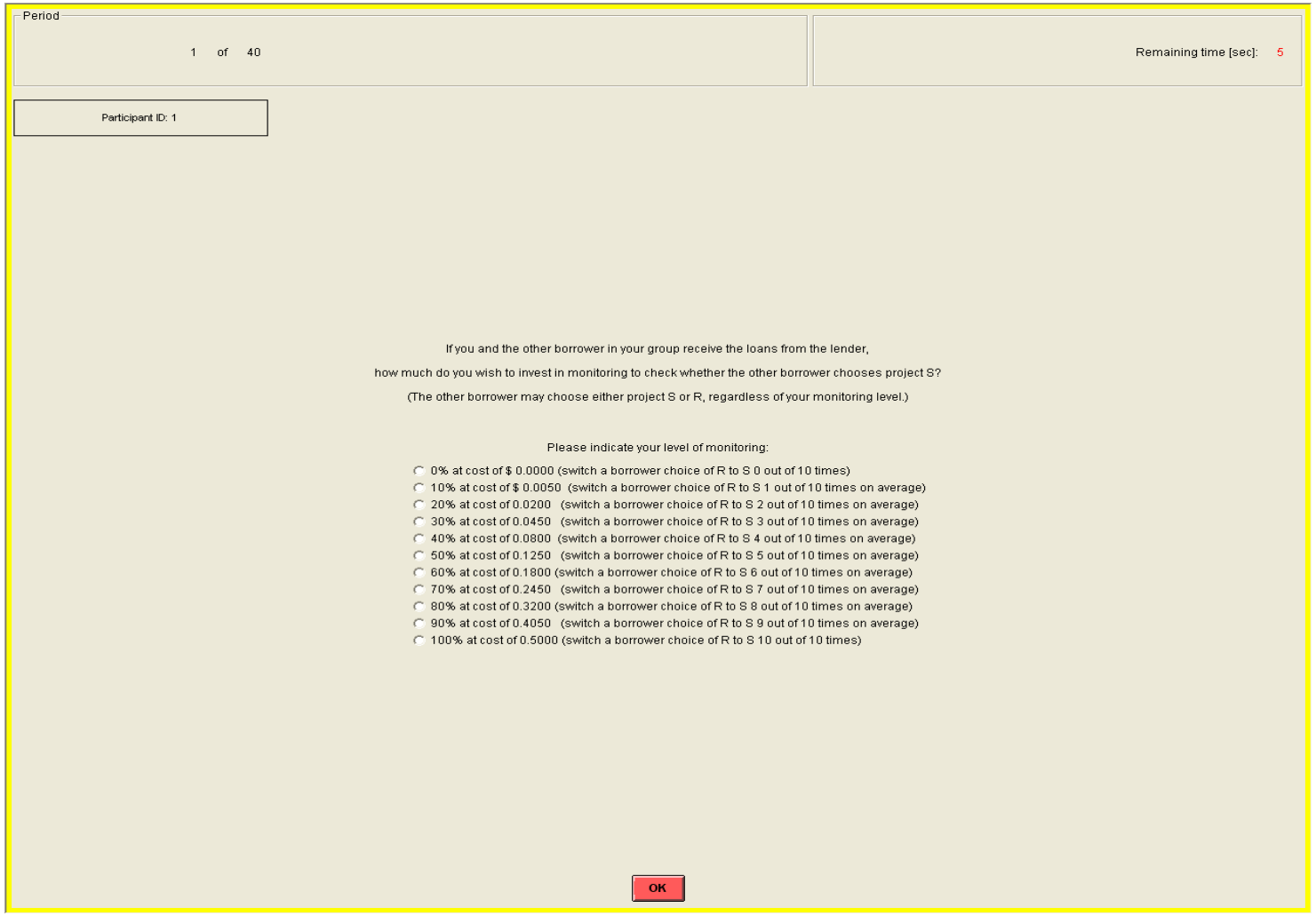

Figure 2: Borrower's monitoring decision screen

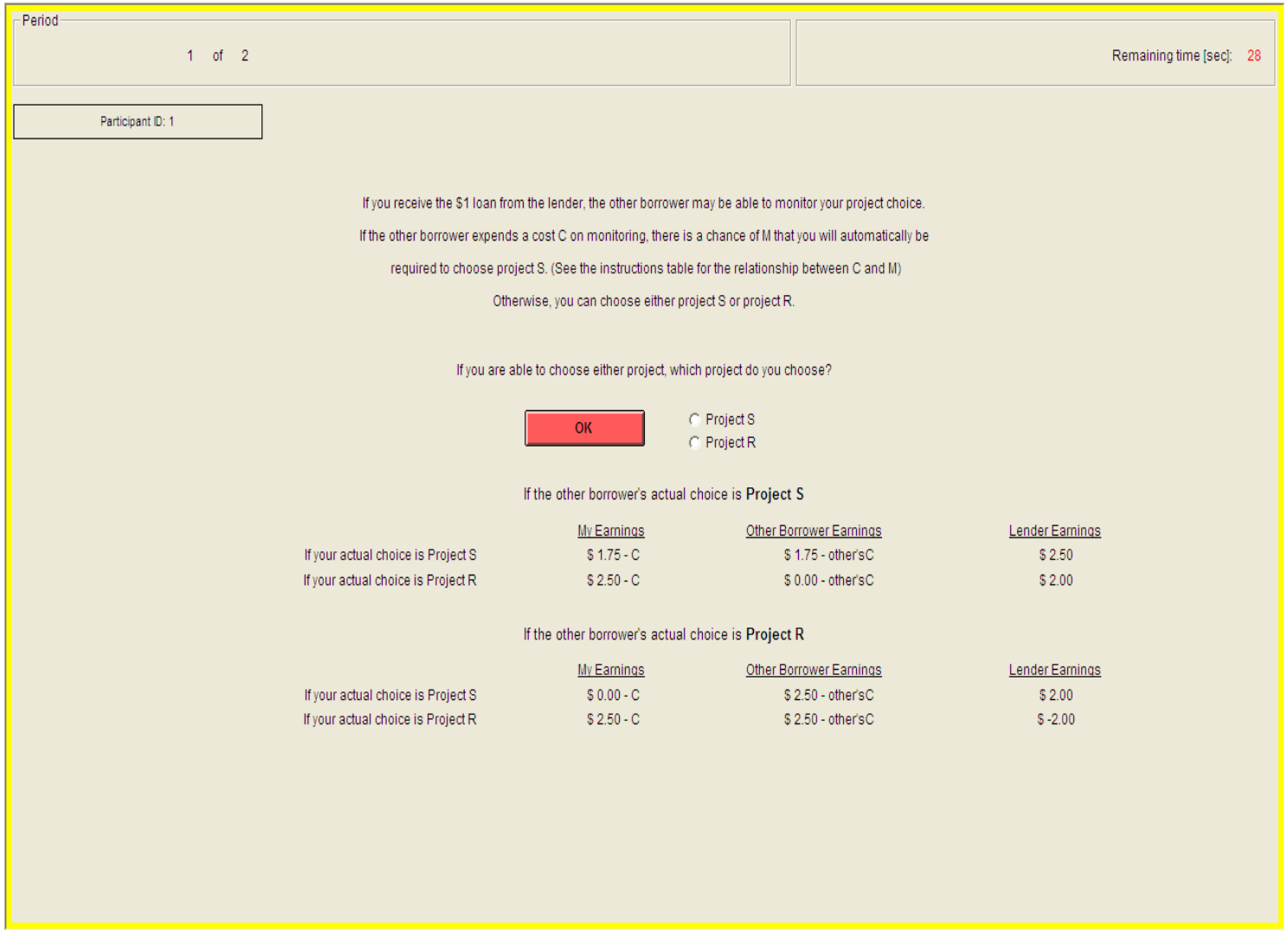

Figure 3: Borrower's project decision screen

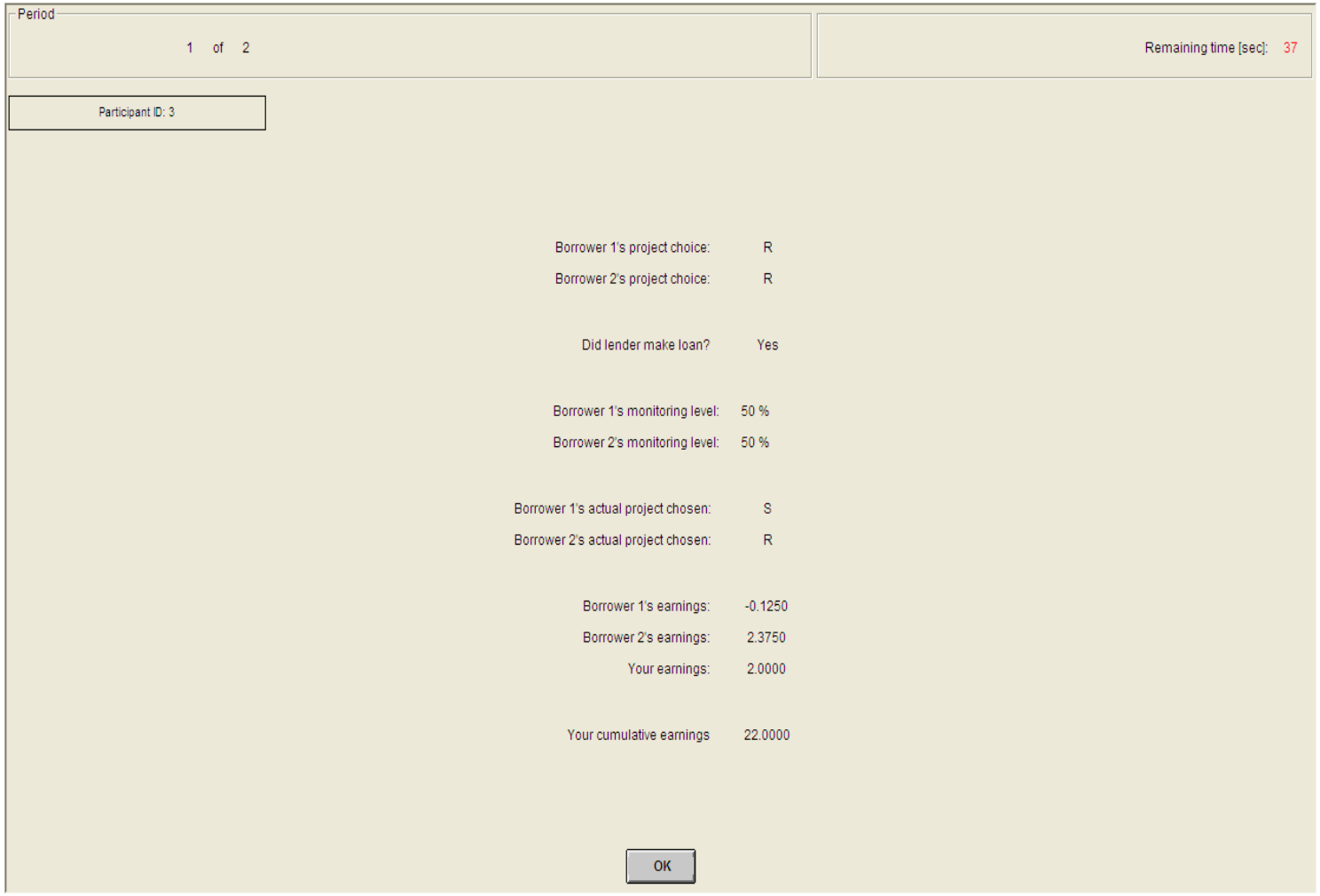

Figure 4: Example output screen

Quiz

Participant ID: _____

Total Number of Correct Answers:

Earnings: Total Number of Correct Answers × $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				