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**ASYMMETRIC GROUP LOAN CONTRACTS:
EXPERIMENTAL EVIDENCE**

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Asymmetric Group Loan Contracts: Experimental Evidence

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Abstract

We design an experiment to study the role of (a)symmetry in the context of group lending with joint liability. The performance of joint-liability contracts crucially hinges on borrowers engaging in peer monitoring. We find that asymmetric contracts, in which monitoring is a dominant strategy for one borrower, increase the monitoring rate, and thus the repayment rate and performance. Moreover, asymmetric contracting also increases expected profits of the lending institution. Overall, our results suggest that asymmetric joint-liability contracts are worth considering as part of a policy to maintain financial stability.

JEL Codes: C91, C92, G21, O16.

Keywords: group loan contracts, asymmetric contracts, joint liability, coordination game, microfinance, laboratory experiment.

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1 Introduction

Group loan contracts with joint liability are a common tool used by microfinance institutions in developing countries to lend to borrowers who have no collateral. For example, De Quidt et al. (2018) document that between 2008 and 2014, joint-liability contracts covered about 30% of the global microcredit market.¹ The popularity of such contracts was spurred by the theoretical argument that joint liability induces peer monitoring among borrowers, which mitigates problems arising from informational and enforcement frictions between the microfinance institution (MFI) and the borrowers (Banerjee et al., 1994; Stiglitz, 1990; Varian, 1990), especially in communities with a high level of social connectedness (Besley and Coate, 1995). In recent years, however, joint-liability loans have become less popular, and a shift can be observed towards individual-liability loans: the fraction of joint-liability contracts in the microcredit market went down from 32% to 24% (De Quidt et al., 2018). This evolution is consistent with recent evidence from behavioral experiments indicating that group loan contracts with joint liability do not necessarily increase repayment rates above what is achieved with individual contracts (e.g. Attanasio et al., 2015; Cason et al., 2012; Giné and Karlan, 2014).²

A crucial question is whether joint-liability contracts can be designed so as to guarantee high performance and high repayment rates. One way to achieve this is to maximize the extent of peer monitoring among the borrowers. This paper shows in an experiment that the likelihood of peer monitoring can be increased if MFIs build asymmetries in their contracts. Specifically, if monitoring is made a dominant strategy for one borrower (the leader), then monitoring is the best response for the other borrower as well. Using such a strategy may allow an MFI to break collusion among borrowers who jointly refuse to monitor each other. We find that with asymmetric contracts the monitoring rate is up to 60 percentage points higher than with symmetric contracts. The consequence is that asymmetric contracts generally result in positive profits for

¹See also Armendáriz de Aghion and Morduch (2010) and Ghatak and Guinnane (1999) for detailed accounts of the economics of microfinance.

²See Abbink et al. (2006) for an experiment showing that individual contracts outperform group lending in a case without monitoring opportunities. Cason et al. (2012) show that group loan contracts outperform individual contracts only if peer monitoring is relatively less costly.

the MFIs, in contrast to symmetric contracts.

The experiment is inspired by the game-theoretic model of Carli and Uras (2017) in which an MFI is faced with two *ex ante* symmetric borrowers who make a private investment. The borrowers can choose whether to monitor each other's investments, and monitoring is non-observable to the MFI and costly.³ If a borrower monitors her peer, then the latter behaves diligently, which leads her investment project to have positive net present value. If a borrower does not monitor her peer, however, the latter can behave neglectfully and reduce the profitability of her project. The crux of the model is contained in the borrowers' monitoring choices. If the terms of repayment are the same for both borrowers, they both have a strong incentive not to monitor if they believe the other will not monitor. The consequence is that a multiplicity of equilibria exists, including a low-performance outcome in which none of the two borrowers monitors. Instead, if the repayment terms are set up such that one borrower is strongly rewarded for monitoring, then both buyers' monitoring becomes the unique equilibrium in the borrower's monitoring game.

The experiment focuses on the monitoring game with two borrowers. Participants in the role of borrower choose whether to monitor the other or not. They make this choice 20 times. After each round of decision-making they are informed about the outcomes and the choice of the matched borrower. In part of the treatments, participants are randomly re-matched to another partner-borrower after each round, as is the case in microfinance programs in which groups may consist of strangers (e.g. FINCA in Peru, discussed by Karlan, 2007). In the other treatments the partner-borrower is fixed for all twenty rounds, with the intention to mimic a repeated relationship between borrowers. Such relationship is present in programs that allow people with former ties to form groups (e.g. FUNDAP in Guatemala, discussed by Wydick, 1999). Participants are randomly allocated to a treatment in which contract terms are symmetric or to a treatment in which contract terms are asymmetric. We thus establish the causal effect of asymmetry in contracts on the rate of peer monitoring and other outcomes.

Asymmetry increases the monitoring rate in our experiment independent of the

³The model builds upon Stiglitz (1990) but relaxes the assumption that peer monitoring comes at no costs for the lender.

matching protocol. In the case of random partners, asymmetry increases the monitoring rate with 60 percentage points whereas with fixed partners the increase is equal to 45 percentage points. Overall, a monitoring equilibrium occurs around 60% of the time with asymmetric contracts versus 8% or less with symmetric contracts, and the expected MFI profit is positive with asymmetric contracts, while it is negative with symmetric contracts.

Our paper adds to the literature that studies how the performance of microfinance contracts can be improved. For instance, Field and Pande (2008) evaluate the effect of repayment frequency on default rates in a field experiment ran in India, and find no difference between monthly and weekly repayment schedules. Transaction costs for borrowers can thus be decreased without changing the default rate. Giné et al. (2010) show in an experiment ran in Peru that installing dynamic incentives can be beneficial for an MFI. They find that cutting off defaulting borrowers from access to future finances reduces the tendency to invest in high-risk projects, and thus increases the likelihood of repayment. Our paper complements these studies by showing that asymmetry in contracts is another policy tool that may improve the performance of joint-liability contracts.

The remainder of the paper is organized as follows. In Section 2 we provide the theoretical background. In Section 3 we discuss the experimental design and procedures. In Section 4 we show the results. Section 5 concludes.

2 Theoretical background

The model of Carli and Uras (2017) assumes there are three agents in the economic environment: an MFI and two identical borrowers. Each borrower has access to a set of mutually exclusive investment projects, namely a *good* project and a *bad* project. Each project requires one unit of cash investment and generates a verifiable financial return equaling either 0, in the case of failure, or θ , in the case of success. The probability of success of the good project (p) is greater than that of the bad project (p_B), i.e., $p > p_B$. The bad project yields a non-pledgable private benefit worth $B > 0$ to the borrower whereas the good project does not. The private benefit B can be interpreted as the borrower's opportunity cost of managing the project diligently.

Both borrowers need 100% external MFI finance to operate an investment project.

Figure 1: Timing

Because the project choice is not observed by the MFI, in the absence of the right incentives, borrowers choose opportunistically and prefer projects that are not necessarily profit-maximizing for the MFI. Key in the model is that the MFI can incentivize the borrowers' investment choices by relying on *peer monitoring*. Peer monitoring refers to the borrowers' costly monitoring of one another. Because peer monitoring is non-observable to the MFI, and thus non-contractible, the delegation of monitoring to the borrowers is not trivial.

The sequence of events corresponds to a dynamic game consisting of two stages, described in Figure 1. We start by discussing the second stage and then move to the first stage. In the second stage each borrower privately chooses a project option conditional on the first-stage outcomes. Formally, given a first-stage history h , borrower i 's feasible actions in the second stage are described by the set $\mathcal{A}_i^h \subseteq \{0, B\}$. The action B corresponds to the borrower investing in the bad project, which has success probability p_B and yields private benefit B . The action 0 corresponds to the borrower investing in the good project, which has probability of success p and yields no private benefit to him. At the end of the second stage the borrowers' investment outcomes realize. We define $s_i \in \{H, L\}$ to be the realization of borrower i 's project with H denoting the high state with return θ and L the low state with zero return. At the end of the second stage borrowers repay and all agents consume.

In the first stage the MFI offers a group lending contract to the borrowers. Borrowers are protected by a limited liability clause, which implies that repayments to the MFI cannot exceed the project output and cannot be negative in any contingency. Individual-specific repayments, however, can be conditioned on the realization of one's

own project as well as the peer's project outcomes. A group lending contract is thus a collection of repayments, $(R_i^{s_1, s_2})_{i=1,2}$, contingent on the realizations of the two projects.⁴ Borrowers decide whether to accept (A) or reject (R) the group lending contract. If they both accept, borrowers choose the monitoring effort $\delta_i \in \{n, m\}$, where $\delta_i = m$ if borrower i monitors his peer and $\delta_i = n$ if he does not. By exerting monitoring effort a borrower incurs a disutility of ψ but eliminates the bad project from the set of feasible investments of the peer. Formally, the first-stage monitoring outcome determines the first-stage history, i.e., $h \in \{n, m\} \times \{n, m\}$, which in turn dictates the borrowers' set of feasible actions in the second stage, $\mathcal{A}_i^h$, for $i = 1, 2$. The MFI cannot observe or verify the extent of peer monitoring.

Whether asymmetry of contractual terms has an effect on the monitoring choice of the borrowers is theoretically relevant if and only if the following assumptions hold:

- A1. $p\theta > 1 > p_B\theta$.
- A2. $\frac{p}{p - p_B}B > p\theta - 1$.
- A3. $\psi \leq \min \left\{ \frac{p_B B}{p}, \theta p_B(p - p_B), \frac{2p_B(p\theta - 1)(p - p_B)}{p^2 + pp_B} \right\}$.
- A4. $\psi \leq \min \left\{ \frac{p_B}{p + p_B}B, \left(\frac{p - p_B}{p} \right)^2 p_B\theta \right\}$.

Assumption A1 guarantees that the good project has positive net present value whereas the bad project's pledgeable portion has negative net present value, making the implementation of the latter undesirable to the MFI. Assumption A2 ensures that the MFI can incentivize borrowers' diligent behavior only through peer monitoring, i.e., by using a group loan contract. Individual lending is not profitable because the information rents that the MFI needs to give to a borrower in order to take the good project exceed the project's net present value. Assumptions A3 and A4 together provide necessary and sufficient conditions for the existence and the optimality of a group loan contract that motivates both borrowers to monitor the peer borrower.

Under these four assumptions, the optimal contract has two important features (Proposition 5.4 and Lemmas 5.5 and 5.6 in Carli and Uras, 2017). First, it exhibits joint

⁴For instance, $R_1^{H,L}$ is borrower 1's repayment when her project return is in the high state, $s_1 = H$, while borrower 2's project return is in the low state, $s_2 = L$.

liability, i.e., $R_1^{HL} > R_1^{HH}$, $R_2^{LH} > R_2^{HH}$. Borrowers are liable for their peer's low investment return; if not, they would have no incentives to monitor. Indeed, if $R_1^{HH} = R_1^{HL}$ and $R_2^{HH} = R_2^{LH}$, no borrower would monitor her peer. Second, the contract includes an asymmetric treatment of *ex ante* identical borrowers, i.e., $R_1^{HH} < R_2^{HH} < R_2^{LH} = R_1^{HL}$. In particular, borrower 1 (the leader) gets rewarded with a lower required repayment when both borrowers succeed and, thus, her expected repayments are smaller than those of borrower 2.⁵ Asymmetric treatment of borrowers is part of the optimal contract, and yields a unique equilibrium in the monitoring subgame. If the contracts were symmetric, there would be a second Nash equilibrium in the borrowers' monitoring subgame because of the strategic complementarities between borrowers' monitoring decisions (Proposition 6.1 in Carli and Uras, 2017). In this second equilibrium each borrower chooses not to monitor her peer and then invests in the bad project yielding private benefit B . Therefore it can be expected that the extent to which borrowers monitor each other, and repay, is (weakly) lower if no asymmetry is included in the contracts.

Whether contractual asymmetry increases or decreases expected MFI profits, as compared to symmetric contract terms, depends on (i) the repayment schedule that is optimally determined by the group loan contract, and (ii) the borrowers' monitoring behavior. There are two countervailing effects at work. On the one hand, mobilizing monitoring by the leader by means of an asymmetric contract induces additional costs for the MFI. On the other hand, by using an asymmetric contract the MFI can avoid losses associated with a no-monitoring equilibrium. Which of the two effects dominates thus depends on the equilibrium arrived at when contracts are symmetric. Formally, in a monitoring equilibrium the MFI obtains

$$\begin{aligned}
 EV_{MFI}^A &= \underbrace{\left\{ p\theta - 1 - \frac{p}{p_B} \cdot \frac{p}{p - p_B} \psi \right\}}_{\text{Borrower1}} + \underbrace{\left\{ p\theta - 1 - \frac{p}{p - p_B} \psi \right\}}_{\text{Borrower2}}, \\
 EV_{MFI}^S &= \underbrace{\left\{ p\theta - 1 - \frac{p}{p - p_B} \psi \right\}}_{\text{Borrower1}} + \underbrace{\left\{ p\theta - 1 - \frac{p}{p - p_B} \psi \right\}}_{\text{Borrower2}},
 \end{aligned}$$

⁵Without loss of generality, we are assuming here that the optimal contract selects borrower 1 to be the group leader. The leader selection process can be easily performed through a fair lottery, in which case borrowers have equal chances of becoming the leader.

where EV_{MFI}^A is MFI's expected profits with asymmetric contracts and EV_{MFI}^S is MFI's expected profits with symmetric contracts, when both borrowers monitor their peer. In both expressions the first term is the expected repayment of borrower 1 (the leader) and the second term is the expected repayment of borrower 2. Given that $p > p_B$, borrower 2's expected repayment is the same in both cases whereas borrower 1's expected repayment is lower with asymmetric contracting. In the equilibrium with symmetric contracts where borrowers do not monitor their peer the MFI's expected profits are equal to

$$EU_{MFI}^S = \underbrace{\left\{ p_B \theta - 1 - \frac{p_B}{p} \frac{p_B}{p - p_B} \psi \right\}}_{\text{Borrower1}} + \underbrace{\left\{ p_B \theta - 1 - \frac{p_B}{p} \frac{p_B}{p - p_B} \psi \right\}}_{\text{Borrower2}} < 0.$$

3 Experiment and hypothesis

Design In the experiment we focus on the monitoring behavior of the borrowers. We assume that the borrowers have accepted the terms of the loan contract proposed by the MFI at the beginning of the first stage of the (monitoring) game. Moreover, we assume that in the second stage borrowers behave according to the subgame perfect Nash equilibrium; they optimally choose a good or bad investment project conditional on the outcome of the monitoring stage.⁶ Doing so allows us to study the monitoring behavior of the borrowers — which is at the core of the theoretical model — in a clean way, thereby ruling out possible confounds due to non-optimizing behavior in other stages of the game.

This leads to a decision-making setting in which two borrowers choose whether to monitor each other (M) or not (N), and where the contract is either symmetric or asymmetric. Figure 2 shows the payoffs of the borrowers depending on the choices they make. With a symmetric contract there exist two equilibria in pure strategies, namely (M, M) and (N, N), whereas with an asymmetric contract, the game has a unique pure-strategy equilibrium, namely (M, M). The payoffs are based on a parameterization of the Carli-Uras model described above that ensures that none of the two equilibria in the game with symmetric contracts are risk dominant (see Section B of the Appendix

⁶For each combination of first-stage choices, there exists a unique optimal second-stage choice.

Figure 2: Monitoring games in the experiment

(a) Symmetric contract		(b) Asymmetric contract	
		2	
		M	N
1	M	5 , 5	8 , 4.5
	N	4.5 , 8	8.5 , 8.5

		2	
		M	N
1	M	9 , 5	10 , 4.5
	N	6 , 8	9.5 , 8.5

Notes: The figure depicts decision-making and related payoffs for borrowers labeled 1 and 2 when the contract is symmetric (left-hand-side panel) or asymmetric (right-hand-side panel). M refers to monitoring and N to non-monitoring. Numbers at the left (right) of the parentheses refer to the payoffs of borrower 1 (2).

for details).⁷

Participants in the experiment played 20 rounds of the symmetric or asymmetric monitoring game. At the end of each round they were informed about the choice of the matched partner and realized payoffs in that round. In all treatments participants kept the same role (borrower 1 or 2) throughout.

We implemented two different matching protocols which varied between treatments. In the *random partners* treatments participants were randomly re-matched with another participant after each round of play.⁸ The purpose was to mimic the one-shot nature of the theoretical model in Carli and Uras (2017) as closely as possible. In the *same partner* treatments, participants were matched to the same partner for all rounds. From these treatments we aim to learn whether the model's equilibrium predictions are valid if borrowers are involved in repeated interaction, which is often present in real-world loan markets.

Table 1 gives an overview of the number of sessions, independent observations and participants in each of the treatments. The table also shows that the treatments were balanced in terms of the share of female participants, the share of economics students, the share of European students and the year of study.

⁷Risk dominance is key for predicting which equilibrium behavior in experiments converges in games with multiple equilibria (e.g. Battalio et al., 2001; Cooper et al., 1990; Schmidt et al., 2003).

⁸Participants were randomly re-matched in matching groups of 10 participants each but they were unaware of the size of the matching group.

Table 1: Information on treatments

	<i>Random partners</i>		<i>Same partner</i>		Total
	<i>Symmetric</i>	<i>Asymmetric</i>	<i>Symmetric</i>	<i>Asymmetric</i>	
# Sessions	2	2	2	2	7
# Participants	36	40	24	28	128
# Independent obs.	4	4	12	14	34
Female (in %)	58,7	47,7	61,1	65,1	56,9
Economics (in %)	87,3	87,7	47	55,8	72,4
European (in %)	58,7	79,1	70,3	59	69,1
Year of study	2018,5	2018,4	2017,1	2017,2	2017,9

Notes: Independent observations refer to matching groups (in the case of random partners) or to pairs of matched borrowers (in the case of same partners). Matching groups consisted of 10 participants.

Procedures The experiment was conducted in May and October, 2019, in CentERlab at Tilburg University, and has been pre-registered (Carli et al., 2019). Participants were recruited by email among students who had indicated a willingness to take part in experiments. Upon arrival in the lab, they were randomly allocated to a computer terminal and were distributed instructions. To ensure incentive-compatibility, the instructions were written in neutral language (see Appendix A). To ensure a sufficient understanding of the instructions, participants had to correctly answer comprehension questions prior to making choices.

Participants were informed that earnings in Euros would depend on their choices and the choices of others as indicated in the games shown in Figure 2. They were informed that at the end of the experiment one round would be randomly selected for payment.

Research hypothesis We build our hypothesis upon the model discussed in Section 2, focusing on the effect of asymmetry of contract terms on the extent of monitoring, which is directly connected to the likelihood of ending up in the full monitoring equilibrium (M, M). Specifically, our hypothesis is:

The percentage of monitoring is higher in the asymmetric treatments than in the symmetric treatments, controlling for the matching protocol.

Our experiment allows us also to infer the effect of symmetry of contract terms on MFI profits. If the monitoring rate is substantially higher with asymmetric contract

terms than with symmetric contract terms, then it can be expected that MFI profits are higher in the former than in the latter case.

4 Results

We study the effect of asymmetry of contracts on the rate at which participants in the role of borrower choose to monitor. Figure 3 shows the monitoring rate averaged over all 20 rounds by treatment, and Figure 4 shows the evolution of the monitoring rate by treatment. As can be seen in both figures, asymmetry of contracts strongly increases the monitoring rate. This holds independent against whether interactions take place with random partners or with the same partner. Our research hypothesis is thus confirmed.

With random partners asymmetry increases the monitoring rate from 18.9% to 80% ($p < 0.001$). If borrowers keep the same partner across rounds, then the monitoring rate increases from 14.2% to 63.7% ($p < 0.001$).⁹ As shown in Figure 4 the effect of asymmetry with random partners appears already in the first round. In sessions where participants are matched to the same partner, the effect takes a few rounds of interaction to be established.

The implication of the observed behavior for outcomes is that random partners end up 66% of the time in the monitoring equilibrium with asymmetric contracts versus 3% of the time with symmetric contracts. A non-monitoring outcome, in which both borrowers choose not to monitor, is observed 6% of the time with asymmetric contracts and 66% of the time with symmetric contracts (recall that only in the latter case did both borrowers not monitoring constitute an equilibrium). In the same partner treatments we find that borrowers with asymmetric contracts are 56% of the time in the monitoring equilibrium and 29% in the non-monitoring equilibrium. Borrowers with symmetric contracts are 8% of the time in a monitoring equilibrium and 80% of the time in a non-monitoring equilibrium.

Another important question is whether the difference in monitoring rates between asymmetric and symmetric treatments is large enough to generate a difference in MFI

⁹Reported p -values are from probit regressions in which the dependent variable is regressed on a binary *asymmetric* treatment variable. The dependent variable is a binary variable indicating whether a participant chooses to monitor in a particular round. Standard errors are robust to clustering at the level of independent observations. Results are reported in Table C.1 in the Appendix.

Figure 3: Monitoring rate by treatment

Notes: The figure shows the monitoring rate by treatment. Error bars correspond to 95% confidence intervals estimated in probit regressions in which the dependent variable (equal to 1 if choice equals M) is regressed on an *Asymmetric* treatment dummy (see Table C.6 in the Appendix for details).

Figure 4: Evolution of monitoring rate

profits. The quantitative results indicate that the profits are indeed larger in the asymmetric treatment. Specifically, computing profits using the parameterized model for the case of random partners leads to a positive profit for the MFI with asymmetric contracts of 0.115 and a loss of -0.083 with symmetric contracts (statistically significant difference with $p < 0.001$). If the partner remains the same, the MFI earns a profit of 0.032 in the case of asymmetric contracts and of -0.123 in the case of symmetric contracts (with a statistically significant difference with $p < 0.001$).

These results imply that asymmetric contracts lead to financial stability and higher

expected MFI profits. The causal effect of asymmetry on monitoring is thus large enough to induce higher (relative) profits. It is important to highlight that the causal effect on monitoring behavior and MFI profits is robust to the matching protocol (random partners versus same partner).

5 Discussion

Understanding the efficiency of group loan contracts with joint liability is essential for the design of optimal financial development policies and for improving financial inclusion. These contracts have been pervasively used by MFIs in developing countries and have received theoretical back-up. Yet a number of empirical and theoretical studies cast doubt on their performance. We show in an experiment inspired by Carli and Uras (2017) that performance can be increased if the MFI introduces asymmetric, borrower-specific contract terms that make monitoring a dominant strategy for one borrower (the leader). Such asymmetry breaks coordination by borrowers who jointly refuse to monitor each other, and mobilizes peer monitoring, which in turn increases the probability of repayment.

Asymmetric contracts of the type studied may be particularly attractive in cases or circumstances where joint-liability contracts have not performed well in the past or are expected to lead to financial instability. Examples include cases in which the borrower groups consist of clients with little interpersonal trust or weak social ties (see e.g. Besley and Coate, 1995; Cassar et al., 2007; De Quidt et al., 2018; Hermes et al., 2006, 2005; Karlan, 2007; Paxton et al., 2000). In such a context Paxton et al. (2000), Hermes et al. (2005) and Hermes et al. (2006) find that the quality of the group leader is positively related to its repayment performance, which could be seen as evidence for the fact that the group leader plays a prominent role in screening, monitoring and enforcing repayment within a group. That said, we find that in the treatment with random partners, which is arguably closest to the case of weak social ties, asymmetric contracts achieve a monitoring rate of 80%. This is almost 17 percentage points higher than that in the treatment where partners remain the same throughout the experiment. Although the difference is statistically not significant ($p = 0.118$), the qualitative effect is quite substantial and relates to Paxton et al. (2000) and Wydick (1999), who show that strong social ties do not improve loan repayment performance of the group, and

may even have a negative effect.¹⁰

Finally, our results are relevant for forms of group lending that do not rely on joint liability, such as, for example, fintech crowdfunding lending. On crowdfunding platforms borrowers can form groups to develop a reputation and to reduce information asymmetries vis-à-vis a large number of investors. Remarkably, Freedman and Jin (2017) find that in the context of crowdfunding social ties could weaken group loan performance due to easing up collusive behaviour among borrowers. Moreover, empirical research by Iyer et al. (2016) and Hildebrand et al. (2017) shows that group loan contracts outperform individual contracts in terms of repayment in this context, and highlights that the presence of a leader-borrower is key for the performance of group loans. Interestingly, Hildebrand et al. (2017) show that the unconditional compensation of group leaders does not raise performance of group loans in crowdfunding. Our results suggest that if compensations were to take the form of conditional rewards, the repayment performance of the group may in fact increase also in the context of crowdfunding group loans.

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¹⁰Paxton et al. (2000) show that the homogeneity of the group in terms of ethnicity reduce repayment performance using data from a group-lending program in Burkina Faso. Wydick (1999), shows an insignificant effect of social ties on group loan performance in an experimental setting.

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Appendix

A Experimental Instructions

A.1 Treatment *Symmetric Random Matching*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in “Points.” The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of each round, you will be randomly matched with another participant.

Each round in the experiment will consist of 2 stages:

1. In the first stage you and the other participant will simultaneously choose between two options: option A or option B.
2. In the second stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both choose A	5	5
You choose A and the other chooses B	8	4.5
You chooses B and the other chooses A	4.5	8
Both choose B	8.5	8.5

In other words:

- If you both choose A, you will receive 5 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 8 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 4.5 points, and the other participant will receive 8 points.

A.2 Treatment with *Asymmetric* contracts and *Random* partners

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in “Points.” The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of each round, you will be randomly matched with another participant.

Each round in the experiment will consist of 3 stages:

1. In the first stage you will randomly be assigned a type. You can either be Type 1 or Type 2.
2. In the second stage you and the other participant will simultaneously choose between two options: option A or option B.
3. In the third stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both Types choose A	9	5
Type 1 chooses A and Type 2 chooses B	10	4.5
Type 1 chooses B and Type 2 chooses A	6	8
Both Types choose B	9.5	8.5

In other words:

- If you are Type 1 and the other participant is Type 2:

- If you both choose A, you will receive 9 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 9.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 10 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 6 points, and the other participant will receive 8 points.

- If you are Type 2 and the other participant is Type 1:

- If you both choose A, you will receive 5 points, and the other participant will receive 9 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 9.5 points.
- If you choose A and the other participant chooses B, you will receive 4.5 points, and the other participant will receive 10 points.
- If you choose B and the other participant chooses A, you will receive 8 points, and the other participant will receive 6 points.

A.3 Treatment with *Symmetric* contracts and *Same partner*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in “Points.” The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of the first round, you will be randomly matched with another participant. You will remain matched with this participant for 20 rounds.

Each round in the experiment will consist of 2 stages:

1. In the first stage you and the other participant will simultaneously choose between two options: option A or option B.
2. In the second stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both choose A	5	5
You choose A and the other chooses B	8	4.5
You chooses B and the other chooses A	4.5	8
Both choose B	8.5	8.5

In other words:

- If you both choose A, you will receive 5 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 8 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 4.5 points, and the other participant will receive 8 points.

A.4 Treatment *Asymmetric Partner Matching*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in “Points.” The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of the first round, you will be randomly matched with another participant. You will remain matched with this participant for 20 rounds.

Each round in the experiment will consist of 3 stages:

1. In the first stage you will randomly be assigned a type. You can either be Type 1 or Type 2.
2. In the second stage you and the other participant will simultaneously choose between two options: option A or option B.
3. In the third stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both Types choose A	9	5
Type 1 chooses A and Type 2 chooses B	10	4.5
Type 1 chooses B and Type 2 chooses A	6	8
Both Types choose B	9.5	8.5

In other words:

- If you are Type 1 and the other participant is Type 2:

- If you both choose A, you will receive 9 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 9.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 10 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 6 points, and the other participant will receive 8 points.

- If you are Type 2 and the other participant is Type 1:

- If you both choose A, you will receive 5 points, and the other participant will receive 9 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 9.5 points.
- If you choose A and the other participant chooses B, you will receive 4.5 points, and the other participant will receive 10 points.
- If you choose B and the other participant chooses A, you will receive 8 points, and the other participant will receive 6 points.

B Parameterization of the model in the experiment

First, we choose parameters in the experimental games such that assumptions A1-A4 hold. The only additional feature that we introduce relative to the optimal contract by Carli and Uras (2017) is that monitoring is a strictly dominant strategy for the group leader. We do this by reducing the group leader's repayment, R_1^{HH} , by ϵ . We choose ϵ small enough to guarantee that the profit of MFI are still positive when both borrowers exert monitoring activity.

Second, we take into account that risk dominance is an important determinant of behavior in games with multiple equilibria (Battalio et al., 2001; Cooper et al., 1990; Schmidt et al., 2003). Specifically, we choose parameters such that the non-monitoring equilibrium in the symmetric monitoring game is not risk dominant by making sure that the basin of attraction of the non-monitoring choice is the same as that of the monitoring choice (i.e., equal to 0.5). Our aim is to avoid the non-monitoring equilibrium becoming an attractor of behavior simply due to its risk dominance. Following Battalio et al. (2001); Dubois and Prade (2012), we define the basin of attraction, q , for the non-monitoring choice as follows:

$$q = (E^{M,NM} - E^{NM,NM}) / ((E^{NM,M} + E^{M,NM} - E^{NM,NM} - E^{M,M})),$$

where E^{C^1,C^2} is defined as the expected earnings for a player given her choice C^1 , and her partner's choice C^2 .

An overview of the parameters used in the experimental games is shown in Tables B.1 and B.2. Tables B.3 and B.4 show the resulting payoffs in the case of symmetric and asymmetric contracts depending on the monitoring choice of the borrowers in the first stage of the game (monitor versus not monitor) and their choice of projects in the second stage (good versus bad).¹¹ The equilibria are highlighted in bold.

¹¹We rounded the parameterized model to the nearest 0.5.

Table B.1: Parameters of the model

Variable		Variable description
p	0.85	Probability of success for the good investment project
p_b	0.41	Probability of success for the bad investment project
ψ	0.19	Monitoring costs
B	0.56	Private benefit yielded by the bad investment project
θ	1.84-2.43	Investment return in case successful
E	1	Endowment
ϵ	0.18	used to relax binding 6b

Table B.2: Repayments resulting from calibrated model

	Symmetric repayment terms	Asymmetric repayment terms
R_1^{HH}	1.15-1.74	0.61-1.20
R_2^{HH}	1.15-1.74	1.15-1.75
R_2^{LL}	0	0
R_1^{LL}	0	0
R_1^{HL}	1.84-2.43	1.84-2.43
R_1^{LH}	0	0
R_2^{LH}	1.84-2.43	1.84-2.43
R_2^{HL}	0	0

Table B.3: Payoffs in the two-stage symmetric game

		M		N	
		Good	Bad	Good	Bad
M	Good	5 , 5	.	5 , 7	.
	Bad	.	.	8 , 4.5	.
N	Good	7 , 7	4.5 , 8	7 , 7	4.5 , 10
	Bad	.	.	10 , 4.5	8.5 , 8.5

For each second-stage continuation game (i.e. each sub-game following an outcome of the monitoring choices in the first stage), the unique Nash equilibrium is indicated with bold font.

Table B.4: Payoffs in the two-stage asymmetric game

		M		N	
		Good	Bad	Good	Bad
M	Good	9 , 5	.	9 , 4.5	.
	Bad	.	.	10 , 4.5	.
N	Good	11 , 5	6 , 8	11 , 7	6 , 10
	Bad	.	.	12 , 4.5	9.5 , 8.5

For each second-stage continuation game (i.e. each subgame following an outcome of the monitoring choices in the first stage), the unique Nash equilibrium is indicated with bold font.

C Supplementary tables

Table C.1: Effect of asymmetry on monitoring

	Random partners		Same partner	
	Est. (S.E.)	M.E	Est. (S.E.)	M.E
Constant	-0.887 (0.089)		-1.073 (0.332)	
<i>Asymmetric</i>	1.729 (0.120)	0.613***	1.425 (0.373)	0.496***
Pseudo R^2	0.290		0.200	
Observations	1520		1040	
Clusters	34		22	

Notes: Estimation results (including marginal effects, M.E.) are reported from probit regressions with standard errors clustered at the level of independent observations. *Asymmetric* is a dummy variable equal to 1 in the treatments with asymmetric contracts. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.