Pay, peek, punish? Repayment, information acquisition and punishment in a microcredit lab-in-the-field experiment[*]

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October 2012

Preliminary and Incomplete: Comments welcome!

Joint liability group lending in microfinance has been shown to address adverse selection and moral hazard by seizing local private information and existing social capital. While repayment performance in group lending has been outstanding, anecdotal evidence from the field suggests that there is over-extensive peer punishment among borrowing group members. I conduct a microcredit lab-in-the-field experiment with actual microfinance borrowers in North India to analyze repayment coordination and peer punishment in joint liability group lending. Non-credible enforcement technologies such as the possibility to costly observe a peer's investment return (peer peeking) or to costly sanction a peer (peer punishment) are incorporated in the microcredit game. While non-cooperative game theory suggests little repayment and no peer peeking and punishment for this setup, I find that loan repayment is extremely high and subjects excessively peek on their peers and punish defaulters. Unwilling and strategic defaulters are punished alike, indicating that borrowing peers reluctantly mutually insure each other and penalize defaulters in any case. These experimental results match anecdotal evidence from the field. They may be better explained by social preferences than by an expected utility maximizing individual but only with an infeasible high level of altruism. Another possible alternative explanation for this behavior is that microfinance clients have internalized the credo of microfinance institutions of being a good borrower, repay the loan and discipline the peers.

Keywords: Microcredit, lab-in-the-field experiment, joint liability group lending, peer punishment
JEL categories: C92, O16

1 Introduction

Microcredit has been praised for its innovative lending techniques that circumvent problems of information asymmetries in credit markets in the absence of physical collateral. Joint liability of

borrowers within group lending structures is probably the best known innovation in microcredit. In this concept, borrowers in a lending group are jointly liable for each other's loan repayment. The lender seizes existing social capital and local information advantages among the group members to address adverse selection and moral hazard issues. High repayment rates above 95 percent have been recorded for microfinance institutions and have been attributed to the applied innovative lending techniques, in particular to joint liability (Morduch (1999)).

Theoretical models have shown that joint liability contracts in group lending can positively influence the lending group's repayment performance. Ghatak and Guinnane (1999) study theoretically how joint liability seizes local private information advantages among group members and induces peer selection, and how existing social capital induces peer monitoring and peer pressure with the threat of social sanctions. In their theoretical model, joint liability fosters mutual insurance among group members, prevents free-riding and ensures a good repayment performance for the lender.[1] Besley and Coate (1995) and Armendáriz de Aghion (1999) specifically look at the role of social sanctions in repayment enforcement and the reduction of strategic default. Both models show that if social capital can be harnessed to credibly impose the threat of peer punishment and social sanctions repayment performance is higher in group lending with joint liability compared to individual lending.

While in the theoretical models the threat of peer punishment is sufficient to induce repayment given that the lender has some means to punish group default, anecdotal evidence from the microfinance field suggests that there is extensive peer punishment. Social anthropological studies such as Rahman (1999) and Karim (2008) argue that Bangladeshi microfinance institutions instrumentalize patriarchal structures and honor and shame codes in rural societies in order to enforce loan repayment. They report cases of drastic social pressure on defaulting borrowers such as verbal harassment, shaming in public, raiding of houses to confiscate assets to sell in order to cover the loan installments and stripping down the defaulter's house completely.[2] As a consequence of observed peer pressure and insufficient mutual insurance, many microfinance institutions started to move away from joint liability contracts in favor of individual liability contracts. First and foremost among institutions making this move was the flagship of joint liability lending, the Grameen Bank in Bangladesh, that introduced individual liability in 2002 with the *Grameen Generalised System* also known as *Grameen Bank II* (Yunus (2002)). As reported in Rutherford *et al.* (2004), with the *Grameen Bank II* system the Grameen Bank strengthened its emphasis on 'tension-free microcredit' practices that do not involve any form of joint liability and

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[1] Several other models look at specific frictions and problems related to information asymmetries in credit markets and analyze how joint liability structures help to overcome adverse selection problems via peer selection (Ghatak (1999), Armendáriz de Aghion and Gollier (2000) and Ghatak (2000)), ex ante moral hazard in project and effort choice via peer monitoring (Stiglitz (1990), Varian (1990) and Madajewicz (2011)), and ex post moral hazard in repayment enforcement and strategic default via peer punishment (Besley and Coate (1995) and Armendáriz de Aghion (1999)).

[2] Taking possession of a defaulting member's house has a long history in Bangladeshi rural society as reported by Karim (2008). "It is known as *ghar bhanga* (house-breaking) and is considered as the ultimate shame of dishonor in rural society." (Karim (2008), p.19).

resulting pressure among borrowers. With the microfinance crisis in the Indian state of Andhra Pradesh in 2010, however, criticism of harsh enforcement mechanisms for loan repayment and of fostering over-extensive peer punishment in borrowing groups in rural societies accelerated in the popular press (Gokhale (2009), Biswas (2010), Buncombe (2010) and Klas (2011)). But rigorous empirical evidence on the level and the appropriateness of peer punishment in group lending is missing.

While theoretical models explain high repayment rates in joint liability group lending observed in reality, they fail to account for the extensive peer punishment that is increasingly being noticed. Also, first rigorous empirical evidence by Giné and Karlan (2010) suggests that not joint liability but rather the group structure itself is essential for high repayment performance. In a randomized evaluation, they compare repayment performance in joint liability and individual liability group loans of a Philippine microlender and find no significant difference in repayment performance among borrowing groups with joint liability and individual liability loans. This puzzle between theoretical models and empirical observations is yet to be explained, but systematic data on peer punishment and repayment coordination in borrowing groups are hardly, if not impossible to observe structuredly.

In this study I address the puzzle of observed high repayment performance in joint liability group lending and extensive peer punishment in the field. I conduct a one-shot microcredit lab-in-the-field experiment with actual microcredit clients in northern India in which I replicate the real-life borrowing situation and analyze repayment and peer punishment decisions.[3] In particular, I look at joint liability group lending where a borrower can default strategically and has the possibility to observe her peer's investment return (peer peeking) and to punish a defaulting peer (peer punishment).[4] I analyze group repayment coordination and the use of the two social-capital based enforcement technologies. To analyze whether there is excessive use of peer peeking and peer punishment as reported in anecdotal evidence from the field, both enforcement techniques are designed to be non-credible such that they will not be chosen by an expected utility maximizer. I restrict the analysis to static decisions in a one-shot game to exclude various explanations for cooperation and punishment in repeated interactions.

The underlying model of joint liability group lending is similar to Besley and Coate (1995) and Armendáriz de Aghion (1999). Besley and Coate (1995) stress the trade-off between mutual insurance among group members in case of negative investment shocks and free-riding on the repayment obligation of the other group members. Assuming that a bank has access to a punishment technology to penalize default, they analyze how social collateral is harnessed to in-

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[3] This type of experiment would be categorized as a *framed field experiment* in the behavioral literature which follows Harrison and List (2004) for a classification of types of experiments. In development economics, it is common to refer to this type of experiments as *lab-in-the-field experiments*.

[4] The terminology for observing the investment returns of peers without any actual consequences is not clear in the literature. While Armendáriz de Aghion (1999) labels this as *peer monitoring*, most other studies (e.g. Stiglitz (1990) and Madajewicz (2011)) refer to *peer monitoring* for monitoring actions regarding the project or effort choice of borrowers that potentially eliminate ex ante moral hazard. Hence, I refrain from using the term *peer monitoring* here, and instead refer to the pure observation of the peer's investment return as *peer peeking*.

crease repayment rates under joint liability compared to individual liability. In their model with continuous investment returns, strategic default is reduced if social sanctions that borrowers can impose on their joint liability group members are severe enough.[5] Under the assumption that group members only impose social sanctions on a partner who defaults strategically, Besley and Coate (1995) conclude that mutual insurance between group members is fostered by joint liability. This in turn leads to better repayment of the borrowing group while free-riding is reduced by peer punishment.

Armendáriz de Aghion (1999) considers the role of peer monitoring in her study on strategic default in joint liability schemes. While she follows Besley and Coate (1995)'s assumption that peers punish other group members which strategically default, her focus is on the trade-off between increased repayment due to the threat of social sanctions and the cost of peer monitoring. Additionally, she incorporates dynamic incentives in her model where the bank denies access to future loans for a defaulting borrowing group as a penalty instead of some exogenous penalty function. She finds that if the unit cost of monitoring is sufficiently low relative to the size of possible social sanctions, strategic default among borrowers can be prevented. In this case, joint liability lending in groups strictly outperforms individual lending in terms of repayment performance. Both these studies model incentives for high repayment performance in joint liability lending with selfish profit-maximizing borrowers, credible social sanctions among peers, and a severe bank punishment technology for group default. While both models have been used to explain the high repayment performance in microfinance practice, they fail to explain high social pressure and peer punishment reported as anecdotal evidence in the social anthropological literature and the regular press.

In this study I analyze the puzzle of observed high repayment rates and high, even excessive levels of peer punishment in the field. For this, I study the repayment coordination problem put forward by Besley and Coate (1995) in the absence of social sanctions. Then I introduce non-credible social sanction techniques to analyze whether they are used excessively and whether they influence repayment coordination. For this I relate to experimental studies from the behavioral economics literature that studies punishment in cooperation, in particular Fehr and Gächter (2000) and Fehr and Gächter (2002) as detailed below.

In the absence of social sanctions Besley and Coate (1995) state the potentially asymmetric equilibrium that at least one borrower will repay the loan while the other one may free-ride on this repayment (case 1 in their proof of proposition 1 without social sanctions), but they do not analyze the implications of this coordination problem explicitly. This type of structure resembles a Chicken Game that does not have a unique theoretical equilibrium, but rather two asymmetric

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[5]Besley and Coate (1995) and Armendáriz de Aghion (1999) refer to the project payoff as *investment return*. Since they do not consider investment costs, the terminology refers to gross investment returns instead of project payoffs as in Abbink *et al.* (2006). The terminology applied in this paper follows Besley and Coate (1995) and Armendáriz de Aghion (1999) and refers to the gross investment return as the *investment return*. The term *payoff* is used to describe the earnings in the experimental sessions after the repayment obligation has been deducted from the investment return.

equilibria in terms of repayment decisions. The microcredit lab-in-the-field experiment conducted in this study allows me to test experimentally the theoretically ambiguous predicted actions in a one-shot interaction in this repayment coordination problem with strategic default and no peer punishment possibilities.

In an extension of the microcredit game, I test for the use of non-credible enforcement technologies that resemble social sanctions and their effects on repayment. I rely on methods and evidence from experimental studies in behavioral economics on punishment and cooperative behavior. Various motives for punishment have been studied, such as inequity-aversion, emotions, reciprocity, confusion, spite, and social norms (Casari (2005)). Punishment is mostly studied in Public Good Games for cooperation where people in one group decide how much to contribute to a public good. In general, observed contributions to the public good are higher than explainable for an expected utility maximizing individual who would contribute nothing and free-ride on the others' public good provision. When there is the possibility to punish defectors, many individuals chose to punish defectors even when it is costly and pecuniary non-beneficial due to low punishment fines, high costs for punishment, and lacking repeated interactions in static experiments (Fehr and Gächter (2000) and (2002)). Even though punishment is not credible in these studies excessive levels of punishment and increased levels of cooperation are observed. Carpenter (2007) showed that the demand for the level of punishment is price sensitive. Fehr and Gächter (2000) and (2002), and Carpenter (2007) argue that punishment of free-riders can be explained by an aversion of people against being taken advantage of when being cooperative. Based on artifactual field experiments in 15 diverse populations, Henrich *et al.* (2006) and Henrich *et al.* (2010) argue that costly punishment of norm deviators is part of human psychology. Following Fehr and Gächter (2000) and Fehr and Gächter (2002) I design treatments with enforcement technologies resembling social sanctions that are costly and pecuniary non-beneficial due to a static setting in a one-shot experiment. Hence, they should not be exercised by expected utility maximizers which allows me to test whether peer peeking and peer punishment are excessively exercised.

The design of the microcredit game is based on Abbink *et al.* (2006)'s microfinance investment game on strategic default in microfinance under group and individual liability lending conducted as a conventional lab experiment with college students from the University of Erfurt. In their experiment, subjects in groups of two, four or eight borrowers receive either a joint liability or an individual liability loan which is automatically invested in an individual risky project. The project yields a high investment return with a 5/6 probability, in which case the individual participant can decide to repay her loan and contribute to the group repayment. Investment returns are private knowledge. Joint liability is automatically enforced in the sense that the loan repayment is equally distributed among all group members who decided to contribute to the group repayment and who have a high investment return. If too few group members contribute to the loan repayment, the game ends prematurely. Otherwise subjects continue the experiment

for in total ten rounds. In this way bank punishment for group default in terms of dynamic incentives in microfinance with the denial of access to future loans for all group members is incorporated into the game. This microfinance investment game allows them study the fundamental dilemma in group lending of trading off mutual insurance against involuntary defaults on the one hand and the incentive to free-ride by individually relying on fellow borrowers to contribute to the loan repayment on the other hand. Abbink *et al.* (2006) observe high willingness to repay in their experiment although game theory suggests free riding. With increasing group size, the dilemma between the insurance effect and the incentives to free-ride intensifies and cooperation decreases. However, due to dispersion of risks in larger groups, lower repayments are absorbed and the group's repayment performance is surprisingly robust with respect to its size.

In the present study, I rely on Abbink *et al.* (2006)'s microfinance investment game on strategic default as the standard microcredit game with three modifications. First, I only look at two person borrowing groups to facilitate a game theoretic analyses. Second, I conduct the microcredit game in a static instead of a dynamic setup to exclude various explanations for cooperation and punishment in repeated interactions. Third, instead of the bank punishment in form of dynamic incentives I assume that the lender has access to a punishment technology that allows him to punish each borrower to the highest possible extent in case of group default. This standard microcredit game is augmented by three different treatments in which non-credible enforcement technologies are introduced: first, the possibility to costly observe the peer's investment return (peer peeking), second, the possibility to reduce a defaulting peer's payoff (peer punishment), and third, the possibilities to observe the peer's investment return and to reduce a defaulting peer's payoff (peer peeking-cum-punishment). The experimental sessions are conducted with actual microfinance clients from a microlender in Bihar, Northern India. I rely on this subject pool, since the standard subject pool of university students differs substantially from microfinance clients in rural societies in terms of their socioeconomic characteristics, their social group structures and their daily exposure to financial decisions with limited household income. The framing in the context of microcredit has been chosen to observe realistic behavior and to minimize biases in behavior in abstract experiments from real-life decisions as observed for example in List (2006). This controlled experimental environment allows me to study real stakeholders' decisions in situations similar to their actual financial decisions as microcredit clients. In this setting, I explore experimentally the coordination problem in repayment with a Chicken Game structure, and the use of non-credible enforcement technologies and their influence on repayment behavior.

While non-cooperative game theory suggests little repayment and no punishment for this setup, I find that cooperation in form of loan repayment is extremely high and cannot be explained by standard preferences of an expected utility maximizing individual. Analyzing the use of non-credible enforcement technologies reveals that subjects excessively peek on their

peers and punish defaulters. Unwilling and strategic defaulters are punished alike, indicating that borrowing peers reluctantly mutually insure each other but penalize defaulters in any case. While the results cannot be explained by an expected utility maximizing behavior, they may also only be explained by infeasible high levels of altruism when considering social preferences. An alternative explanation for this behavior is that the results display an internalized behavior on the part of microfinance clients who are following the credo of the microfinance institution of being a good borrower by repaying their loan and disciplining their peers.

The remainder of the paper is organized as follows. Section 2 reviews experimental evidence on mechanisms in microfinance and on cooperative behavior and punishment in cooperation. Section 3 gives an overview of the experimental design and the game theoretic foundations of the microcredit game. The experimental procedure and the results are presented in section 4. Section 5 discusses potential shortcomings of the experimental design and the interpretation of results, and section 6 concludes.

2   Related experimental evidence on microfinance, cooperation and punishment

The conventional lab experiment by Abbink *et al.* (2006) was the first experimental study that designed a novel microfinance investment game to model a group lending situation. Since then, two strands of experimental studies have been predominantly carried out in microfinance research. First, artifactual field experiments with standard games from experimental economics, such as the Trust Game, have been conducted with actual microfinance clients or potential microfinance clients as the subject pool. Compared to university students in developed countries, the subject pool of actual or potential microfinance clients is better suited for explaining the social behavior of microfinance clients. These microfinance clients differ from university students in developed countries substantially in terms of socioeconomic characteristics such as education, age and income status and in terms of social structures within their societies. Hence, studying the social behavior of actual and potential microfinance clients might yield different results than studying the behavior of university students in western countries. It is of vital importance to understand behavior in a real-world microfinance context. In these artifactual field experiments with standard games, social behavior or social characteristics are elicited and later combined with actual repayment data.

Since theoretical models such as Besley and Coate (1995), Ghatak and Guinnane (1999) and Armendáriz de Aghion (1999) have claimed a positive effect of social capital on repayment performance, Karlan (2005) approximates social capital of microfinance clients in Peru by using a Trust Game to measure trust and trustworthiness and a Public Good Game to measure the propensity to voluntarily contribute to a public good. While Karlan (2005) does not find any effect of the size of the monetary contribution in the Public Good Game on repayment per-

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formance, he does find a positive relation between trustworthiness and repayment performance and a negative relation between trust and repayment performance. The positive relation between trustworthiness and repayment performance confirms the theoretical view of a positive effect of social capital on repayment in group lending, but the negative relation of trust and repayment is surprising. Karlan (2005) argues that instead of contradicting theory, the negative effect raises doubt on the validity of experimental measures in the Trust Game to truly measure trust and approximate social capital properly. Carpenter and Williams (2010) elicit the propensity to monitor among new microfinance clients in artifactual field experiments in Paraguay. They follow theoretical models on peer monitoring mitigating ex ante moral hazard (e.g. Stiglitz (1990) and Madajewicz (2011)) and ex post moral hazard (e.g. Armendáriz de Aghion (1999)). Six months after the experiments, they correlate the experimental measures on the propensity to monitor peers with the actual repayment performance of borrowing groups. They find a strong relationship between the average monitoring propensity of a loan group and its repayment. These studies, however, fail to identify channels through which the measured social characteristics affect repayment.

A second strand of experimental studies imitates important features of microfinance and develops tailored microfinance experiments to identify specific channels more accurately. Barboni *et al.* (2010) study adverse selection and ex ante moral hazard in group lending with microfinance clients of a Bolivian microlender. They find that a riskier pool of investors self-selects into group liability contracts and that risk taking in project choices is increased under joint liability. Giné *et al.* (2010) study ex ante moral hazard in a framed field experiment with potential microcredit clients in a central market place in Peru. They test how potential borrowers choose between risky and safe investments and manage the risk of default under group liability or individual liability. They find that group liability leads to increased risk taking because of the implied insurance against investment losses in joint liability contracts. Both studies contradict theoretical predictions that joint liability mitigates ex ante moral hazard. Instead they show that actual and potential borrowers apparently exploit the mutual insurance within a joint liability group and invest in riskier projects..

Cassar *et al.* (2007) study the effect of social capital on strategic default in joint liability groups. They combine the artifactual field experiment by Karlan (2005) to measure trust with the lab experiment of Abbink *et al.* (2006) using a non-standard subject pool of typical microfinance clients in South Africa (60 participants) and Armenia (156 participants). They modify the microfinance investment game of Abbink *et al.* (2006) to a fixed group size of six participants and resolve the last period problem in Abbink *et al.* (2006) by a probabilistic continuation of the game after the sixth period. Cassar *et al.* (2007) find that specific trust between borrowers of a group is more important for repayment than trust in society as a whole, and that social homogeneity in borrowing groups is moderately helpful for a good repayment performance. They also find that group repayment can break down from random shocks or non-contribution. Although they

can confirm the theoretical importance of social capital measured by trust between members of a borrowing group and social homogeneity within a group for repayment, the coordination problem underlying the microfinance repayment game with dynamic incentives is not dealt with explicitly.

Contributing to the literature, the present experimental study analyzes the underlying repayment coordination problem in microfinance explicitly. Instead of considering measures for social capital, enforcement technologies usually associated with social capital such as costly observation of investment returns (peer peeking) and social sanctions (peer punishment) are examined directly. The underlying model of microfinance is similar to Besley and Coate (1995), with a specific focus on the coordination problem in group repayment. When both borrowers in a borrowing group have high investment returns and can repay their loan, each borrower has an incentive not to repay her loan when her peer repays and is made liable for repaying the total group loan. Two theoretical equilibria with asymmetric repayment strategies evolve in this Chicken Game structure. With simultaneous decision making, theoretically there is no unique action recommendation in pure strategies for one-shot interactions. The microcredit game in this experiment is designed to capture the Chicken Game structure and to yield experimental evidence about the theoretical ambiguously predicted pure strategies played.

The setup in this experiment can be related to Neugebauer *et al.* (2008) which is one of the first experimental studies of cooperation in a Chicken Game structure or the Hawk-Dove Game.[6] The underlying game structure in their study obtains two asymmetric Nash equilibria in pure strategies of cooperation or defection and a mixed strategy equilibrium in which each player utilizes a mix between the two strategies. Neugebauer *et al.* (2008) elicit both unconditional and conditional cooperation decisions and derive four distinct cooperative types of players. While only the self-interested cooperation type can be explained with standard expected utility maximizing preferences, social preferences à la Fehr and Schmidt (1999) can explain all cooperation types. This structure of a social dilemma arising from non-coordination with no dominant strategy captures strategic interactions between individuals and has been largely neglected by experimental economists (also see Cabon-Dhersin and Etchart-Vincent (2011) for a study on cooperation in a Chicken Game). While many studies on cooperative behavior showed the importance of inequity aversion, fairness and reciprocity (see Fehr and Schmidt (2006) for a survey), Neugebauer *et al.* (2008) observe a large group of subjects behaving in a self-interested way. They attribute this to the more competitive structure of the Hawk-Dove Game compared to classical Public Good Games.

Fischbacher *et al.* (2001) and Rustagi *et al.* (2010) look at different types of cooperative

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[6] Although Taylor and Ward (1982) already stated the importance of a Chicken Game structure in the analysis of public goods provision and cooperation, most studies focus on Prisoners Dilemma Games for these analyses (see Fehr and Schmidt (2006) for a survey). Early experimental research by van de Kragt *et al.* (1983), Rapoport (1985), Bagnoli and Lipman (1989) and Erev and Rapoport (1990) looked at Threshold Public Goods in which a minimum contribution to the public good was specified that transformed the Prisoners Dilemma Game into a Chicken Game.

behavior. Both studies find that a high share of people is conditionally cooperative, meaning that they cooperate if the others cooperate and defect if the others defect. Moreover, Rustagi *et al.* (2010) relate the experimentally elicited type of cooperative behavior to actual commons management of forest user groups in Ethiopia. They observe higher cooperation levels in groups with higher conditional cooperators, and conditional cooperators are more likely to engage in cooperation enforcement via monitoring.

The present experiment relates to the literature on punishment in cooperations and combines it with experimental studies on strategic default in microfinance. Since theoretical models on joint liability in microfinance rely on the willingness of borrowers to punish defaulting peers, the possibilities to observe peers' investment returns and to punish defaulting peers are included as treatments in the microcredit game. Following Fehr and Gächter (2000) and Fehr and Gächter (2002), I model these enforcement technologies as costly but pecuniary non-beneficial such that they should not affect game theoretic recommendations for repayment decisions of an expected utility maximizer. Following Fischbacher *et al.* (2001) and Rustagi *et al.* (2010), I identify different repayment types to explain observed behavior as in Neugebauer *et al.* (2008).

3 Experimental design

This section sets out the experimental design. After introducing the subject pool of microfinance clients, repayment in the microcredit game is modeled as a Chicken Game and gametheoretically analyzed. Both standard and social preferences are considered for deriving theoretical behavior recommendations.

SUBJECT POOL

To analyze the behavior of the adequate stakeholders in microfinance, namely actual microfinance clients, this framed field experiment was carried out with microfinance clients of *Gramyasheel Microfinance* in the northern Indian state Bihar. The choice of the subject pools allows me to directly study decision making processes of actual microfinance clients in a microfinance environment. This has several advantages. First, compared to university students, microfinance clients have substantially different socioeconomic characteristics: they are usually older and might display more mature and conscious behavior in risky investment, they are less educated and literate which influences their decision making and risk assessment, and they usually have less income at their disposal, placing a higher value on monetary returns. Second, microfinance clients typically run their own microenterprise or household business such that they are familiar with making investment decisions and handling money even though they are likely illiterate or have low education levels. Moreover, they are microcredit borrowers and hence have experience with taking and repaying a loan in a borrowing group which they can draw upon in the experiment. Third, microfinance participants live in societies with different social structures including

social networks and institutions for informal contract enforcement. This feature is crucial to group lending and quite distinct from more individual oriented western societies. This setting allows me to study realistic decisions of actual microfinance clients in a framed setting similar to their microfinance reality. Therefore, biases in behavior in abstract experiments from real-life decisions as observed for example in List (2006) are minimized.

Gramyasheel Microfinance is an NGO-based microfinance institution in the Supaul district in Bihar that operates in a remote area with limited access to finance, including microfinancial services. It employs a group lending methodology for female clients where five women form a joint liability group (JLG) securing loan repayment through joint liability among the group members. Each joint liability group is part of a center that consists of up to four joint liability groups resulting in centers of 10 to 20 clients. Women can join *Gramyasheel Microfinance* only as new joint liability groups affiliated to a center. Hence, the selection of borrowers within one group is made by the peers in the group and it is subject to approval by the center. Additionally, *Gramyasheel Microfinance* screens potential clients during house visits made by the loan officer responsible for the affiliated center. Before the group is approved, it has to fulfill a compulsory group training on the rules and procedures of microfinance and pass a group test on the understanding of microfinance and joint liability. There are weekly center meetings in which the loan officer visits the center to collect the repayment installments. In the beginning of the meeting, the clients recite a pledge to always support their group and repay their loan which further induces solidarity among the group members and towards *Gramyasheel Microfinance*. The joint liability is officially defined at the group level, but there is also a defined responsibility for the center which leads to de facto joint liability at the center level. If one client cannot repay her loan, the loan officer first asks the other joint liability group members to cover her repayment. If they fail to do so, the loan officer turns to the other center members for loan repayment stressing the center responsibility. The center structure is similar to the classical group lending structure of the Grameen Bank, and it reduces organizational costs since most client interactions are carried out at the center level. Due to the approval of a new joint liability group by the center and the weekly center meetings, there exist some social ties between all members of one center. I rely on the center structure in recruiting subjects for the experiment.

Gramyasheel Microfinance offers loans of 5,000 Indian Rupees (Rs.) in the first loan cycle, Rs. 10,000 in the second loan cycle and Rs. 15,000 in the third loan cycle.[7] The loans are disbursed subsequently to each client of a joint liability group with a one week interval. While credit disbursement takes place at the *Gramyasheel Microfinance* office, loan repayments are collected by a loan officer at weekly center meetings in the neighborhood of the center members. The loans have to be repaid in 52 weeks with equated weekly installments, and an interest rate of 15 percent flat per year is charged on all loans.

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[7]The loan amounts correspond to $ 111, $ 222, and $ 333 at the time of study in April 2011, with an exchange rate of 44.94 INR/USD.

Table 1: Socio-economic characteristics of participants

	Peer peeking (1)	Peer punishment (2)	Peer peeking-cum-punishment (3)	All treatment groups (4)	F-stat p-value (5)
Age (years)	32.18	33.26	33.46	33.07	0.332
	(9.14)	(7.65)	(7.61)	(7.99)	
Household size	5.96	7.70	5.84	6.36	0.009
	(2.05)	(2.37)	(2.02)	(2.25)	
Education (years)	2.29	1.48	3.20	2.51	0.372
	(3.80)	(3.57)	(4.28)	(4.01)	
Literate	0.25	0.11	0.36	0.27	0.050
	(0.44)	(0.32)	(0.48)	(0.44)	
Annual household income	34464	27815	40684	35716	0.280
(in Rs.)(self-reported)	(18099)	(26420)	(29748)	(26551)	
Number of observations	28	27	50	105	

Notes: Table includes means of subject characteristics by treatment groups (column 1 - 3) and in total (column 4). Standard deviations are in parentheses. Standard errors clustered at the joint liability group (JLG) - level for the F-test regressions of characteristics on treatment dummies, F-test compares (2) and (3) to (1).

For the experiment, 12 centers with 10 to 20 clients were selected randomly to participate. Six sessions were organized in total, and in each session there were around 20 participants from one or two centers invited to the session. I relied on pre-existing centers of microfinance clients because it simplified the organization of the experiment significantly. The microfinance organization asked the clients to come to its office where the experiment took place. Clients were not told that they would take part in an experiment for which they will be compensated monetarily.[8] Contacting clients in their center meetings via their loan officer was the easiest way to ask them to participate. Most clients do not have a phone connection to contact them, and contact via mail would not have worked either since most clients are illiterate. This way, the center as a whole was asked to participate, and the loan officer and the center leader assured that center members showed up to the experimental session.

The characteristics of the participating microfinance clients are set out in Table 1. The average age of the participating women is 33 years. On average, the subjects went to school for 2.5 years, but only 27 percent of them state that they are literate. Literacy refers to being able to read and write and most clients stated to be literate when they can read and write their names. The actual share of clients able to read and understand the instructions in the experiment by themselves was much lower. The average number of household members is 6.3, but the household size differs significantly across the three treatments. The average self-reported total annual household income is Rs. 35,716.[9] Due to substantial problems of underreporting

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[8]Beforehand, it was arranged with the microfinance institution to tell their clients about the experiment and the financial compensation, but the mincrofinance institution decided not to do so. They stated as a reason that they did not want other clients to find out about the possibility of financial compensation which would have created jealousies and many discussions.

[9]This corresponds to $ 750.

FIGURE 1: Subjects' occupation type
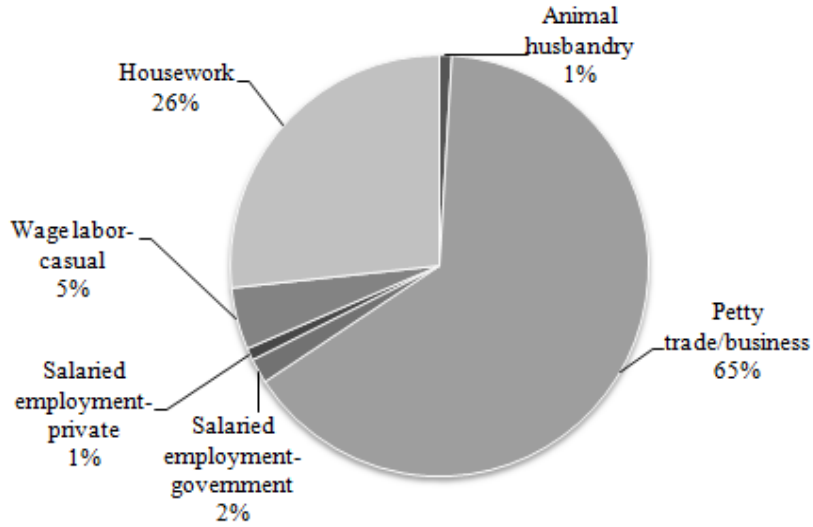
with self-reported income measures, this figure has to be treated with care.[10] Although the majority of subjects is illiterate, they know how to handle money and run a business. In fact, as illustrated in Figure 1, 65 percent listed petty trade and business as their main occupation. Moreover, the subjects are actual microfinance clients of *Gramyasheel Microfinance.* They are responsible for their microloan, and hence they are familiar with working with money and the concept of credit.

Comparing the subject characteristics across the different treatment groups in the experiment shows that they differ significantly in the number of household members, and the binary literacy variable (Table 1, column 5). While the number of household members should not influence decisions regarding repayment, peer peeking or peer punishment in the experiment, the difference in literacy might affect decision making. This issue will be discussed in section **??**.

MICROCREDIT GAME - EXPERIMENTAL SETUP

The microcredit game in the present study aims at analyzing strategic default decisions in the repayment coordination problem. When both borrowers in a borrowing group have high investment returns and can repay their loan, both can split the group repayment burden equally. However, each borrower has an incentive to default on her loan when her peer repays and made liable for repaying the total group loan. To prevent that defaulting is a dominant strategy for borrowing group members, banks usually punish group default. One common practice is the

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[10] The rural poverty line in Bihar in 2009 and 2010 was set to Rs. 655.6 per person per months and the urban poverty line to Rs. 775.3 by the Planning Commission of the Government of India (Government of India (2012)). Poverty lines in India are usually based on consumption expenditures. Consumption measures of an accompanying household survey with 200 microfinance clients of Gramyasheel Microfinance shows average consumption expenditures of Rs. 26,362 for the total household with on average 4.2 household members (Czura and Hebous (2012)). This gives a more realistic picture and shows that client households on average have consumption expenditures around the poverty line.

denial of future loans for all group members in case of group default which has been modeled theoretically by Rai and Sjöström (2004). Stories from the field also report other, more coercive techniques to punish group default and recover repayments. Arunachalam (2010), for example, states different strategies applied by microfinance institutions to prevent group default and recover repayments, such as obstruction of work, threats, verbal abuse, repossession of property, and physical intimidation. Therefore, a common assumption is that the bank has a punishment technology that punishes all group borrowers in case of group default, as for example assumed in Besley and Coate (1995), Armendáriz de Aghion (1999), and Rai and Sjöström (2004).

Standard microcredit game with joint liability and risky investment returns

The microcredit game is a one-shot game with loan disbursement, automatic investment in an individual risky project, repayment decision on individual loan repayment of the group loan and realization of investment returns and repayments. The timing of the model is illustrated in Figure 2.

FIGURE 2: Timing of the standard microcredit game

In the one-shot microcredit game, each borrower receives a loan of Rs. 100 that is automatically invested in an individual risky project. Following Abbink *et al.* (2006), there is no choice regarding investment projects or effort levels to focus exclusively on ex post moral hazard problems regarding strategic default. With a probability of $p_h = \frac{5}{6}$ the investment yields a high return $y_h = $ Rs. 250, with a probability $p_l = \frac{1}{6}$ the investment yields a low return $y_l = $ Rs. 10. The interest rate is 20 percent such that each borrower has to repay Rs. 120. The total debt of the joint liability group is Rs. 240. Borrowers can only repay their loan when they have a high investment return. If one borrower has a low investment return, she has to rely on mutual insurance by her peer who covers her loan repayment. If both borrowers have a low investment return, the joint liability group cannot repay its loan. In this case the bank punishes each borrower to the highest possible extent such that they are receiving a payout of zero. In contrast, Abbink *et al.* (2006) model the bank punishment in form of dynamic incentives by a premature ending of their dynamic experiment in case of group default.

Before a borrower knows her investment return realization, she has to decide whether to contribute to the loan repayment of her borrowing group or to default. This repayment decision

14

is conditional on having a high investment return and can be regarded as a commitment-to-repay decision. This timing follows Abbink *et al.* (2006), it resembles elements of the strategy method and it allows me to collect repayment decision information even if subjects have low investment returns.[11] If a participant decided to repay, joint liability is automatically enforced in that the borrower has to repay her own loan and if necessary also her peer's loan. The automatic enforcement of joint liability follows Abbink *et al.* (2006) for a simplification of repayment decisions and for repayment decisions independent of investment returns. This feature resembles a revelation of investment returns when a borrower repays her loan in practice. By repaying, the borrower signals to the bank that she had a successful project. The bank can hence demand her repayment of a defaulting peer's share due to the joint liability contract knowing that she had a successful project.

The individual repayment obligation is equal to the group's total loan repayment obligation of Rs. 240 divided by the number of repaying borrowers. This is deducted from the individual investment return and subjects keep whatever is left as payoff. If a borrower repays, she gets Rs. 130 if her partner repays, and Rs. 10 if her partner defaults. If a borrower defaults she gets to keep her investment return of Rs. 250 or Rs. 10 if the total group loan is repaid by her partner. Considering the risky investments that both borrowers have, the expected payoffs are Rs. $93\frac{1}{18}$ if both borrowers repay, Rs. $8\frac{1}{3}$ if the participant repays while her peer defaults, Rs. 175 if she defaults while her peer covers her repayment, and Rs. 0 if both default due to bank punishment of group default. The expected payoffs are illustrated in Figure 3.

FIGURE 3: Expected payoffs in the standard microcredit game

		Player 2	
		Repay	Default
Player 1	Repay	$\left(93\frac{1}{18}, 93\frac{1}{18}\right)$	$\left(8\frac{1}{3}, 175\right)$
	Default	$\left(175, 8\frac{1}{3}\right)$	$(0,0)$

In this experiment, I rely on a one-shot game for two reasons. In repeated models, there are last-period problems that have to be dealt with. Abbink *et al.* (2006) model dynamic incentives in a repeated interaction of ten rounds by a premature end of the experiment if the group cannot repay the total loan. However, their approach was criticized for containing potential last round effects. Cassar *et al.* (2007) therefore modified Abbink *et al.* (2006)'s microfinance investment game by a probabilistic continuation of the game after the sixth round. Aside from simplifying

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[11] The strategy method was first introduced by Selten (1967). It is used to elicit complete strategies of players for the game, and it allows information to be collected on subject's behavior in different hypothetical decision making scenarios and hence provides the individual's complete strategy.

the experiments' organization, a one-shot game has several advantages compared to a repeated game. In a one-shot game confounding effects such as reputation building or learning effects can be excluded. Gächter *et al.* (2004) and Gächter and Herrmann (2009) argue that in cooperation games based on a Prisoners Dilemma structure, cooperation is increased in repeated interactions as these offer strategic reasons to cooperate. According to them, the substantial cooperation that is observed in one-shot cooperation games can be better assigned to strong reciprocity. In the Chicken Game it is far less obvious if repeated interactions offer strategic reasons to cooperate, and since this game has not been studied much experimentally, this experiment was conducted as a one-shot game.

Peer peeking, peer punishment, and peer peeking-cum-punishment treatments

In the standard game, participants do not know anything about their partners investment returns and they cannot sanction free-riders. I introduce three different non-credible enforcement technologies to the standard game as treatments, namely the possibility to observe the peer's investment return for a cost (peer peeking), the possibility to reduce a defaulting peer's payoff (peer punishment), and the possibilities to observe the peer's investment return and to reduce a defaulting peer's payoff (peer peeking-cum-punishment). The timing of the extended model with peer peeking-cum-punishment is illustrated in Figure 4. The timing for peer peeking is without the peer punishment elements, and vice versa.

FIGURE 4: Timing of the treatment microcredit game
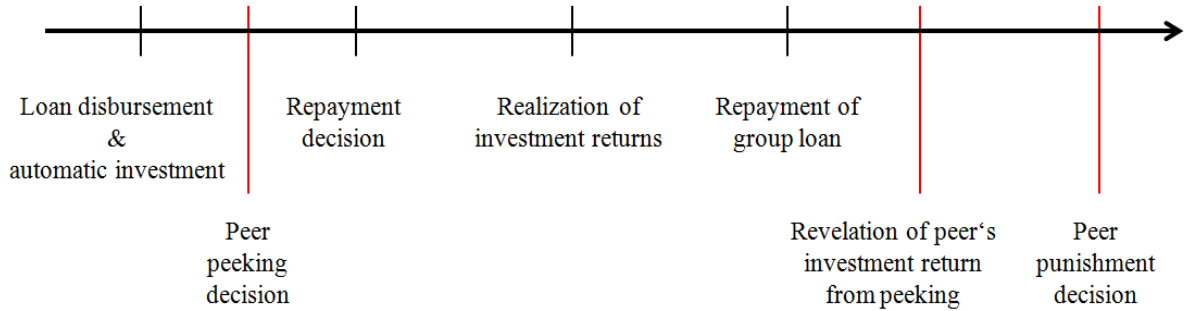
Since anecdotal evidence from the field suggests that there is excessive peer punishment in borrowing groups (e.g. Gokhale (2009), Biswas (2010), Buncombe (2010) and Klas (2011)), the level of punishment may be driven by other aspects than selfish interests for cooperation enforcement. To facilitate analysis, all treatments of acquiring information and penalizing peers in this experiment are designed as non-credible threats that a self-interested, expected utility maximizing individual would not apply. This approach follows Fehr and Gächter (2000)'s study on punishment in cooperations who observe free-rider punishment even though this is pecuniary non- beneficial.

In the *peer peeking* treatment, participants can observe their peer's investment return for

a cost. Before their repayment decision and investment return realization, they can pay Rs. 10 from their show-up fee of Rs. 40 to learn about their peer's investment return after return realization. This only reveals investment returns, but does not influence any other decision due to the timing of decisions with repayment decisions made before returns are realized. In the *peer punishment* treatment, participants can punish a defaulting partner at a cost. After their repayment decision, they can pay Rs. 10 from their show-up fee of Rs. 40 to punish the defaulting partner by reducing her show-up fee by Rs. 20. This decision is made without knowing the peer's investment return and consequently without knowing the default reason, e.g. involuntary default due to bad investment or strategic default. Since there is no repeated interaction, punishment will not influence future behavior as shown subsequently, and since the punishment is small compared to the monetary gains from strategic default, punishment will not change the current behavior of the expected utility maximizing subject. Hence, costly punishment is pecuniary non-beneficial. In the *peer peeking-cum-punishment* treatment, participants could both choose to observe their peer's investment return after loan repayment, and punish a defaulting peer after the repayment decision at a cost. With peer peeking, subjects can distinguish between involuntary and strategic defaulters in their punishment decision.[12] Without peer peeking, subjects make the punishment decision without knowing the default reason. Although it is mostly argued, that there exists an information advantage among peers due to private local information, this design explicitly accounts for costs associated with acquiring local information. The same reasonings as provided above make this combined enforcement technology non-credible.

GAME THEORETICAL ANALYSIS

The standard microcredit game with a two-person joint liability group and expected returns from risky individual investments is formally described by the game tree in Figure 5. Each player i chooses from her strategy set $s_i \in$ *(repay, default)*. After the repayment decisions, the investment returns are realized and the payoffs are calculated. Appendix Figure B.1 presents the different states of nature explicitly.

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[12]In the theoretical models by Besley and Coate (1995) and Armendáriz de Aghion (1999) it is assumed that borrowers punish a peer who defaults strategically which they can distinguish from involuntary default due to their local private information advantage. Here, information acquisition and punishment are explicitly modeled and both can be applied for a cost.

FIGURE 5: Reduced form representation of standard microcredit game with expected payoffs
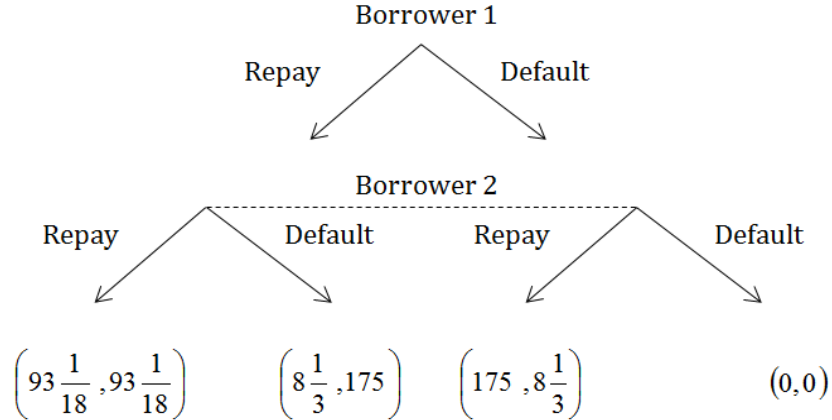
A simultaneous move game best describes the situation of the repayment coordination problem the borrowers in a borrowing group face. The decisions elicited without knowing the peer's repayment decision, which resemble those of a simultaneous move game, are referred to as *unconditional repayment decisions*. Since there is no dominant strategy in the Chicken Game, the conditional decisions depending on the peer's repayment decision might yield better insight into strategic behavior. Hence, the standard microcredit game is also considered as a simultaneous move game. Given the decision of the first mover, the decisions of the second mover will be referred to as *conditional repayment decisions*.

This game is analyzed first with standard preferences of a selfish, and expected utility maximizing individual. Since experimental studies cited above have found substantial evidence for altruism, reciprocity or fairness as motives in human behavior, and since those might be important in a group context such as present in microfinance, the model is analyzed with social preferences à la Fehr and Schmidt (1999) as well. In these social preferences, disutility from inequity aversion driven by envy or altruism is accounted for.

Standard preferences

In the standard game, standard preferences model a selfish expected utility maximizing individual. The individual i behaves such that it is maximizing her expected payoff x_i. Solving the Chicken Game with expected payoffs as in Figure (3) for its Nash equilibria establishes Proposition 1. The proof of Proposition 1 is in the provided in the appendix.

Proposition 1 *If players are risk-neutral, selfish expected utility maximizers with standard preferences:*
(a) in the unconditional repayment decision (simultaneous move) in the standard game, there exist three Nash equilibria (s_i, s_j) of players i and j, two of them are in pure strategies, namely (repay, default) *and* (default, repay)*, while the third one is in mixed strategies with the symmetric Nash equilibrium of player i mixing the pure strategies with* ($\frac{6}{65}$repay, $\frac{59}{65}$default) *probability*

(b) with a sequential move game (conditional repayment decisions) in the standard game, the best response function of each player i as a second mover is choosing the opposing strategy of player j, namely (repay, default) *and* (default, repay).

In the treatment game, peer peeking and peer punishment technologies are available. However, as described in the previous subsection, these are not credible applied. This can be easily seen by backward induction. In the peer peeking treatment, although the decision to peek on the peer's investment return is taken before the repayment decision, the peer's investment return is only observed after the repayment decision. Consequently, the actually observed investment return cannot influence the peer's repayment decision. Anticipating this, a borrower will not peek on her partner in the first place since it is costly. In the peer punishment treatment, punishment is costly and the penalty inflicted upon a defaulter is very small compared to the advantages of free-riding on the partner's group loan repayment. Hence, the possibility of peer punishment will not change the best response structure of the repayment coordination. Looking only at sub-game perfect equilibria, punishment in the second stage of the decision making process will not be chosen since it is costly and pecuniary not beneficial. Anticipating this, an expected utility maximizer will not choose to punish in the first place. Both observations can be summarized by applying the typical backward induction argument as follows: *Peer peeking and peer punishment are non-credible, costly enforcement techniques. They do not influence repayment decisions of the peer in the borrowing group, and consequently will not be chosen by risk-neutral, selfish expected utility maximizers with standard preferences.* With standard preferences, individuals are treated as expected utility-maximizers. In contrast, social preferences allow for other-regarding preferences of individual decision makers.

Social preferences

Especially in group settings such as microfinance where social capital exists between the group members, other-regarding preferences may be important for individual decisions. A simple model of inequity-aversion à la Fehr and Schmidt (1999) can explain even cooperative outcomes in the Chicken Game. A utility function for inequity-avers players augments a linear utility from the monetary payoff x_i of player i by disutility from inequity. Both disadvantageous inequality and advantageous inequality are considered separately in the utility function

$$U_i(x_i; x_j) = x_i - \alpha_i \max[x_j - x_i; 0] - \beta_i \max[x_i - x_j; 0]. \tag{1}$$

Disutility from disadvantageous inequality is captured by the envy parameter α_i. Disutility from advantageous inequality is captured by the altruism parameter β_i.[13] With social preferences and

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[13] Fehr and Schmidt (1999) only consider the case where individuals get more disutility from disadvantageous than from advantageous inequality with $\alpha \geq \beta$). Neugebauer *et al.* (2008) extend the Fehr and Schmidt (1999) social preference model and also consider the case of altruism with $\beta \geq \alpha$.

a linear utility function, the reduced form matrix of the expected payoffs can be transformed to a matrix with the utility of expected payoffs which includes social preferences as in Figure 6. Since the game is symmetric for both players i and j, $\alpha_i = \alpha_j = \alpha$ and $\beta_i = \beta_j = \beta$.

FIGURE 6: Expected payoffs in the standard microcredit game with social preferences

Player 2

	Repay	Default
Repay	$\left(93\frac{1}{18}, 93\frac{1}{18}\right)$	$\left(8\frac{1}{3} - 166\frac{2}{3}\alpha_1, 175 - 166\frac{2}{3}\beta_2\right)$
Default	$\left(175 - 166\frac{2}{3}\beta_1, 8\frac{1}{3} - 166\frac{2}{3}\alpha_2\right)$	$(0,0)$

(Player 1 labels the rows)

In contrast to the standard preferences with no dominant strategies and two asymmetric equilibria in pure strategies (*(repay, default)* and *(default, repay)*), social preferences can also support the symmetric coordination equilibrium by introducing dominant strategies in the Chicken Game.

Following Neugebauer *et al.* (2008), four different repayment types can be distinguished that can all be explained with social preferences and different parameter restrictions for the envy parameter α and the altruism parameter β. The four different types are individuals who (1) always repay their loan, (2) never repay their loan, (3) repay their loan reciprocal to their peer, e.g. choose to repay if the partner repays, and default if the partner defaults, and (4) repay their loan conversely to their peer, e.g. repay if the peer defaults, and default if the peer repays. All repayment types can be explained by different parameter specifications as summarized in Table 2.

TABLE 2: Repayment types and social preferences parameters

	Always repay	Never repay	Repay reciprocal	Repay conversely
	(1)	(2)	(3)	(4)
Envy parameter α	$< \frac{1}{20}$	$> \frac{1}{20}$	$> \frac{1}{20}$	$< \frac{1}{20}$
Altruism parameter β	$> \frac{59}{120}$	$< \frac{59}{120}$	$> \frac{59}{120}$	$< \frac{59}{120}$
Equilibrium concept	Dominant Strategies		Nash	

A small α indicates that the aversion against being taken advantage of is limited, whereas a big β indicates a high aversion against advantageous inequity or altruism. For this combination, cooperation becomes a dominant strategy and the cooperative outcome with both borrowers repaying can become a Nash equilibrium. Repayment types based on the conditional repayment decision are used here as a short-cut to model social preferences as in Neugebauer *et al.* (2008). In

the unconditional repayment decision, assumptions on the distribution of social preferences in the population are necessary and are avoided here for simplification. The effect of social preferences can be summarized as: *For players with social preferences, different parameter combinations of the envy and altruism parameters can explain cooperative or reciprocal behavior as dominant strategies in the Chicken Game which may result in the cooperative outcome.* A sketch of a proof of the parameter specifications in Table 2 is provided in Appendix A.

From the different parameter specifications for the four repayment types, four cooperation types can be classified as in Neugebauer *et al.* (2008). Here, from the conditional repayment decisions four different repayment types can be distinguished: (1) the *always repay*-type who unconditionally cooperates, (2) the *never repay*-type, (3) the *repay reciprocal*-type who conditionally cooperates and, repays if the peer repays and default if the peer defaults, and (4) the *repay conversely*-type who repays if the peer defaults, and default if the peer repays.

Evidence on monitoring and punishment in cooperation shows, that those with a high propensity to cooperate also have a high propensity to enforce cooperation via monitoring and punishment at personal costs (Fehr and Gächter (2002), Falk *et al.* (2005) and Rustagi *et al.* (2010)). An observed positive level of costly, pecuniary non-beneficial peer peeking or peer punishment can be explained, for example, by conditional cooperators being more engaged in the sanctioning of defection in cooperation. Hence, for players with social preferences, positive levels of costly, pecuniary non-beneficial peer peeking and peer punishment may be observed, and conditional cooperators are more likely to incur such personal costs for norm enforcement.

SOCIAL WELFARE CONSIDERATIONS

Until now, the games have been analyzed from an individual's decision making perspective. From a social welfare perspective, the outcome that maximizes the total payoffs in the society is preferred when distribution preferences are not considered. In the present coordination problem, if both borrowers have a high investment return, only the symmetric coordination with both borrowers defaulting is inferior for social welfare. In both the asymmetric anti-coordination outcome when one borrower defaults while the other repays and in the symmetric outcome with both borrowers repaying, social welfare is equally high. This was chosen to abstract from any welfare effects and only focus on strategic cooperation decisions when both borrowers have a high investment return. However, by the individual risky investment returns, the expected payoffs of the cooperative outcome are slightly higher than those of the asymmetric outcomes (e.g. $183\frac{1}{3}$ in the asymmetric outcomes compared to $186\frac{1}{9}$ in the symmetric coordination outcome). Hence, from a social welfare perspective the symmetric coordination outcome in which both borrowers of a borrowing group repay is preferred. Since peer peeking and peer punishment are costly, and since they have no pecuniary benefits under standard preferences, their use decreases social welfare.

4 Microfinance investment game - the experiment

This section sets out the microfinance investment experiment conducted with actual microfinance clients. After describing the procedural details of the experiment, the results on repayment, peer peeking and peer punishment are presented.

PROCEDURAL DETAILS

In each experimental session the participants conducted the standard microcredit game and one of the three treatments. The treatment played in the second round was assigned to the experimental session before the series of all experimental sessions started. The participants did not know in advance, that two different games would be played during a session, which excludes any anticipation effects in their decisions.

All experimental sessions took place in the big meeting room at *Gramyasheel NGO* from which *Gramyasheel Microfinance* evolved. The office of *Gramyasheel Microfinance* where credit disbursements take place is next to this meeting room. At the beginning of the session, the participants received a participation code with which they were identified during the experiment. All participants were told that only this participant code, instead of their names or client identities, would identify them in the experiment and that no information on individual decisions in the experiment would be transmitted in any form to *Gramyasheel Microfinance*. The clients were seated in rows with sufficient space between each row and between any two women within one row.

The decisions sheets of the standard game and the respective treatment games, pens and dice were distributed to the participants.[14] The instructors noted the participant codes on the decision sheets. The participants rolled a dice twice, the number from the first roll was noted on the first page for the standard game and the number from the second roll was noted on the second page for the treatment game. To facilitate the notation of the rolled number, pictures of all six sides of a dice were provided such that clients only had to circle the respective number. If participants had difficulties in rolling a dice or noting the number, the instructors assisted them.[15] After this the participants were asked to turn the decision sheets around so that they were face down and nobody could read the information provided on it. Then the explanation of the experiment started.

First, the instructions for the standard game were read to the clients. The situation of a business investment financed with a joint liability loan, the structure of the game and the payoffs were described to them. After this, the game was illustrated to the participants by a role play conducted by two instructors. They were sitting back to back to symbolize that they could not observe each other's actions. Sheets of paper with the payoff numbers written on them were used

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[14] The decision sheets for the standard game and all treatment games are displayed in the appendix.

[15] Most of the women were unfamiliar with rolling dice, especially since gambling is prohibited in that area.

for illustration of the microcredit game. In addition, it was explained how the individual risky investment returns were determined.

The instructor explained all of the following steps:

1. Every player rolls a dice once and notes this number as her *losing number* (the instructor pointed out that the participants already finished this step).

2. Every player gets *Rs. 100* as a loan.

3. Every player invests the *Rs. 100* and the possible returns of *Rs. 10* for the *losing number* and *Rs. 250* for all other numbers.

4. Every player has to decide to repay or to default for the case that she can repay.

5. Payoffs are determined by rolling a dice to determine the *losing number* of the session.

6. Every player is told her payoff after receiving her investment return and paying her loan obligation which also depends on her borrowing partner's repayment decision.

This illustration was carried out three times to show the possible payoffs for different repayment decisions: first, both partners chose to repay their loan, second, one partner defaults on her loan, the other one repays, and third, both partners default on their loan. After each step the instructor asked the women what was happening in the illustration.[16] After each round of illustration, the instructor checked whether there were questions. Some women asked questions showing that they were following the game properly. After the illustration, the game was explained again. The instructor pointed out that each participant would be matched in the game with a partner from her real-life borrowing center who was also present in the room, but that they would not know the exact identity of the person they are matched to. Moreover, it was emphasized that they would earn some payoff at the end of the session based on all decisions they make in the experiment. The questions on decision making were read aloud by the instructor. When the participants had questions, these were answered first, otherwise the women stated what they decided for the scenario in question. Because most of the women were illiterate, they only had to answer questions with *yes* or *no* and circle the respective answer. The instructors helped the women by stating which field noted *yes* and which *no*. Moreover, the instructors made sure that each participant answered the respective question and was not interacting with other participants.

In the experiment, all decisions were elicited using a variant of the strategy method. This method based on Selten (1967) is used to elicit complete strategies of players for the game. It allows information to be collected on subject's decisions in different hypothetical scenarios and

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[16]Questions included "The first person got a loan of Rs. 100, the second got a loan of Rs. 100, both have to pay Rs. 20 interest, how much do they have to repay?", "What are they doing? Did she decide to repay? Did the other one decide to repay? What will happen now to the payoff?".

hence provides the individual's complete strategy. Without the strategy method, information would only be collected on one decision in a particular situation.[17] Using the strategy method allows me to elicit unconditional decisions when the repayment decision of the peer is unknown, as well as conditional repayment decisions when it is known that the peer repays or defaults. This setup follows Fischbacher *et al.* (2001) and Rustagi *et al.* (2010), as well as Neugebauer *et al.* (2008), and it allows me to distinguish different repayment types later in the analysis.

After the standard game, the participants were informed that they would play another game in which they had to make decisions. The actual payout that they would receive after the session, would be calculated based on the decisions made in one of the two games which are considered for payoff calculation with the same probability. The game with the respective treatment was explained and illustrated in a role play. The illustrations were carried out three times with the same variations in repayment decisions as in the standard game, but in each illustration peer peeking and peer punishment were chosen. The costs of monitoring and punishment were made clear with information sheets in front of the illustrators, a sheet with a big eye represented *peeking* and a big sheet with a bat represented *punishment.* Then the decision scenarios were presented and clients made their decisions regarding repayment, as well as peer peeking, peer punishment and peer peeking-cum-punishment. To prevent experimenter bias, the instructors participating in the illustration were the same in all sessions and for all games. Also the decision sheet of each game was always read aloud by the same instructor. After all decisions were made, the decision sheets were collected, and the *losing number* of the game was drawn. While the payoffs for each participant were calculated, sociodemographic characteristics of the subjects were collected, such as age, gender, relation to household head, number of household members, level of education, literacy, primary occupation, husband's occupation and self-reported total yearly household income.

Before the series of six experimental sessions started, it was randomly determined by rolling a dice which game the payoff calculation would be based on (e.g. standard game or treatment game). Players were matched to two-person borrowing groups by assigning them as player A and B based on the participants list and subsequently pairing them into groups. In the standard game a two-stage mover approach was applied to incentivize all decisions. It was randomly determined by rolling a dice which player moved first and which player moved second. The unconditional repayment decision of the first mover was matched with the corresponding conditional repayment decision of the second mover. In the treatment game the payoffs were calculated based on the unconditional repayment decision of both players since no conditional repayment decisions were elicited. This procedure monetarily incentivized all decisions properly. After the session

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[17]See for example Falk *et al.* (2005), Fischbacher *et al.* (2001), Rustagi *et al.* (2010), and Fischbacher and Gächter (2010) for applications of the strategy method in conditional cooperation experiments and Neugebauer *et al.* (2008) for an application of the strategy method in the Chicken Game. Brandts and Charness (2011) provide a meta-study comparing experiments with the strategy method versus a direct-response method. The majority of studies considered do not find any difference between these two methods. However, it appears that punishment levels are substantially lower with the strategy method since emotions are curbed in hypothetical decisions.

finished, the participants were called one by one into a separate room where they handed in the piece of paper with their participant's code and were paid according to the determined payoff. The decision sheets were shown to them, which also included the peer's investment return if a participant chose to observe her peer's return in the treatments with the peer peeking option.[18]

In total, 105 clients participated in six sessions with on average 17.5 participants per session, and an average session lasted 2.5 hours. The payoffs of the participants, including a show-up fee of Rs. 40, ranged from Rs. 20 to Rs. 290, with an average payoff of Rs. 131. In perspective, the daily wage of an agricultural laborer is around Rs. 100 in the area in which the study was conducted and is similar to the daily income of most clients according to *Gramyasheel Microfinance*.

REPAYMENT RESULTS

The unconditional repayment decision in the standard game mirrors the simultaneous move coordination problem of repayment in group lending in this Chicken Game setup. In the standard microcredit game in the experiment, on average 93 percent of the subjects repay when they do not know their peer's repayment decision (Table 3). The result for the unconditional repayment decision in the standard game does not differ significantly across the three different treatment groups (Table 4, column 1). In the conditional repayment decisions, on average 81 percent of subjects repay their loan given her peer repays, and 74 percent repay given her peer defaults. The drop in repayment rates compared to the unconditional repayment is driven by the lower repayment of the peer peeking-cum-punishment treatment group. Here, the conditional repayment drops to 70 percent both when the peer repays and defaults. In the peer peeking treatment and in the peer punishment treatment, repayment only drops in the conditional repayment decision when the partner defaults. This leaves a marginally significant difference across the treatments in the conditional repayment decisions in situations where the peer repays (Table 4, column 2).

The overall high repayment rates in the standard game contradict Proposition 1. A substantially higher share of subjects repays in the unconditional repayment decision than recommended by game theory for an expected utility maximizer. Under standard preferences it is optimal to play an asymmetric strategy in pure strategies and to place more probability weight on the strategy to default in mixed strategies. Since mixed strategies are not elicited in the experiment, the mixed strategy equilibrium here can only refer to the share in the population that played a specific strategy. In the conditional repayment decisions, under standard preferences an asymmetric strategy is optimal, implying it is best to repay if the peer defaults and to default if the peer repays. The results show, however, that a high share of subjects repays in both conditional repayment decisions, which cannot be explained with standard preferences.

Result 1 *The share of subjects repaying the loan based on the unconditional (93 percent) and the*

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[18]Clients were so distracted by the money that they did not concentrate on the payoffs and decisions of their partners. If they asked, the decisions and the calculation of payoff were explained to them.

TABLE 3: Decisions on repayment, peer peeking, and peer punishment in standard and treatment games

	Peer peeking (1)	Peer punishment (2)	Peer peeking-cum-punishment (3)	All treatment groups (4)
Standard Game				
Repayment - unconditional	0.96	0.96	0.90	0.93
	(0.19)	(0.19)	(0.30)	(0.25)
Repayment - peer repays	0.89	0.93	0.70	0.81
	(0.31)	(0.27)	(0.46)	(0.39)
Repayment - peer defaults	0.79	0.78	0.70	0.74
	(0.42)	(0.42)	(0.46)	(0.44)
Belief that peer repays	0.86	0.96	0.90	0.90
	(0.36)	(0.19)	(0.30)	(0.29)
Treatment Games				
Repayment - unconditional	0.82	0.96	0.76	0.83
	(0.39)	(0.19)	(0.43)	(0.38)
Belief that peer repays	0.93	0.93	0.84	0.89
	(0.26)	(0.27)	(0.37)	(0.32)
Peer peeking	0.86		0.86	0.86
	(0.36)		(0.35)	(0.35)
Belief that peer peeks	0.89		0.78	0.82
	(0.31)		(0.42)	(0.39)
Peer punishment		0.85	0.88	0.87
		(0.36)	(0.33)	(0.34)
Belief that peer punishes		0.81	0.80	0.81
		(0.40)	(0.40)	(0.40)
Peer punishment			0.82	0.82
- unwilling default of peer			(0.39)	(0.39)
Peer punishment			0.78	0.78
- strategic default of peer			(0.42)	(0.42)
Belief that peer punishes			0.88	0.88
- unwilling default			(0.33)	(0.33)
Belief that peer punishes			0.76	0.76
- strategic default			(0.43)	(0.43)
Number of Observations	28	27	50	105

Notes: All variables are binary variables equal to 1 if participant decides to take the respective action, 0 otherwise. Table includes means and standard deviations. Standard deviations are in parentheses below the means.

TABLE 4: Differences in repayment in standard and treatment games across treatment groups

	Standard game			Treatment game
	Repayment - unconditional	Repayment - peer repays	Repayment - peer defaults	Repayment - unconditional
	(1)	(2)	(3)	(4)
Punishment	-0.001	0.033	-0.008	0.142
	(0.048)	(0.080)	(0.101)	(0.101)
Peeking-cum-punishment	-0.064	-0.193*	-0.086	-0.061
	(0.056)	(0.109)	(0.098)	(0.106)
Peer peeking	0.964***	0.893***	0.786***	0.821***
(Constant)	(0.033)	(0.067)	(0.070)	(0.095)
R-squared	0.016	0.072	0.009	0.049
Observations	105	105	105	105
P-value F-test	0.278	0.028	0.444	0.002
Punishment=Peeking-cum-punishment				

Notes: Dependent variable: Repayment - binary variable equal to 1 if participant repays, 0 if participant defaults. (1) Unconditional repayment without knowledge of partner's repayment decision in the standard game. (2) Conditional repayment given the partner repays in the standard game. (3) Conditional repayment given the partner defaults in the standard game. Peer peeking treatment is the reference category. Standard errors are clustered at the joint liability group (JLG)-level. P-value of F-test reported for coefficients of peer punishment and peer peeking-cum-punishment. * p < 0.10, ** p < 0.05, *** p < 0.01.

conditional repayment decisions (81 percent repay when peer repays, 74 percent repay when peer defaults) cannot be explained by standard preferences of an expected utility-maximizing individual.

Social preferences can help to explain such high repayment share. As outlined in section 3, different individual repayment strategies can be explained by specific compositions of envy and altruism among the participants. Following Neugebauer *et al.* (2008), the parameter specification of social preferences is analyzed based on cooperation types. Here, from the conditional repayment decisions four different repayment types can be distinguished: (1) the *always repay*-type who unconditionally cooperates, (2) the *never repay*-type, (3) the *repay reciprocal*-type who conditionally cooperates and, repays if the peer repays and default if the peer defaults, and (4) the *repay conversely*-type who repays if the peer defaults, and defaults if the peer repays.

In this experiment, 63 percent of the participants always repay, independent of their peer's repayment decision (Table 5). 18 percent of the participants repay reciprocal to their partner by responding to repayment with repayment and to default with default and are comparable to conditional cooperators. Reciprocal repayment types reward cooperation with cooperation and punish defection with defection. 11 percent of the players repay conversely to their peer and repay when their peer defaults and vice versa. This is the expected utility-maximizing strategy and should be the most observed one under standard preferences. The rest of the subjects (eight percent) never repay in the conditional repayment decision. Those subjects are hard to interpret. All of them repaid in the unconditional repayment decision, so they cannot be characterized as general defectors, but rather by displaying an inconsistent behavior. The likelihood of being of

TABLE 5: Repayment type based on conditional repayment decisions in standard game

	Peer peeking	Peer punishment	Peer peeking-cum-punishment	All treatment groups	F-stat p-value
	(1)	(2)	(3)	(4)	(5)
Always repays	0.71	0.74	0.52	0.63	0.111
	(0.46)	(0.45)	(0.50)	(0.49)	
Never repays	0.04	0.04	0.12	0.08	0.425
	(0.19)	(0.19)	(0.33)	(0.27)	
Repays reciprocal	0.18	0.19	0.18	0.18	0.998
	(0.39)	(0.40)	(0.39)	(0.39)	
Repays conversely	0.07	0.04	0.18	0.11	0.075
	(0.26)	(0.19)	(0.39)	(0.32)	
Number of Observations	28	27	50	105	

Notes: Dependent variables: Repayment type - binary variable equal to 1 if participant is of the respective type, 0 otherwise.. (1) Always repays-type repays in conditional repayment decision when peer repays and when peer defaults. (2) Never repays-type defaults in conditional repayment decision when peer repays and when peer defaults. (3) Repay reciprocal-type repays in conditional repayment decision when peer repays and defaults when peer defaults. (4) Repay conversely-type repays in conditional repayment decision when peer defaults and defaults when peer repays. Standard errors clustered at the joint liability group (JLG)-level for the F-test regressions of characteristics on treatment dummies, F-test compares (2) and (3) to (1).

a specific type does not differ across the treatment groups, except for the repay conversely-type (Table 5, column 5). However, none of the socioeconomic characteristics is significantly correlated to the repayment type so it is hard to explain this difference based on observed characteristics (Appendix Table B.1).

Including social preferences can actually lead to cases in which specific strategies are dominant in the Chicken Game, although no dominant strategies exist under standard preferences. As described in Table 2, *always repay* becomes a dominant strategy for individuals with high altruism ($\beta > \frac{59}{120}$) and low envy ($\alpha < \frac{1}{20}$). In contrast, *repay reciprocal* becomes a best response for individuals with both high altruism ($\beta > \frac{59}{120}$) and high envy ($\alpha > \frac{1}{20}$). The expected utility-maximizing strategy *repay conversely* remains a best response for individuals with low other-regarding preferences ($\beta < \frac{59}{120}$ and $\alpha < \frac{1}{20}$). The high share of subjects who always repay their loan can be described by altruistic preferences in the extended version of the Fehr-Schmidt model as in Neugebauer *et al.* (2008).

Result 2 *High altruistic behavior ($\beta > \frac{59}{120}$) can explain unconditional and conditional cooperation resulting in the observed high repayment rates of over 90 percent.*

In comparison, Neugebauer *et al.* (2008) could classify 53 percent of subjects as selfish, expected utility-maximizing individuals playing the asymmetric cooperation strategy, and 30 percent as unconditional cooperators who always cooperate in their conventional lab experimental on the Chicken Game. Cabon-Dhersin and Etchart-Vincent (2011) also find that cooperation levels are much higher in their conventional lab experiment than theoretically predicted. They can assign higher probabilities of cooperating to a higher share of strategic cooperators in the

population who use expected utility-maximizing strategies. Although comparable in terms of higher experimentally observed cooperation than theoretically predicted, the observed cooperation level in the present experiment is far higher than in the other experiments on cooperation in the Chicken Game. Compared to studies on conditional cooperators in public goods, the share of conditional cooperators in this experiment corresponding to the repay reciprocal-type (18 percent) is lower than observed in studies by Fischbacher *et al.* (2001) (50 percent conditional cooperators) or Rustagi *et al.* (2010) (34 percent). Instead the level of unconditional cooperators with 63 percent is substantially higher than for example found in Rustagi *et al.* (2010) (two percent of altruists). Although other studies find more cooperation than predicted for expected utility maximizers, the parameter β for altruism has to be over ten times larger than the parameter α for envy to explain the high repayment levels in this experiment. Fehr and Schmidt (1999), in contrast, exclude the case of $\beta > \alpha$ since they argue that individuals will always suffer more from disadvantageous than from advantageous inequality. Consequently, the necessary parameter specification for social preferences in this experiment contains an infeasible high level of altruism.

Explanations from the social-anthropology literature stress honor and honesty among the poor as described for Bangladesh by Karim (2008). He argues that "for the poor, the discourse of honor is a symbolic covenant with God. It is a moral resource through which they view themselves as morally superior to rich and urban people." Hence, it is understandable if they do not want to dishonor themselves by defaulting. Nevertheless, the failure of credit markets and the introduction of joint liability show that this explanation cannot be sufficient for guaranteeing loan repayment in microfinance.

Other interpretations of the results seem plausible. In the microfinance institution studied, clients receive a group training where the concept of joint liability lending is explained and tested before clients receive a loan. To further induce solidarity with the group and with the microfinance institutions, clients take a pledge at every meeting, stating that they will support their group and always repay their loan. These measures could have actually induced clients to internalize behavior patterns of *good borrowers* who always repay their loan which may cause the high repayment rates observed in the experiment. Section 5 discusses this point further.

Peer peeking and peer punishment results

Assumptions in theoretical models advocate peer monitoring and peer punishment, and experimental observations find that people punish even when this does not yield any pecuniary benefits. Based on these two findings, the treatments of peer peeking, peer punishment and peer peeking-cum-monitoring were designed to analyze experimentally the use of non-credible enforcement technologies and their effect on repayment behavior.

The unconditional repayment decision in the treatment games is similar to the one observed

in the standard game. On average, 83 percent of subjects chose to repay their loan (Table 3), with no significant difference between the treatments (Table 4, column 4). In the treatments, participants decide to engage in costly peer peeking or peer punishment. Both non-credible enforcement technologies are costly without yielding any pecuniary benefits. An expected utility-maximizing individual will neither choose to peek on her peer nor to punish her. On average across the peer peeking and the peer peeking-cum-punishment treatment, 86 percent of subjects observe the investment return of her peer at a cost after loan repayments have been conducted (Table 3) with no difference between the level of peeking in the peer peeking treatment (86 percent) and in the peer peeking-cum-punishment treatment (86 percent) (Wilcoxon rank sum test, z = -0.035, Prob > |z| = 0.9724). A similar high share believes that her peer costly observes her investment return (82 percent) with no difference between both treatments with peer peeking (Wilcoxon rank sum test, z = 1.238, Prob > |z| = 0.2158).

The observed level of peer punishment is on average 87 percent, with 85 percent of subjects punishing a defaulting peer in the peer punishment treatment and 88 percent in the peer peeking-cum-punishment. There is no significant difference in this unconditional punishment decision across the treatment groups (Wilcoxon rank sum test, z = -0.348, Prob > |z| = 0.7276). On average, 80 percent believe that her peer will punish her in case of default with no difference in beliefs across treatments (Wilcoxon rank sum test, z = 0.156, Prob > |z| = 0.8763).

In the peer peeking-cum-punishment treatment, subjects can distinguish between the reasons for default, e.g. unwilling default because of an unlucky investment or strategic default. While both theoretical models by Besley and Coate (1995) and Armendáriz de Aghion (1999) assume that borrowers within a group use their local information advantage to distinguish between unwilling and strategic defaulters and only punish strategic defaulters, I find that unwilling and strategic default is punished alike. 88 percent of participants in the peer peeking-cum-punishment treatment punish a defaulting peer when they do not know the reason of default since they lack the possibility of observing the peer's investment return or due to the decision not to observe it. This share reduces marginally to 82 percent who punish unwilling default due to bad investment with no statistically significant difference to the unconditional punishment decision (Wilcoxon signed-rank test, z = 0.832, Prob > |z| = 0.4054). Strategic default is punished by 78 percent of participants. While this is not statistically significant from the punishment of unwilling default when the default reason is known (Wilcoxon signed-rank test, z = 0.577, Prob > |z| = 0.5637), it is lower than punishment when the default reason is unknown (Wilcoxon signed-rank test, z = 1.667, Prob > |z| =0.0956). This difference, however, is only marginally significant. The observed high level of punishment implies that borrowers do not distinguish the reasons for default, but punish unlucky investors who unwillingly defaulted and rely on mutual insurance via joint liability to the same extent as strategical defaulters who take advantage of the joint liability and free-ride on the repayment of their peer. The result can be summarized as:

Result 3 *A substantial share of participants engages in costly peer peeking (86 percent) and*

peer punishment (87 percent). Participants do not distinguish between unwilling and strategic default and punish defaulters in both cases alike.

These results strongly reject the game theoretic suggestions that subjects with standard preferences would not engage in costly peer peeking or peer punishment that is pecuniary non-beneficial. These results are more likely to be explained by social preferences for which positive levels of costly, pecuniary non-beneficial peer peeking and peer punishment may be observed. As outlined by Carpenter (2007), under social preferences it may be rational for individuals to engage in costly punishment.

Possible explanations for the high observed level of punishment could follow Fehr and Gächter (2000)'s finding that people punish free-riders because they are averse to being taken advantage of. In their study they observe a punishment level of up to 51 percent. In the present experiment, not only strategic default but also unwilling default is punished. The motives to punish seem to be beyond what Fehr and Gächter (2000) suggest. Henrich *et al.* (2006) study punishment in one-shot situations in different non-standard populations and claim that the willingness to engage in costly punishment is part of human psychology and a key element in social organization. They also find that costly punishment varies with altruistic behavior across populations. The high level of altruism necessary to explain the unconditional cooperation in the standard game could also be an explanation for the high punishment observed in the experiment. However, measures of altruism were not assessed experimentally, so this point is hard to verify.

Rustagi *et al.* (2010) find that the share of conditional cooperators in a group is positively related to a higher investment in cooperation enforcement. While this has been shown with a standard subject pool by Fehr and Gächter (2002) and Falk *et al.* (2005), Rustagi *et al.* (2010) show that this also holds true in actual commons management in Ethiopia. In the present experiment, the correlation between the unconditional repayment decision in the treatment game and the likelihood of engaging in peer peeking or peer punishment is positive (Table 6). The strong and significant correlation (Spearman's $\rho = 0.5891$) between the unconditional repayment decision and the decision to peek on ones peer is significantly different from zero at the one percent significance level. The positive correlation (Spearman's $\rho = 0.1353$) between the unconditional repayment decision and peer punishment of defaulting peers is not significantly different from zero. The conditional repayment decisions in the standard game classify the repayment type similar to general cooperation types in studies on conditional cooperation. Analyzing the correlation between the repayment type and the decision to peek on peers and punish defaulters, there is a positive correlation between the *always repay*-type, as well as the *repay conversely*-type and both the decision to peek on and punish a peer. The correlation between the *never repay*-type and the *repay reciprocal*-type and both the decision to peek on and punish a peer is negative. Only the negative correlation between the *repay reciprocal*-type is significantly different from zero at the ten percent significance level. The results indicate that those who unconditionally cooperate have a higher propensity to engage in costly, non-credible enforcement technologies within the

TABLE 6: Correlations of repayment decisions and use of non-credible enforcement technologies

Spearman's ρ between	Peer peeking decision	Peer punishment decision
	(1)	(2)
Repayment - unconditional	0.5891	0.1353
	(0.000)	(0.241)
Always repays	0.1114	0.1555
	(0.332)	(0.177)
Never repays	-0.0017	-0.0122
	(0.989)	(0.916)
Repays reciprocal	-0.1944	-0.2185
	(0.088)	(0.056)
Repays conversely	0.0583	0.0343
	(0.612)	(0.767)

Notes: Table includes Spearman's ρ of correlation between row variable and (1) peer peeking or (2) peer punishment in the treatment game. P-values of t-test of the Spearman's ρ in parentheses.

treatment game. But these results are not confirmed by combining the measures of repayment types in the standard game and the peeking and punishment decisions in the treatment game.

One implication of the observed high level of punishment is particularly interesting for the case of joint liability. Since subjects punished unwilling and strategic defaulters alike, it seems that borrowing peers do not happily provide mutual insurance for an unlucky investor who unwillingly defaults. Instead they punish her in the same way as a strategic defaulter. This results contradicts the assumption made in the theoretical models by Besley and Coate (1995) and Armendáriz de Aghion (1999) who state that borrowers within a group use their local information advantage to only punish strategic defaulters. Also, the observed high level of punishment in the experiment is mirrored in anecdotal evidence on extensive levels of punishment (Rahman (1999), Karim (2008) and Klas (2011)). So far, there are no theoretical models considering peer punishment decisions and in particular no theoretical models that differentiate between punishment for unwilling and strategic defaulters. Also the possible implications for repayment and client welfare have not been studied yet. This experimental study provides first evidence that the assumptions made so far may not match reality. Consequently, further theoretical and empirical research is needed to analyze peer punishment decisions and potential changes in welfare implications of joint liability lending.

5 Discussion of experimental design and results

This framed field experiment was conducted with actual microfinance clients in northern India. The objective of the research design is to model the borrowing situation in group lending as realistic as possible. The clients' low literacy level and the limited infrastructure in the field were major challenges that influenced the design of the experiment. This section discusses potential concerns with the experimental design and the consequences for the results.

The first concern is that the participants did not understand the game properly. Due to the lacking literacy of the subject pool, no formal questions to test understanding that clients would answer by pen and paper could be asked. Instead, during the illustrations, the instructor always asked questions, and the explanations were repeated until the instructors felt comfortable with the participants' understanding. Moreover, some participants asked questions during the instructions, which also indicates that they were following the instructions closely. If participants had had difficulties understanding the game, better educated participants would have displayed a different repayment behavior. Table 7 shows that participants' level of education or literacy does not have any significant correlation with the repayment decisions with one exception. The years of education show a positive, marginally significant effect on the client's conditional repayment decision when the partner does not repay (Table 7 column 3). However, if clients who understood the game had chosen the expected utility-maximization strategy of converse repayment, a negative effect of education or literacy as a proxy for client understanding would be expected for the conditional repayment decision when the partner repays. Since this is not supported by the data, and since the microfinance game was designed very similar to participant's real-life microcredit experience, I am very confident that the participants understood the game properly. In addition, the education level or literacy are not significantly correlated with the repayment types which gives further confidence (Appendix Table B.1).

A second concern regards the comparability of the unconditional repayment decision in the standard and the treatment games. Because the standard game was always played before the treatment game, learning effects from the standard game to the treatment game are possible. Since the present design lacks an extension game without treatment, learning effects cannot be identified and repayment decisions in the standard and treatment games are not directly comparable.

A third concern is the lacking privacy in decision making and the presence of the real-life borrowing group in the experimental session. Due to logistical challenges clients were seated in rows in one big room with their real-life borrowing group members instead of being seated in separate booths. The chosen location was already the most suitable one in the field. The illiterate clients needed the instructors' assistance to show where to circle the answers *yes* or *no*. This assistance could be provided more easily in the chosen seating configuration. Participants were seated in three rows with around a one meter space between the rows. They were asked to turn their decision sheets around once they made a decision by circling *yes* or *no*. Clients followed this instruction eagerly and secured the turned pages with their hands. The instructors made sure that participants were not talking to each other or peeked at their neighbor's decision sheet. Given these precautions and given the illiteracy of most participants it seems very unlikely that participants could observe the answers of the other participants and hence fear consequences from their real-life borrowing group partners because of their decision making in the experiment. Further, the concern that the presence of group members influenced decisions only yields a

TABLE 7: Determinants of repayment in standard and treatment games

	Standard game			Treatment game
	Repayment - unconditional	Repayment - peer repays	Repayment - peer defaults	Repayment - unconditional
	(1)	(2)	(3)	(4)
Age	-0.003	0.004	0.001	-0.000
	(0.004)	(0.005)	(0.005)	(0.004)
Relation to household head	0.017	0.053	0.026	0.051*
	(0.014)	(0.038)	(0.038)	(0.027)
Household size	0.016	-0.016	0.013	0.013
	(0.010)	(0.021)	(0.017)	(0.019)
Education (years)	0.001	0.007	0.032*	-0.025
	(0.007)	(0.023)	(0.019)	(0.026)
Literate	0.007	-0.131	-0.283	0.217
	(0.047)	(0.145)	(0.194)	(0.173)
Annual household income (in Rs.)	0.000	0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.812***	0.583**	0.502**	0.673***
	(0.164)	(0.216)	(0.239)	(0.184)
R-squared	0.080	0.058	0.059	0.035
Observations	104	104	104	104

Notes: Dependent variable: Repayment - binary variable equal to 1 if participant repays, 0 if participant defaults. (1) Unconditional repayment without knowledge of partner's repayment decision in the standard game. (2) Conditional repayment given partner repays in the standard game. (3) Conditional repayment given partner defaults in the standard game. Standard errors are clustered at the joint liability group (JLG)-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

plausible explanation for the high repayment rate, but not necessarily for the high punishment level. Regarding the high repayment levels, the presence of the real-life borrowing group members could induce subjects to cooperate and repay as a signal to the other group members of being a good, cooperating borrower. However, with punishment, the effect is less clear. On the one hand, subjects may want the other group members to see that they are a norm enforcer willing to punish any default. On the other hand, subjects may not want to openly punish other people whom they have social relationships with because this may induce mistrust or other negative emotions. If the group presence should be inducing behavior that is beneficial to the group it is questionable whether this would include high or low levels of punishment.

A fourth concern is that the experiment uses the same institutional setting in the lab-in-the-field experiment as clients actually do in their real-life borrowing. Although in practice, loan repayments are not collected at the location of *Gramyasheel Microfinance* but at the decentralized center meetings, subjects participating in the framed field experiment may associate the experiment with their real-life lending institution. The similar institutional setting might have induced the clients to behave in the experiment how they were trained to behave by the microfinance institution. This is exactly what this lab-in-the-field experiments aimed to study. However, there are two possible explanations for the observed behavior. The subjects' behavior in the experiment shows how they would actually act in reality as a result of the microlender's borrowing training and mission indoctrination. Alternatively, subjects behaved this way in the experiment to impress the microlender and signal that they are good borrowers who repay their loan and discipline their peers. This experimental setup does not allow me to distinguish between these two explanations. To minimize the possibility of clients behaving to impress the microlender, it was explained in the beginning of the session that individuals' decisions in the experiment will only be identified by the participant code, and that the real identity of the participants will not be revealed. Moreover, it was stated that none of the decisions made in the experiment, will be revealed to the microfinance institution. This point was stressed by banning *Gramyasheel Microfinance* staff from the experimental sessions. When they tried to enter the room, they were immediately asked to leave. To disentangle both drivers of behavior, data on real life punishment behavior could help to distinguish whether clients displayed their genuine behavior in the experiment or whether they tried to behave in a way they believed would meet their microlender's expectation of good borrower behavior. Unfortunately, this kind of data is hardly ever available. The only information available in this case stems from an accompanying client survey with 200 clients of *Gramyasheel Microfinance* in which coping mechanisms of clients with income shocks were studied (Czura and Hebous (2012)). Questions on the knowledge about fellow group members' private and business situations reveals that clients exert some effort to observe their peers business and private situations. Over 40 percent state that they go to the business or home of a fellow client in order to check the situation, which is similar to the peer peeking in this experiment.

Figure 7: Real-life information on peer peeking
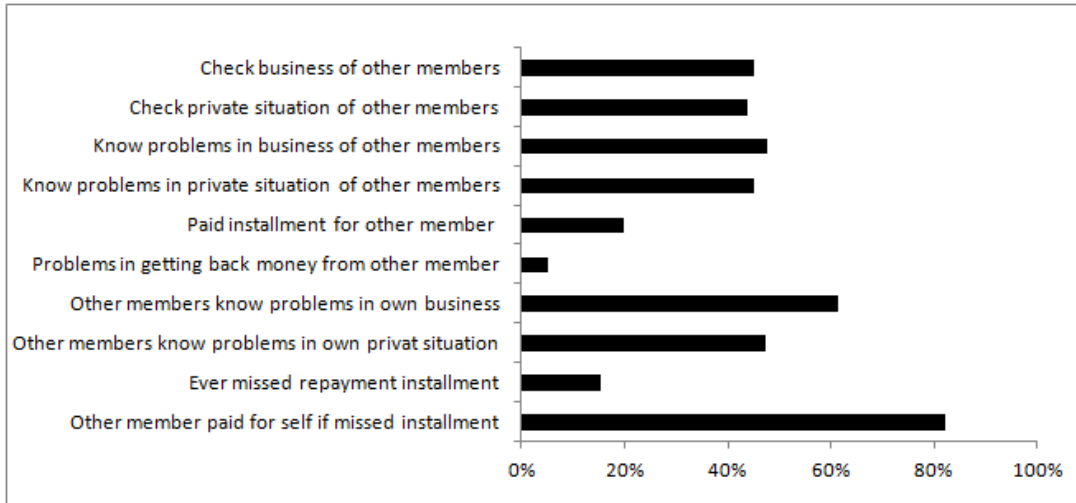
Note: Information based on household survey data of Gramyasheel Microfinance clients in 2011 by Czura and Hebous (2012)

This gives some confidence that the behavior exposed in the microfinance investment game replicates subjects' real behavior in their every day microfinance related activities and not just imitates expected behavior from the microlender. One possible explanation of the observed behavior in the experiment aside high levels of altruism among participants is that clients have internalized the credo of the microfinance institution about being a good borrower who repays her loan and disciplines her peers.

6 Conclusion

Joint liability is the best known innovative technique in microfinance. It addresses adverse selection and moral hazard issues by seizing local private information to induce peer selection, and existing social capital to induce peer monitoring and peer pressure with the threat of social sanctions. While this is manifested in high repayment rates in joint liability lending it is also accompanied by anecdotal evidence suggesting that there is over-extensive peer punishment in the field.

I use a microcredit lab-in-the-field experiment to shed light on the coordination problem in group loan repayment and the use of non-credible enforcement technologies, namely peer peeking, peer punishment, and peer peeking-cum-punishment. Combining game theoretical analysis of the Chicken Game describing the coordination problem in group loan repayment and experimental evidence on repayment, peer peeking, and peer punishment, I find that cooperation in form of loan repayment is extremely high and cannot be explained by standard preferences of an expected utility maximizing individual. Social preferences can explain such high repayment rates only with infeasible high levels of altruism. Analyzing the use of non-credible enforcement

36

technologies reveals that subjects excessively peek on their peers and punish defaulters. Unwilling and strategic defaulters are punished alike, indicating that borrowing peers reluctantly mutually insure each other and penalize defaulters in any case. This excessive peer peeking and peer punishment cannot be explained for an expected utility maximizer. An alternative explanation for the behavior is that subjects have internalized behavior based on the microfinance institution's credo of being a good borrower by repaying the loan and disciplining the peers.

Although there are limitations in the design and the actual realization of this lab-in-the-field experiment, it is one of the first studies that actually looks explicitly at the coordination problem in microfinance as modeled by the Chicken Game. It is also the first approach to analyze decisions on costly peer peeking and peer punishment. The results cannot be explained by selfish, expected utility maximizing behavior, and only by infeasible high levels of altruism. This suggests that other explanations such as behavioral motives and the mission indoctrination of the microlender aimed at inducing desired behavior are needed for understanding how repayment coordination in group lending works, if joint liability induces too much peer pressure, and what structures may replace joint liability for achieving similar repayment rates with less peer pressure.

References

ABBINK, K., IRLENBUSCH, B. and RENNER, E. (2006). Group size and social ties in microfinance institutions. *Economic Inquiry*, **44** (4), 614–628.

ARMENDÁRIZ DE AGHION, B. (1999). On the design of a credit agreement with peer monitoring. *Journal of Development Economics*, **60** (1), 79–104.

— and GOLLIER, C. (2000). Peer group formation in an adverse selection model. *Economic Journal*, **110** (465), 632–43.

ARUNACHALAM, R. S. (2010). What is coercion in repayment: A client perspective from Indian micro-finance, online source: http://microfinance-in-india.blogspot.de/2010/11/what-is-coercion-in-repayment-client.html.

BAGNOLI, M. and LIPMAN, B. L. (1989). Provision of public goods: Fully implementing the core through private contributions. *Review of Economic Studies*, **56** (4), pp. 583–601.

BARBONI, G., CASSAR, A., TREJO, A. R. and WYDICK, B. (2010). Adverse selection and moral hazard in joint-liability contracts: Evidence from an artefactual field experiment, working paper.

BESLEY, T. and COATE, S. (1995). Group lending, repayment incentives and social collateral. *Journal of Development Economics*, **46** (1), 1 – 18.

BISWAS, S. (2010). India's micro-finance suicide epidemic, BBC News South Asia: online source http://www.bbc.co.uk/news/world-south-asia-11997571.

BRANDTS, J. and CHARNESS, G. (2011). The strategy versus the direct-response method: A first survey of experimental comparisons. *Experimental Economics*, **14** (3), 375–398.

BUNCOMBE, A. (2010). Suicides and pressure tactics tarnish image of micro-finance lending, The Independent, online source http://www.independent.co.uk/news/world/asia/suicides-and-pressure-tactics-tarnish-image-of-microfinance-lending-2140314.html.

CABON-DHERSIN, M.-L. and ETCHART-VINCENT, N. (2011). The puzzle of cooperation in a Chicken Game: An experimental study, working paper.

CARPENTER, J. and WILLIAMS, T. (2010). Peer monitoring and microcredit: Field experimental evidence from Paraguay, working paper.

CARPENTER, J. P. (2007). The demand for punishment. *Journal of Economic Behavior & Organization*, **62** (4), 522 – 542.

CASARI, M. (2005). On the design of peer punishment experiments. *Experimental Economics*, **8**, 107–115.

CASSAR, A., CROWLEY, L. and WYDICK, B. (2007). The effect of social capital on group loan repayment: Evidence from field experiments. *Economic Journal*, **117** (517), F85–F106.

CZURA, K. and HEBOUS, S. (2012). The role of microfinance and migration in disaster management: Evidence from Northern India, working paper.

EREV, I. and RAPOPORT, A. (1990). Provision of step-level public goods: The sequential contribution mechanism. *Journal of Conflict Resolution*, **34** (3), pp. 401–425.

FALK, A., FEHR, E. and FISCHBACHER, U. (2005). Driving forces behind informal sanctions. *Econometrica*, **73** (6), 2017–2030.

FEHR, E. and GÄCHTER, S. (2000). Cooperation and punishment in public goods experiments. *American Economic Review*, **90** (4), 980–994.

— and GÄCHTER, S. (2002). Altruistic punishment in humans. *Nature*, **415**, 137–140.

— and SCHMIDT, K. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, **114** (3), 817–868.

— and — (2006). The economics of fairness, reciprocity and altruism - Experimental evidence and new theories. In S.-C. Kolm and J. M. Ythier (eds.), *Handbook of the Economics of Giving, Altruism and Reciprocity*, vol. 1, Amsterdam: North Holland, pp. 615–691.

FISCHBACHER, U. and GÄCHTER, S. (2010). Social preferences, beliefs, and the dynamics of free riding in public goods experiments. *American Economic Review*, **100** (1), 541–56.

—, GÄCHTER, S. and FEHR, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters*, **71** (3), 397–404.

GHATAK, M. (1999). Group lending, local information and peer selection. *Journal of Development Economics*, **60** (1), 27–50.

— (2000). Screening by the company you keep: Joint liability lending and the peer selection effect. *Economic Journal*, **110** (465), 601–31.

— and GUINNANE, T. (1999). The economics of lending with joint liability: Theory and practice. *Journal of Development Economics*, **60** (1), 195–228.

GINÉ, X., JAKIELA, P., KARLAN, D. and MORDUCH, J. (2010). Microfinance games. *American Economic Journal: Applied Economics*, **2** (3), 60–95.

— and KARLAN, D. (2010). Group versus individual liability: Long term evidence from Philippine microcredit lending groups, working paper.

GOKHALE, K. (2009). Group borrowing leads to pressure, The Wall Street Journal: online source http://online.wsj.com/article/SB125008232217325553.html.

GOVERNMENT OF INDIA (2012). Poverty estimates for 2009-2010 - Press release of the planning commission, online source http://planningcommission.nic.in/news/press_pov1903.pdf.

GÄCHTER, S. and HERRMANN, B. (2009). Reciprocity, culture and human cooperation: Previous insights and a new cross-cultural experiment. *Philosophical Transactions of the Royal Society B: Biological Sciences*, **364** (1518), 791–806.

—, — and THÖNI, C. (2004). Trust, voluntary cooperation, and socio-economic background: Survey and experimental evidence. *Journal of Economic Behavior & Organization*, **55** (4), 505 – 531.

HARRISON, G. W. and LIST, J. A. (2004). Field experiments. *Journal of Economic Literature*, **42** (4), 1009–1055.

HENRICH, J., ENSMINGER, J., MCELREATH, R., BARR, A., BARRETT, C., BOLYANATZ, A., CARDENAS, J. C., GURVEN, M., GWAKO, E., HENRICH, N., LESOROGOL, C., MARLOWE, F., TRACER, D. and ZIKER, J. (2010). Markets, religion, community size, and the evolution of fairness and punishment. *Science*, **327** (5972), 1480–1484.

—, MCELREATH, R., BARR, A., ENSMINGER, J., BARRETT, C., BOLYANATZ, A., CARDENAS, J. C., GURVEN, M., GWAKO, E., HENRICH, N., LESOROGOL, C., MARLOWE, F., TRACER, D. and ZIKER, J. (2006). Costly punishment across human societies. *Science*, **312** (5781), 1767–1770.

KARIM, L. (2008). Demystifying micro-credit. *Cultural Dynamics*, **20** (1), 5–29.

KARLAN, D. (2005). Using experimental economics to measure social capital and predict financial decisions. *American Economic Review*, **95** (5), 1688–1699.

KLAS, G. (2011). *Die Mikrofinanz-Industrie: Die grosse Illusion oder das Geschäft mit der Armut*. Assoziation A.

LIST, J. A. (2006). The behavioralist meets the market: Measuring social preferences and reputation effects in actual transactions. *Journal of Political Economy*, **114** (1), pp. 1–37.

MADAJEWICZ, M. (2011). Joint liability versus individual liability in credit contracts. *Journal of Economic Behavior & Organization*, **77** (2), 107 – 123.

MORDUCH, J. (1999). The microfinance promise. *Journal of Economic Literature*, **37** (4), pp. 1569–1614.

NEUGEBAUER, T., POULSEN, A. and SCHRAM, A. (2008). Fairness and reciprocity in the Hawk-Dove game. *Journal of Economic Behavior & Organization*, **66** (2), 243 – 250.

RAHMAN, A. (1999). Micro-credit initiatives for equitable and sustainable development: Who pays? *World Development*, **27** (1), 67 – 82.

RAI, A. and SJÖSTRÖM, T. (2004). Is Grameen lending efficient? Repayment incentives and insurance in village economies. *Review of Economic Studies*, **71** (1), 217–234.

RAPOPORT, A. (1985). Provision of public goods and the MCS experimental paradigm. *American Political Science Review*, **79** (1), pp. 148–155.

RUSTAGI, D., ENGEL, S. and KOSFELD, M. (2010). Conditional cooperation and costly monitoring explain success in forest commons management. *Science*, **330** (6006), 961–965.

RUTHERFORD, S., MANIRUZZAMAN, M., SINHA, S. and ACNABIN & CO (2004). Grameen II - At the end of 2003 - a 'grounded view' of how Grameen's new initiative is progressing in the villages, MicroSave report.

SELTEN, R. (1967). Die Strategiemethode zur Erforschung des eingeschränkt rationalen Verhaltens im Rahmen eines Oligopolexperimentes. In H. Sauermann (ed.), *Beiträge zur Experimentellen Wirtschaftsforschung*, Tübingen: J.C.B. Mohr (Paul Siebeck), pp. 136–68.

STIGLITZ, J. E. (1990). Peer monitoring and credit markets. *World Bank Economic Review*, **4** (3), 351–66.

TAYLOR, M. and WARD, H. (1982). Chickens, whales, and lumpy goods: Alternative models of public-goods provision. *Political Studies*, **30** (3), 350–370.

VAN DE KRAGT, A., ORBELL, J. and DAWES, R. (1983). The minimal contributing set as a solution to public goods problems. *American Political Science Review*, **77** (1), pp. 112–122.

VARIAN, H. R. (1990). Monitoring agents with other agents. *Journal of Institutional and Theoretical Economics*, **146**, 153–174.

YUNUS, M. (2002). Grameen Bank II - Designed to open new possibilities, Grameen Dialogue, online source http://www.grameen.com.

Appendix A   Proofs

Simultaneous moves game - part (a) of Proposition 1

Given that player 1 *repays* with probability p, the expected payoff for player 2 is $93\frac{1}{18}\cdot p + 8\frac{1}{3}\cdot(1-p)$ if she *repays* and $175 \cdot p + 0$ if if she *defaults*. Hence, player 2's best response is to *repay* if $93\frac{1}{18} \cdot p + 8\frac{1}{3} \cdot (1-p) > 175 \cdot p$, that is if $p < \frac{6}{65}$. Likewise, player 2's best response is *default* if $p > \frac{6}{65}$. For $p = \frac{6}{65}$ player 2 is indifferent between *repay* and *default*. Let $b(p)$ denote the probability of *repaying* in the best response of player 2 to player 1's probability to *repay* p, then the best response correspondence of player 2 is given by

$$b(p) = \begin{cases} 1 & \text{if } p < \frac{6}{65} \\ (0,1) & \text{if } p = \frac{6}{65} \\ 0 & \text{if } p > \frac{6}{65} \end{cases} \tag{2}$$

Let q denote the probability that player 2 *repays*. Player 1's best response correspondence is symmetric to player 2's best response correspondence and is given by

$$b(q) = \begin{cases} 1 & \text{if } q < \frac{6}{65} \\ (0,1) & \text{if } q = \frac{6}{65} \\ 0 & \text{if } q > \frac{6}{65} \end{cases} \tag{3}$$

A Nash equilibrium is a pair of probabilities (p,q) such that $p \in b(q)$ and $q \in b(p)$. It is easily seen that the only three equilibria are $(1,0), (0,1)$ and $(\frac{6}{65}, \frac{6}{65})$. This corresponds to two equilibria in pure strategies (*repay*, *default*) and (*default*, *repay*) and one symmetric equilibrium in mixed strategies were player i plays ($\frac{6}{65}$*repay*, $\frac{59}{65}$*default*).

Graphically this is illustrated in Figure A.1.

Sequential move game - part (b) of Proposition 1

The conditional repayment decision is modeled by the best response of a second mover, given all possible moves of the first mover in a sequential setup. If player 1 repays, it is player 2's best response to default, since $93\frac{1}{18} > 8\frac{1}{3}$. If player 1 defaults, it is player 2's best response to repay, since $8\frac{1}{3} > 0$. The symmetric game structure shows that player 1's best response to player 2's strategies is the same. This establishes part (b) of the proposition.

This proves both parts of Proposition 1.∎

FIGURE A.1: Best response correspondences for player 1 and 2
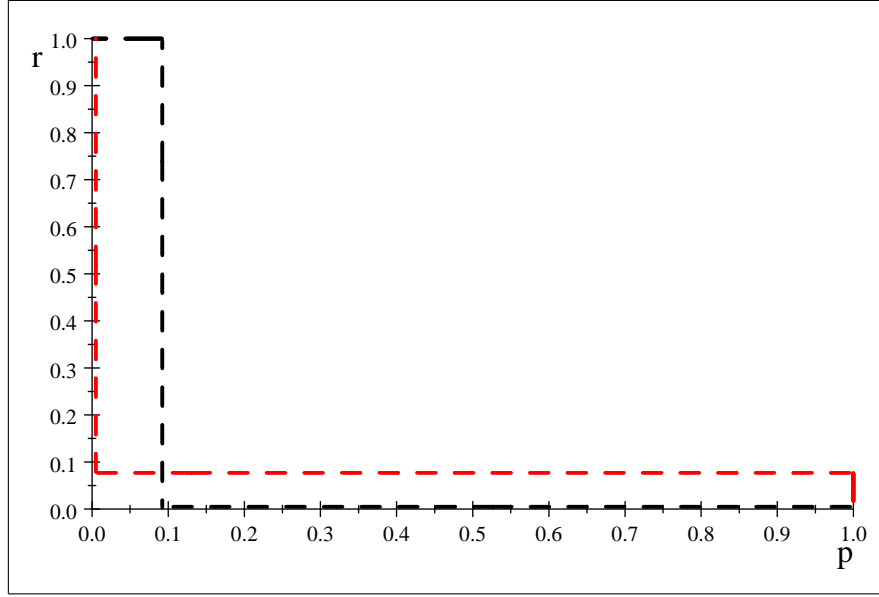
SKETCH OF PROOF OF PROPOSITION 3

With social preferences, the best response structure of the game changes which can lead to cooperative outcomes in the Chicken Game. Also, dominant strategies can arise. Table 2 sets out the parameter restrictions for different best responses of player i.

- *Always repay* becomes a best response for player i if

$$93\frac{1}{18} > 175 - 166\frac{2}{3}\beta \quad \text{and}$$
$$8\frac{1}{3} - 166\frac{2}{3}\alpha > 0$$

  or $\alpha < \frac{1}{20}$ and $\beta > \frac{59}{120}$.

- *Never repay* becomes a best response for player i if

$$93\frac{1}{18} < 175 - 166\frac{2}{3}\beta \quad \text{and}$$
$$8\frac{1}{3} - 166\frac{2}{3}\alpha < 0$$

  or $\alpha > \frac{1}{20}$ and $\beta < \frac{59}{120}$

- *Repay reciprocal*, e.g. repay when the other player repays, and default when the other

43

player defaults, becomes a best response for player i if

$$93\frac{1}{18} \quad > \quad 175 - 166\frac{2}{3}\beta \quad \text{and}$$
$$8\frac{1}{3} - 166\frac{2}{3}\alpha \quad < \quad 0$$

or $\alpha > \frac{1}{20}$ and $\beta > \frac{59}{120}$.

- *Repay conversely*, e.g. repay when the other player defaults, and default when the other player repays, becomes a best response for player i if

$$93\frac{1}{18} \quad < \quad 175 - 166\frac{2}{3}\beta \quad \text{and}$$
$$8\frac{1}{3} - 166\frac{2}{3}\alpha \quad > \quad 0$$

or $\alpha < \frac{1}{20}$ and $\beta < \frac{59}{120}$.

If a player's best response structure is to always repay or repay reciprocal, cooperative outcomes occur in the Chicken Game.
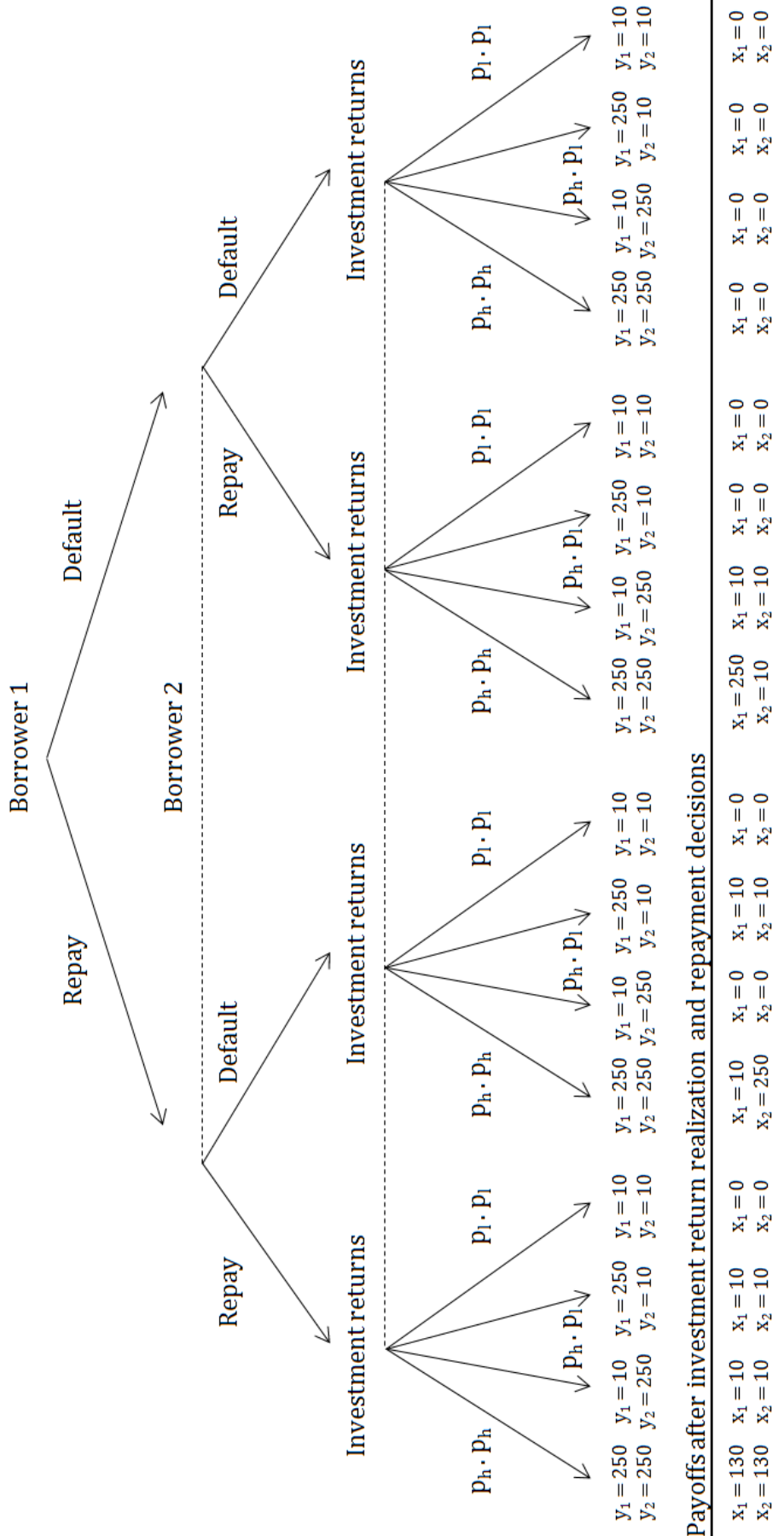
Appendix B Tables

TABLE B.1: Determinants of repayment type

	Always repays	Never repays	Repays reciprocal	Repays conversely
	(1)	(2)	(3)	(4)
Age	0.005	0.000	-0.001	-0.004
	(0.005)	(0.002)	(0.006)	(0.004)
Relation to house-	0.055	-0.024	-0.002	-0.028
hold head	(0.044)	(0.020)	(0.036)	(0.032)
Household size	0.003	0.006	-0.019	0.010
	(0.020)	(0.013)	(0.016)	(0.017)
Education (years)	0.027	-0.012	-0.020	0.005
	(0.026)	(0.013)	(0.014)	(0.018)
Literate	-0.246	0.168	0.114	-0.037
	(0.180)	(0.153)	(0.130)	(0.104)
Annual household	0.000**	-0.000	-0.000	-0.000
income (in Rs.)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.194	0.109	0.389	0.308
	(0.207)	(0.128)	(0.246)	(0.186)
R-squared	0.082	0.043	0.033	0.029
Observations	104	104	104	104

Notes: Dependent variable: Repayment - binary variable equal to 1 if participant repays, 0 if participant defaults. (1) Unconditional repayment without knowledge of partner's repayment decision in the standard game. (2) Conditional repayment given the partner repays in the standard game. (3) Conditional repayment given the partner defaults in the standard game. Peer peeking treatment is the reference category. Standard errors are clustered at the joint liability group (JLG)-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FIGURE B.1: Extensive form representation of standard microfinance investment game

Appendix C   Experimental material - decision sheets

Decision Sheet – Standard Microfinance Game

1) Investment Return		
Roll a die before the game starts and circle the outcome. Your investment return will be calculated based on a "losing number". A die will be rolled in each round to determine the "losing number". If you picked the "losing number" in that round, you will receive Rs. 10 from your investment. If you did not pick the "losing number" in that round, you will receive Rs. 250 from your investment.		
⚀ ⚁ ⚂ ⚃ ⚄ ⚅		
2) Repayment Choice		
a) Suppose you do not know what your partner will be doing, will you repay if you can repay?	YES	NO
Now suppose you know what your partner is doing.		
b) If you can repay, will you repay if your partner repays?	YES	NO
c) If you can repay, will you repay if your partner does NOT repay?	YES	NO
3) Belief		
Do you expect your partner to repay if he is able to repay his loan?	YES	NO
4) Individual Return		
After you stated your repayment choice, the decision sheet will be collected by the instructors. By rolling a die the investment return "losing number" will be generated for the round. Your individual return from your investment will be stated here at the end of the whole session.		
5) Individual Payoff		
Your individual payout after subtracting your repayment will be stated here. Your repayment depends on your decision to repay, on your partners decision to repay, and on both your returns from investment. However, you only know your investment return. Your individual payoff will be stated here at the end of the whole session.		

Decision Sheet – Standard Microfinance Game + Peeking

1) Investment Return		
Roll a die before the game starts and circle the outcome. Your investment return will be calculated based on a "losing number". A die will be rolled in each round to determine the "losing number". If you picked the "losing number" in that round, you will receive return Rs. 10 from your investment. If you did not pick the "losing number" in that round, you will receive return Rs. 250 from your investment. ⚀ ⚁ ⚂ ⚃ ⚄ ⚅		

2) Peeking		
You have the possibility to pay Rs. 10 from your investment return to get to know the investment return of your partner at the end of the game. Do you want to pay Rs. 10 to get to know the payoff of your partner at the end of the game?	YES	NO

3) Belief of Peeking of Partner		
Do you believe your partner will choose to pay Rs. 10 to get to know your payoff?	YES	NO

4) Repayment Choice		
Suppose you do not know what your partner will be doing, will you repay if you can repay?	YES	NO

5) Belief of Repayment of Partner		
Do you expect your partner to repay if he is able to repay his loan?	YES	NO

6) Individual Return	
After you stated your repayment choice, the decision sheet will be collected by the instructors. By rolling a die the investment return "losing number" will be generated for the round. Your individual return from your investment will be stated here.	

7) Individual Payoff	
Your individual payout after subtracting your repayment will be stated here. Your repayment depends on your decision to repay, on your partners decision to repay, and on both your returns from investment. If you choose to monitor, you will know your partner's investment return as well. However, if you do not choose to monitor, you only know your investment return.	

8) Partner's Return	
Your partner's return from his investment will be stated here. She has the same investment realization possibilities as you have.	

47

Decision Sheet – Standard Microfinance Game + Punishment

1) Investment Return		
Roll a die before the game starts and circle the outcome. Your investment return will be calculated based on a "losing number". A die will be rolled in each round to determine the "losing number". If you picked the "losing number" in that round, you will receive return Rs. 10 from your investment. If you did not pick the "losing number" in that round, you will receive return Rs. 250 from your investment.		

2) Repayment Choice		
Suppose you do not know what your partner will be doing, will you repay if you can repay?	YES	NO

3) Belief of Repayment of Partner		
Do you expect your partner to repay if he is able to repay his loan?	YES	NO

4) Individual Return
After you stated your repayment choice, the decision sheet will be collected by the instructors. By rolling a die the investment return "losing number" will be generated for the round. Your individual return from your investment will be stated here.

5) Individual Payoff
Your individual payout after subtracting your repayment will be stated here. Your repayment depends on your decision to repay, on your partners decision to repay, and on both your returns from investment. However, you only know your investment return. Your individual payoff will be stated here at the end of the whole session.

6) Punishment		
After getting to know your individual payoff, you know if you made a repayment for your partner or not, however, you do not know your partner's investments return. You have the possibility to pay Rs. 10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20. Do you want to pay Rs. 10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20 if your partner did not repay?	YES	NO

7) Beliefs about Punishment by Partner		
a) Suppose your partner does NOT know what you did. Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20?	YES	NO
Suppose your partner knows what you did:		
b) Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20 if you have contributed to the repayment?	YES	NO
c) Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20 if you have NOT contributed to the repayment?	YES	NO

Decision Sheet – Standard Microfinance Game + Peeking + Punishment

1) Investment Return		
Roll a die before the game starts and circle the outcome. Your investment return will be calculated based on a "losing number". A die will be rolled in each round to determine the "losing number". If you picked the "losing number" in that round, you will receive return Rs. 10 from your investment. If you did not pick the "losing number" in that round, you will receive return Rs. 250 from your investment.		
⚀ ⚁ ⚂ ⚃ ⚄ ⚅		

2)Peeking		
You have the possibility to pay Rs. 10 from your investment return to get to know the investment return of your partner at the end of the game. Do you want to pay Rs. 10 to get to know the payoff of your partner at the end of the game?	YES	NO

3) Belief of Peeking of Partner		
Do you believe your partner will choose to pay Rs. 10 to get to know your payoff?	YES	NO

4) Repayment Choice		
Suppose you do not know what your partner will be doing, will you repay if you can repay?	YES	NO

5) Belief of Repayment of Partner		
Do you expect your partner to repay if he is able to repay his loan?	YES	NO

6) Individual Return	
After you stated your repayment choice, the decision sheet will be collected by the instructors. By rolling a die the investment return "losing number" will be generated for the round. Your individual return from your investment will be stated here.	

7) Individual Payoff	
Your individual payout after subtracting your repayment will be stated here. Your repayment depends on your decision to repay, on your partners decision to repay, and on both your returns from investment. If you choose to monitor, you will know your partner's investment return as well. However, if you do not choose to monitor, you only know your investment return.	

8) Partner's Return	
Your partner's return from his investment will be stated here. She has the same investment realization possibilities as you have.	

9) Punishment		
After getting to know your individual payoff you know if you made a repayment for your partner or not, however, you only know your partner's true investment return when you decided to pay Rs. 10. You have the possibility to pay Rs.10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20.		
Suppose you do not know the return of your partner:		
a) Do you want to pay Rs. 10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20 if your partner did not repay?	YES	NO
Suppose you know the return of your partner:		
b) Do you want to pay Rs. 10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20 if your partner did not repay because she could not repay due to low return?	YES	NO
c) Do you want to pay Rs. 10 from your initial endowment of Rs. 40 to reduce your partner's endowment by Rs. 20 if your partner did not repay because she did not want to repay although she had a high return?	YES	NO
10) Beliefs about Punishment by Partner		
a) Suppose your partner does NOT know what you did. Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20?	YES	NO
Suppose your partner knows what you did:		
b) Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20 if you have contributed to the repayment?	YES	NO
c) Do you expect your partner to pay Rs. 10 from his endowment to reduce your endowment by Rs. 20 if you have NOT contributed to the repayment?	YES	NO