The social dilemma of microinsurance
A framed field experiment with microcredit groups in Tanzania

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Abstract

This paper demonstrates how demand for microinsurance can be suboptimal when offered in existing informal risk-sharing networks, for instance in microcredit groups. Members of microcredit groups share idiosyncratic risks through joint liability for loan repayment. We model health insurance decisions in such groups as a Prisoner's Dilemma. Theoretically, credit group members with high risk aversion prefer to enroll in insurance as long as the majority of group members do. Those with low risk-aversion rather rely on fellow group members' contributions when falling ill and have an incentive to forgo individual insurance. The binding nature of group insurance offers a simple way to commit these free-riders to the social optimum. Findings from microinsurance games played with 355 microcredit clients in Tanzania confirm these predictions. We conclude that group insurance increases demand for insurance, which is relevant for the provision of insurance in the context of microfinance institutes as well as other informal risk-sharing networks.

Keywords: Framed field experiments, microcredit, health insurance, public good game
JEL Codes: D71, I10, I11, G21, G22

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1 Introduction

In the absence of formal insurance and social security, poor households rely on informal strategies to manage risk. One such coping strategy is to share risk with other households, such as the extended family, neighbors or savings and credit group members (Fafchamps and Lund, 2003). Since these informal risk-sharing networks provide only partial protection from shocks (Udry, 1994; Townsend, 1994), microinsurance schemes are currently being piloted across the globe (Dercon et al., 2009). We argue that demand for microinsurance can be suboptimal when introduced in existing risk-sharing networks, undermining the financial sustainability of such schemes.

This paper uses a framed field experiment to study whether suboptimal demand for insurance in microcredit groups can be attributed to a social dilemma. Such groups serve as an example of informal risk-sharing networks because microcredit is still typically offered through group-based lending[1], where jointly liable clients can borrow often increasingly large amounts only if the previous full group loan is repaid. Such dynamic incentives motivate group members to contribute for peers who cannot repay (Besley and Coate, 1995). This means that the risks of individual members are pooled within the credit group. Risk-pooling offers only partial protection though, because a default will occur nonetheless if too many group members cannot repay.

The decision to take individual health insurance - which mitigates the group default risk - is then a Prisoner's Dilemma. In jointly liable credit groups, clients can rely on their fellow group members' contributions in case of catastrophic health expenditures. Because the insurance premium does not internalize such informal support to repay the loan, clients have a private incentive to forgo individual insurance. As a result, group members may all individually decide not to enroll, even though everybody had been better off under full enrollment. The binding nature of group insurance on the other hand provides a solution to the social dilemma. If health insurance is offered at the group level, either none or all group members enroll. A group member unwilling to join blocks its fellow group members from insurance as well. Clients can hence only reduce the risk of group default by enrolling themselves.

We model demand for insurance, distinguishing between two types of group mem-

[1]Although Grameen Bank has moved to individual liability and more institutes are expected to follow given Giné and Karlan (2009)'s discussion on individual versus joint liability, group-based lending is still the predominant way to bank the poor. Further, even credit schemes with individual liability still operate through credit groups in which risk pooling is encouraged as opposed to enforced.

bers: clients with low versus high risk aversion. Because lending is terminated if the group defaults, both types are better off when all group members enroll than when nobody enrolls. Both types will take insurance offered at the group level. However, when insurance is offered at the individual level, only group members with high risk aversion prefer to pay for insurance. Those with low risk aversion are tempted to free-ride and rely on fellow group members' contributions when falling ill. Unless group members credibly threaten these free-riders not to enroll in future loan cycles themselves, they have limited commitment to the social optimum. This is why demand may be higher for group than individual insurance.

We test this framework by means of a framed field experiment (Harrison and List, 2004). In the experiment, 355 members from a microfinance institution (MFI) in Dar es Salaam, Tanzania, played microinsurance games. We developed these public good games to capture essential features of group-based lending, including health risk and the option to enroll in welfare-improving health insurance. Participants are offered welfare-improving insurance either at the individual or group level.

The experimental findings suggest that demand for individual insurance in credit groups is suboptimal. Although private demand for health insurance is very high for more risk-averse individuals under both the individual and group insurance treatment, a large number of individuals with low risk aversion forgo insurance when it is offered at the individual level. In the experiment, clients appear unable to commit their group members to the social optimum. Group insurance however solves the social dilemma as most players with low risk-aversion in that treatment opt for insurance.

The design of this study contributes to the existing literature in four distinctive ways. First, the experimental design provides a controlled setting where distortions of initial wealth, health status, or expectations do not play an endogenous role. Equilibrium strategies can thus be identified for different types of players. Second, the experiment offers insights into the dynamics of repeated insurance decisions within a short time span. It is hence possible to test whether conditional cooperation evolves over time. Third, unlike hypothetical survey questions, participants face real monetary incentives based on their decisions during the games. Finally, framed experiments conducted in the field shed light on the replicability of findings from public good games in conventional lab experiments. The microinsurance games mimic real-life decisions for a population that differs from the usual participant in many respects (Cardenas and Carpenter, 2008).

The experiment was framed within the context of health shocks. Illnesses and injuries are a major reason for default in microcredit groups (Pradhan et al., 2010) and among the most important unprotected risks in developing countries (Dercon et al., 2009). The World Health Organization estimates that 150 million households globally fall into poverty every year due to ill health (Xu et al., 2007). However, the experiment is equally applicable to other commonly occurring idiosyncratic shocks such as business failure or livestock disease.

Moreover, these findings are relevant not only for the provision of insurance in MFIs. The benefits of group insurance as opposed to individual insurance may generalize to other informal risk-sharing networks such as communities, extended families, religious organizations or informal savings and credit groups. The key insight is that individuals who are used to pool risks in informal ways are likely to have suboptimal demand for formal microinsurance. Even when such insurance is welfare-improving, individuals have an incentive not to pay for insurance because they can rely on the informal support from their peers.

Given the recent interest in alleviating risks for poor households, this study has important policy implications. It highlights a crucial difference between individual and group insurance schemes that is currently ignored in the literature. The binding nature of group insurance does not only limit adverse selection and reduce the administrative burden of such schemes, but also solves problems of limited commitment to enroll in individual schemes. Because experience from a variety of contexts shows that enrollment in microinsurance schemes remains at low levels (De Allegri et al., 2009), this conclusion is relevant for those programs in developing countries that are struggling to increase their low uptake and renewal rates.

The remainder of the paper is structured as follows. The next section models the insurance decision in a jointly liable microcredit group. Section 3 describes the framed field experiment that was developed to test this theoretical framework, including the experimental design and procedures. It also discusses the main hypotheses and the econometric methodology. Section 4 describes the study population and participants, and tests whether their characteristics are well balanced over the different treatments. Results on demand for insurance are discussed in Section 5. Section 6 addresses policy implications as well as the external validity of the findings. The final section concludes.

2 Theory

2.1 The model

We model the insurance decision as a repeated public good game for jointly liable microcredit group members who face health risk. A group of n microcredit clients jointly borrows nl in every loan cycle $t \in \{1, ..., \infty\}$. Ill group members incur health expenditures and cannot repay their share of the loan. Their fellow group members (henceforth peers) contribute to loan repayment but if too many members fall ill, the group defaults and lending is terminated. If instead the full group loan is repaid, the group will continue to the next loan cycle. Group members can decide to pay for actuarially fair health insurance as a protection against health risk, thus reducing the group default risk.

Figure 1 presents the game graphically. The first block in the figure indicates profits before contributing for ill peers. Clients invest their share of the loan, l, in their enterprise and earn e net of loan repayment. Prior to repayment, each group member risks falling ill. This health shock is IID and occurs with probability p for every group member. Ill group members incur catastrophic health expenditures $h > e$. They cannot fully repay their loan, hence repay as much as possible and earn 0 in the present loan cycle.

Before the realization of the health shock, credit group members have the opportunity to enroll in health insurance. Insurance fully covers health expenditures at an actuarially fair insurance premium ph. Thus, insured group members earn $e - ph$ irrespective of their health outcome. The model ignores a loss in profits due to absenteeism. Most clients are microentrepreneurs whose household members temporarily take over the business in case of illness. We hence assume that business income does not affect ill clients' profits. Instead, the model focuses on health expenditures. This simplification does not qualitatively affect the results.

The second block indicates the value after contributing for ill peers. Group-based lending offers informal insurance as clients contribute for ill group members, but risk-pooling is imperfect. If too many individual group members fail to repay, the group will not be able to repay the full loan. Define $n^* \in \{1, ..., n-1\}$ as the maximum number of members for which a group can contribute without default and F as the number of peers who fail to repay, with $p_f = P(F = f)$ being the probability that f peers fail to repay. If more than n^* peers fail to repay, $f > n^*$, group members contribute as much as possible to loan repayment but this is insufficient to avoid a group default. Lending is terminated and nothing is earned from the present, nor from future loan cycles.

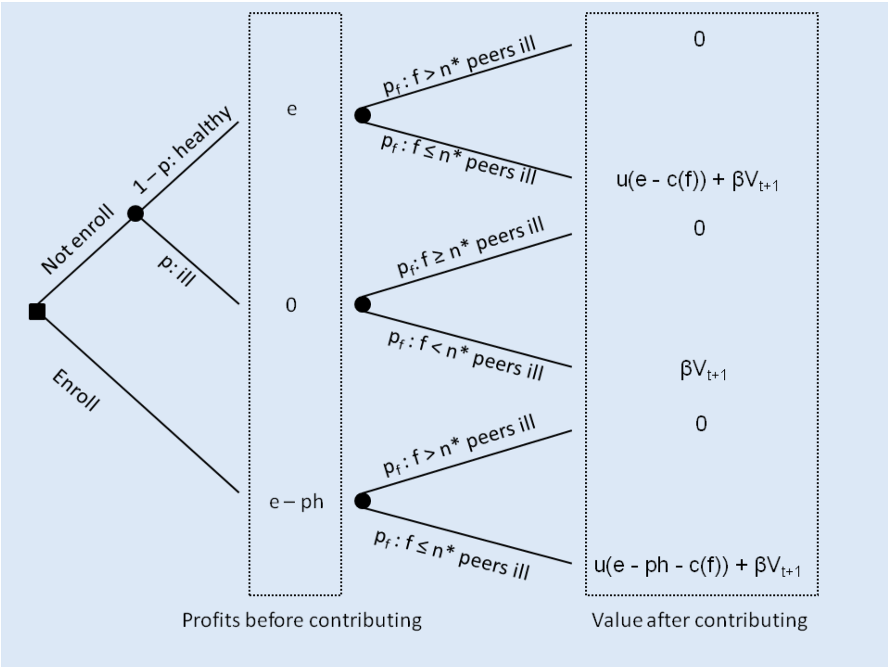


Figure 1: Game tree. The symbol p represents the health shock probability, e earnings, h health expenditures, p_f the probability that f peers fail to repay, n^* the maximum number of members for which a group can contribute, $c(f)$ the contribution for f peers as defined in (1), β the discount rate and V_{t+1} the value of continuing to the next loan cycle.

If n^* or less peers fail to repay, $f \leq n^*$, the group jointly contributes $h - e$ for each member that fails to repay so that the group loan is fully repaid.[2] Thus, repaying clients' earnings are reduced by the contribution for f group members who failed to repay:

$$c(f) = \frac{f}{n-f}(h-e) \text{ if } f \leq n^* \tag{1}$$

Since the group does not default, it continues to the next loan cycle. The discounted value of continuation to the next loan cycle is βV_{t+1}, where $\beta < 1$ is the discount rate.

Four key assumptions are made. First, individuals always repay and contribute for others when possible. This assumption is not only convenient from an analytical perspective, but also reflects MFI practices. Although these decisions are voluntary, MFIs generally enforce loan repayment through the threat of loan termination, fines, compulsory savings accounts, the confiscation of assets, as well as social factors such as guilt, reputation, fairness and feelings of group solidar-

[2] Every ill group member repays $e + l - h$. This means that $l - (e + l - h) = h - e$ is left for group members to repay.

ity (Armendariz and Morduch, 2010). These incentives to contribute to group loan repayment are compatible with an automatic contribution and our framework focuses on the insurance decision instead, i.e. the model does not include a discretionary contribution decision.

Second, earnings from previous loan cycles cannot be used to repay. This can be interpreted in two ways. Earnings are either immediately consumed or invested in illiquid assets, such as housing and children's education. Thus, clients cannot save a buffer stock. The analysis in this paper studies the interplay between formal insurance and informal risk-sharing networks to cope with risk, not savings as an alternative mechanism.

Third, paying the insurance premium does not create budget constraints with respect to group loan repayment:

$$(n - n^*)(e - ph) \geq n^*(h - e)$$

Despite the insurance premium payment, ph, $n - n^*$ group members are able to cover the loan repayment for n^* uninsured ill peers. This assumption ensures that taking insurance does not increase the risk of group default.[3]

Fourth, the model does not allow for adverse selection (heterogeneity in p), epidemics (cross-sectional correlation) or chronic illness (serial correlation). Qualitatively, the theoretical results of this paper are robust to such generalizations. Moreover, the homogeneity in health risk implied in the model can be interpreted as assortative matching driving group formation. Group members with similar health statuses find each other and form a group, which seems a plausible assumption.

Clients' preferences form the final essential building block of the model. Clients decide whether to enroll in health insurance by maximizing expected utility over the present and all future loan cycles, taking into account beliefs about the current number of insured peers and insurance decisions in the past. Let d_{-it} indicate the number of insured peers for individual i at time t, $d_{it} \in \{0, 1\}$ individual i's own insurance decision, and $\mathrm{E}\, U^i_{d_{it}, d_{-it}}$ client i' s expected utility. Utility is strictly increasing, concave and time-separable and utility from zero earnings is normalized to zero.

There are two types of clients in the group: n^h clients with high risk aversion and $n^l = n - n^h$ clients with low risk-aversion. High risk-aversion is defined such that clients prefer to enroll in an individual one-shot insurance game without joint liability or dynamic incentives; in other words, prefer to earn e minus the insurance premium ph with certainty over the gamble of earning e only when healthy.

[3]See Cole et al. (2010) for a discussion on liquidity constraints and demand for insurance.

Definition high and low risk aversion: An individual has *high risk aversion* if and only if

$$U^h_{1,n-1} = U^h(e - ph) \geq (1-p)U^h(e) = U^h_{0,n-1} \quad (2)$$

An individual has *low risk aversion* if and only if

$$U^l_{1,n-1} = U^l(e - ph) < (1-p)U^l(e) = U^l_{0,n-1} \quad (3)$$

Notice that not every strictly concave utility function satisfies (2). This is because health expenditures exceed earnings net of loan repayment, $h > e$. In other words, the implicit costs of insurance are higher than the premium payment itself because uninsured ill clients partly default on their loan. As a result, the one-time earnings with insurance, $e - ph$, are strictly below the expected one-time earnings without insurance, $e(1-p)$. Indeed, a key factor driving our results is that actuarially fair insurance (for an insurer) is actuarially unfair for members of informal risk-sharing networks.[4]

2.2 Predictions for individual and group insurance

This section studies under what conditions full enrollment in health insurance is a subgame perfect Nash equilibrium. First, we show when full enrollment is an equilibrium under group insurance. Next, we predict decisions under individual insurance. Appendix 1 provides proofs for all propositions in this section.

If insurance is introduced at the group level, either none or all group members enroll since unanimity is required. For group members with high risk aversion, full enrollment is by definition welfare-improving over zero enrollment:

Proposition 2.1 (Pareto optimum for clients with high risk aversion) *Full enrollment is a Pareto-improvement over zero enrollment if* $n^l = 0$.

In groups with less risk averse members, full enrollment is not necessarily a Pareto-improvement. Full enrollment is welfare-enhancing if and only if their expected discounted utility over the present and all future loan cycles is maximized when the group enrolls:

$$V^l_{always} \geq V^l_{never} \quad (4)$$

[4]The reduced group default risk due to insurance can also be interpreted as a rent for the MFI that is not shared with the groups by means of reduced interest rates.

where V^l_{always} and V^l_{never} represent the expected net present value of current and future utility for individuals with low risk aversion if their group always enrolls or never enrolls, respectively.[5]

The next proposition shows that in a group that contains members with low risk aversion, full enrollment being Pareto-improving on zero enrollment is necessary and sufficient for full enrollment to be an equilibrium outcome.

Proposition 2.2 (Group insurance) *Under group insurance, full enrollment is a SPNE if and only if* $n^l = 0$ *or (4) is satisfied.*

Thus, groups only enroll in group insurance if it does not make some or all group members worse off. Full enrollment is not a unique equilibrium solution even when it is socially optimal. If a group member believes its peers are unwilling to take insurance, he or she will be indifferent. Voting in favor of insurance is hence only a weakly dominant strategy for all group members.

The next question is when Inequality (4) is satisfied. Figure 2 indicates at what discount rates β and health shock probabilities p full enrollment is Pareto-improving on zero enrollment in groups with clients that have low risk aversion. Given the large number of parameters, the figure focuses on the parameter values as adopted in the game; a group consists of $n = 5$ clients, group members are able to contribute for at most $n^* = 1$ ill peers, health expenditures fully absorb profits before loan repayment, $h = e + l$, and net profits are a little over half the size of a loan: $e = 9/16l$.

In Regime 1, Inequality (4) does not hold. By Proposition 2.2, a group enrolls if and only if all members have high risk aversion. At low β, clients with lower risk aversion do not sufficiently value the increased probability of continuation to the next loan cycle. Also, as the probability of a health shock and hence insurance premium increases, insurance becomes increasingly less attractive since the premium is actuarially fair for the insurer but not the client, who also takes into account contributions for and from peers.

In the remaining regimes, insurance is welfare-improving for clients both with high and low risk aversion. By Proposition 2.2, outside Regime 1, full enrollment is hence a SPNE when offered group insurance.

[5] An individual in a group that will enroll forever earns $e - ph$ in the present loan cycle and the discounted value from continuing to the next loan cycle is βV^l_{always}:

$$V^l_{always} = U^l(e - ph) + \beta V^l_{always}$$

Rearrange this equation to get the value for full enrollment, V^l_{always}. A similar derivation yields the value of never enrolling, V^l_{never}.

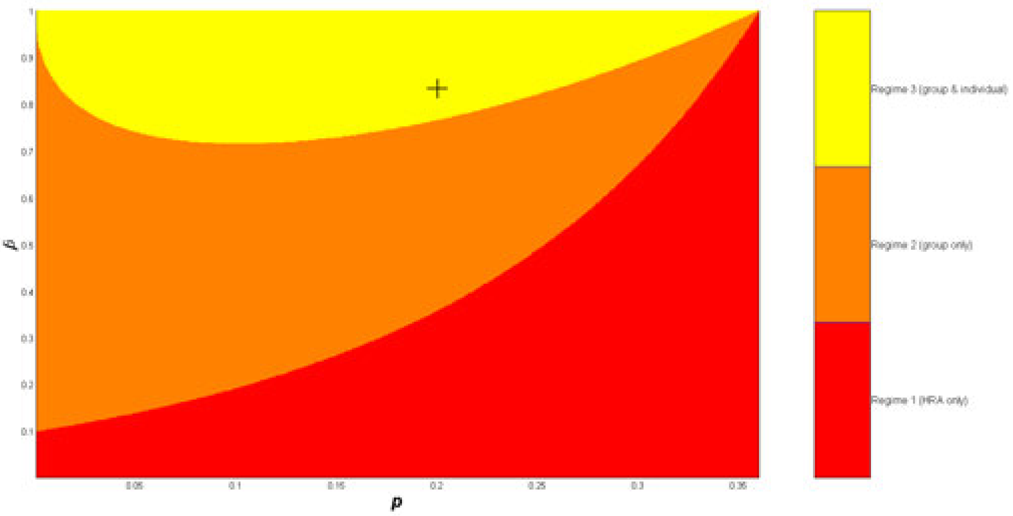


Figure 2: Solution regimes if $e = 9/16l$, $h = e + l$, $n = 5$ and $n^* = 1$.

When offered individual insurance, on the other hand, groups have limited commitment to the social optimum. To show this, we first focus on the stage game in which current insurance decisions do not depend on past actions. The following proposition states that this game is a social dilemma in which clients with low risk aversion have limited commitment to the social optimum under individual insurance.

Proposition 2.3 (Individual insurance with path-independent strategies) *Under individual insurance, full enrollment is a Nash equilibrium in the stage game if and only if all group members have high risk aversion,* $n^h = n$.

If all peers enroll, they ensure continuation to the next loan cycle, irrespective of the individual's own insurance decision. There are hence no dynamic incentives to enroll, meaning that individuals face a trade-off between the risk-free insurance option of earning $e - ph$ or a gamble with higher but uncertain earnings equal to e. By definition, clients with high risk aversion prefer to enroll and do not have an incentive to deviate from full enrollment. Clients with low risk aversion, on the other hand, benefit from a one-time defection and will free-ride on their insured peers.

If Inequality (4) holds, insurance is a public good that increases the group' s probability of continuation to the next loan cycle and mitigates a group's contributions to ill peers' loan repayment. Clients do not internalize these externalities, which is why clients with low risk aversion have an incentive to defect from full enrollment.

Path-dependent equilibrium strategies may solve this social dilemma. As informal risk-sharing often occurs in a context of repeated interactions, clients are able to sanction free-riders by staying uninsured in the future themselves. In that case, an individual enrolls if and only if its peers always enrolled in the past *and* are believed to enroll in the current loan cycle. The proposition below states a necessary condition for this trigger strategy to commit clients with low risk aversion to full enrollment, the social optimum.

Proposition 2.4 (Individual insurance with path-dependent strategies) *Under individual insurance, full enrollment is a SPNE in the repeated insurance game if (i) $n^l = 0$ or, (ii) if $n^l > 0$, only if Inequality (4) holds and dynamic incentives are sufficiently strong:*

$$(1-p)U^l(e) - U^l(e-ph) < \beta \left(V^l_{always} - V^l_{never}\right) \tag{5}$$

A necessary condition for full enrollment to be an equilibrium is Equation (5). It states that the expected utility gain from defection, $(1-p)U^l(e) - U^l(e-ph)$, is strictly smaller than the discounted expected utility loss due to peers not enrolling in future loan cycles. Regime 3 in Figure 2 satisfies this condition for any concave utility function. The discount rate is sufficiently large for clients not to defect at the cost of future income losses.

Note that this equilibrium strategy is not credible if clients have so much aversion to the health risk that they enroll despite the number of insured peers. In Appendix 2, we however show that even in the limiting case, where a client's risk aversion is going to infinity, there is only a small area in the upper-left corner of Figure 2 in which the most risk averse client enrolls regardless of the number of insured peers in either past or present loan cycles. The trigger strategy is hence credible for a wide range of parameters.

To sum up, we have identified three regimes with qualitatively different equilibrium outcomes if the group has members with low risk aversion. Whenever full enrollment is not welfare-improving over zero enrollment for them, as is the case in Regime 1, full enrollment is not an equilibrium if the group contains at least one member with low risk aversion; neither under individual nor under group insurance. Groups enroll if and only if all members have high risk aversion.

Outside Regime 1, full enrollment is a Pareto-improvement over zero enrollment and therefore an equilibrium under group insurance. Under individual insurance, on the other hand, the insurance decision entails a social dilemma with suboptimal demand that is solved only when dynamic incentives are sufficiently strong to commit less risk averse members to the social optimum. This is the case in Regime 3.

In Regime 2, dynamic incentives are relatively weak. Clients with low risk aversion cannot be committed to the social optimum as the benefits of a one-time defection from full enrollment outweigh the cost of future income losses - even if present insurance decisions were conditioned on past behavior.

This section focused on the question when full enrollment could be sustained in equilibrium. Another question is whether individual insurance is associated with equilibria in which less than n group members enroll. Section 3.2 discusses this question in relation to the hypotheses tested by the microinsurance games.

3 Method

To test the theoretical predictions, 355 microcredit clients from a Microfinance Institute (MFI) in Dar es Salaam, Tanzania, played microinsurance games. This framed field experiment was carried out by the University of Dar es Salaam and the Amsterdam Institute for International Development, during a period of three weeks in March and April 2011.

3.1 Design

The experimental identification includes two steps. First, participants played a basic microinsurance game with both credit and insurance offered at the individual level. Since participants are not jointly liable in this game, their decision yields a basic measure of risk aversion. Participants subsequently played a public good game that was framed as a health insurance decision in a jointly liable microcredit group. This microinsurance game closely resembles the theoretical framework described in Section 2.

3.1.1 Measure for risk aversion

The first introductory game *without* joint liability can be represented by the left part of Figure 1. A participant borrows $l = 40,000$ Tanzanian Shillings (TZS) and falls ill with probability $p = 1/5$. Healthy participants, able to repay their loan, earn a profit $e = 22,500$ after loan repayment. Ill participants on the other hand incur health expenditures that fully absorb their revenue before loan repayment; $h = 62,500$. As a result, they earn nothing and cannot repay their loan. Defaulting participants do not continue to the next loan cycle.

Every round, before the realization of the health shock, participants are offered actuarially fair health insurance at a premium equal to $ph = 12,500$. An insured player's profit after loan repayment is $e - ph = 10,000$. Insured participants can repay their loan irrespective of their health outcome and thus continue to the next loan cycle with certainty.

This game was played for two rounds to increase clients' understanding of the dynamic incentives in the game. In the second and last round of the game, dynamic incentives are absent. In this round, the participant faces a trade-off between lower risk-free earnings versus higher but risky earnings. In theory, clients with low risk aversion will not enroll in this round by Definition (3), because insurance is actuarially unfair from the perspective of the client. Those with high risk aversion on the other hand prefer insurance.[6]

Because there is no joint liability in this first introductory game, the insurance decision does not affect payoffs for peers. The measure for risk aversion therefore reflects risk attitudes rather than social preferences or altruism.

3.1.2 Demand for insurance

Participants next play a microinsurance game *with* joint liability. The main difference with the introductory game is that participants are now assigned to microcredit groups with $n = 5$ members and group members contribute for peers who cannot repay their share. Loan size, earnings, health expenditures and insurance premium are the same as in the introductory game. These parameters are associated with the cross in Regime 3 in Figure 2. Equation (4) is satisfied: both clients with low and high risk aversion prefer full enrollment over zero enrollment. Equation (5) is also satisfied: if individuals take into account past decisions, the threat of a trigger strategy is credible.

If one group member cannot repay, its four peers (both insured and uninsured) each contribute $10,000$ for the defaulter. The group loan is entirely repaid and the group continues to the next loan cycle. But if more than one group member cannot repay, the remaining group members have insufficient earnings to contribute. Thus, given these parameter values, the group defaults if more than $n^* = 1$ uninsured

[6]For the CRRA utility function $u(x) = x^{1-\gamma}/(1-\gamma)$ if $\gamma \neq 1$, and $u(x) = ln(x)$ if $\gamma = 1$, a client with low risk aversion has a CRRA parameter $\gamma < 1-(ln(4)-ln(5))/(ln(10,000)-ln(22,500)) = .725$, whereas this parameter is $\gamma \geq .725$ for clients with high risk aversion.

group members fall ill. In that case, the group repays as much as it can afford. Profits are zero for all members. The group defaults and the game ends.

Participants were told that they would play the game for a large, unknown number of rounds. The game continued for at least four rounds as long as the group repaid. After the fourth round, the group appointed one of its group members to toss a die. If the die landed at 1, the game would end for the group.[7] Or, as stated by one of the participants:

"I congratulate our sister for throwing another number than one, which enables us to play this round. That means the game goes on and our earnings increase as well." (based on transcripts from one communication treatment).

As earnings were accumulated within a relatively short time span, we assume that there is no discounting in the game. Rather, the probability of continuation determines the value of future rounds. Therefore, we substitute the discount rate in the theoretical framework, β, for the probability of continuation in the game for rounds 4 and higher:

$$\beta_t = 1 \text{ if } t < 4 \text{ and } \beta_t = \frac{5}{6} \text{ if } t \geq 4 \tag{6}$$

The microinsurance game with joint liability varied in two dimensions: the type of insurance and the possibility to communicate (see Table 1). Under individual insurance (II), enrollment was an individual decision. Alternatively, in the treatment with group insurance (GI), the group members unanimously had to agree to pay for insurance. This was determined by casting anonymous votes. Group members would enroll if and only if all group members expressed their willingness to join. In treatments without communication (NC), group members could not talk to each other. In the communication treatments (C), group members had the option to discuss health insurance for two minutes preceding every round. Communication was recorded, transcribed and translated to English.

Treatments varied by session. Each session included 3 to 6 groups of five individuals. The individual insurance treatments with and without communication were both played in three sessions with on average 5 groups per session, resulting in a sample size of 75 participants each (see Table 1). Four sessions were organized for the group insurance treatments, resulting in a sample size of 90 and 115 participants for the treatments without and with communication respectively. More sessions were played with group insurance in anticipation of higher default

[7] Because of time constraints, a maximum number of 6 rounds was played in practice. Clients were not informed that the sixth round was the last round to avoid a last round effect (Cassar et al., 2007).

Table 1: Experimental design

	Individual Insurance		Group Insurance
No Communication	II-NC	⇔	GI-NC
	n=75 (3 sessions)		n=90 (4 sessions)
	↕		↕
Communication	II-C	⇔	GI-C
	n=75 (3 sessions)		n=115 (4 sessions)

rates if groups would not unanimously agree to enroll, leaving all members uninsured.

3.2 Hypotheses

This section examines in more detail the optimal decisions for the parameter range specific to the games. The cross in Figure 2 indicates the theoretical regime associated with the selected parameters: under group as well as individual insurance, full enrollment can be sustained in equilibrium.

Table 2 summarizes the hypotheses on demand for group compared to individual insurance. Under individual insurance, full enrollment can be sustained in equilibrium if group members play a trigger strategy and clients with low risk aversion believe that their more risk-averse peers will not enroll after a defection. In this case, demand for individual insurance is equally high as demand for group insurance, which is postulated by Hypothesis 1 in Table 2.

If groups do not coordinate on this trigger strategy, the predictions for individual insurance depend on the distribution of risk types and the number of peers believed to enroll. Clients with low risk aversion do not enroll irrespective of the number of enrolled peers. Their demand for individual insurance is therefore strictly lower than demand for group insurance, as stated by Hypothesis 2a.

For clients with high risk aversion, demand for individual insurance is decreasing in the number of peers believed not to enroll. By Definition (2), they enroll if all four peers do. If at most three peers are believed to enroll, the least risk-averse clients satisfying (2) however prefer not to do so. If clients believes only one or no peers will enroll, even the most risk-averse will forgo insurance.[8]

[8]Calculations available from the authors upon request, also for rounds 1-3. Figure 2 applies to the fourth round and higher when the continuation probability is constant, $\beta = 5/6$. These results however generalize to earlier rounds when the game could not be terminated by the exogenous end-of-the-game shock due to the toss of a die. In those rounds, dynamic incentives

To sum up, if there are only high risk-averse peers in the group, $n^h = n$, symmetry requires that all participants either decide not to enroll or coordinate on the social optimum. The game boils down to a coordination problem and demand for individual insurance is at most as high as it is for the group scheme (Hypothesis 2b).

If at least one group member has low risk aversion, $n^h < n$, this member forgoes insurance and free-rides on contributions from more risk-averse peers. The game resembles a prisoner's dilemma in which peers with high risk aversion anticipate the behavior of less risk-averse group members by not enrolling either. According to Hypothesis 2c, demand for insurance is hence lower under individual than group insurance and this difference is increasing in the number of peers with low risk aversion.

Finally, we expect that communication increases demand under individual insurance especially for individuals with high risk aversion, because it works as a signaling device and allows coordinating on the profit maximizing equilibrium. Communication in the games is cheap talk because decisions are anonymous, so theoretically communication should have no effect on enrollment decisions of risk-neutral individuals, although abundant empirical evidence suggests that communication reinforces social norms even in the absence of sanctioning mechanisms (Cardenas et al., 2004; Sally, 1995).

Table 2: Hypotheses on demand for insurance

1.	Participants adopt a trigger strategy under II	$II = GI$
2.	Participants do not adopt trigger strategy under II	
	a) Low risk aversion:	$II < GI$
	b) High risk aversion with $n^h = n$:	$II \leq GI$
	c) High risk aversion with $n^h < n$:	$II < GI$ $\partial(II - GI)/\partial(n - n^h) \leq 0$

3.3 Procedures

The experimental sessions were organized near clients' houses or businesses in eight different areas of Dar es Salaam, in restaurants where credit groups typically meet with their loan officers for the weekly loan repayment. Participants were recruited during these loan group meetings and invited to come to one of the 14

are stronger, which results in clients with a given degree of risk aversion enrolling if less peers are believed to insure. The main results however do not change qualitatively and hypotheses remain the same as in Table 2.

sessions. To enhance participation rates, people were encouraged to bring along group members (snowball sampling). Treatments were assigned such that every treatment was played at most once in an area and they were not announced during mobilization.

Because clients were unfamiliar with the concept of experimental games, the study was introduced as an interactive seminar about health insurance. Clients were further informed about the show-up fee of 7,000 TZS (US $ 4.67) and were told that they could earn in addition up to 27,500 TZS (US $ 18.35). Clients unable to participate in a group of 5 received a transport fee and were invited to come back for the next session.

As clients arrived, assistants administered for each participant a short questionnaire on socio-demographics, health care utilization and credit group characteristics. Three games were played: the introductory microinsurance game with insurance and lending at the individual level to elicit a measure for risk aversion; the same game but with more expensive insurance (a premium of 17,500), which served as a robustness check; and the game with joint liability. To conclude a session, clients were asked for their feedback. An experimental session lasted approximately 3 to 4 hours.

Clients were randomly assigned to a group. Although participants knew who was in their group, all decisions were taken in private and remained anonymous. Every game started with Kiswahili instructions (see Appendix 4 for an English translation). Earnings throughout the game were stored in a closed wooden box (the piggybank) and paid in cash at the end of the meeting. For every 10,000 earned, a participant received 1,000 TZS. On average, participants earned 18,000 TZS (US $12.01) including the 7,000 TZS show-up fee. This equals nearly an average day's profit for most participants (7,500 TZS).

3.4 Econometric specification

The main variable of analysis is the willingness to join insurance, henceforth referred to as demand. In treatments with individual insurance both without and with communication (II-NC and II-C), demand is measured as individual enrollment in health insurance. In the treatments with group insurance (GI-NC and GI-C), demand is based on the individual votes that are preference-revealing if participants play their weakly dominant strategy. Demand for participant i in group g and round t is indicated by a dummy variable d_{igt} such that $d_{igt} = 1$ if a participant is willing to join. It is estimated using a linear probability model based on the following equation:

$$d_{igt}^{a} = \beta_0 + \beta_1 g_g + \beta_2 gc_g + \beta_3 c_g + \beta_4 \mathbf{x}_{ig} + u_{igt} \tag{7}$$

where g_g is a dummy variable equal to 1 if group g is in a group insurance treatment, c_g is a dummy variable equal to 1 if communication is permitted, gc_g is the interaction between these two variables, and $\mathbf{x}_{ig}$ is a vector of control variables.

The vector $\mathbf{x}_{ig}$ includes a number of socio-economic, health-related, and credit-related characteristics as well as social ties among game participants and dummy variables for rounds 2 to 6. Variables were included based on two selection criteria: a variable was either significant in one of the regressions, or was unbalanced over different treatments. The next section describes which variables were available for potential inclusion. Standard errors are robust and clustered at the group level. The residuals u_{igt} will be further discussed below. Lastly, groups that drop out of the game due to an unlucky toss of the die are excluded from the analysis in subsequent rounds.

To test Hypothesis 1 and 2a in Table 2, Equation (7) is estimated for both the full sample and the risk-neutral subset of the population, respectively. Hypotheses 1 - demand is equal for group and individual insurance - is rejected if for the full sample of participants, $\beta_1 + \beta_2 > 0$.[9] Hypothesis 2a is confirmed if $\beta_1 + \beta_2 > 0$ for the subsample of risk-neutral clients.

To test Hypotheses 2b and 2c, which apply to the risk-averse population, we also included the number of risk-neutral group members n_g^{rn} and its interaction with group insurance to Equation (7) as follows:

$$d_{igt}^{b} = \beta_0 + \beta_1 g_g + \beta_2 gc_g + \beta_3 c_g + \beta_4 \mathbf{x}_{ig} + \beta_5 n_g^{rn} + \beta_6 n^{rn} g_g + u_{igt} \tag{8}$$

This equation is estimated for the subsample of risk-averse participants. Hypothesis 2b - risk-averse types with only risk-averse peers are at least as likely to demand group compared to individual insurance - is confirmed if $\beta_1 + \beta_2 \geq 0$. Hypothesis 2c - in a group with risk-neutral peers, risk-averse are more likely to demand group than individual insurance, and this difference is increasing in the number of risk-neutral peers - is confirmed if $\beta_1 + \beta_2 + \beta_6 > 0$ and $\beta_5 < 0$ or $\beta_6 > 0$.

Hypotheses 2a, 2b and 2c will also be jointly tested by estimating Equation (8) for the full sample, adding dummies for being risk-neutral and its interaction with group insurance.

[9] We also test whether $\beta_1 > 0$ for treatments without communication.

We will also estimate a Heckman selection model to control for selective attrition because demand d_{igt} is unobserved once a group has defaulted. This default risk is increasing in the number of uninsured participants, and particularly so under group insurance where single unwilling participants prevent their entire group from enrolling. In order to avoid biased estimates of demand for insurance, the analysis takes into account the risk of group default.

Formally, if y_{igt} indicates whether individual i in group g is still in the game in round t, we only observe demand d_{igt} if $y_{igt} = 1$. To identify the selection bias, we add the (random) lagged number of ill peers N^{ill}_{t-1} as an exclusion restriction in the selection equation:

$$y_{igt} = \gamma_0 + \gamma_1 g_g + \gamma_2 g c_g + \gamma_3 c_g + \gamma_4 \mathbf{x}_{ig} + \gamma_7 N^{ill}_{t-1g} + v_{igt} \tag{9}$$

4 Data

4.1 Study population and participant characteristics

The microfinance games were played by clients of Tujijenge Tanzania Ltd, an MFI that started its operations in 2006 in several areas in Dar es Salaam. Tujijenge currently has approximately 12,800 members engaged in group lending schemes. The average loan is $450,000$ Tanzanian Shillings (US $ 300) and interest percentages are 12 percent per loan cycle of three months. Interested micro-entrepreneurs form groups of five members with people they trust and know well enough for monitoring purposes. The groups are jointly liable for loan repayment. They join a larger group of 15-35 members that is ultimately responsible if a small group cannot repay. The larger groups formulate by-laws such as fines for not repaying ("delinquency") in the weekly loan repayment meeting ("marejesho"). The larger group confiscates a delinquent's assets if a marejesho has been missed three consecutive times.

Table 3 (columns 1-3) describe the main characteristics of the 355 participants in the games. The other columns will be discussed at a later stage. Panel A summarizes demographic and socio-economic characteristics. As is common in microfinance institutes, the majority of our participants is female. The average participant has completed around 7 years of education, corresponding to primary school. Monthly household income is on average 84,425 TZS per capita (US $ 54).

Table 3: Descriptives of participants and the target group

		Games		Tujijenge		Probit LRA	
	N	Mean	(s.d.)	Mean	Diff	Mean	(s.d.)
A. Demographic and socio-economic characteristics							
Female (%)	355	74.6	(44)	67.8	-2.08*	-0.337†	(0.182)
Age	355	36	(8.5)	36	0.117	-0.535	(0.365)
Household size	354	5.1	(2.1)	4.6	-4.14**	0.0865†	(0.0461)
Married (%)	355	76.1	(43)	80.8	1.61	-0.0291	(0.194)
Muslim (%)	355	58.3	(49)	N/A			
Christian (%)	355	41.7	(49)	N/A			
Years of education	354	7.7	(2.4)	8.2	2.39*	0.0420	(0.0356)
Per capita HH income (TSH)	349	84,425	(60,378)	82,700	-0.337	0.112	(0.105)
B. Health characteristics							
Knows health insurance (%)	355	41.1	(49)	N/A			
Has health insurance (%)	355	7.3	(26)	11.2	1.77†	0.612*	(0.308)
Client visited provider (%)	355	54.9	(50)	24.8	-8.93**	-0.0497	(0.187)
Health exp. (TSH)	348	13,382	(29,711)	5,569	-4.25**	-0.0550†	(0.0298)
Other visited provider (%)	355	73.5	(44)	37.6	-10.6**	0.0321	(0.264)
Health exp. others (TSH)	350	29,113	(70,443)	26,954	-0.131		
Nr. times foregone care	355	0.6	(1.4)	N/A			
C. Microcredit variables							
Membership years	355	1.1	(1.6)	N/A			
Profit business (TSH)	323	225,944	(204,725)	N/A			
Has a loan (%)	355	89	(31)	97.1	4.48**	-0.556*	(0.252)
Last loan (TSH)	347	460,029	(369,377)	424,750	-1.33	-0.0688	(0.129)
Default in group (%)	355	32.4	(47)	N/A			
Contributed (%)	355	27.3	(45)	N/A			
Client defaulted (%)	355	13.0	(34)	N/A			
Group contributed (%)	355	6.8	(25)	N/A			
D. Game-related variables							
Nr. known	355	1	(1.1)	N/A			
Nr. in credit group	355	0.5	(0.79)	N/A			
Low RA (%)	355	25.6	(44)	N/A			

** $p < .01$ * $p < .05$ † $p < .1$.

LRA: low risk aversion. Probit regression uses a log transformation for age, health expenditures, household income and loan size.

Health expenditures are aggregated on the household level in the Probit regression.

Panel B describes the population in terms of health characteristics. Although 41.1 percent of the participants knows what health insurance is, only 7.3 percent is currently enrolled in health insurance. Just more than half of the participants (54.9 percent) consulted a health care provider in the past 3 months, and for 73.5 percent, at least one other household member did so. Average household-level health expenditures over that same period were 8,332 TZS (US $ 5) per capita, or 9.9 percent of monthly per capita income. It happened on average 0.6 times in the past 3 months that one of the participant's household members needed care but did not receive it due to a lack of money.

Panel C presents descriptive statistics for a number of credit-related variables. The average number of membership years was just over one year. Eleven percent of participants recently joined Tujijenge and are waiting to take out their first loan. The average monthly profit is TZS 225,944 (US $ 145), representing a considerable proportion of total monthly household income. Approximately one third of the participants indicates that at least one of their credit group members defaulted on a (bi-)weekly loan repayment in the past three months. In almost all cases did the respondent contribute for this person. A further 13 percent of respondents could not repay themselves in the past 3 months. Half of them (6.8 percent of the total) respond that group members contributed on their behalf.

Panel D shows the game-related variables. The first two variables examine the social ties between group members in the games. On average, participants know one other person in their group in the game by sight, but only 0.5 of their game group members are also a member of their Tujijenge credit group. Finally, Panel D summarizes the risk aversion measure as explained in Section 4.1. One quarter (25.6 percent) of the participants has low risk aversion and the remainder are labeled with 'high risk aversion'.[10]

4.2 Balance of characteristics over treatments

To examine the comparability of treatment groups, Table 4 compares the characteristics of the participants in each of the four treatments. The first two columns compare individual and group insurance without communication. The last two columns compare both treatments with communication. The significance levels are calculated based on an unpaired t-test of a comparison of means, with standard errors clustered at the group level.

[10]Our main findings are robust to using alternative risk aversion measures, i.e. the insurance decision in the first instead of the second round of the game; the insurance decision in the second round of the game only for those still in the game; and the insurance decisions in the second game with an insurance premium of TZS 17,500 instead of TZS 12,500 .

Table 4: Balance of participant's characteristics and game-related variables

	No communication		***Communication***	
	II mean	GI diff	II mean	GI diff
A. Socio-economic characteristics				
Female	74.7	70	77.3	76.5
Age	35.8	36	36.1	36
Household size	5.2	5.3	5.2	4.9
Married	81.3	75.6	78.7	71.3
Muslim	68.0	52.2†	54.7	59.1
Years of education	8	7.4	7.7	7.8
Per capita HH income (TSH)	83,956	85,011	87,554	82,155
B. Health characteristics				
Knows health insurance	45.3	31.1†	49.3	40.9
Has health insurance	8.0	3.3	12.0	7
Client visited provider (%)	52.0	52.2	61.3	54.8
Health exp. (TSH)	12,046	11,963	16,182	13,542
Other visited provider (%)	73.3	73.3	72.0	74.8
Health exp. others (TSH)	28,532	32,400	27,146	28,136
Nr. times foregone care	0.50	0.6	0.70	0.5
C. Microcredit variables				
Membership years	1.1	1	1.0	1
Profit business (TSH)	274,541	227,415	240,507	193,906
Has an outstanding loan	85.3	93.3†	86.7	89.6
Last loan (TSH)	552,329	450,000	455,946	410,797
Delinquent in group	25.3	28.9	37.3	36.5
Contributed for peer	28.0	24.4	32.0	26.1
Has been delinquent	9.3	12.2	10.7	17.4
Peers contributed	4.0	6.7	2.7	11.3*
D. Game-related variables				
Nr. known personally	0.80	0.9	1.1	1.2
Nr. in credit group	0.50	0.4	0.60	0.6
Risk-neutral	26.7	31.1	22.7	22.6
Ill (%)	17.3	23.1	17.0	21.5
- in round 1 (%)	12.0	21.1	14.7	14.8
- in round 2 (%)	21.3	21.2	16.0	20.9
- in round 3 (%)	24.0	18.7	18.6	22.9
- in round 4 (%)	9.3	20†	18.6	24
- in round 5 (%)	16.9	21.7	14.5	16.8
- in round 6 (%)	21.5	14.5	13.3	23.8
Number of observations	75	90	75	115

Notes: ** $p < .01$ * $p < .05$ † $p < .1$. Standard errors clustered by group.

Participants in each of the treatments are very similar on a large number of key characteristics. Only a few characteristics are not well balanced over the four treatments at the 10%-significance level. This may be due to chance alone. Neither are participants ill-balanced in terms of risk aversion. In other words, the assignment of treatments seems to have resulted in four comparable treatment groups. To increase precision, the analyses will nevertheless control for differences in characteristics across treatments.

Health shocks were random in the games. As predicted by the law of large numbers, a health shock occurred for around 20 percent of the observations. The prevalence of illness is however lower under individual insurance without communication in round 4. This is one of the later rounds and is therefore unlikely to have far-reaching consequences for demand.

5 Results

This section discusses whether the willingness to join group versus individual insurance, henceforth demand, corresponds to the hypotheses postulated in Section 3.2. We present results for the full sample as well as participants with high versus low risk aversion separately.

5.1 Aggregate demand for insurance

According to the first hypothesis in Section 3.2, demand for individual and group insurance is equal if the more risk-averse commit their less risk-averse peers to the social optimum. Table 5 shows descriptive statistics on demand by treatment. The first row applies to the full sample. Demand for individual insurance is suboptimal at 79.6 percent. The percentage of players willing to join increases to 96 percent in the group insurance treatment. These statistics do however not control for participants' characteristics or selective attrition in the games.

Table 6 presents the results of a number of multivariate regression models that formally test the hypotheses. The dependent variable in every column is the demand for insurance. Panel A gives the estimated coefficients. Panel B combines the partial effects into the total effect of group insurance compared to individual insurance for different types of participants. Total effects are shown for the No Communication and Communication treatments separately.

Column (1) estimates the linear probability model in Equation (7) for the full sample using OLS. On average, group insurance increases demand with 12.2 percentage points if communication is not allowed and with 16.5 percentage points under communication. Both effects are significant at the 5% error level. As discussed in Section 3.4, these OLS estimates may be biased due to selective group default.

Column (2) provides the Heckman estimates that correct for selective attrition. The main findings do not change qualitatively and remain very similar in size. The estimate for lagged number of ill peers, used to identify the selection effect, has a large negative and statistically significant effect on continued participation in the games (see Appendix 3 for the full estimation of model (2)).

Because demand for individual insurance is lower than the demand for group insurance, we reject Hypothesis 1. The repeated nature of the game did not enable participants to fully cooperate on the Pareto-efficient outcome. The remainder of this section describes the results related to the path-independent hypotheses.

5.2 Demand among participants with low risk aversion

According to Hypothesis 2a, demand for insurance among participants with low risk aversion is higher in treatments with group insurance. The middle row of the descriptive Table 5 gives the demand for health insurance among less risk-averse individuals. Demand under group insurance is substantially higher at an average of 91.6 percent than under individual insurance at an average of 45.3 percent.

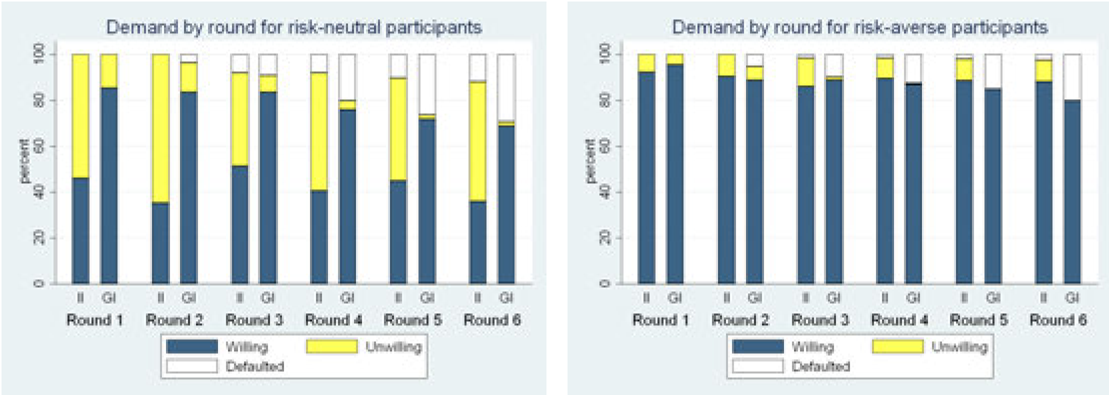
Table 5: Demand for insurance by risk type

	All		No Comm		Comm	
	Individual	Group	Individual	Group	Individual	Group
All	0.7963	0.9600	0.8093	0.9483	0.7813	0.9686
	(0.4030)	(0.1960)	(0.3933)	(.2216)	(.4139)	(.1746)
Low Risk Aversion	0.4526	0.9158	0.4561	0.8913	0.4474	0.9407
	(0.4991)	(0.2782)	(0.5003)	(0.3124)	(0.5005)	(0.237)
High Risk Aversion	0.9024	0.9755	0.9367	0.9739	0.8662	0.9766
	(0.2970)	(0.1546)	(0.2439)	(0.1596)	(0.3410)	(0.1513)

NB: The demand for insurance excludes defaulters. The descriptives may be biased if attrition in later rounds is selective.

Figure 3 disaggregates demand by round. It pools the treatments with and without communication. The left-hand panel of the Figure shows how demand evolves over time for the less risk-averse. The proportion of individuals with low risk aversion *not* willing to take insurance in the group treatment steadily decreases from 16.7 percent in round 1 to 2.0 percent in round 6. This stands in contrast to the persistent majority of participants with low risk aversion unwilling to take insurance in the individual treatment.

Figure 3: Demand for insurance by risk type



Column (3) of Table 6 estimates Equation (7) for the less risk-avese subsample. Column (5) estimates the same equation for the full sample by means of OLS including dummy variables for less risk-averse types. Panel B shows that participants with low risk aversion are between 42.9 and 54.3 percentage points more likely to vote for insurance under group compared to individual insurance. These effects are significant at the 99% confidence level.[11]

To correct for a potential selection bias, column (6) shows the Heckman results for the pooled sample, corresponding to the OLS results in column (5). The correlation ρ between the residuals of the selection equation and the main equation is significant and around 25 percent. But selective attrition does not bias the main result; group insurance increases demand among less risk-averse participants with more than 40 percentage points. Thus, in line with Hypothesis 2a, demand for individual insurance among participants with low risk aversion is significantly lower than for group insurance both in an economic and statistical sense.

5.3 Demand among participants with high risk aversion

According to Hypothesis 2b, demand will be at least as high under group insurance as under individual insurance in groups with more risk-averse players only, as

[11]The results in Table 6 are robust to the in- or exclusion of control variables and to the use of alternative measures of risk attitudes as described in Table 3 panel D.

Table 6: Private demand

	(1) ALL (OLS)	(2) ALL (HM)	(3) RN (OLS)	(4) RA (OLS)	(5) All (OLS)	(6) ALL (HM)
Panel A. Regression coefficients						
Group	0.122*	0.113*	0.443**	0.0145	0.00493	0.000797
	(0.0477)	(0.0481)	(0.0890)	(0.0346)	(0.0425)	(0.0428)
Group x Comm	0.0436	0.0490	0.100	0.0697	0.0613	0.0650
	(0.0736)	(0.0742)	(0.126)	(0.0517)	(0.0656)	(0.0664)
Communication	-0.0236	-0.0297	-0.0248	-0.0614	-0.0466	-0.0520
	(0.0684)	(0.0684)	(0.101)	(0.0478)	(0.0587)	(0.0590)
High RA x n^l				-0.0199	-0.0247	-0.0249
				(0.0212)	(0.0224)	(0.0225)
Group x High RA x n^l				0.0112	0.0147	0.0120
				(0.0231)	(0.0247)	(0.0253)
Low RA					-0.474**	-0.476**
					(0.0678)	(0.0680)
Group x Low RA					0.424**	0.421**
					(0.0759)	(0.0766)
Panel B. Total effect of group insurance						
No Communication						
Group Total	0.122*	0.113*				
	(0.0477)	(0.0481)				
Group Low RA			0.443**		0.429**	0.421**
			(0.0890)		(0.0827)	(0.0832)
Group High RA, no Low RA peers				0.0145	0.00493	0.000797
				(0.0346)	(0.0425)	(0.0428)
Group High RA, 1 Low RA peer				0.0257	0.0196	0.0128
				(0.0283)	(0.0341)	(0.0346)
No Communication						
Group Total	0.165**	0.162**				
	(0.0542)	(0.0560)				
Group Low RA			0.543**		0.490**	0.486**
			(0.0864)		(0.0810)	(0.0823)
Group High RA, no Low RA peers				0.0842*	0.0663	0.0658
				(0.0362)	(0.0442)	(0.0446)
Group High RA, 1 Low RA peer				0.0954*	0.0809	0.0778
				(0.0421)	(0.0489)	(0.0496)
Rho		0.243				0.257*
		(0.178)				(0.120)
N	1791	1942	445	1346	1791	1942

† $p < .1$, * $p < .05$, ** $p < .01$. Robust standard errors in parentheses are clustered at the group level. Controls (1)-(6): Female, Log age, Household size, Married, Muslim, Knows insurance, Visited provider, Log hh health exp, Membership years, Outstanding loan, Contributed, Peers contributed, Knows group member.

they may not be able to coordinate on the optimal equilibrium under individual insurance. The difference between demand for individual versus group insurance is increasing in the number of peers with low risk aversion (Hypothesis 2c).

The bottom row of Table 5 shows demand by type of insurance for participants with high risk aversion. The differences with the less risk-averse are stark. Average demand for individual and group insurance among the more risk-averse is very high throughout the game at 90.2 and 97.6 percent respectively. On the other hand, as the right-hand panel of Figure 3 shows, also for this subsample the percentage of participants *not* willing to take insurance is consistently larger for the individual treatment compared to group insurance in every round. It ranges between 8.0 and 12.4 percent under individual insurance. Under group insurance, the number of individuals unwilling to insure decreases from 5.3 percent in the first round to 0.0 percent in rounds 5 and 6.

Table 6 column (4) estimates Equation (8) for high risk-averse clients based on a multivariate OLS regression. In line with Hypothesis 2b, Panel B shows that more risk-averse players with only high risk-averse peers are indeed 8.4 percentage points more likely to take group insurance compared to individual insurance, but only when they are allowed to communicate. Total effects in the treatments without communication are small and insignificant. Surprisingly, when the more risk-averse *are* able to talk to each other, they are *less* likely to coordinate on the optimal strategy under individual insurance, leaving room for the group contract to increase demand.

Hypothesis 2c postulates that the difference in the willingness to join for the risk-averse is positive and non-decreasing in the number of less risk-averse peers. To test this hypothesis, Table 6 column (4) also includes a variable for the number of peers with low risk aversion and its interaction with group insurance. Panel A shows that the partial effect of an additional peer with low risk aversion under group insurance is small and statistically insignificant. Panel B confirms that the total effect of group insurance for more risk-averse clients with one less risk-averse peer is negligible if communication is not permitted. However, if communication is permitted, group insurance has a large, positive and significant effect of 9.5 percentage points. Columns (5) and (6) find similar findings for the demand of the more risk-averse but coefficients are estimated imprecisely in comparison with column (4).

To summarize, demand patterns are largely in line with the theoretical predictions associated with path-independent strategies. Hypothesis 1 is rejected because group insurance is associated with higher demand than individual insurance. The average willingness to join is especially higher under group than individual insurance when looking at the subsample of participants with low risk aversion. This corresponds to the interpretation of group insurance as a binding contract that enables participants to overcome the social dilemma inherent to the game.

6 Policy implications and external validity

The previous section has shown that a group contract increases demand for insurance in jointly liable credit groups. Does this also lead to higher enrolment rates in insurance and to improvements in other financial performance indicators? To answer these questions, this section analyzes the implications of the various demand patterns from three different perspectives: the insurer, the MFI and its clients.

6.1 Enrollment rates

Microinsurance providers are currently mostly concerned with increasing uptake and renewal. Despite the potentially large benefits of microinsurance, experience from a variety of contexts shows that enrollment remains at very low levels, even when premiums are highly subsidized (Thornton et al., 2010; Giné et al., 2010; De Allegri et al., 2009; Schneider, 2004). Low enrollment rates reduce the size of the risk pool with potentially severe consequences for the financial sustainability of insurance schemes.

When insurance is offered at the group level, one group member can block the entire group from enrolling. This potential disadvantage is an important consideration for microinsurance schemes that are often hesitant to offer group insurance. To quantify this effect in the microinsurance games, Table 7 column (1) estimates the difference in actual enrollment rates for group versus individual insurance for the full sample. Individuals who dropped out due to group default are included in the analysis as non-enrollees in subsequent rounds. Panel A gives the estimated coefficients for the main regressors. Panel B summarizes the total effect of group insurance in the treatments without and with communication respectively.

Group insurance does not significantly affect enrollment rates. Without communication, a few individuals continue to vote against group insurance every round. Although their absolute number is small, a mere two percent of negative voters in the sample could reduce the overall enrollment rate by ten percent. Communication gives group members the opportunity to convince their peers to enroll.

However, this positive effect is counterbalanced by individuals whose group defaulted in early rounds and hence, who are no longer able to enroll. Thus, it seems worthwhile from an insurer's perspective to offer group insurance and simultaneously stimulate credit group members to discuss the advantages thereof.

Table 7: Other outcomes

	OLS (1) P(Enroll)	OLS (2) P(Group Default)
Panel A. Regression coefficients		
Group	-0.139	0.0226
	(0.108)	(0.0197)
Group x Comm	0.226	-0.0315
	(0.144)	(0.0242)
Communication	-0.0832	0.00960
	(0.0883)	(0.0134)
Panel B. Total effect of group insurance		
Group - No comm	-0.139	0.0226
	0.108	0.0197
Group - Comm	0.0869	-0.00883
	0.0980	0.0139
Observations	1942	371

† $p < .1$, * $p < .05$, ** $p < .01$. Robust standard errors are clustered at the group level.
Column (1) includes groups that defaulted as 'not enrolled'.
Controls (1): Female, Log age, Household size, Married, Muslim, Knows insurance, Visited provider, Log hh health exp, Membership years, Outstanding loan, Contributed, Peers contributed, Knows group member, Round (standardized)
Controls (2): Round dummies and n^{rn}.

6.2 Default rates

MFIs with microcredit as their primary business may not be interested so much in enrollment as in the impact on default rates or clients' pressure to repay. Under individual insurance, unprotected risk is scattered over the population. As group insurance leads to a concentration of uninsured participants within a few credit groups, it increases groups' vulnerability to collective default.

The second column in Table 7 estimates the probability that a group defaults under individual versus group insurance.[12] As the results show, the probability of group default does not significantly differ between individual and group insurance. This suggests that the opposite effects of a greater vulnerability to shocks for the uninsured but a higher probability of being insured balance each other out in the group treatment.

Although individual default is common, group default rates in most MFIs are low.[13] Higher default rates in the games can be partly attributed to a relatively high probability of catastrophic expenditures. Uninsured participants faced a one-fifth probability of incurring health expenditures as large as their earnings before loan repayment. Contrarily, only 10.2 percent of participants reported health expenditures equal to or above per capita income. Figure 2 however shows that the game had also been a social dilemma for all $p \in (0.02, 0.25)$.

The Tujijenge data further underscore the importance of health shocks for individuals' capacity to repay: 28 percent of individual defaults are caused by an illness or injury in the household. This picture is common across MFIs in different parts of the world. Failure to repay can cause extreme psychological pressure and distress. Individuals go to large lengths to avoid default and the associated social shame and sanctions. MFIs concerned with the well-being of their clients will attempt to reduce the psychological pressures from individual default. This may explain why even MFIs with low default rates are interested in providing microinsurance.

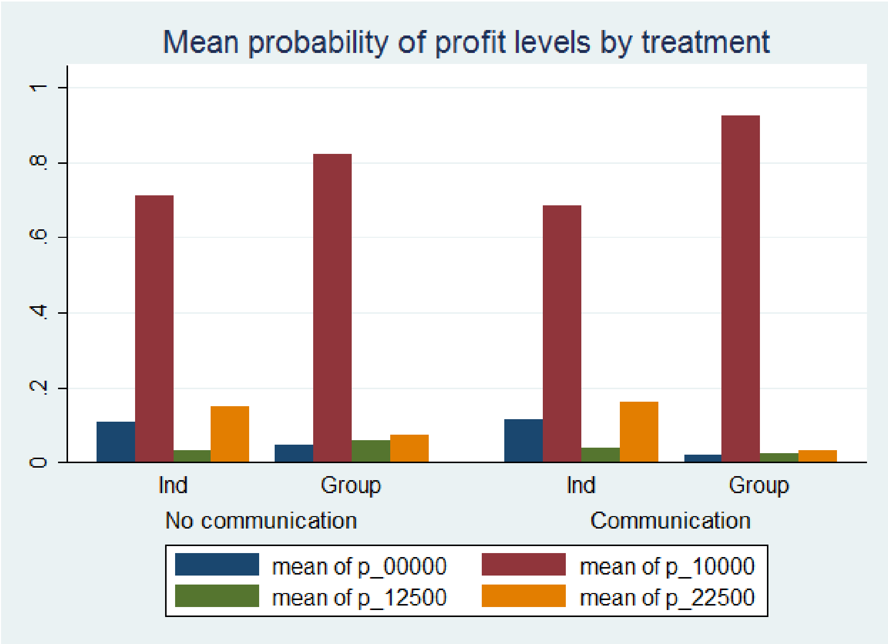
6.3 Profits

Clients are concerned with current and future earnings levels. High risk-averse individuals will also seek a stable level of profits, shielded from fluctuations due to both own and peers' health risks. We estimate the distribution of expected profits based on the enrollment decisions throughout the game in combination with the health shock probability p. Results are shown in Figure 4. Overall, expected profits are not significantly different between the treatments. Group insurance does however substantially reduce the variance of profits, especially when communication is allowed: the probability of both low profits of TZS 0 and high profits of TZS 22,500 are significantly less likely compared to individual insurance.

[12] The probability of group default is calculated for each group in each round as $1 - P'_{n^*}(d_{it}, d_{-it})$, one minus the probability that at most $n^* = 1$ group members fail to repay.

[13] For instance, 98% of Tujijenge groups repay their loan.

Figure 4: Distribution of expected profits



Finally, free-riding pays off. Participants with low risk aversion, the majority of whom did not enroll in individual insurance, earned substantially more throughout the individual insurance games than their risk-averse group members with averages of 65,081 versus 50,877.

To summarize, the higher demand under group insurance does not translate into higher enrollment rates or expected profits nor lower default risk. Its main merit from the different stakeholder perspectives is a decrease in the variance of profits, which will be valued especially by more risk-averse clients.

6.4 Risk attitudes in the population

The extent to which group insurance affects demand, enrollment, default and profits depends on the target group's risk attitudes. In target groups with a large proportion of less risk-averse individuals, group insurance is more likely to benefit enrollment, as these clients have highest incentives to free-ride under individual insurance. This section looks in more detail at the implications of the target group profile for the extrapolation of our predictions to the average Tujijenge client.

Participants in the game are not perfectly representative of the target group. Table 3 shows a comparison with a representative survey among 407 Tujijenge clients conducted three months before the microfinance games. The last two columns give population averages and the t-statistic corresponding to a test for equal means in the two samples (unpaired). Game participants are more likely to be female, have larger households, are less well educated and less likely to be insured. They are also twice as likely to have visited a health provider in the past three months and spent substantially more on health care. This could be due to seasonal differences in disease, since the games and the Tujijenge survey were not conducted in the same period. Another explanation for higher health care utilization is an explosion in a munition depot near one of the study areas (Gongo La Mboto) just prior to the games. This accident caused injuries for a substantial proportion of households in the surrounding neighborhoods.

To better understand whether results would be similar for a more representative group, it is necessary to know which variables correlate with risk aversion. The final column of Table 3 presents correlates for low risk aversion. Women as well as players with higher household health expenditures - both overrepresented in the games - are more risk averse. Participants' negative perceptions of the quality of the main existing insurance scheme may explain why those with health insurance - underrepresented in the games - take more risks (Dercon et al., 2011).

These estimates are used to predict that 30.7% of clients in the target group have low risk aversion. This is slightly higher than the 25.6% in the participant sample, which suggests that our results represent a lower bound for the effectiveness of group insurance in the games. The difference in the proportion of clients with low risk aversion is however not significant. Standard errors calculated by means of the Delta method yield a confidence interval equal to [23.3,38.2].

7 Conclusion

Because most poor households do not have access to formal insurance, they have developed informal ways to cope with different types of risk. As a result, informal risk-sharing arrangements are widespread. These provide only limited insurance though, creating scope for the introduction of accessible and affordable formal insurance. This paper demonstrates that pre-existing informal risk-sharing networks will affect the demand for insurance differently dependent on the level at which insurance is offered: the individual or the group.

We developed a theoretical model which shows that the introduction of individual insurance in jointly liable credit groups creates an incentive problem, especially for individuals with low risk aversion. Under a wide range of parameters, a social dilemma can arise in which low risk-averse types prefer to forgo insurance and free-ride on contributions from their peers when they fall ill, although all had been better off if the entire group were insured. We hypothesized that the binding nature of group insurance may offer a way out of this social dilemma and increase the demand for health insurance to optimal levels.

The theoretical predictions were tested by means of microinsurance games played with 355 microcredit clients in Tanzania. These games closely mimicked the health insurance decision in a microcredit group. Four treatments varied whether participants were offered individual or group insurance, and whether it was allowed to communicate or not.

The findings broadly supported the hypotheses. Group insurance increased the demand for insurance, especially when communication was permitted and among participants with low risk aversion, whose demand rates increased from 45.3 to 91.6 percent. For more risk-averse individuals, differences were much smaller but increasing in the number of less risk-averse (potentially free-riding) peers.

The paper also investigated the implications of these demand patterns for other outcomes. Notably, overall enrollment rates in the games were as high under group as under individual insurance despite a larger average willingness to join. This was mainly due to a small minority of individuals who consistently voted against insurance. The marketing of a group insurance scheme could hence benefit from discussion platforms within the credit groups.

In addition, group insurance did not affect the probability of group default. The improved protection against health shocks in insured groups was canceled out by their increased vulnerability. Under group insurance uninsured individuals are concentrated within credit groups instead of scattered throughout the population. Although expected profits did not differ across treatments, variability of earnings was lower under group insurance.

These results suggests that the standard choice faced by MFIs to offer insurance either at the individual or at the group level should reach beyond administrative and financial considerations or a concern for adverse selection . Up to date, the debate has ignored the importance of existing risk-sharing arrangements within the credit group. These may well have unintended negative effects on demand for individual insurance.

Given the potential benefits of group insurance for both clients and the insurer, this naturally leads to the question why MFIs do not make enrollment mandatory for all clients. MFIs are very reluctant to do so because they fear that this restrictive policy will chase their clients away to other microfinance institutes. SKS

Microfinance in India and many other organizations have encountered such client resistance to mandatory enrollment (Duflo and Banerjee, 2011).

This paper shows that the combination of a theoretical model with a framed field experiment can provide important insights that are not easily gained from alternative methods such as surveys alone. The experiment provided the opportunity to study within a limited time span how dynamic cooperation evolves over time. Moreover, participants were not recruited from a standard student population but were potential beneficiaries of a newly developed micro health insurance scheme. As such, the results extend findings from public good games played in laboratory experiments to the field. The microinsurance games resembled the real world of the Tujijenge microcredit group members as closely as possible.

External validity nevertheless remains a caveat even with framed field experiments. The success of group versus individual insurance will depend on many more factors than can possibly be modeled in a game. We therefore recommend MFIs that consider introducing health insurance to pilot the two schemes next to each other, preferably by means of a well-designed randomized controlled trial (RCT) that limits bias due to confounding factors. An RCT could also evaluate different decision rules such as unanimity voting, majority voting or decision by consensus, as well as various forms of interactive marketing approaches to enhance discussions among clients.

To conclude, group insurance can solve problems of limited commitment in individual schemes that depress demand for individual health insurance, an issue that is currently ignored in the literature. Given low enrollment rates in micro-insurance and the recent interest alleviating the poor's vulnerability to different types of risk, our findings are relevant for the design of ongoing pilots of microinsurance schemes. Since informal risk-sharing arrangements extend beyond the credit group, the findings may generalize to other contexts such as communities, extended families or cooperatives.

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Appendix 1 - Proofs

Proposition 2.1 (Pareto optimum for clients with high risk aversion) *Full enrollment is a Pareto-improvement over zero enrollment if* $n^l = 0$.

Proof To see this, note that insurance increases the probability of continuation, and within a round, full enrollment creates higher utility, $U^h_{1,n-1}$, than zero enrollment, $U^h_{0,0}$:

$$U^h_{1,n-1} = U^h(e - ph) > (1-p)U^h(e) > (1-p)\sum_{f=0}^{n^*} p_f U^h(e - c(f)) = U^h_{0,0} \quad (10)$$

The first inequality follows from Definition (2) and the second inequality from the fact that $c(f) > 0$ for any $f > 0$, while $\sum_{f=0}^{n^*} p_f < 1$ because $n^* < n$. ■

Proposition 2.2 (Group insurance) *Under group insurance, full enrollment is a SPNE if and only if* $n^l = 0$ *or (4) is satisfied.*

Proof First, assume that (4) is satisfied or that the group has no members with low risk aversion. This means that no group member has an incentive to vote against insurance. Thus, full enrollment is a SPNE. Second, if (4) is not satisfied, group members with low risk aversion will vote against insurance even if everyone else votes for insurance. Full enrollment is then not a SPNE. Therefore, full enrollment is a SPNE if and only if (4) is satisfied. ■

Proposition 2.3 (Individual insurance with path-independent strategies) *Under individual insurance, full enrollment is a Nash equilibrium in the stage game if and only if all group members have high risk aversion,* $n^h = n$.

Proof First, we prove that if full enrollment is a Nash equilibrium, then $n^h = n$. If full enrollment is a Nash equilibrium, no group member has an incentive to deviate from full enrollment. Clients with low risk aversion however have an incentive to deviate. To see this, note that the expected utility for type i under full enrollment, meaning that all peers enroll, $d_{-it} = n - 1$, is:

$$U^i(e - ph) + \beta V^i \quad (11)$$

An insured individual earns e with certainty and pays the insurance premium ph in the present loan cycle. Continuation to the next loan cycle is guaranteed since all peers are enrolled as well.

Defecting individuals who do not take insurance expect to earn e when healthy, with probability $1 - p$, but risk being ill and earning 0, with probability p. In this case, the insured peers will contribute and secure the next loan cycle. Expected utility from defection hence is:

$$(1-p)U^i(e) + \beta V^i \tag{12}$$

By Definition 3, individuals with low risk aversion have an incentive to defect from full enrollment since the utility from insurance (11) is strictly below the expected utility from defecting (12):

$$U^l(e-ph) - (1-p)U^l(e) < 0 \tag{13}$$

If full enrollment is an equilibrium, the group can hence not contain any clients with low risk aversion.

Second, we prove that if $n^h = n$, then full enrollment is a Nash equilibrium. For clients with high risk aversion, the utility difference between enrolling and defection is non-negative by Equation (2),

$$U^h(e-ph) - (1-p)U^h(e) \geq 0,$$

which means that clients with high risk aversion have no incentive to deviate from full enrollment. Thus, full enrollment is a Nash equilibrium if and only if $n^h = n$. ■

Proposition 2.4 (Individual insurance with path-dependent strategies) *Under individual insurance, full enrollment is a SPNE in the repeated insurance game if (i) $n^l = 0$ or, (ii) if $n^l > 0$, only if Inequality (4) holds and dynamic incentives are sufficiently strong:*

$$(1-p)U^l(e) - U^l(e-ph) \leq \beta \;\; V^l_{always} - V^l_{never} \tag{14}$$

Proof Statement (i) is implied by Proposition 2.3. Regarding statement (ii), which applies to group members that have low risk aversion, assume that group members adopt the trigger strategy $d_{it} = 1 \Leftrightarrow d_{-is} = n-1$ for all $s \leq t$. For group members with low risk aversion, expected utility from full enrollment is:

$$U^l(e-ph) + \beta V^l_{always} \tag{15}$$

Expected utility from defection is:

$$(1-p)U^l(e) + \beta V^l_{never} \tag{16}$$

The client will defect if doing so yields higher expected utility than full enrollment:

$$(1-p)U^l(e) - U^l(e-ph) > \beta \;\; V^l_{always} - V^l_{never} \tag{17}$$

Hence, if group members have low risk aversion, Equation (5) is a necessary condition for full enrollment to be a SPNE. ■

Appendix 2 - Credible threat

In Regime 3, a trigger strategy commits less risk averse group members to the social optimum. Whether this is an equilibrium strategy however depends on whether the threat of staying uninsured is credible. In other words, do clients have no incentive to enroll if their peers neither enroll? As the most risk averse clients are most likely to deviate from zero enrollment, we consider the limiting case where a group member has Leontief preferences, meaning that the client is indifferent between any strictly positive earnings ($u(x) = 1$ for any $x > 0$), and has value zero from zero earnings function (henceforth referred to as 'infinitely risk-averse' clients).

The following proposition derives two sufficient conditions for the threat of remaining uninsured upon defection to be credible.

Proposition 7.1 *Under individual insurance, if $d_{-it} = 0$, then $d_{it} = 0$ in the repeated insurance game if insured group members are just able to repay for n^* group members,*

$$\frac{n^*}{n} = \frac{e - ph}{h - ph}, \tag{18}$$

and clients are relatively impatient:

$$\beta < \frac{p_{n^*} - pP_{n^*}}{P_{n^*}^2(1-p) - P'_{n^*}P_{n^*-1}}, \tag{19}$$

where p_f is the probability that f peers fail to repay, P_f is the cumulative probability that at most f peers fail to repay, and P'_f is the probability that at most f group members, including oneself, fail to repay.

Proof In the limiting case, where $U^h(x) = 1$ for any $x > 0$ and $U^h(0) = 0$, the value of remaining uninsured forever is:

$$V^h_{never} = (1-p)P_{n^*} + \beta P'_{n^*}V(0) = \frac{(1-p)P_{n^*}}{1 - \beta P'_{n^*}}$$

where P_{n^*} and P'_{n^*} are the cumulative probabilities that at most n^* peers or n^* group members, including oneself, are ill, respectively:

$$P_{n^*} = \sum_{k=0}^{n^*} \binom{n-1}{k} p^k (1-p)^{n-1-k} > \sum_{k=0}^{n^*} \binom{n}{k} p^k (1-p)^{n-k} = P'_{n^*}$$

Each uninsured group member earns a strictly positive amount if and only she is healthy and at most n^* peers are ill, which occurs with probability $(1-p)P_{n^*}$.

Every period, the group continues to the next loan cycle if and only if at most n^* group members are ill, which occurs with probability P'_{n^*}.

Whether an infinitely risk averse client would prefer to enroll if her peers do not enroll, depends on the payoff if n^* peers fail to repay. Insured group members need to contribute for peers but have also paid the insurance premium. If insured clients have strictly positive earnings even if they contribute for n^* peers,

$$e - ph - n^* \frac{h-e}{n-n^*} > 0 \Leftrightarrow \frac{n^*}{n} < \frac{e-ph}{h-ph},$$

the value of being the single insured group member is:

$$P_{n^*} + \beta P_{n^*} V^h_{never}$$

The expected utility difference between staying uninsured and enrolling is:

$$-pP_{n^*} - \beta \left(P_{n^*} - P'_{n^*}\right) V^h_{never} < 0$$

because the probability of continuation is largest if one client enrolls, $P_{n^*} > P'_{n^*}$. An infinitely risk averse client is indifferent between any strictly positive earning and thus with respect to paying the insurance premium. There is hence no immediate benefit of not taking insurance. At the same time, insurance mitigates the probability of a health shock with probability p and increases the probability of continuation. A trigger strategy is thus not credible for infinitely risk averse clients.

However, if the client is just able to contribute for n^* group members and does not earn anything if that number of peers fail to repay,

$$\frac{n^*}{n} = \frac{e-ph}{h-ph},$$

insurance has an immediate cost: having to contribute and not earning anything if n^* peers fall ill. The value of enrolling in an uninsured group is:

$$P_{n^*-1} + \beta P_{n^*} V^h_{never}$$

If p_{n^*} is the probability that n^* peers fall ill (not cumulative), and an insured player has zero earnings after contributing for n^* peers, the benefit of staying uninsured is:

$$p_{n^*} - pP_{n^*} - \beta \left(P_{n^*} - P'_{n^*}\right) V^h_{never} = p_{n^*} - pP_{n^*} - \beta \left(P_{n^*} - P'_{n^*}\right) \frac{(1-p)P_{n^*}}{1-\beta P'_{n^*}} \quad (20)$$

For extremely impatient clients, $\beta = 0$, this expression reduces to:

$$p_{n^*} - pP_{n^*} > 0 \Leftrightarrow p < \frac{p_{n^*}}{P_{n^*}}$$

So even for infinitely risk averse clients, a trigger strategy can be incentive-compatible if p is sufficiently small and clients are impatient. By continuity, in uninsured groups, no player has an incentive to deviate for small β such that (20) is strictly positive:

$$\begin{aligned} 0 &< (p_{n^*} - pP_{n^*})(1 - \beta P'_{n^*}) - \beta (P_{n^*} - P'_{n^*})(1-p)P_{n^*} \\ \beta &< \frac{p_{n^*} - pP_{n^*}}{P^2_{n^*}(1-p) - P'_{n^*}(P_{n^*} - p_{n^*})} = \frac{p_{n^*} - pP_{n^*}}{P^2_{n^*}(1-p) - P'_{n^*}P_{n^*-1}} \end{aligned}$$

This yields the conditions under which even the most risk-averse group member has no incentive to deviate from zero enrollment. ■

The first condition is that insured group members are just able to repay for n^* group members. If a group member has strictly positive earnings as long as the number of delinquents does not exceed n^*, the client is indifferent between any strictly positive earning and thus with respect to paying the insurance premium in the limiting case. Insurance mitigates health shocks and increases the probability of continuation at zero cost. An infinitely risk-averse client would therefore always enroll irrespective of the number of free-riding peers. A trigger strategy is not credible with such risk preferences.

If on the other hand insured group members are just able to repay for n^* group members, insurance has an immediate cost: having to contribute and not earning anything if n^* peers fail to repay. In this case, infinitely risk-averse clients enroll mainly because their insurance protects the group from default. Only if clients are sufficiently impatient, even infinitely risk-averse clients will not enroll if nobody else does so. This is reflected by Equation (19). Hence, if both the first and the second condition in Proposition 7.1 are satisfied, any risk-averse client can credibly announce not to enroll whenever a group member free-rides.

In Figure 5, the maximum β for which a trigger strategy is credible in the limiting case with infinitely risk averse clients is indicated by the black U-shaped line in the upper left corner. At low health shock probabilities, clients with conventional discount rates, $\beta \leq .9$, have no incentive to deviate from the trigger strategy. At higher health shock probabilities, Condition (19) is satisfied for any discount rate, $\beta < 1$. This figure applies to the case where a group of $n = 5$ members is able to contribute for at most $n^* = 1$ delinquent.

Figures 6 and 7 illustrate maximum discount rates for groups with $n = 5$ and $n = 10$ members at alternative values for n^*. The trigger strategy is incentive

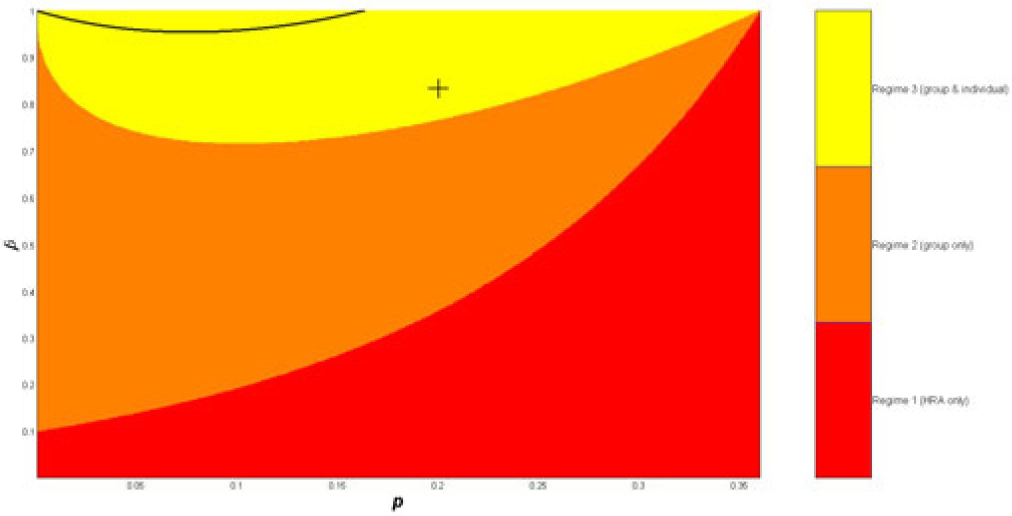


Figure 5: Solution regimes if $e = 9/16l$, $h = e + l$, $n = 5$ and $n^{*} = 1$.

compatible with a wide range of health shock probabilities as long as the group is able to contribute only for a small proportion of members.

Figure 6: Threshold values β and p if $n = 5$

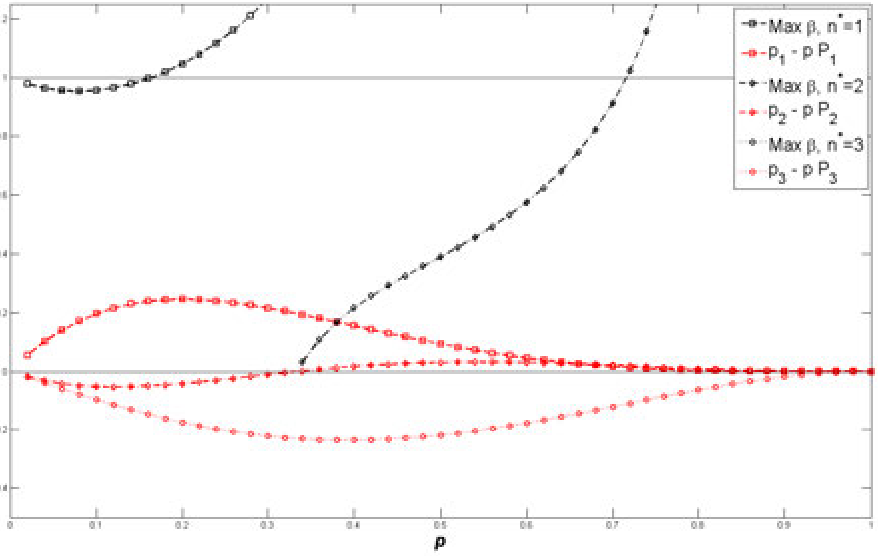
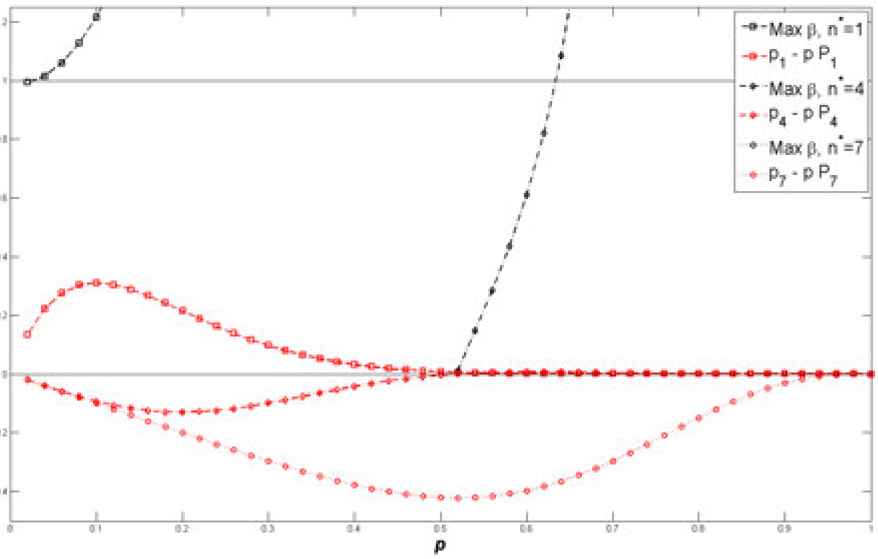


Figure 7: Threshold values β and p if $n = 10$



Appendix 3 - Table controls / selection equation

	(1) OLS (1)	(2) HM (2)	(3) Select (2)
Group Insurance	0.122*	0.113*	-6.178**
	(0.0477)	(0.0481)	(0.452)
Group x Comm	0.0436	0.0490	6.318**
	(0.0736)	(0.0742)	(0.847)
Communication	-0.0236	-0.0297	-5.921**
	(0.0684)	(0.0684)	(0.685)
Round (standardized)	0.0182*	0.0148	-0.485**
	(0.00906)	(0.00963)	(0.130)
Female	0.0641^{+}	0.0627^{+}	-0.0860
	(0.0376)	(0.0377)	(0.215)
Log age	-0.0406	-0.0383	0.605
	(0.0430)	(0.0430)	(0.375)
Household size	0.00473	0.00492	0.0584
	(0.00536)	(0.00537)	(0.0398)
Married	-0.0526*	-0.0565*	-0.664**
	(0.0211)	(0.0223)	(0.197)
Muslim	0.0209	0.0197	-0.268
	(0.0286)	(0.0290)	(0.239)
Knows health insurance	0.00553	0.00405	-0.223
	(0.0295)	(0.0299)	(0.264)
Client visited provider	-0.0364	-0.0350	0.177
	(0.0353)	(0.0354)	(0.205)
Log hh health expend	0.0115*	0.0114*	0.00895
	((0.00505)	(0.00504)	(0.0304)
Membership years	0.0177*	0.0180**	0.0514
	(0.00677)	(0.00682)	(0.0797)
Has an outstanding loan	0.0209	0.0211	-0.0579
	(0.0364)	(0.0364)	(0.274)
Contributed for peer	-0.0408	-0.0407	-0.0434
	(0.0297)	(0.0298)	(0.132)
Peers contributed	0.0240	0.0259	-0.127
	(0.0371)	(0.0377)	(0.376)
Nr. in credit group	-0.00347	0.00150	1.083**
	(0.0281)	(0.0289)	(0.255)
Lag nr ill group members			-1.218**
			(0.183)
Constant	0.820**	0.812**	7.206**
	(0.156)	(0.157)	(1.422)
Observations	1791	1942	1942

Robust standard errors in parentheses are clustered at the group level.
† $p < .1$, * $p < .05$, ** $p < .01$
Dependent variables: (1)-(2) Private demand, (3) Being in the game

Appendix 4 - Instructions

First game

Introduction It starts as follows:

- You are one of five members of a micro loan group.
- Assume that you are borrowing from a bank every month for your business to make a profit.
- Your profit is 22,500 Shillings.
- If you can repay the loan, you will repay it and you will be able to borrow for the second time and therefore you will play this game twice.
- You will not be able to play again if you wont repay the loan.

Health problems But before you repay your loan, two things may happen: you may get sick or you may not. If you are well, you will be able to repay the 40,000 shilling debt to the bank. A research assistant will put a profit of 22,500 shillings in your piggybank. Since you repay your loan, the bank is allowing you to borrow again.

But if you are sick, you will be forced to use your full income on treatment. Therefore, pay a research assistant your 62,500 shillings and your profit will be 0. It means that you will not be able to repay the bank the loan. The bank will not lend you the money again and hence you will not be able to play again this game. You will be able to borrow again from the bank and get money again only when a new game starts. It is important that you know you will not be able to open the piggybank when the game is in play. Therefore, you cannot use the money from the piggybank to repay your debt.

To know if you are sick or not, the research assistant will tell you to get a card from an envelope. There are 5 cards in an envelope. Four (4) of the cards have no writings on them and one card has a picture. If you get a card with a picture of sickness, you are sick. You are supposed to take a card while you are not looking at it. After you get the card, look at it and then put it back into the envelope and another person should do the same so that every person should get the equal opportunity to be the sick one.

Health insurance Now let's see another important step. You can get health insurance policy every time you play this game and it costs 12,500 shillings. You will not be required to pay for medical expenses if you get sick and you go to a hospital. Therefore you will pay the bank loan of 10,000 shillings. Therefore your profit is 10,000 shillings. The research assistant will put this profit in the piggybank. The bank will now allow you to borrow again.

If you do not have health insurance, you will not pay 12,500 shillings for the insurance policy. If you are not sick, you will pay the loan and your profit will be 22,500 shillings. If you are sick, you will loose all your income and you will not be able to repay the loan and your profit will be 0 and you will not play in this round again. You will be able to borrow from the bank again and get money in a new game.

The insurance will be used only on one round. You will be allowed to decide if you want to pay for the health insurance policy or not on every round of the game.

A test game Now lets try for a moment. What you will do in this round will not negatively affect your final income. The first (second/third/fourth/fifth) player may step forward to the assistant.

1. They will give you your income of 62,500 shillings.
2. Now, please tell the research assistant if you want to pay for health insurance. Pay 12,500 shillings if you want to pay for it and don't pay anything if you do not.
3. Now, the research assistant will allow you to pick a card. Pay 62,500 shillings for your treatment if you get the sick card and you did not pay for health insurance. Do not pay anything if the above does not apply to you.
4. If you can pay, pay now your loan of 40,000 shillings.
5. If this game was real, the research assistant would have put the money on the piggybank. The game would have been over if you could not pay back the loan.

The group score board Now the research assistant will show you if members of different groups managed to pay or not. The research assistant will do this after every round. Every member in your group is represented by a symbol: square, moon, circle, triangle and a star. The research assistant will put the symbol on the board.

A group member's profit is 22,500 shillings if the member is here, did not pay for health insurance and is not sick in this round. A group member's profit is 0 shillings and will not continue to play the game in future rounds if the member is on the red line, did not pay for health insurance and is sick. A group member's profit is 10,000 shillings if the member is here, paid for health insurance but did not get sick. All members who are on the green line can pay and hence can continue to play the game in future rounds.

Please remember that you can not converse with anybody when the game is in play. Your group members do not know your symbol and hence are ignorant of your decisions.

Now lets start with the first round of the game if everybody has understood. We will play this game two more times. From this point onward, the plastic money you will win will be converted to real money. You will get paid in cash the money in the piggybank at the end of this game. You will get paid 1,000 shillings in real money for every 10,000 shillings in plastic money in the bank.

Second game

Introduction The second game is very similar to the first one. The difference with the first game is how much health insurance policy cost. It costs 17,500 shillings in this game. If you get the policy, your profit will be 5,000 shillings. If you do not get the policy and you did not get sick, your profit will be 22,500 shillings. If you did not get the policy and you got sick, you will not get any profit and you will not be able to play the game in the next rounds.

Third game (Group insurance[14])

Introduction The third game looks like the first one. The cost of health insurance is 12,500 shillings. The difference with the first game is the requirement that the decision on getting or not getting a health insurance must be made by the whole group, not individually. The other difference is that now the loan from the bank is requested as a group and the loan is to be paid by the whole group in full. The bank will allow the group to borrow again if the group will repay the loan. The game will be over to the whole group if the group fail to repay the loan in full. Let's look at this game step by step.

First, take a vote to decide if the group wants a health insurance policy or not. The policy will be paid if the whole group vote and agree. If it happens that at least one member of the group votes not to get one, the whole group will go without having one.

[14] Instructions for individual insurance with and without communication are available upon request.

Second, each group member will go to the research assistant and get their income, pay health insurance if each member of the group vote to get one. You will get a card from the envelope, and you will pay your loan like in the first game. Like in the beginning, the research assistant will show each member of the group if they can return it or not.The difference with the first game is that now the whole group is required to pay the loan in full and together. Therefore, if the group can repay the loan, those who cannot cover their part of the share should get assistance from their fellow group members. How much assistance will be required depends on how many group members fail to repay their share of the loan.

If all five members of the group can repay their loans, each member will pay 40,000 shillings. All five members of the group will advance to the next round. If four group members manage to repay their loans and one failed, each of those four will pay their loans of 40,000 shillings and will assist the one who failed with 10,000 shillings each. All group members will advance to the next round including the one who failed to meet their responsibility. If those who manage to repay their loans is below four, meaning two or more groups members fail to repay their loan, then the group will not be able to repay it in full. Those who will be able to pay will have to pay their 40,000 shilling loan and do what they can to help their group members who are short. Not all group members will advance in the next round and therefore each group is required to have four or more members to advance to the next round of the game.

Test round Now let's try. What you will do in this round will not negatively affect your final income. It will be decided by vote if the group will get a health insurance policy or not. The group will get the policy only if all group members vote yes. If one or more group member prefer not to pay for the policy no group member will have their insurance policy paid for them therefore no one will pay for the policy. Your group members will not know how you voted.

Now you will vote on this card saying you want to get the policy or not. Circle the symbol on the left marked with a cross if you want to buy the policy. Circle the symbol on the right marked with a cross with a line passing through it if you do not want to pay for the insurance policy.

If there is no member of a group here, all five members of the group can afford to pay, therefore each one will pay their loan of 40,000 shillings. Group members who are here did not take health insurance policy and did not get sick. Their profit is 22,500 shillings. Group members who are here or they took the policy and their profit is 10,000 shillings. All group members advance to the next round of this game.

Members of a group who are here did not take the insurance policy and they got sick. They can not repay their loans and their profit is 0 shillings. If there is one group member here, then each remaining four is capable of raising 10,000 shillings for the member who could not repay their loans. Group members who are here did not take the health insurance policy and are not sick. They paid their loans, now pay 10,000 shillings and their profit is 12,500 shillings. Group members who are here or here took the health insurance policy. They paid their loans, now contribute 10,000 shilling and their profit is 0. All group members advance to the next round together with those who failed to repay their loans.

If there are two or more group members here, then less than four group members are capable of paying and the group will not be able to pay the loan in full. Group members who are here did not take the health insurance policy and are not sick. They paid their loans, now will contribute as much as they can - 22,500 shillings - and their profit is 0 shillings. Group members here or here took health insurance policy. They paid for their policy and now contribute as much as they can - 10,000 shillings - and their profit is 0 shillings. Because less than four group members can afford to pay then the loan will not be able to be paid in full. No group member will continue in the next round of the game, including group members who managed to give back.

Treatments without communication Please remember that you can not converse with anybody when the game is in play. Your group members do not know your symbol and hence are ignorant of your decisions.

Treatments with communication Please remember that: It is not allowed to communicate with anyone while the game is in play. But before each round begins, you are allowed to communicate with your fellow loan group members about the insurance policy. You may communicate with them for two minutes. Communication will not be allowed after these two minutes.

We will be recording your voices with voice recorders to know how you have understood our questionnaires in this game. What you will say will be recorded but it will be a secret known only to researchers and it will be used only for research purposes. It will also not negatively affect your income. So please, pay no attention to these microphones. Your fellow group members do not know your symbol and hence are ignorant of the choices you are making.

Number of rounds in the game Another difference with the other games is that we will play more rounds. We are not certain how many rounds. If you pay for insurance policy, you will be able to play at least four times. From the fourth round, we will toss a die to decide after every round to know if we will continue. The game will continue if the die is turned and it yields number 2, 3, 4, 5 or 6. The game will stop for everybody if it settles on number 1.