Microfinance Games*

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Abstract

Microfinance has been heralded as an effective way to address imperfections in credit markets. From a theoretical perspective, however, the success of group-based microfinance has puzzling elements. Group-based mechanisms tend to be vulnerable to free-riding, especially in the absence of explicit contracts. We conducted eleven different games over seven months in a local market in Lima, Peru. We find that the tendency toward free-riding also emerges in group liability structures, and that patterns of risk-taking broadly conform to predicted patterns. We also find that inefficiencies are allayed by allowing clients to form their own groups voluntarily. The endogenous formation of groups allows customers to sort into relatively homogenous pairings that limit the degree to which groups induce free-riding and tax safe behavior. Given endogenous group formation, microfinance contracts can function effectively to reduce moral hazard.

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1. Introduction

Banking in low-income communities can be a notoriously difficult business. Banks from outside typically have limited information about their customers and face costly contract enforcement. Customers, for their part, frequently lack adequate collateral or credit histories with other commercial banks. Moral hazard and adverse selection, coupled with small transaction sizes, together limit the possibilities for banks to lend profitably. In the past three decades, though, microfinance practitioners have defied predictions by finding workable mechanisms through which to make small loans to very poor customers. Repayment rates on their unsecured loans often exceed 95 percent, and by 2005 (officially-designated the United Nations International Year of Microcredit) microfinance institutions had served about 100 million customers around the world.

The success has been exciting to many, and some advocates describe microfinance as a revolutionary way to reduce poverty (e.g., Yunus 1999). From a theoretical perspective, though, the success has puzzling elements. Many of the new mechanisms rely on groups of borrowers to jointly monitor and enforce contracts themselves. Group-based mechanisms, however, tend to be vulnerable to free-riding—especially in the absence of explicit contracts. Inefficiencies are well known to emerge in similar contexts, amply documented in the literatures on public goods, the tragedy of the commons, insurance, and environmental externalities (e.g., Gruber 2004). We show that the tendency toward free-riding also emerges in experimental settings that simulate microfinance transactions: moral hazard is exacerbated by simple group-based microfinance contracts.

We show that the inefficiencies, however, are allayed by allowing customers to form their own groups voluntarily. The endogenous formation of groups, we argue, allows customers to sort into relatively homogenous pairings that limit the degree to which groups induce free-riding and tax safe behavior. Given endogenous group formation, microfinance contracts do function effectively to reduce moral hazard.

The simulations were implemented as a series of microfinance-related experiments (or games) in Lima, Peru.[1] The experiments took place in a local market, Polvos Azules, populated with small-scale entrepreneurs--individuals with demographic and economic profiles similar to those of typical microfinance customers. Twice a week between July 2004 and February 2005, we engaged participants in a series of simulated microfinance transitions, in which participants chose hypothetical risky projects, received loans, and managed the risk of defaulting. In a typical day, we played two or three games. Eleven different types of games were played over the course of the seven months, and each type was played on average 27 times. In total, 491 participants played an average of eleven games each. Participants were compensated based on their success as borrowers in the simulations.

The simulated environment allowed us to test a wide range of contracts in a systematic way, a strategy that would be impractical for practitioners. The approach involved modifying important parts of credit contracts in order to isolate specific features that drive successes and create tensions. The controlled setting also allowed us to identify clearly participants' choices as "risky" or "safe," enabling precise testing of hypotheses. By working in Lima and designing the games to replicate actual microfinance scenarios, our aim has been to understand the logic of the

[1] Harrison and List (2004) would classify the approach as a series of "framed field experiments." Examples of the approach in other settings include List (2004) and Barr and Kinsey (2002). The closest study to this paper is Cassar, Crowley and Wydick (2005) which conducts a series of repeated public goods games in South Africa and Armenia in order to relate contributions to the public good to likely behavior in a microfinance setting.

mechanisms with individuals likely to participate in an actual microfinance program, but not to replicate exactly customers' experience with microfinance.

In Section 2, we discuss the microfinance mechanisms which have motivated this experimental economics study. In Section 3, we describe the laboratory setting, an urban marketplace in Peru. In Section 4, we present the 11 variations of the game that were implemented. Section 5 presents the theoretical predictions along with empirical results. Section 6 concludes.

2. Microfinance mechanisms

Microfinance mechanisms contain a series of components, and theorists have explained how isolated components work to mitigate problems imposed by information asymmetries. Empirical progress, though, has been slower. Researchers have found that, in particular, the workings of specific components prove difficult to disentangle in practice. Disentangling the role of the components, though, is critical for understanding the functioning of credit markets—and for locating where newer innovations might lie. As Rai and Sjöström (2004) argue, the group-based microfinance mechanisms may be workable, but they are not efficient: the contracts are dominated in theory by alternative mechanisms that induce information revelation.

Consider the following microfinance mechanism, often called a "group lending" or "joint liability" contract; it is based on models employed first in South Asia and Latin America in the late 1970s. The mechanism begins with a lender deciding to enter a new market. In preparation for entry, the lender announces to residents that loans will soon be available. The stipulation, though, is that potential customers approach loan officers in small, self-formed groups. A contract is written such that borrowers obtain loans as individuals and invest the funds independently, selecting investments based on perceptions of risk and return. The group feature is invoked only if a risky investment turns sour for any of the borrowers. At that point, all group members are held liable for the repayment of the loans, not just the borrowers whose investments failed. Access to future loans continues without interruption as long as the group finds a way to fully repay current loans, but the entire group is cut off when repayment problems cannot be adequately resolved.

Without making it explicit, the mechanism serves to harness customers' information about each other and their mutual relationships. In the first place, insisting on self-formed groups provides a screening mechanism that can help to reduce adverse selection (e.g., Ghatak 1999). The repeated interactions can also serve as a way to reduce moral hazard (Armendariz de Aghion and Morduch 2000). The group element provides an inducement for members to monitor each other (Banerjee, Besley and Guinnane 1994) and to punish each other in the face of moral hazard, possibly through social sanctions (Wydick 1999; Karlan 2004). In these ways, the mechanism can reduce risk-taking in a way that can be helpful for banks. The mechanism, though, might also increase risk-taking by fostering a mutual insurance arrangement within the group (which could be helpful for the bank; see, e.g., Sadoulet 2000) or, less helpfully, by creating free-rider problems.

By just observing the mechanism as implemented, it is not clear how important are the roles of group formation, dynamic incentives, monitoring, enforcement, insurance, or free-riding. Ideally, researchers would like to analyze the behavior of customers who are offered a wide range of (randomly) different credit contracts, each of which is designed to reveal the logic of a particular component. As a practical matter, though, this kind of randomized variation is difficult to implement. We use the methods of experimental economics as an alternative route to understanding the logic of microfinance mechanisms. The next section describes the structure of the simulations, and the subsequent section describes predictions.

3. The lab setting in Peru and the nature of the simulations

We set up our experimental lab in a side room to a large consumer market, Polvos Azules, located in central Lima. The market has approximately 1,800 stalls where vendors sell clothes, shoes, personal items, jewelry, and consumer electronics. We used two methods to recruit participants. First, we hired delegates from the local association of micro-entrepreneurs to recruit participants. We then invited participants to return for subsequent game sessions and to invite their neighbors from the market.

We played 11 different games a total of 324 times (an average of 27 times for each different game) over the course of seven months (from July, 2004 to February, 2005). Our sample includes data from 324 games played over the course of 81 days. We had 491 participants who played an average of eleven games each. 238 participants attended only one session, while 23 participants attended more than ten sessions.

Each session consisted of two or three games followed by a social networks survey. To conduct the networks survey, we had participants stand up one at a time. While participant *J* was standing, we asked the other participants to indicate if they knew participant *J*'s name, if they knew where her store was located, if they had ever watched her store for her, if they met her on social occasions, and if they were related to her. We then used these data to create both an individual level mapping of the social network and average social network density variables for each game session.

We also conducted a survey of micro-entrepreneurs working in Polvos Azules. The market survey serves four purposes. First, it allows us to control for demographic and socioeconomic characteristics in our experimental analysis. Second, we can examine hypotheses about heterogeneous behavior (e.g., do men play differently than women, do the risk averse play differently than the less risk averse?). Third, we use the census data to learn about the matching process for the game in which individuals choose their own partners. Fourth, we can use the census data to examine sample frame selection biases; e.g., does the nature of the games specifically attract risk-seeking individuals to participate?[2]

Demographic summary statistics of our subject pool are provided in Appendix Table 1. The data suggest that most of our participants are not poor according to common metrics: most completed secondary school and own a refrigerator and a television. However, 11 percent indicate that they cook with kerosene, a characteristic that Peruvians (and the Peruvian government) use to identify poor households. Approximately half of our subjects own a micro-enterprise in Polvos Azules. The rest are microenterprise employees. Only 6 percent have experience with group lending, but 65 percent have participated in an informal rotating and saving and credit association (ROSCA).

The design of the games

The games are designed to capture the functioning of group contracts. As noted above, group contracts can worsen (or create) free-riding problems. On the other hand, a well-structured contract will allow a bank to reduce default levels through requiring neighbors to repay each others loans in times of crisis. The two phenomena are of a piece, and one question is whether the bank can structure contracts to take advantage of the benefits without incurring excessive

[2] The bias of those who opt-in to the games is not only rarely mentioned but almost never studied; a recent exception is Lazear, Malmendier and Weber (2005).

costs.

Games consist of multiple rounds. Participants were told that the probability of continuing after any given round was 16.6%. Games typically lasted five or six rounds, and no game lasted more than ten rounds.

In each round, participants are given a "loan" of 100 points and instructed to invest it in one of two projects: a safe project ("project square") yields a return of 200 points with certainty, while a riskier project ("project triangle") pays out 600 points with probability ½ and zero otherwise. (At no time throughout the games did we refer to the choices as "safe" and "risky.") Individuals whose project succeeds must repay their loan. Individuals whose project fails do not. Wealth from prior rounds cannot be used to repay the current round's loan. Hence in each round, the safe project has an expected (and certain) return of 100 points, whereas the risky project has an expected return of 250 points.[3] The figure below summarizes the net payouts.

	State of the world	Net Payout	Probability of state
■: Safe project choice	Good	100	1
▲: Risky choice	Good	500	0.5
	Bad	0	0.5

Table A: Net payouts each round in the benchmark case (individual one-shot games)

Individuals were told that the points won in each round would convert to Nuevos Soles at a constant rate, and payouts were made after all games were completed each day. Each individual was awarded ten soles for showing up on time, an amount which is equivalent to a day's wage for the average Peruvian micro-entrepreneur (but is only about half a day's wage for a small business owner in Lima). Total earnings from the games were always under twenty

[3] These payoffs were chosen because in pilot testing they yielded the most balanced base case in which participants were equally likely to choose safe versus risky.

soles. All rules were explained to all members in public, and no written instructions were provided except for large poster boards on the wall to explain the rules.

Eleven different manipulations of the basic borrowing game were played. Each manipulation (other than the benchmark game) involves adding one or more treatments to the basic individual liability situation. The treatments we ran are described below. See Table 1 for summary tabulations of each game:

- ***Repeated one shot versus dynamic games:*** *In repeated one-shot games,* the bank does not penalize default, and participants are allowed to continue playing even if they have defaulted in previous rounds. They are called one-shot games since in each round the stakes are identical, and outcomes from one round do not affect stakes in later rounds. *Dynamic games* differ from repeated one shot games because individuals who default in any round are forced to sit out the rest of the game. Individuals in the dynamic games were allowed to participate in the next game (if there was another that day), but not any further rounds in the current game. They are "dynamic games" in the sense that they incorporate dynamic incentives.
- ***Individual versus joint liability games:*** In joint liability manipulations, each participant is matched with a partner. When any participant is unable to repay her loan, her partner is responsible for it and must repay a total of 200 points (unless the partner is also unable to repay anything). The 200 points are made up of a participant's own 100-point loan repayment plus the loan repayment of their partner. In the base joint liability settings (all settings except "communication" and "elected partner" below), the individuals do *not* know who their partner is, nor will they be told at the end.
- In ***monitoring games***, each participant receives complete information about her partner's

project choice and outcome at the end of each round. Monitoring is costless and automatic. The relevant information is highlighted on each participant's game card when project outcomes are determined and recorded. At no point, during of afterward, do participants learn their partner's identity.[4]

- In ***communication games***, partners were seated together and were allowed to talk during the course of play. So, each participant knew both the identity of her partner and the action her partner was taking.
- ***Elected partner games*** were communication games in which participants chose their partners before the commencement of play: again participants sat together and could talk between themselves.

Figure 1 describes the permutations.

4. Predictions and Results

One-shot games

The benchmark games are one-shot individual liability games. There is no consequence to defaulting here, and no joint liability mechanism. As a result, participants make choices solely depending on their level of risk aversion. The safe project choice guarantees a payout of 100 in all states of the world, whether good or bad, while the risky choice pays out 500 half the time and zero the other half. Table A above gives the net payouts in this game. Participants who are averse to risk will opt for the safer option; otherwise the riskier choice yields a much higher expect payout. The solid black line in Figure 2 shows that participants choose the safe option

[4] We also played a variation that we have not yet analyzed completely, *punishment games* that built on dynamic games with monitoring. In these games, participants learned at the beginning of the game that they would be allowed to punish their partners at the end of the game. After the completion of each punishment game, each participant was given an opportunity to pay 50 points and deduct 500 points from the final point total of her partner. All punishment games were dynamic games with monitoring.

about 40 percent of the time.

Table 2 examines the demographic determinants of risky choice in both the experimental economic game as well as the hypothetical survey question. These specifications are all estimated using OLS. For the survey (Column 1), the dependent variable is scored 1 to 6, with 6 being the least risk averse. For individual choice in the game (Columns 2-6), the dependent variable is the mean choice for that individual across all games (or in just the individual games for Column 2). All independent variables in this table are static, and the unit of observation is the individual. Column 7 shows the demographic characteristics of participants joined in pairs that both choose the risky project.

Using just the individual-liability game (column 2), which is closest to a simple risk aversion question, we find that the following characteristics are associated with higher levels of risk aversion: (1) female (not statistically significant), (2) older individuals, significant at the 99% level, (3) those who have more trust in others, measured by the General Social Survey questions,[5] significant at 90%, (4) those who are more patient in hypothetical time preference questions, significant at 95%, (5) those who exhibit more patience in hypothetical time preference questions in the survey, significant at 95%, (6) those who choose risky gambles in hypothetical risk aversion questions (insignificant for individual liability games only, significant at 90% when including joint liability games in Column 3), (6) those who played the games the

[5] The General Social Survey (GSS) contains three questions on "trust," "fairness" and "helping" which purport to measure social capital. The exact wording is as follows: the trust question, "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?", the fairness question, "Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?", and the helpful question, "Would you say that most of the time people try to be helpful, or that they are mostly just looking out for themselves?" In cross-country regressions, several studies find that these GSS questions correlate with outcomes of interest. Knack and Keefer (1997) finds correlations with growth; Kennedy et al. (1998) and Lederman et al. (2002) with crime; Brehm and Rahn (1997) with civic involvement; and, Fisman and Khanna (1999) with communication infrastructure. In experimental economics, Karlan (2005) finds that positive answers to the GSS questions are predictive of repayment of loans one year after the survey, and that positive answers to the GSS questions predict trustworthy behavior in a Trust game (conducted shortly after the GSS questions).

least, significant at 99%. Neither hypothetical risk preference questions nor playing the local government lottery are strongly correlated with risky choice in the game.

Our central interest however is to examine how choices change when elements are added to the basic set-up.

Adding dynamic games

The table below provides the expected payouts for a given round in the dynamic game. The choices are similar to those above, but now default leads to exclusion from future rounds. If a participant always makes safe choices, the expected value of staying in the game until the final period T is simply $v = \sum_{t=1}^{T} \delta^t \cdot 100$, where δ is the discount factor (which is, effectively, the probability that the game will end). For those who always make risky choices, the expected value is $w = \sum_{t=1}^{T} \delta^t \cdot 0.5^t \cdot 500$.

	State of the world	**Net Payout**	**Probability of state**
■: Safe project choice	Good	100 + v	1
▲: Risky choice	Good	500 + w	0.5
	Bad	0	0.5

Table B: Net payouts in the dynamic individual game

Adding dynamic incentives to the individual game should push participants toward safer behavior. A participant that chose the safe option in the one-shot individual game will continue to choose the safe option. If they felt uncomfortable with the risky project choice in the one-shot set-up, it should be an even less attractive option now that failure of the risky project leads to an automatic end of the game. For risk-taking participants in the one-shot game, the incentive is now to choose the safer option.

Project choices, on average, should thus become safer relative to the one-shot individual liability games. The first row of Table 3, Columns 1 and 2 (and others) demonstrate this result. In both specifications, the individual is 21.4 percentage points (significant at 99%) less likely to choose the risky option under the dynamic game, relative to one-shot game. The safe option is now favored about 60 percent of the time, up from about 40 percent.

The shift toward the safe choice may make it feasible for a bank to lend without collateral in this sort of setting, but the move is achieved by the bank with a relatively blunt instrument. When participants do make risky choices they default half the time, implying that the bank loses half of their risk-taking customers in each round. The question is whether a group contract can maintain incentives for safe behavior while reducing the defaults for those making risky choices.

Adding joint liability to the one-shot game

Adding a joint liability element to the individual one-shot game introduces free-riding as a potential problem. Consider participant A's choices. If participant A believes that their partner will always choose the safe project, the structure of payouts is unchanged from the one-shot individual game described above: there is no reason for participant A to change behavior. But if participant A believes that her partner will take the risky choice, being safe becomes less appealing for her. Now, the partner's choice serves as a tax, so that half of the time participant A is left bailing out her partner, leaving her with 0 half the time rather than a safe 100 always.

	Participant's draw	Partner's draw	Participant's net Payout	Probability of state
■: Safe project choice	Good	Good	100	0.5
		Bad	0	0.5
▲: Risky choice	Good	Good	500	0.25
		Bad	400	0.25
	Bad	Good	0	0.25
		Bad	0	0.25

Table C: Net payouts in the one-shot group game when partner chooses the risky project

The choice of receiving either 400 or 500 half the time is always more appealing than the choice of 100 half the time. Thus, if participant A chose the risky project in the one-shot individual games, she should continue making risky choices here. If she chose the safe project in the one-shot individual games, she should exhibit a tendency (to the extent that she believes that her partner will choose the risky option) to now make risky choices herself. The switch is not totally unambiguous since the risky option becomes slightly less appealing as well (now half the time a lucky participant must bail out her partner, but the cost is relatively small—a decrease in payout from 500 to 400--given the big gross payout received on average). In sum, project choices in the one-shot joint liability games should, on average, become riskier relative to the one-shot individual games.

Table 3 demonstrates that indeed the one-shot joint liability game, relative to individual liability, generates riskier behavior. The specifications are all run with OLS with the dependent variable equal to one if the participant chooses the risky project, and include fixed effects for each individual participant. The coefficient on "joint liability games" in Column 1 indicates a 2.3 percentage point increase in the likelihood of playing risky in the one-shot games (significant at the 95% level).

Adding joint liability to the dynamic game.

Table D below shows the payouts of the joint liability dynamic game. Not only do the probabilities change for the given states of the world in the round at hand, but the future value of staying in the game also changes. In this case, the future value of taking the safe choice falls sharply when a partner always takes the risky choice, and the future value of the risky choice improves. The up-shot is an even stronger recipe for moral hazard. For a safe-acting participant with a risk-taking partner, the value of future play, x, falls to ½ v (half the future value in the individual dynamic game above). For a risk-taking participant with a risk-taking partner, the value of future play, y, is now $\sum_{t=1}^{T} \delta^t \cdot 0.75^{t-1} \cdot (500+400)/4$. For δ = 1/(1+.10) and T = 3, y is 439 points relative to w = 378 in the individual dynamic game. The calculations show that taking risk is now more appealing, even when your partner takes risk as well. This is because when you have a bad draw, half the time your partner will bail you out. In the one-shot joint liability games, your partner bailed you out as well, but it had no consequence. Here, the insurance matters.

	Participant's draw	**Partner's draw**	**Participant's net Payout**	**Probability of state**
■: Safe project choice	Good	Good	$100 + x$	0.5
		Bad	$0 + x$	0.5
▲: Risky choice	Good	Good	$500 + y$	0.25
		Bad	$400 + y$	0.25
	Bad	Good	$0 + y$	0.25
		Bad	0	0.25

Table D: Net payouts in the dynamic group game when partner chooses the risky project

By adding joint liability, a risky individual whose project failed is bailed out by their safe-playing partner or by their risk-taking (but lucky) partner. The bank loses its money only when both members make the risky choice and both simultaneously fail. This happens just one quarter of the time for risky-risky pairs. The joint liability contract thus provides an important advantage for the bank's financial bottom line. On the other hand, the joint liability element also induces riskier behavior overall (relative to behavior in the individual dynamic game), but not so much that it undermines the additional protection to the bank from joint liability.[6] Table 3 Column 8 shows that under the dynamic game, adding joint liability increases the likelihood that the participant takes the risky choice by 8.5 percentage points (significant at 99%).

Adding monitoring to one-shot games

Adding monitoring in this context will sharpen differences. Monitoring reveals one's partner's project choices (but not the partner's identity) in the prior round. If participant A learns through monitoring that their partner is playing safe, participant A is more likely to continuing playing safe if that was their course of action in the one-shot individual game. But the more strongly that participant A predicts that their partner is playing risky, then their choice should shift more strongly toward risky choices. The switch, as above, is asymmetric: if participant A chose the risky project in the one-shot individual game, they have no incentive to switch to the safer choice here (assuming that they are acting purely selfishly).

As Table 3, Column 5 shows, we find that monitoring produces *safer* choice in the one-shot game (but not significant statistically). The more interesting test here however is the asymmetric prediction made above. Table 3, Column 3, 7 and 8 examine the asymmetric results. Here, we first measure the underlying risk preferences of an individual by using the one-shot

[6] In much theoretical work on microfinance, safer projects are assumed to have higher expected returns than riskier projects, the social optimum in these models is equivalent to the bank's optimum and the "challenge" is to design a lending contract that induces safe project choice (e.g., Stiglitz, (1990)). We relax this assumption here, both to allow investigation of a broader range of optima and because our pilot games suggested that participants were risk averse even over small stakes (even though the typical stakes equated to more than the daily wage).

individual game choices they made. We then interact the riskiness of the individual (calculated as the proportion of rounds of the individual one-shot game in which they chose the risky option) with an indicator variable for being in a monitoring game. The asymmetric prediction is that monitoring should not alter the behavior of those predisposed to take risk, but should increase the likelihood that a "safe" individual switches to the risky choice. In Column 3, we restrict the analysis to joint liability games and regress risky choice on an indicator variable for being a monitoring game and the interaction of the monitoring and the underlying risk preference of the individual. The positive and significant coefficient (11.0 percentage point increase, significant at 99%) on "monitor" is the effect of monitoring on the risk averse individuals, whereas the negative and significant coefficient (-14.0 percentage point decrease) on "risk-taking individual * monitor" indicates that the less risk-averse individual the individual, the less the monitoring matters. Hence, monitoring motivates those who chose safe without monitoring to switch to the risky project, but monitoring does not induce safer choices among those who are already likely to take risk. Improving locally-held information does not, by itself, reduce moral hazard.

Adding monitoring to dynamic games

The logic in the dynamic setting with monitoring is similar to that above. In the dynamic setting, if a participant chooses safe in the individual games, they are apt to continue choosing the safe project if they are certain that their partner is also choosing the safe project. But when they learn (via monitoring) that their partner is taking the risky option, the safe participant has a motive to shift to the risky choice. The partner making risky choices knows this and is best off if the first participant continues to choose safe. They may thus be tempted to switch to safe in order to maintain a safe-safe pairing. However, if a participant chose risky in the dynamic individual game, there will be no gain to a safe-safe pairing. Playing risky-risky here yields more favorable payouts than playing risky in the individual game. In short, adding monitoring to the dynamic group game will not push risk-taking participants toward the safe choice. Worse yet, monitoring may push a safe participant toward greater risk-taking if they learn that their partner is risk-taking. Safer choice will be induced only if a safe participant (i.e., one who chose safe in the dynamic group game without monitoring) learns that their partner is safer than expected. The overall effect, relative to the game without monitoring, depends on how the new information is used by safe participants to update views about their partners. Column 2 of Table 3 shows that dynamic group games with monitoring are associated with a 4.4 percentage point increase in risk-taking.

Allowing communication in one-shot games

The analysis above assumes that participants act in their narrow self-interest following neoclassical economic precepts. The assumption makes sense when participants are anonymous, but once identities are revealed social forces can enter the equation. If participants are altruistic toward each other, for example, they may choose the safe project even when it is individually rational to choose the riskier project. Allowing communication between the participants in a group (they are allowed to meet, sit next to each other, and talk during play) heightens the role of forces like altruism or social sanctions.

To the extent that a risky choice is seen as imposing a tax on one's partner—and to the extent that participants are swayed by social forces (e.g., altruism)—group lending could turn risky participants into safe ones. By considering choices in one-shot communication games relative to choices under monitoring (where anonymity is still maintained), the analysis controls for the information revelation inherent in communication. The switch from risky to safe choices here can thus be interpreted as a sign of pure social elements, over and above information revelation. Allowing communication might also turn safe participants into risk-takers if it becomes clear through talking that partners are sure to make risky choices as well.

Table 3, Column 2 shows that "communication" produces a 4.0 percentage point increase in risky choices (significant at 99%), and is consistent for both dynamic and one-shot games (the interaction with "dynamic" is close to zero and insignificant). This result is relative to the monitoring condition, since the "communication" treatment is only conducted with the monitoring treatment. We find that allowing face-to-face discussion exacerbates the asymmetry predicted above in the monitoring discussion. Since the "talking" game is a subset of the "monitoring" game, the coefficients in Table 3 Column 4 are additive to the monitoring results: risk-averse individuals are 16.4% (11.0% + 5.4%) percentage points more likely to make the risky choice under communication than without monitoring, and the non-risk-averse do not change their behavior with communication, relative to choices without communication and monitoring. Hence, monitoring, and even more so monitoring plus communication, helps the "safe" types realize they are being taxed, but does not inspire the risky types to reduce their risk-taking to match to a safe type.

The set-up provides another prediction: there is no incentive in the one-shot games for one member of a two-person pair to make a risky choice while the other chooses the safe one. Playing safe while the partner plays risky provides no insurance for the risky participant—since no insurance is needed given the lack of consequence for default. The safe participant pays a cost of 100 when the risky participant fails, but the risky participant gets no advantage.

Table 5 demonstrates this result. Here, the dependent variable is the joint choice of the partners. Columns 3 shows that "communication" leads to a 5.5 percentage point (one-shot) increase in the likelihood that both participants choose the risky option. Communication also leads to convergence, as shown by Column 9. Convergence, defined as 3 consecutive rounds of identical strategy, is 13.8 percentage points more likely to occur).

Allowing communication in dynamic games

Allowing communication brings social forces into the dynamic context again. The dynamic games, though, hold a very different set of possibilities than in the one-shot games. Now, a safe-risky combination offers real advantages, both to participants and the bank. When one participant takes the safe choice and the other participant takes the risky one, the bank is always guaranteed that repayments will be made. By the same token, both participants will be sure that play will continue without interruption. All risk is removed. The looming problem rests with the large advantage to the participant choosing risky and the disadvantage for the participant choosing safe. If the participants could communicate and cooperatively figure out a strategy, a safe-risky combination could be viable. They might alternate rounds playing safe-risky and then risky-safe, for example. It would certainly dominate safe-safe play.

If cooperation breaks down, the participants face a standard prisoner's dilemma and play is likely to devolve to risky-risky choices (as in Stiglitz (1990), for example). Risky-risky choices may be preferred anyway, if participants favor the risk-return profile, but the possibility should be no greater than under the monitoring game. The bottom line here is that, relative to choices under the group dynamic game with monitoring, communication should allow a greater share of safe-risky choices. The movement should be manifested as a decrease in both safe-safe and risky-risky play. For the bank, reducing risky-risky choice is the chief objective.

Table 5, Column 6 demonstrates this result. Here, we predict the likelihood of the pair choosing the *opposite* project. The coefficient on "communication" (the one-shot game) is negative 7.5 percentage points. This, combined with the above result from Column 9, demonstrates that communication in the one-shot makes participants more likely to converge on either safe-safe or risky-risky, but not safe-risky. Adding the dynamic element to the communication treatment, however, produces the right incentives for pairs to find the "opposite" solution. The coefficient on the interaction term "Dynamic * Communication" is large and significant (9.3 percentage points). Allowing full communication mitigates the push toward greater free-riding associated with the monitoring treatment.

Allowing partner choice.

The final manipulation keeps everything as above but allows participants to choose their own partners. Cooperation should be easier to achieve with self-formed groups, accentuating the tendency described above. Because cooperating around safe-risky choices dominates safe-safe choices—and thus is most valuable for those who made safe choices in the dynamic individual game, participants with intrinsically safe preferences (as seen through the census questions) should be the ones most likely to group together. As above, we expect to see less risky-risky choice and an increase in risky-safe play.

In this way, the full-blown group lending model (with dynamic incentives, partner choice, and communication) can allow participants to maximize output while minimizing risk. Table 7 shows the results. Table 7 compares the proportion of pairs that are similar along different demographic characteristics when participants choose their partners versus when participants are randomly assigned to their partner. To a degree, partners match on underlying risk preferences, tending toward assortative matching. As the first row shows, partners who answer the hypothetical survey question (conducted outside of the laboratory) similarly are more likely to match with each other when partner selection is endogenous. Of partnerships chosen endogenously (when the partners were free to walk around and find a partner), 43 percent have similar risk preferences, whereas only 37 percent of partnerships chosen randomly by the computer have similar risk preferences (the difference is significant at 95%).

The results are again seen in Table 3. Column 2 shows that allowing endogenous matching reduces risk-taking by 3.6 percentage points in the dynamic games (over and above the full communication treatment). In Column 9 this same result hold, but, with just half the sample size, it is not significantly significant. Column 9 provides no evidence that the behavior changes are especially strong for those participants that took riskier choices in the benchmark one-shot games without monitoring, but there is some indication of this in Table 6. Table 6 shows how the results vary with demographic characteristics. Allowing partner choice reduces risk-taking for men and younger participants especially. We also find especially strong reductions in risk (a reduction in risk-taking by 8.1 percentage points) for participants that show the strongest measure of risk aversion in the independent participant survey.

5. Demographic Results

Much is written on how credit contracts may or should differ for different demographic groups. For many reasons, microfinance historically has focused on females (Armendariz de Aghion and Morduch 2005). One reason is because of higher repayment rates for women and a perception or belief that men are more likely to commit moral hazard (Karlan and Zinman 2005). We examine our primary set of results for different demographic groups in order to learn whether we observe any systematic differences in the responses to the incentives of the different mechanisms.

Table 6 shows the basic results from the other tables, but broken down by several important demographic variables. Strikingly, we find no gender differences, and only minor differences for the old versus the young and those who have high versus low trust in society and trust in society (as measured by the GSS social capital questions discussed earlier).

As noted above, though, important differences do emerge with regard to endogenous group formation. Columns 2, 3, and 6 show that risk-taking is reduced by 7 to 8 percentage points for those participants who are male, young, and more risk averse. The latter finding on risk preferences comes from risk aversion as measured by the independent survey instrument, not the games. The differential response along risk aversion lines is consistent with earlier predictions and tests shown in Table 3 and discussed earlier.

6. Conclusion

Microfinance is transforming thinking about banking in low-income communities. The mechanisms that are employed to ensure loan repayments contain a multiplicity of elements, and we have taken them apart in order to examine how important elements function in isolation and how they change when re-packaged.

Our focus is on group-based mechanisms. We describe a balancing act: the group-mechanisms reduce defaults since group members bail each other out when luck is bad. The lender's financial bottom line thus benefits, holding all else the same. But the mechanisms can also generate riskier behavior on the part of borrowers, undermining some of the lender's gains. Our findings here thus confirm the existence of a puzzle that is often overlooked in theoretical models of group-based lending: the group-based mechanisms that are frequently employed can induce moral hazard rather than reduce it. Moreover, improving the information flows between members can make matters even worse. But we show that allowing participants to form groups by themselves helps to mitigate these tendencies—and, through assortative matching, the positive features of group banking can be established.

Apart from the insight into group-based mechanisms, we also found that dynamic incentives are powerful in themselves in reducing moral hazard—even when using individual-based mechanisms. These results are consistent with recent shifts by micro-lenders from group-based mechanisms toward individual-based mechanisms. The Grameen Bank of Bangladesh and Bolivia's BancoSol, for example, are the two best-known group lending pioneers, but they have both shifted toward individual lending as their customers have matured and sought larger loans. The approach allows customers (and lenders) more flexibility without worry about moral hazard induced by the use of groups. The methods used here can be adapted to better understand these dynamic incentives; researchers could, for example, explore the role of upward-sloping profiles of future loan sizes or the effect of varying outside options for customers.

The results draw from a series of experimental "microfinance games" run over seven months in Peru. The experimental approach allows us to pose sharp questions and generate precise hypotheses. By locating the games in Peru we could afford to run a wide range of games, testing eleven different permutations over an extended period. We were also able to attract participants who are similar to typical microfinance customers—and some who were in fact customers of local microfinance institutions. The participants behaved strategically according to predictions drawn from neo-classical theories of choice under risk, but participants were also sensitive to social elements of the simulated credit contracts. Ultimately, the microfinance games show how strategic behavior and social concerns interact to yield effective contracts that can work both for customers and for lenders.

Figure 1: Treatment Manipulations of the Basic Game

	Repeated One Shot Games	***Dynamic Games***	
Individual Games	Individual Game	Individual Dynamic Game	
Group Games	Group Game	Group Dynamic Game	
Plus Monitoring	Monitoring Game	Dynamic Monitoring Game	Punishment Game
Plus Communication	Communication Game	Dynamic Communication Game	
Plus Partner Choice	Elected Partner Game	Dynamic Elected Partner Game	

Figure 2: Rates of Safe Project Choice in Individual Games

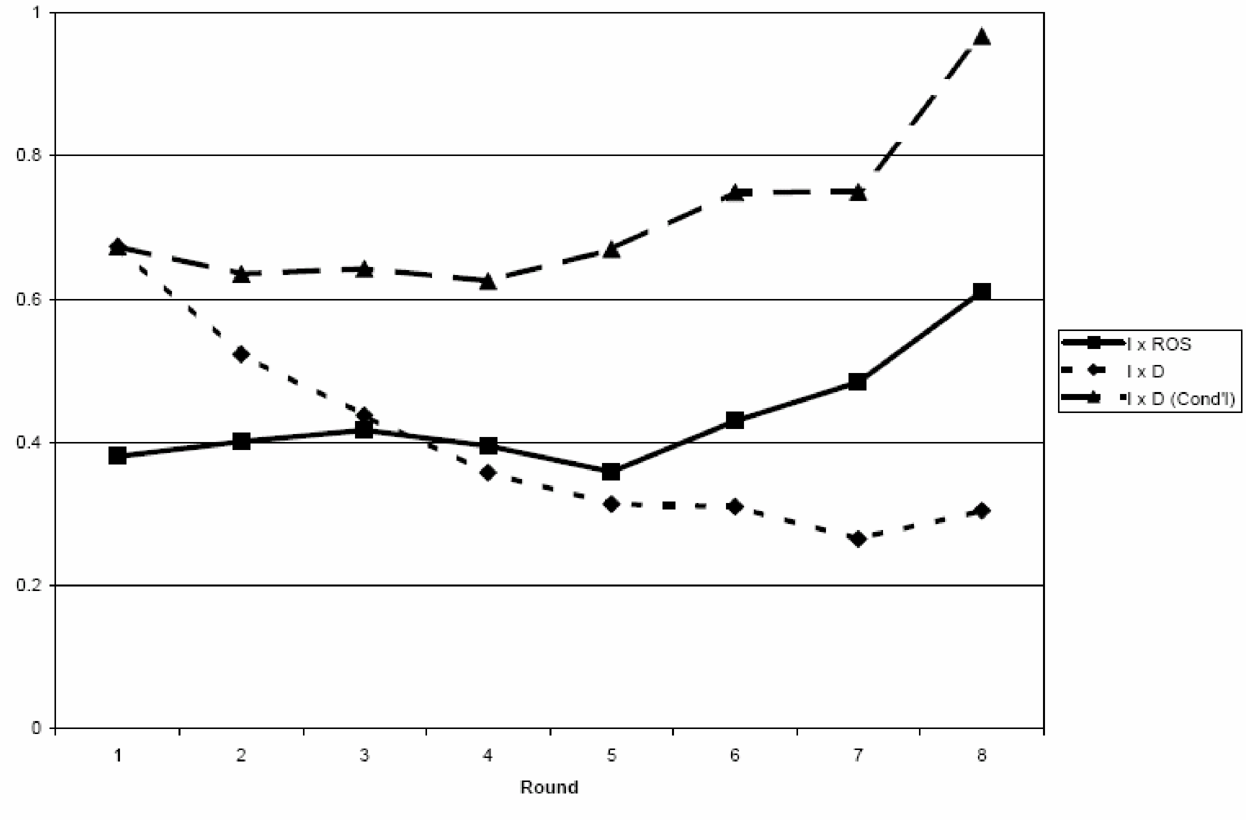

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Table 1: Games Played

Game Type	Games Played (1)	Mean Player Count (2)	Minimum Player Count (3)	Maximum Player Count (4)
Individual One-Shot Games	34	17 (6.633)	6	26
Individual Dynamic Games	36	18.472 (6.134)	8	26
Joint Liability One-Shot Games	31	18.645 (6.458)	8	26
Joint Liability Dynamic Games	33	17.485 (6.539)	6	26
Monitoring One-Shot Games	32	16.375 (6.862)	6	26
Monitoring Dynamic Games	27	17.333 (6.102)	10	26
Monitoring + Communication Joint Liability One-Shot Games	22	17.727 (6.656)	8	26
Monitoring + Communication + Choose Partner Joint Liability One-Shot Games	25	18.24 (6.515)	6	26
Monitoring + Communication Joint Liability Dynamic Games	26	16.846 (7.487)	6	26
Monitoring + Communication + Choose Partner Joint Liability Dynamic Games	24	15.417 (6.473)	8	26
Monitoring + Punishment Dynamic Games	32	11.875 (3.964)	6	22

Table 2: Demographic Determinants of Risky Choice

	Survey	Games					
	Surveyed Participants	Individual Liability Games Only	All Games				Joint Liability Games Only
Gender:	Both	Both	Both	Both	Male	Female	Both
Dependent Variable:	Risk Averse (in survey)	Choose Risky	Choose Risky	Choose Risky	Choose Risky	Choose Risky	Both Choose Risky
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Male	0.058	0.042	0.036			0.037	0.020
	(0.274)	(0.041)	(0.029)			(0.029)	(0.020)
Age	0.011	-0.002	-0.004***	-0.006**	-0.002	-0.004***	-0.002**
	(0.014)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Married	0.089	-0.102**	-0.024	-0.041	-0.000	-0.023	-0.027
	(0.286)	(0.043)	(0.030)	(0.052)	(0.038)	(0.030)	(0.023)
Years of education	0.047	0.017**	0.013**	0.012	0.016**	0.013**	0.007**
	(0.051)	(0.008)	(0.005)	(0.009)	(0.007)	(0.005)	(0.004)
# of church visits in the past year	0.004*	-0.000	-0.000	-0.001**	-0.000	-0.000	-0.000
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trust (GSS questions)	0.228	-0.059*	-0.035	-0.049	-0.037	-0.032	-0.025*
	(0.205)	(0.031)	(0.022)	(0.031)	(0.031)	(0.022)	(0.015)
Plays lotto	0.174	-0.029	-0.002	0.060	-0.026	-0.000	0.010*
	(0.379)	(0.057)	(0.040)	(0.059)	(0.059)	(0.040)	(0.005)
Patient	-0.073	-0.097**	-0.063**	-0.033	-0.062*	-0.063**	0.019
	(0.268)	(0.040)	(0.028)	(0.046)	(0.037)	(0.028)	(0.026)
Risk Averse (in survey)		0.008	0.013*	0.017	0.007		0.014***
		(0.010)	(0.007)	(0.011)	(0.010)		(0.003)
	0.011	0.008	0.014***	0.011*	0.013***	0.014***	-0.051***
	(0.033)	(0.005)	(0.004)	(0.006)	(0.004)	(0.004)	(0.019)
Constant	2.385**	0.471***	0.496***	0.610***	0.377***	0.528***	0.272***
	(0.947)	(0.144)	(0.101)	(0.167)	(0.133)	(0.101)	(0.065)
Observations	234	3091	17106	6531	10555	17106	284
Number of participants		225	234	100	132	234	
R-squared	0.03	0.11	0.18	0.24	0.17	0.17	0.14

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Column (1) predicts risk preference with those who completed the survey. Dependent variable is "Risk averse (in survey)", an indicator of individuals' risk preference between 1 (most risk averse) and 6 (least risk averse). Regressions in Columns (2) through (7) are run with those who played different types of games. Dependent variable for columns (2) through (6) equals one if the individual chooses risky option in the game, and dependent variable for column (7) equals to one if the pair makes risky choice in the game.

Table 3: Determinants of Risky Choice

Dependent Variable: Choose Risky

	All Games				One-Shot Games	Dynamic Games	One-Shot Games	Dynamic Games
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dynamic games	-0.214***	-0.214***	-0.158***	-0.155***				
	(0.013)	(0.013)	(0.006)	(0.006)				
Joint liability games	0.023**	0.020*	0.048***	0.049***	0.027**	0.071***	0.021*	0.085***
	(0.010)	(0.012)	(0.009)	(0.009)	(0.012)	(0.014)	(0.012)	(0.015)
Monitoring		-0.022*	0.110***	0.054***	-0.020	0.012	0.109***	-0.045
		(0.012)	(0.016)	(0.019)	(0.012)	(0.012)	(0.030)	(0.028)
Monitoring + Communication		0.040***		0.150***	0.031**	0.043***	0.215***	0.118***
		(0.013)		(0.024)	(0.014)	(0.013)	(0.037)	(0.034)
Monitoring + Communication + Choose Partner		0.008		-0.077***	0.009	-0.034**	-0.130***	-0.040
		(0.013)		(0.027)	(0.013)	(0.015)	(0.036)	(0.041)
Dynamic * Partner games	0.078***	0.059***						
	(0.014)	(0.018)						
Dynamic * Monitoring		0.044***						
		(0.017)						
Dynamic * (Monitoring + Communication)		-0.008						
		(0.018)						
Dynamic * (Monitoring + Communication + Choose Partner)		-0.036*						
		(0.020)						
Risk-taking individual * Monitoring			-0.140***	-0.064**			-0.201***	0.113***
			(0.023)	(0.027)			(0.042)	(0.040)
Risk-taking individual * (Monitoring + Communication)				-0.197***			-0.286***	-0.139***
				(0.035)			(0.053)	(0.050)
Risk-taking individual * (Monitoring + Communication + Choose Partner				0.097**			0.220***	-0.006
				(0.039)			(0.051)	(0.060)
Total Days Participant Played	0.015***	0.014***	0.015***	0.015***	0.017***	0.011***	0.018***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Constant	0.627***	0.627***	0.609***	0.608***	0.601***	0.452***	0.611***	0.450***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.015)	(0.013)	(0.017)
Observations	26724	26724	23631	23631	13517	13207	11979	11652
Number of participants	493	493	324	324	474	449	324	302
R-squared	0.05	0.05	0.05	0.05	0.02	0.04	0.03	0.04

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable for all regressions is "Choose Risky," where the value is equal to one if the individual (or the group) makes risky choice in the game. The sample for column (1) through (4) is individuals in all games, for columns (5) and (7) is those in dynamic games, and for columns(6) and (8) is those who played one-shot games.

Table 4: Default to Bank

Dependent Variable: Default

Sample:	All	All	Female	Male	Young	Old	Least risk averse (in survey)	Most risk averse (in survey)	Some Trust (GSS questions)	No Trust (GSS questions)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dynamic Games	0.074***	0.074***	0.070***	0.079***	0.070***	0.090***	0.090***	0.077***	0.090***	0.079***
	(0.009)	(0.008)	(0.011)	(0.012)	(0.014)	(0.012)	(0.015)	(0.012)	(0.015)	(0.012)
Monitoring	-0.130***	-0.024	-0.119***	-0.150***	-0.126***	-0.144***	-0.199***	-0.105***	-0.174***	-0.116***
	(0.013)	(0.018)	(0.016)	(0.018)	(0.022)	(0.018)	(0.024)	(0.017)	(0.023)	(0.018)
Monitoring + Communication	0.037**	0.029	0.038*	0.036	0.002	0.048*	0.107***	-0.006	0.074**	0.005
	(0.018)	(0.020)	(0.022)	(0.024)	(0.028)	(0.025)	(0.032)	(0.022)	(0.030)	(0.023)
Monitoring + Communication + Choose Partner	-0.026	-0.020	-0.023	-0.034	-0.026	-0.024	-0.016	-0.031	-0.041	-0.014
	(0.018)	(0.018)	(0.021)	(0.023)	(0.027)	(0.024)	(0.030)	(0.022)	(0.026)	(0.025)
Joint Liability Games		-0.229***								
		(0.018)								
Dynamic * Joint Liability Games		-0.033								
		(0.023)								
Dynamic * Monitoring		0.039								
		(0.032)								
Dynamic * (Monitoring + Communication)		0.010								
		(0.032)								
Dynamic * (Monitoring + Communication + Choose Partner)		-0.009								
		(0.035)								
Total Days Participant Played	0.004***	0.005***	0.003***	0.005***	0.001	0.004***	0.002	0.003**	0.003*	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Observations	29231	29231	16742	11730	7501	11422	6892	12031	6739	12184

Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable for all regressions is "default," which is equal to one if the individual defaults. "Young" is equal to one if the age is under 37, which is the median age of the sample. "Some Trust (GSS questions)" equals one if the individual has at least one positive answer to three GSS questions; otherwise, they are classified as No Trust (GSS questions)".

Table 5: Determinants of Joint Play, Game Type

	Fixed Effect, OLS									Multinominal logit	
	All	All	One-Shot Games	Dynamic Games	All	All	One-Shot Games	Dynamic Games	All Games	All Games	
Dependent Variable:	Both Choose Risky				Choose opposite				Converged	Both Choose Risky	Both Choose Safe
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dynamic Games	-0.231***	-0.223***			0.027**	0.020			-0.125***	0.778***	-0.662***
	(0.011)	(0.020)			(0.012)	(0.023)			(0.024)	(0.139)	(0.110)
Monitoring		-0.031	-0.029	0.000		0.031	0.027	-0.015	-0.047*	-0.044***	-0.115
		(0.023)	(0.022)	(0.015)		(0.022)	(0.022)	(0.022)	(0.027)	(0.008)	(0.108)
Communication		0.071***	0.055**	0.030*		-0.075***	-0.056**	0.010	0.138***	-0.010	0.360***
		(0.025)	(0.025)	(0.017)		(0.025)	(0.025)	(0.025)	(0.031)	(0.154)	(0.122)
Choose partner		0.003	0.001	-0.042**		0.004	0.005	0.029	0.027	-0.103	-0.007
		(0.026)	(0.024)	(0.019)		(0.026)	(0.025)	(0.031)	(0.035)	(0.182)	(0.131)
Dynamic * Monitoring		0.038				-0.055*			0.065*	-0.109	0.067
		(0.028)				(0.031)			(0.033)	(0.196)	(0.150)
Dynamic * (Monitoring + Communication)		-0.056*				0.093**			-0.130***	0.021	-0.166
		(0.031)				(0.036)			(0.039)	(0.188)	(0.171)
Dynamic * (Monitoring + Communication + Choose Partner)		-0.041				0.023			0.018	0.016	-0.297
		(0.033)				(0.041)			(0.046)	(0.223)	(0.197)
Total Days Participant Played	0.009***	0.007***	0.013***	0.004*	0.001	0.003	-0.000	0.003	-0.000	0.069	0.032***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.257)	(0.005)
Constant	0.532***	0.522***	0.521***	0.240*	0.289**	0.298**	0.317***	0.400**	0.683***	-0.030	0.413**
	(0.117)	(0.117)	(0.055)	(0.143)	(0.127)	(0.128)	(0.058)	(0.183)	(0.122)	(0.207)	(0.205)
Observations	24558	24558	11172	13386	24558	24558	11172	13386	24558	24558	
Number of participants	491	491	453	416	491	491	453	416	491		
R-squared	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.02	0.10	0.05	

Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. The dependent variable for Columns (1) through (4) equals one if both players are risky, and the dependent variable for Columns (5) through (8) equals to one if two players are opposite types. For Columns 10 and 11, the multinonial logit specification, the base outcome is "Opposite" in which one player chooses risky and the other safe.

Table 6: Demographic Determinants of Risky Choice, Game type/demographic interaction terms

Dependent Variable: Choose Risky

Sample:	Female	Male	Young	Old	Least risk averse (in	Most risk averse (in survey)	Positive answer in GSS	Negative answer in GSS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dynamic games	-0.171***	-0.195***	-0.178***	-0.135***	-0.169***	-0.140***	-0.171***	-0.141***
	(0.011)	(0.014)	(0.018)	(0.014)	(0.018)	(0.014)	(0.019)	(0.014)
Monitoring	-0.009	-0.015	0.042*	-0.046***	-0.050**	0.006	-0.010	-0.015
	(0.014)	(0.016)	(0.022)	(0.017)	(0.022)	(0.017)	(0.023)	(0.017)
Communication	0.042**	0.029	-0.021	0.079***	0.130***	-0.006	0.060**	0.031
	(0.018)	(0.020)	(0.026)	(0.021)	(0.027)	(0.021)	(0.027)	(0.021)
Choose partner	0.000	0.028	-0.014	0.017	-0.031	0.022	-0.001	0.007
	(0.017)	(0.020)	(0.025)	(0.021)	(0.026)	(0.020)	(0.025)	(0.021)
Dynamic * Monitoring	0.055***	0.096***	0.022	0.090***	0.105***	0.042*	0.102***	0.045**
	(0.019)	(0.022)	(0.029)	(0.023)	(0.030)	(0.023)	(0.030)	(0.023)
Dynanmic * (Monitoring + Communication)	-0.003	-0.011	0.053	-0.058**	-0.080**	0.017	-0.005	-0.021
	(0.024)	(0.027)	(0.035)	(0.029)	(0.037)	(0.028)	(0.036)	(0.028)
Dynamic * (Monitoring + Communication + Choose partner)	-0.020	-0.076***	-0.072*	-0.027	0.028	-0.081***	-0.044	-0.048
	(0.026)	(0.029)	(0.037)	(0.030)	(0.039)	(0.029)	(0.038)	(0.030)
Total Days Participant Played	0.011***	0.021***	0.014***	0.013***	0.013***	0.013***	0.008***	0.017***
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Constant	0.473***	0.717***	0.870*	0.180	0.224	0.724***	0.764*	0.240
	(0.099)	(0.130)	(0.445)	(0.456)	(0.448)	(0.228)	(0.449)	(0.452)
Observations	16157	11228	7144	10941	6586	11499	6457	11628
Number of participants	253	197	115	121	79	158	73	165
R-squared	0.05	0.05	0.05	0.04	0.06	0.03	0.05	0.04

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Dependent variable for all regressions is "Choose Risky," where the value is equal to one if the individual (or the group) makes risky choice in the game.

Table 7: Characteristics of Endogeneous Partners

	Choose Partner	Partner assigned	T-test of equality
	(1)	(2)	(3)
Similar risk preference	0.449	0.374	0.023
	(0.030)	(0.015)	
Gender	0.505	0.522	0.661
	(0.035)	(0.018)	
Married	0.430	0.539	0.005
	(0.034)	(0.018)	
Positve answer in GSS	0.514	0.499	0.699
	(0.035)	(0.018)	
Play lotto	0.688	0.706	0.606
	(0.032)	(0.016)	
Patient	0.505	0.472	0.397
	(0.035)	(0.018)	

Standard errors in parentheses.

Appendix Table 1: Summary statistics of demographic characteristics

	Mean	Std. error
Male	0.386	0.003
Age	40.293	0.077
Married	0.644	0.003
Years of education	11.426	0.024
# of church visits in the past year	50.099	0.664
Play lotto	0.144	0.002
Patient	0.509	0.004
Risk Averse (in survey)*	3.761	0.014

*Risk averse (in survey): 1 = most risk averse, 6 = least risk averse