Reputation in a Public Goods Game:
Taking the Design of Credit Bureaus to the Lab

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Abstract.
We present the results of a new laboratory experiment designed to mimic the ways in which credit bureaus will alter microfinance markets. Where loans are taken in groups, bureaus can build reputations for borrowers at the group or the individual level, and the optimal contract is not obvious. In a modified public good game with ejection and re-assignment played by Guatemalan micro-entrepreneurs, we find the use of group reputation to be effective in increasing contributions. Given the costs of transitioning microfinance bureaus to the sharing of individual information, our results suggest that this change would not be cost effective.

Keywords: Information, reputation, public goods, credit bureaus, microfinance.

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1. INTRODUCTION.

This paper investigates the formation of reputation by groups of individuals. Reputation in such contexts can be held either by the group itself or by the individuals within the group. If reputation is held at the group level, the group is provided with an incentive to be selective about its membership, but individuals may be able to free-ride on group reputation. If in turn reputation is held at the individual level, then incentives for good behavior are more direct but groups have no reason to be selective. This tension between group and individual reputations is strongest where group behavior has a strong public good dimension, and where groups are able to control their membership. In order to understand this tradeoff, we present the results of a repeated public goods game featuring ejection from groups as well as a mechanism for dynamic reputation formation.

While this reputation problem arises in many contexts (firms, governments, or universities), we motivate the issue using a very explicit policy mechanism for generating an intertemporal reputation, namely a credit bureau in a microfinance market. In our experiment, the dynamic environment of group lending is imitated via a repeated public goods game. A well-informed group 'leader' is given the power to eject members, and different treatments simulate a credit bureau that reassigns ejected players to the game using different rules. In a 'no information' treatment, ejected players are reassigned randomly to represent an environment with no external institution generating reputation. In a 'group information' treatment players from the best groups are reassigned to the game, mimicking the group reputation mechanism of a typical microfinance credit bureau that reports on the performance of groups of borrowers. In an 'individual information' treatment the best individuals are reassigned to the game, removing the incentives on group quality but more directly incentivizing individual behavior. A simple theoretical model demonstrates player incentives on the extensive and intensive margin, and generates hypotheses that are taken to the data. We verify the presence of stronger group selection under group incentives, but do not observe the predicted superiority of individual incentives in combatting moral hazard. Overall, both types of reputation induce improved contributions to a similar degree.

The tradeoff between group and individual information is particularly pertinent in microfinance, because lenders use both group and individual incentives to enforce repayment in the absence of collateral (Besley and Coate, 1995; Ghatak and Guinanne, 1999; Karlan, 2005; Tedeschi, 2006; Giné & Karlan, 2006; Giné et al, 2010). The rapid proliferation of microfinance lenders has undermined institution-specific incentives for repayment as many alternative lenders compete (McIntosh and Wydick, 2005), and credit bureaus are emerging as a natural solution to this problem (Pagano and

Japelli, 1993; Vercammen 1995; Padilla and Pagano 2000; Jappelli and Pagano 1999; Brown and Zenhder, 2010). The optimal design of bureaus in a group lending environment is not obvious (Galindo and Miller, 2001; Luoto et al., 2007). Credit bureaus in developed markets universally report on individual behavior, since this provides the most direct check on the kinds of moral hazard that a bureau is intended to overcome. In group-based lending, on the other hand, the incentives of groups to select their membership is central, and a credit bureau that reports on the behavior of groups would most effectively reinforce this selection mechanism.[1] Currently, most microfinance lenders report to bureaus on the repayment performance and loan sizes of the *group* to which the individual belongs, as well as the size of the group. The policy question is therefore whether it makes sense to try to transition microfinance bureaus towards the use of more individual information.[2]

This is a question that is difficult to address through a randomized policy trial because it relates to a centralized network feature of institutional design not easily manipulated at the individual level. Further, most credit bureaus have a finely negotiated and very specific form of information sharing in place, the result of a delicate balance between heterogeneous lenders and a regulator. We therefore approach this question through the use of laboratory experiments designed to mimic the ways in which credit bureaus alter moral hazard and selection behavior in groups, and play this game with real microfinance clients. A game that hopes to capture the salient features of the strategic problem must replicate several dimensions of behavior: selection into the game must have both an exogenous dimension (the bureau) and an endogenous one (the group screening decision), and we must be able to measure the 'quality' of a player in terms of willingness to think long-term in an environment of group incentives.

In a public goods game, contributions provide a very straightforward metric of quality. Our game assigns group leaders who have the power to eject, thereby creating an endogenous selection margin. Variation in reputation is generated by the rule that reassigns ejected players to the game, and one tenth of the players sit out (thereby winning nothing) at any time. The experiment focuses on the ways in which changes in this exogenous reputation alters the ejection decisions of leaders.

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[1] de Janvry et al (2010) uncover several ways in which group and individual incentives are in tension during the introduction of a microfinance bureau in Guatemala, and similar tensions existed for Peru's MiBanco (Ferreyra, in IFC 2007, p. 20) as well as in South Africa (IFC, 2006, p. 62).

[2] This is partly because many microfinance lenders at present do not digitally track individual repayment for loans made to groups, rendering individual reporting on group loans impossible with their current systems. It is also the outcome of compromises between lenders that are reluctant to provide detailed information on their own clients for fear of competition (Padilla and Pagano, 2000).

In order to make them sensitive to reputation, leaders select and are then themselves ejected after two further rounds of play. Compared to the 'no information' game, group information should improve overall contributions and also make group leaders more sensitive to members' contributions when making ejection decisions (leaders will soon face the 'bureau' themselves and hence want to get rid of bad members). This elevated ejection effect should not be present when we compare the individual information and no-information games. The fact that bad contributors are more likely to be ejected in the group information treatment yet less likely to be reassigned under the individual treatment if ejected means that the differential effect of the two types of reputation on overall moral hazard and average contributions is ambiguous. The game allows us to understand how exogenous variation in extensive-margin selection alters endogenous group formation and overall contributions among those permitted to remain in the game.

We find improvements in contributions in both information games relative to the no-information game. Even in the no-information game, ejection appears to prevent the decay in contributions over time typically seen in repeated public goods games (Muller et al, 2008). Contributions to the public good start at just under 75% of the possible total in the no-information game, and rise to 82% in the information games. There are no significant differences in mean contribution or ejection between the two information games, but ejection becomes more sensitive to individual play in the group information game, as theory predicts. We find no evidence that individual incentives are more effective at combating moral hazard. The participation of real microfinance clients allows us to validate play in the game against real-world borrowing outcomes, and we find that play in the game correlates in meaningful ways with the real-world behavior of the same individuals as microfinance borrowers. We interpret our results as reaffirming the importance of credit bureaus, but suggestive that converting the current group-level reporting of microfinance bureaus into individual-level reporting is not likely to be justified by improvements in outcomes.

While we use the design of credit bureaus to frame this group versus individual reputation game in a very specific way, the underlying strategic tension is not uncommon. It can be found in any circumstance in which individuals acquire a reputation at some cost to themselves, and that reputation is informed in part by the behavior of a group through which the individual gains access to benefits. Examples of this could include academics inside departments, individuals within a central bank, politicians inside parties, and even churchgoers inside churches. In each case, the more that individual fortunes are subject to the group identity, the stronger are the incentives of group insiders to control membership and thereby improve the collective reputation. Conditional

on membership, however, strong group incentives induce free-riding off of the group reputation and so the incentives to cooperate are weakened. The game introduced here provides a way to examine this tradeoff.

2. GAME DESIGN.

2.1. Motivation.

Recent work in experimental economics has illustrated the role that reputation can play in combating moral hazard and allowing exchanges to take place (Brown and Zehnder 2007; Huck & Lünser 2010). We based the design of the game on three stylized facts about the group credit information environment: (i) Microfinance groups generate a dynamic prisoner's dilemma; (ii) when a bureau is created it serves primarily as a vehicle to screen applicants for new loans, and hence exerts an exogenous extensive margin selection on market participation, and (iii) the threat of expulsion from groups can create incentives to play more cooperatively. We now provide motivation for these three stylized features of the strategic environment and Section 2.2 details how the experimental design attempts to capture them.

Microfinance groups pit the short-term benefits of walking away from repaying a loan against the longer-term benefits generated by membership in a successful group. With no collateral on the line, in any period the borrower would be better off defaulting than repaying. This uncooperative Nash equilibrium arises from the basic time inconsistency of uncollateralized credit. Only because the borrower faces future repercussions can such groups hope to sustain a cooperative outcome in which borrowers continue to repay and lenders continue to offer loans. Repeated public goods games are a standard way of creating such a dynamic prisoner's dilemma in a laboratory setting. The prediction of a finite repeated game with fixed group composition is for each player to contribute nothing (Camerer and Fehr 2004). In contrast, a wealth of experimental evidence suggests that the simple repeated context typically generates relatively high contributions.[3] The question of sustained cooperation in public goods games was originally studied by the comparison of 'stranger' and

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[3] Experimental participants typically begin by contributing 40 to 60 percent of their initial endowment (Carpenter 2007a), however we do see an erosion of contributions as the game nears its end (Sonnemans et al 1999). Burlando & Guala (2005) and Ones & Putterman (2007) provide some evidence on the relationship between group heterogeneity and this decay in contributions by segregating players into homogenous groups according to a first round of play. Overall contributions are found to be enhanced by this regrouping.

'partner' treatments showing that groups can reinforce cooperation through repetition (Andreoni 1988).[4]

The second strategic feature we attempt to capture is the exogenous selection imposed by the credit bureau. Bureaus are mostly used by lenders for the selection of new clients, and this is expected to induce clients who are currently with a lender but expect to be later seeking other loans from other lenders to strive to build a reputation.[5] We create a simple form of reputation by implementing a computer routine that creates a straightforward 'credit score' for players based on their recent contributions. The three treatments for the game are variations in this credit score: random reassignment in the 'no information' game, scores calculated off of group average contributions in the 'group' game, and scoring based on individual performance in the 'individual' game. Each treatment is a distinct reputational environment and we analyze the differential behavior that they induce.

Finally, a key feature of microfinance groups is that they self-select, and can punish under-performing members, including by threatening to eject them. These mechanisms of punishments and expulsion have also been used in public goods games. Punishments have been found to generate substantial increases in contributions (Ostrom et al., 1992), to prevent the decay otherwise observed towards the end of the game (Fehr and Gächter, 2000), and to be sensitive to the cost of punishing (Anderson and Putterman, 2006).[6] Games that permit expulsion such as Cinyabuguma et al. (2005) and Page et al. (2005) also induce sharp increases in average contributions as a result. In our game ejection results in a possibility that players will sit out of the game entirely, which we argue most closely mimics the extensive-margin incentives generated by selection in credit markets.

An important feature of microfinance that we ignore in this paper is that borrowers face uncertainty over their investment. In recent years several researchers have used variants on a microfinance game introduced by Abbink et al. (2006) in order to test theory over microfinance behavior in the lab (Cassar et al. 2007, Giné et al. (2010)). We do not use these microfinance games

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[4] In the 'stranger' treatment individuals are randomly reassigned to groups after every round, while in the 'partner' treatment group composition is fixed across rounds (Keser and van Winden, 2000; Palfrey and Prisbrey, 1997; Croson, 2007).

[5] See Brown and Zehnder (2007) for a modified trust game that allows the first mover (the lender) to restrict his loan offer to selected potential second movers (the borrower). The lender is informed on past behavior of the different borrowers prior to taking his decision. With more lenders than borrowers in the market, worst borrowers are punished by being forced to sit out of the game.

[6] Interestingly, Denant-Boemont et al. (2007) find that when they permit counter-punishments, players commonly avenge punishments they have themselves received, and the increased ability to sanction those who fail to punish others does not compensate for the inefficiency of vengeance.

for several reasons. First, the microfinance games are relatively complex, and since we need to add layers of ejection and re-selection over the top of the basic game, we wanted this basic game to be as simple as possible. Second, such investment-based games directly expose players to uncertainty over investment payoffs, and so players' risk aversion is a central driver of decisions. In our game we wish to focus on strategic incentives to cooperate and select in an environment unconfounded by uncertainty over stochastic outcomes. Finally, in order to draw the analogy to credit bureaus, we need to have a straightforward metric of player quality that is easily understood by players and manifests itself immediately. Hence we chose the public goods game as our starting point rather than a variant of these microfinance games.

2.2 Description of the Treatments.

The games were played over the course of six days in Guatemala City and Chimaltenango.[7] The majority of the players were clients of Genesis Empresariál, one of Guatemala's largest microfinance lenders, and the remainder were micro-entrepreneurs who traded in the same marketplaces as the Genesis clients. Genesis extends loans to two types of clients, individual clients and members of Solidarity Group, which are groups of 2-5 members under a joint liability contract. Genesis began using a new credit bureau, Crediref, three years prior to the experiment (Luoto et al. 2006). The purpose of the game was framed explicitly to players as being to understand the workings of credit bureaus in microfinance markets but no further prompting was provided.

Each day consisted of three games, a no information, a group information, and an individual information game. The no information game is always played first, and then the order of the group and individual treatments is randomized. Figure 1 gives a schematic of the internal sequence of one game. There are 50 players, randomly assigned to ten groups of five players. All play two preliminary rounds of a public goods game, in order to form a "history" of each player's contribution. After these initial rounds, one group is randomly taken out of the game, entering what we refer to as the "applicant pool" of players that wait to be reintegrated in the game. The game continues with nine groups of five players each. A given informational treatment then consists of four more sequences of two rounds of contributions each.

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[7] Chimaltenango is a peri-urban area located about 45 minutes west of Guatemala City, and a center of export-driven agricultural activity.

The public goods game rules are standard: Players are endowed with 20 units at the beginning of each round[8], and choose how many to keep and how many to contribute to the public fund. Everything in the public fund is doubled, and this total is divided equally among the five players in the group.

The extensive-margin role of a credit bureau is simulated through 'selection periods' that occur at the beginning of each sequence of two rounds of contributions. In each selection period, we randomly assign one 'leader' inside each group (Figure 1). The leader is shown the (anonymized) previous two contributions within that game for all group members, and can choose to eject up to two group members if desired at a cost of 1 unit per ejection. These ejected members join the pool of non-players (the group randomly taken out in the first selection period, and a holdover of individuals ejected previously and not reassigned in any other selection period). The reassignment rule then calculates a 'credit score' based on the previous rounds of play within that game and replenishes group membership with the 'best' players in the applicant pool in that selection period according to the informational structure of each treatment. The recomposed group of 5 players then plays for 2 contribution rounds. At the end of this sequence a new selection period occurs. The leader from the previous sequence is ejected. A new leader is randomly chosen among the 4 remaining players, and the process continues.

The instructions for each game explain to players the rules under which leaders operate: the leaders will play the next two contribution rounds with their current group, and will then themselves be removed from the group and placed in the applicant pool for the following selection period. The applicant pool for any selection round therefore consists of those players not reassigned to a group in the previous selection round, those ejected by leaders in this selection round, and the leaders from the previous selection round.[9]

All but five individuals in the applicant pool are reassigned to new groups using a reassignment rule that defines the informational treatments. In the no information treatment, the reassigned players are chosen randomly from the pool; in the group information treatment, the players from the groups with the highest averages over the previous rounds are reassigned; and in the individual information treatment, the individual players with the highest averages over the previous rounds are reassigned. The reassignment rule therefore varies exogenously, but the

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[8] A unit in our game is a Quetzal, the Guatemalan currency, with 1 US $ = 7.2 Quetzales.
[9] Our game also permitted quitting, but this turned out to be sufficiently rare that we ignore it in our presentation and empirical analysis.

composition of players who continue in the game responds endogenously to the incentives of leaders to eject. Each leader therefore has the membership of the group brought back up to five, with reassigned players allocated randomly across their new groups. We retain 5 players in the pool so as to generate incentives around ejection, as well as avoid issues of scale that arise from games involving ejection without replacement (Isaac et al, 1994).

In all treatments, group leaders have a primary incentive to eject low contributors in order to improve payoffs in the next two rounds of contributions. The strategic innovation of our game is that, in addition, group leaders also make a selection decision knowing that they themselves will enter the applicant pool in the following selection period. This feature is central to the incentive structure of the game because it amplifies the way in which the reassignment rule determines the incentives of leaders. In the no information treatment, leaders know that reassignment will be random, and hence while they wish to be in high-contribution groups because of the basic logic of a public goods game, there are no reputation-driven reasons to contribute or eject. In the individual information treatment, leaders' incentives to contribute are strengthened by the reassignment rule, but not their incentives to eject. The group information treatment mimics the selection incentives of group information bureaus by directly inducing leaders to be more picky about group membership; leaders now dislike low-contributing group members not only because they drag down current winnings, but because they diminish the leader's chances of being reassigned to the game in the next selection period.

It is important to describe in detail the information known by players through each treatment. Each game (treatment) is explained to players prior to the beginning of play for that treatment, and no information is given as to the existence or nature of future games. Players are told the average contribution in their group at the end of each round, but only leaders are able to observe the individual play of each member of the group. The new group leader was notified anonymously at the beginning of each selection period and was given a form that listed the individual contributions of each group member over the last two rounds. Individuals were identified using an anonymous code number. Leaders know the reassignment rule but do not have any direct information as to the quality of the individuals in the pool; they therefore must infer the expected quality of reassigned players from the rule that is reassigning them. Non-leaders can infer that they are not themselves leaders, but do not know who the leader of a group in each selection period is.

We now develop a simple theoretical model that makes explicit the first-order differences in behavior across games, as well as illustrating more complex incentive mechanisms that work through differential ejection probabilities and changes in the quality of players in the pool.

3. THEORETICAL MODEL.

3.1. A Public Goods Game with Endogenous Group Selection

As in the standard public good game, players receive an endowment of money normalized to 1 unit per period, from which they choose to contribute $c \leq 1$ to a collective pot. Money that goes into the pot is matched by a factor m and then divided evenly among the N members of the group, whether or not they contributed as individuals. If the average amount contributed to the pot is $\overline{c}$, a player contributing c_i receives $1 - c_i + m\overline{c}$, with $1 < m < N$, for the period. Because $m < N$ it is never immediately beneficial for an individual to contribute to the pot.

In the context of a repeated game it is possible for groups to sustain the high-contribution equilibrium, but a decrease in contributions by one player is likely to be met by corresponding decreases from others. This concept of 'conditional cooperation' is developed theoretically by Keser and Van Winden, 2000. Fishbacher, Gachter, and Fehr (2001) ask players to fill out a detailed menu of strategies and find that roughly half of their sample is composed of such conditional cooperators. We assume that all players are conditional cooperators, and parameterize this dimension of the game by assuming that the future payoffs to a player are a function $g(\overline{c})$ of the current group average contribution, assumed to be increasing and concave in $\overline{c}$. In a standard public goods game with no ejection, we could write payoffs as a function of contributions by the following: $1 - c_i + m\overline{c} + g(\overline{c})$. Individuals should contribute up to the point where they believe $g' = N - m$, where the boosting of contributions among others will be sufficient to overcome the direct costs of contributing. This gives higher contributions where groups are small and the match is high.

We simplify our presentation of the direct incentives of the game so as to focus our modeling exercise on selection effects. Selection occurs through two channels: the rule through which bureaus deny borrowers access to credit markets, and endogenous selection made by the group by ejecting some of its members. We model these two channels by introducing the probability p that a player is allowed to continue playing the game by group members and the probability ω that a player who has been forced to look for a new group is permitted to do so by the 'bureau'. The mechanisms that determine these probabilities are detailed below. Given these two sub-components, the aggregate

probability that an individual is able to continue playing the game in future rounds is given by $\pi = p + (1-p)\omega$. Payoffs in our game with endogenous ejection and mechanical reselection, then, are:

$$U_i = 1 - c_i + m\overline{c} + \left(p + \left(1-p\right)\omega \right) g\left(\overline{c}\right).$$

Our games differ solely in the way that ejected players are reassigned to the game. Under the no-information game (indexed by $\varnothing$), selection is random and thus $\omega = \omega^{\varnothing}$ is a scalar unaffected by contributions. Under the group-information game (indexed by G) reassignment is a function of group average contributions, and thus $\omega = \omega^G\left(\overline{c}\right)$. In the individual information game reassignment is based only on individual contributions, so $\omega = \omega^I\left(c_i\right)$ and reassignment probabilities are only a function of individual contributions.[10] The implication of these assumptions is that an individual's contribution c_i has no effect on her reassignment probability in the no information game, it has a direct effect in the individual game, and a dampened effect by 1/N in the group game. The play of other group members, on the other hand, has no effect on reassignment probabilities in the no information game and in the individual game, but influences reassignment in the group game. Our primary interest, of course, is in the ways in which this variation in rule of access to the game alters behavior in two dimensions: the endogenous group selection exercised by the players themselves and the willingness to contribute.

3.2. Selection Incentives in the Game.

We now consider the endogenous decisions taken by leaders to eject group members. Leaders must pay a fixed cost ε to eject.[11] For the leader, $p \equiv 0$, and so the continuation probability is equal to the re-selection probability ω. Denote $\tilde{c}$ the expected individual contribution of a replacement player. Taking the first derivative of the leader's payoff U_l with respect to a group member's contribution, the leader will decide to eject a member with contribution c_i iff:

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[10] While the continuation benefits may differ across games, we assume that the function driving them is homogeneous (so, for example, g' may be low in the individual treatment because contributions are high overall and $g(.)$ is concave, but the relationship between $\overline{c}$ and $g(\overline{c})$ does not itself change).

[11] Fehr and Gächter (2000) provide evidence that individuals are willing to undertake costly punishments in repeated public goods games even if there is no material benefit to themselves from punishing. We do not consider this type of direct utility for punishing in our treatment of leaders' decisions.

$$\frac{dU_l}{dc_i}\left(\tilde{c}-c_i\right)=\left(\frac{m+\omega g'}{N}+\frac{d\omega}{dc_i}g\right)\left(\tilde{c}-c_i\right)>\varepsilon.\tag{1}$$

The first term in the first parentheses gives the direct benefit of having good group members, and the second term gives the reassignment benefit of having good group members.[12]

The **selection incentives** can be seen by the differential condition for leaders to be willing to eject an individual with contribution c_i across games. While equilibrium values for g and g' can differ across games or in different rounds within a game, we denote with a game-level superscript the elements that directly vary across the games *because* of the reassignment rules: the probability of being reassigned ω and its derivative ω', and the expected quality of the replacement person $\tilde{c}$:

$$\varnothing: \quad \left(\frac{m+\omega^{\varnothing}g'}{N}\right)\left(\tilde{c}^{\varnothing}-c_i\right)>\varepsilon$$

$$G: \quad \left(\frac{m+\omega^{G}g'}{N}+\frac{1}{N}\omega^{G'}g\right)\left(\tilde{c}^{G}-c_i\right)>\varepsilon$$

$$I: \quad \left(\frac{m+\omega^{I}g'}{N}\right)\left(\tilde{c}^{I}-c_i\right)>\varepsilon$$

As expected, the probability of being ejected by a leader is a decreasing function of the player's individual contribution in each game. We focus on distinguishing two first-order effects in the differential selection incentives across games. The first of these is the **reputation effect,** whereby the continuation probability of leaders in the group game is a direct function of the contributions of fellow group members. This effect, given by the term $\frac{1}{N}\omega^{G'}g$, is only present in the group game.

The second source of differential incentives to eject is the **opportunity cost** effect, which is given by the term $\left(\tilde{c}-c_i\right)$. This measures the difference in quality between a given player i and the expected replacement player, $\tilde{c}$, and so gives the strength of the incentives to eject a bad player in order to get a better one. The opportunity cost effect has two component elements: changes in the quality of the players in the 'pool' and changes in the quality of the reassignment from the pool. The simpler of these two is the way in which the re-assignment rule works for leaders in determining the expected quality of replacement players conditional on the quality of the pool. In the no-information game re-selection is random and so the quality of the pool and the reassigned is the

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[12] Note that we do not permit $\tilde{c}$ to be a direct function of a leader's own ejection decisions, as might be the case in a small ejection pool and a long game.

same. The group information game reassigns those from the best *groups*, and the individual game the best individual contributors. Hence the quality of returning players relative to the pool is highest for the individual game and lowest for the no-information game. The quality of the pool itself is the product of competing factors. The mechanical reassignment advantage of individual information is amplified because leaders see that replacement players will be of high quality and are therefore willing to eject individuals further up the relative distribution of player quality. Working against this is the fact that the group game makes ejection more sensitive to contributions through the reputation effect. We expect (and confirm in our data) that the mechanical advantages of individual information dominate, and hence $(\tilde{c}^I - c_i) > (\tilde{c}^G - c_i) > (\tilde{c}^\varnothing - c_i)$.

Therefore ejection should be most sensitive to individual contributions on the margin in the group game, but the high quality of replacement players in the individual game should make leaders willing to eject further up the distribution of relative quality.[13] We can sum up the predicted selection effects as follows (we give the Table or Figure that provides the empirical test of each):

AS1: Ejection will be decreasing with contribution ($p' > 0$, Table 5, first row).

AS2: The rate of ejection conditional on individual contribution will be higher in the information games, ambiguous between the group and individual games (Table 4).

AS3: The marginal response of ejection to changes in contribution will be highest in the group game , or $p^{G'} > \left\{ p^{\varnothing'}, p^{I'} \right\}$ (Table 5, second row).

AS4: The quality of players re-entering the game relative to those playing will be highest in the individual game and lowest in the no-information game (text in section 5.1).

AS5: Leaders should be willing to eject higher up the distribution of relative quality as the distribution of replacement players improves (Figure 4).

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[13] We expect the opportunity cost effect in this experimental environment to be stronger than it would be in reality. This is because typically microfinance borrowers are surrounded by a large number of unserved potential borrowers, and so the average quality of the pool may not be a direct function of the prevailing rate of endogenous ejection. Also, we do not give leaders the ability to reject new assignees, which certainly groups are able to do in practice.

3.3. Moral Hazard.

The three games differ only in their reassignment mechanisms, and so it is only through the possibility of ejection that the games generate differential moral hazard. Consider the derivative of payoffs with respect to individual contributions:

$$\frac{dU_i}{dc_i} = -1 + \frac{m + \pi g'}{N} + \left[\frac{dp}{dc_i}(1-\omega) + \frac{d\omega}{dc_i}(1-p) \right] g \tag{2}$$

Two elements in this expression are directly related to the different reassignment rules across games: the marginal effect of contribution on the probability to be reassigned by the bureau, $d\omega/dc_i$, and, as seen above, the marginal effect of contribution on the endogenous probability of being ejected: dp/dc_i, or p'. The marginal benefit of individual contribution is thus written:

$$\varnothing: \qquad -1 + \frac{m + \pi g'}{N} + \left[p^{\varnothing'}\left(1 - \omega^{\varnothing}\right) \right] g$$

$$G: \qquad -1 + \frac{m + \pi g'}{N} + \left[p^{G'}\left(1 - \omega^{G}\right) + \omega^{G'}\frac{1}{N}\left(1 - p^{G}\right) \right] g$$

$$I: \qquad -1 + \frac{m + \pi g'}{N} + \left[p^{I'}\left(1 - \omega^{I}\right) + \omega^{I'}\left(1 - p^{I}\right) \right] g$$

Abstracting from differences in the specific values in equilibrium for ω, p, g, or g', we have:

MH1:   The optimal contribution under either information game is larger than under the no-information game, but the relative advantage of the group versus individual information systems cannot be signed from theory (Figure 2, Tables 1 and 2).

While the initial intuition on this problem might be that individual incentives provide the best check on moral hazard (because the marginal effect on reassignment probabilities is $\omega^{I'}\left(1 - p^{I}\right)g$ rather than $\dfrac{\omega^{G'}\left(1 - p^{G}\right)g}{N}$), this turns out not necessarily to be the case. The reason for this, as illustrated by the preceding theory, is that the endogenous group selection responds most strongly to contributions under group information sharing because of the additional term on the leader's reassignment probability, $\dfrac{1}{N}\omega^{G'}g$, and thus $p^{G'} > \left\{ p^{\varnothing'}, p^{I'} \right\}$. Once players have incorporated the increased incentives of leaders to eject under group information, group-information bureaus are not

only preferable in reducing adverse selection but may in fact provide a superior check on moral hazard as well. Group incentives will be preferred where groups are small and ejection frequent.

Our theory leads to precise predictions as to the impact of information-sharing regimes on specific dimensions of behavior, but shows that the aggregate effectiveness of the two systems in incentivizing collective behavior cannot be signed.

4. BASIC BEHAVIOR.

4.1. Treatment Effects of Reputation on Contributions.

We begin by examining the basic differences in behavior across the different treatments. Table 1 gives summary statistics for average contribution across games. We see modestly higher contributions in both information games than with the no-information game (a cleaner test of MH1 is provided in Section 5.2). Average contributions rise by roughly 1.5 Quetzales, or 7.5% of the total potential contribution. The t-statistics on the differences in means across the information games and the no-information game are higher than ten. Ejection, ejecting, and quitting are not significantly different across games. Hence the general sense is that while information sharing improves outcomes, individual and group information sharing regimes lead to similar outcomes.

Figure 2 provides a visual presentation of the pattern of contributions over the course of the day and in different games. We keep separate the days that had a different sequence of games in order to distinguish differential patterns related to the ordering of the games. We observe an overall increase in the level of contribution within each game before a decline in the last 2 or 3 rounds. There is also a clear increase in contributions from the no-information to either information game, but no obvious difference between group and individual information.

When we utilize the fact that the order of the information games was randomized, however, we see that there is a slight increase in contributions when we move from the individual game to the group game, but not the reverse. Table 2 confirms this using OLS and FE specifications, partitioning the data according to the order in which the games were played and clustering standard errors at the player level. The first column, using OLS, shows increased contributions from information, but no differential effect between information games. Using player fixed effects (which focus on within-player changes) we see a borderline significant additional effect when group incentives follow individual incentives (columns 2-4).[14] This difference is significant at 95% when

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[14] Note that since all players play roughly the same number of rounds in each of the 3 games, the fixed effects are orthogonal to the treatment by construction. The same argument can be made for inclusion of round

we use player fixed effects (Column 2) and at 90% when we add round fixed effects (Column 3). The absolute magnitude of this effect is small; .3-.4 units out of a total possible contribution of 20, or roughly 2% of the initial endowment.

We may be concerned that results could be overstated because of the presence of autocorrelation in player contributions. We can verify in a simple regression of individual contribution on lagged contributions that 45% of the variation in individual contributions can be explained with their first lag, and models run with an auto-regressive error process find that term to be significant. As a simple way of dealing with this issue, we collapse the data at the player/game level, leaving us with three observations on each player (similar to the course recommended in Bertrand, Duflo, and Mullainathan, 2004). Column 5 presents the results of this exercise (again clustering at the player level); point estimates are similar to Column 2, although the number of observations is one-tenth as large and the standard errors are correspondingly larger. We nonetheless still find that group information significantly improves contributions when it follows individual information. We conclude that autocorrelation, while present in the data, is not driving our main results.

Having illustrated these aggregate changes across games, we now confirm some basic features of the our reference no-information game with selection: contributions are larger than in a standard public goods game, ejection weeds out bad contributors, and players appear to be conditional cooperators.

4.2. Strategic Behavior in the No-Information Game with Ejection.

Contributions are Higher than what is Typically Found in Basic Public Goods Games.

Our basic no-information game differs from a standard public goods game in one fundamental way: it permits endogenous group selection across rounds. In and of itself, ejection might be expected to provide an additional stimulus to contribution, and the presence of non-playing members (partially the ejected) also drives up average contributions among those playing through a positive selection effect. Further, our pool of players consists of ongoing microfinance group borrowers, presumably in itself a sample of those willing to work cooperatively. We play the game with individuals who may have social or commercial connections with each other, and while they do

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fixed effects when comparing behavior across rounds. Thus the only difference between the OLS and FE specifications is that marginal effects are not informed in the latter by observations who contribute the same amount across all games (which is the case for 14 of the 292 players in the sample).

not know the identity of members of their own group, these connections may drive up contributions relative to the same people interacting with strangers. Finally, the experiment took place in a context of research on microfinance, which may have had cueing effects on players to behave in a more collective fashion. We therefore expect contributions to be higher in our game than in the standard literature on public goods games.

Indeed, average contributions in the base game are 14.9 out of 20, above the usual high-end contribution of 60% by an additional 15 percentage points. 7.6% of players are ejected each selection period in the no-information game, and 26% of people choose to eject someone when they are leaders. Therefore considerable selection is taking place across rounds of the game.[15]

Relationship between Contribution and Ejection.

The active ejection mechanism enables us to test the most basic predictions of our model. Given the fixed cost to ejecting, we should see that leaders only eject those substantially below the expected quality of the replacement individual (AS1). This is verified in Figure 3.

The Dynamic Response to Group Average Contributions g(.).

The pattern of reciprocity of a conditional cooperation strategy that we assumed in the model implies that individual contribution should respond positively to lagged contribution by other members of the group. Table 3 shows a simple distributed lag analysis of individual contributions during the no-information game. We drop the first two rounds (where players may have still been learning the rules) and the last two rounds (after the final selection period, where incentives are different). Indeed, we find a strong correlation with the first or second lag of other players' contributions (columns 2 and 3), but not the third (column 4), which might be expected given that the third lag necessarily took place prior to the previous selection round. Column 5 verifies the Granger causality in the relationship by showing that there is no correlation with the lead.[16]

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[15] Quitting, on the other hand, proves to be very rare. Players only quit a total of three times in all of the no-information selection periods, out of a total of 1,168 chances to do so. Consequently we do not focus on differential incentives to quit in either the theory or the empirical analysis as the variation in our data does not permit us to do so.

[16] We do not have rich data on conditional strategies such as was analyzed by Fischbacher, Gachter, and Fehr (2001), however we can examine our data for the types of heterogeneity they examine. We find *no* complete free-riders in our sample, but 3% of our sample maintain low contributions throughout all games, and 10% of the players contribute the maximum for at least all but four plays.

We now move to establish the ways that our treatments alter adverse selection and moral hazard in the game.

5. ADVERSE SELECTION & MORAL HAZARD EFFECTS.

5.1 Adverse Selection Effects

We move by steps into establishing empirically the ways in which information sharing places a check on adverse selection, as expressed in equation (1) and the different predicted effects summarized in section 3.2.

The 'Opportunity Cost'

The most mechanical impact is the opportunity cost effect, whereby the relative quality of replacement players changes as the reselection rule is altered. With no-information sharing, the distribution of the reassigned is sampled directly from the distribution in the pool and this difference is centered around zero. The information sharing rules select only the best in the pool, but the group rule is less precise in doing so because it is affected by the behavior of other group members.[17] If we generate the distributions of (deviation from game average) contributions among those reassigned to the game, a Kolmogorov-Smirnov test for the equality of the distributions rejects equality between any pair at the 1% significance level. Hence, in the opportunity cost effect we have a strict ranking whereby the individual game generates superior replacement players to the group game, and the group game to no information. This confirms AS4.

Ejection Across Games

This opportunity cost effect induced by the rules of the game should be amplified by the ejection decisions of leaders (AS5). This effect can be seen in Equation 1, which shows that leaders should be willing to eject further up the quality distribution as the quality of the replacement players goes up. In other words, quality-based reassignment should be internalized by leaders in terms of the opportunity cost of a current player. Figure 4 subtracts the game average contribution off of

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[17] As a way of quantifying this, we can regress individual contributions on group mean contribution, with both amounts calculated as deviation from game/day averages. The R-squared from this regression gives the share of variation in individual performance that can be explained with group performance. We get an R-squared of .21, so in these five-person groups little more than a fifth of individual performance can be explained with group average performance. This seems reasonable given the initially random group assignment in each game.

individual contributions, and shows how the relative quality of those ejected changes across games. Leaders ejected only from the left tail of the distribution in the no-information game because the replacement player had an expected contribution equal to the mean of the pool. With information-driven reassignment in place, however, the replacement player has an expected quality above the mean of the pool, and so leaders eject further up into the distribution of relative contributions. While the group and individual games have similar distributions, they appear to feature rejection across a broader range of qualities than the no information game. However, a Kolmogorov-Smirnov test of equality of distributions fails to reject for any comparisons across these distributions; p-values are .337 for comparison of no information to group, .425 for no information to individual, and .851 for group to individual. Hence while the figure appears to confirm AS5 visually, the limited number of ejections (between 55 and 66 per game) and the muted differences in the relative quality of ejected players do not generate statistically significant differences even between both information-sharing games and the no information game. Nonetheless, the shift in the endogenous pattern of ejection serves to reinforce the opportunity cost effect, meaning that the pool of ejected players improves slightly even as the selection rule improves reassignment.

We now move to establishing the ways in which the use of information in reassignment alters leaders' ejection decisions, controlling for the absolute level of individual contribution, rather than its relative value in all similar games (AS2). This is done by regressing ejection probabilities on dummies for the information games while controlling for the contribution of the player. Table 4 shows the results of this estimation, clustering standard errors at the player level. The first column tests for differences in ejection between the no-information and information games and finds no differences, as we would expect from the initial figures. The second column controls for individual contribution, and finds that ejection probability is strongly decreasing in individual contribution. The coefficient on the information games is now significant and positive, indicating that a player making the same contribution across games would be 2 percentage points more likely to be ejected in the information games, an increase of a third from a base rate of 6 percentage points. Column (3) shows that there is no differential ejection across the two information games. Column (4) shows these results are robust to the addition of control variables.

The Sensitivity of Ejection to Reputation.

The incentives for leaders to select good group members are stronger in the group game by the term $\frac{1}{N}\omega^{G\prime}g$, because in this game reassignment probabilities are a direct function of group contributions. This should make leaders in the group round more sensitive to player quality in their ejection decisions (AS3). Table 5 tests this hypothesis by interacting player quality with dummies for the information games in the ejection regression. In distinction to Table 4 which looks at the overall levels of ejection across games, Table 5 tests whether the probability of ejection is more sensitive to player contribution in the group game than in the other games. We define individual quality in three different ways. The first is the relative quality directly suggested by the theory: the deviation between an individual's contribution and the expected amount from a player returning from the pool. Because this latter quantity may be difficult for leaders to predict in such a new environment, we also try using two additional frames of the relative quality of a player. The second quality measure is the deviation from the average contribution in the rest of the group, and the third is the deviation from the leader's own contribution. These two quantities are directly observable to the leader, and so may generate stronger framing effects.

Table 5 shows that indeed ejection becomes differentially less likely as player contribution increases in the group game. While the interaction effect is not significant using deviation from returning pool expected contribution, it is significant at 5% using deviation from group contribution, or from the leader's contribution.

In summary, changes to the reassignment rule create strong differences in exogenous selection across games, and these differences are amplified by the endogenous ejection behavior of leaders in various ways. Leaders are slightly more willing to eject further up the quality distribution in the information games, and they eject more conditional on quality when information is used in reassignment than when it is not. Leaders become most sensitive on the margin to player contributions in the group information game, and the greatest differential sensitivity in ejection is to differences between leader and player contributions.

5.2. Moral Hazard Effects

We now move to attempt at isolating the moral hazard effects modeled in Section 3.3 (MH1). We can do this very rigorously for the (selected) subset of players who remained in the game during every round of each treatment. Because no selection effects are present in this group, dummy

variables for each treatment (while including fixed effects for player, round, and game order) give the average differences in contributions solely as a result of incentive effects. Results reported in Table 6 show that contribution is significantly higher in games with information, but group incentives do not have a stronger impact on contributions than individual incentives. These results are robust to controlling for lagged contribution, or taking averages over all rounds. The fact that these players do *not* contribute more under the individual game is seen as suggestive evidence that the increased threat of ejection resulting from the group incentives is indeed itself a direct check on moral hazard.

It is quite possible however that individuals who are never selected out of the game differ from the overall population of players in their response to incentives. It may be the case that these individuals are more sensitive to incentives (if only those who responded to the MH incentives managed to not get kicked out in the information games) or that they are less sensitive to any incentives. The direction of the difference is thus a priori indeterminate.

Note however that the information game effects are similar to those obtained in Table 2 for the whole population. If one assumed that the restricted population that is never ejected does not significantly differ from the population as a whole, then the comparison between these two results suggests that the weakly improved performance of the group game relative to the individual game in Table 2 was being driven by adverse selection effects. Our mechanical reselection rule favors the individual information, and so this dominance of group information sharing only when selection effects are present is taken as strong evidence that the endogenous group selection process is significantly improved by retaining group incentives.

5.3. Individual Player Heterogeneity

Correlates of contributions.

The actual practice of microfinance in much of the world is driven by the idea that women behave more collectively than men. The reasons given for this have been diverse, from social norms to discrimination in formal institutions. In Guatemala, similar claims are frequently made that indigenous communities are 'more collective' than their wealthier, more urban Ladino counterparts. Similarly, models of microfinance such as Navajas and Conning (2003) tend to show that individuals with preferences for collective action will tend to gather in group lending. Table 7 shows no evidence of any of these relationships at play in our public goods game. Results from regressing average player contributions or the probability of ejecting another player on a set of demographic

covariates show no evidence that women, indigenous, and group borrowers behave differently in the public good games than men, Ladinos, and individual borrowers.

Of individual attributes, only a behavioral trait (risk-lovingness) has any real explanatory power, showing an association with higher contributions.[18] Demographic characteristics are all insignificant. If risk-lovingness were strongly associated with other characteristics such as taking an individual loan from Genesis, might that create a pattern of behavior consistent with stereotypes?   In column 2, we omit risk-lovingness from the above regressions. If it projected strongly into the other attributes, this would create the expected pattern when risk-lovingness is omitted. All of these relationships remain insignificant, however, illustrating that no strong correlations exist through the risk-lovingness channel. In general risk preferences are remarkably similar across demographic groups. Hence these finding provide no evidence that play in the game differed in any important way across demographic groups, but do motivate the idea that a high-contribution strategy is most attractive to the risk tolerant.

5.4. Connection to Performance as Genesis Clients.

Because many of the players were clients of Genesis Empresariál we can examine the ways in which actual credit market outcomes correlate with play in the game. This provides us with a critical form of cross-validation and allows us to fortify claims of external validity in generating policy conclusions from our laboratory experiment. In order to study this, we match players to the Genesis database, and analyze the difference between Genesis 'defaulters' and those who are Genesis clients but have not defaulted. We identified 22 individuals who had had repayment problems in Genesis and 183 who had not, and calculate player/game average outcomes, giving us three observations per player.[19]

Table 8 demonstrates that variation in contributions in our experimental setting is tied in significant ways to variation in real-world microfinance behavior. Column 1 shows that defaulters contribute substantially less than non-defaulters, implying that real correspondence exists between play in the game and the behaviors we are attempting to simulate. The next question we address is

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[18] The risk-lovingness measure was collected in a risk game played by participants at the end of the day. It is defined as the amount they bet (out of a 20 Qtz endowment).   The bet was a coin flip; if they won, they received 2.5 times the bet; if they lost, then they lost their bet. Whatever they didn't bet of the 20 Qtz they kept as well.

[19] The large number of missing observations come from an error that lead us not to collect the identity of the participants in one day of experiment, preventing us from matching those players to the Genesis database.

whether those who have faced real repayment problems in Genesis respond differently to the incentives within the game. In column 2, we use a client fixed effects model, and show contributions of defaulters to be uniquely insensitive to information sharing. While the effect of information for defaulters is imprecisely measured, the coefficient almost exactly counteracts the positive effect of information sharing for non-defaulters (significant at the 10% level), meaning that defaulters do not respond to this shift in incentives at all.[20]

A complication in interpreting these results is that we ourselves are calculating default based on a database that reports at the group level. Therefore while individual borrowers from Genesis have directly experienced repayment problems, group borrowers may simply have been members of a group in which others defaulted. The behavioral repercussions of these two might be quite different, and the signal is more informative for individual borrowers. Column 3 tests for differences between those who defaulted as individual Genesis clients and those who were in defaulting groups. Given dummies for information games, individual borrowers, defaulting, and the interaction between individual and defaulting, the coefficient on any default tests for the difference between defaulting and non-defaulting group borrowers. The difference is not significant. For individual borrowers, however, the signal is much stronger: defaulters contribute 4.4 Quetzales less than non-defaulters, the largest marginal effect found on a binary variable in this analysis. This difference in contributions provides an interesting demonstration of the mechanical advantage of individual information sharing: an improved ability to predict individual behavior. Columns 4-6 show ejection impacts that move in the direction we would expect given the pattern of contributions, but show that the inferior play of real-world defaulters is not sufficiently strong as to result in their having significantly higher probabilities of being ejected in our game. In any case we interpret these results as confirmation that the variation discussed in this paper has a real-world analog in microfinance borrower behavior.

6 CONCLUSION.

We conducted an artefactual field experiment designed to mimic the introduction of different types of credit bureaus into microfinance markets. Our experimental field game induces endogenous group selection in the public goods game, thereby allowing us to study how different informational environments alter the decisions of Guatemalan entrepreneurs over group

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[20]   If we repeat this analysis without individual fixed effects the standard errors are slightly larger but point estimates are identical.

composition. The key purpose of the games is to permit comparison of information systems that create a reputation over group quality versus systems that create an individual reputation. We find that in the strongly group-driven strategic environment of the public goods game, information over group quality induces an advantageous selection effect that is not present in the other games. This effect is sufficiently strong as to make group reporting equal or superior to individual reporting. While play in the game correlates to actual repayment performance as microfinance clients, we find no evidence that women, indigenous people, or real group borrowers are more likely to contribute.

The game introduced here is itself an innovation in the experimental study of collective decision-making. We endogenize group selection in a manner that permits the study of collective action problems when both extensive margin and intensive margin effects are of interest. Many strategic contexts feature groups that control their own membership and require their members to make costly investments in a public good. In such cases, the costs imposed on individuals by ejection are critically related to the nature of the reputation that an ejectee carries to future potential groups. Our game generates controlled variation in this parameter, and so allows us to examine the relative advantages of group versus individual reputation. Our results provide a rationale for the persistence of collective reputation aggregators such as academic departments or firms: the ability of these entities to control membership can lead to better equilibrium outcomes than a world in which all incentives are directed purely at individual behavior.

The extension of our results to the very real-world problem of optimal credit bureau design, of course, involves questions of external validity that are difficult to verify. Our game cannot capture the effect of competition between lenders, and the public goods game does not generate the kinds of 'bad luck' outcomes that may be quite common in credit market default. However, we do find evidence that play in our game relates to real-world credit market behaviors such as default. Further, the fact that the games were played with micro-entrepreneurs, most of whom were clients of an institution that had recently instituted a group-information credit bureau lends more credence to the idea that these results are pertinent to microfinance marketplaces. Since most extant microfinance bureaus report on the group behavior of individual borrowers, only strong evidence demonstrating the efficacy of individual repayment reporting would warrant a major policy shift. We find no such evidence here.

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Table 1. Difference in Contribution and Ejection across Games

	No Information Mean (Ø)	Group Information Mean (G)	t-statistic on test (Ø-G)=0	Individual Information Mean (I)	t-statistic on test (Ø-I)=0	N in each game
Contribution	14.943	16.339	-10.51	16.370	-10.77	2680
Ejected by leader	0.076	0.074	0.20	0.064	1.04	863
Ejects other when leader	0.260	0.273	-0.30	0.245	0.36	215
Quits	0.003	0.007	-1.51	0.009	-2.15	1168

Table 2. Impacts of Information Treatments on Contributions.

	(1)	(2)	(3)	(4)	(5) Player FE, collapsed
Dependent variable: Contribution	OLS	Player FE	Player FE	Player FE	
Games sequence : None-Group-Individual					
Information game	1.066	0.712	0.754	0.671	0.659
	(3.75)**	(3.13)**	(3.31)**	(3.03)**	(2.20)*
Individual information game	0.353	0.095	0.016	-0.018	-0.002
	(1.81)	(0.57)	(0.09)	(0.11)	(0.01)
Games sequence : None-Individual-Group					
Information game	1.434	1.29	1.333	1.196	1.085
	(5.72)**	(5.35)**	(5.43)**	(5.15)**	(3.38)**
Group information game	0.275	0.407	0.327	0.292	0.618
	(1.61)	(2.15)*	(1.74)	(1.58)	(2.05)*
Rounds fixed effects			Y		
$F_{(9, 7743)}$; p-value			(3.4; 0.0004)		
Lagged group contribution[1]				0.016	
				(4.50)**	
Constant	14.943	15.126	14.851	13.988	14.914
	(61.75)**	(136.66)**	(61.19)**	(45.21)**	(105.46)**
Observations	8050	8050	8050	8050	876
R-squared	0.02	0.03	0.04	0.04	0.09
Number of players		292	292	292	292
Test of equality for information game across sequences - pvalue	0.376	0.082	0.081	0.105	0.333

Robust t statistics in parentheses; * significant at 5%; ** significant at 1%; errors clustered at the player level.

[1] Column 4 includes dummy variables for the first round of each game, thereby breaking the link between contributions across games.

Columns 1-4 use the player/round as the unit of analysis. Column 5 collapses the data within treatments to give one observation per player/game.

Table 3. Dynamic Effects of Group Average Contribution (no-info game only).

Dependent variable: Contribution	(1)	(2)	(3)	(4)	(5)
Others' average this period	0.022	-0.087	-0.127	-0.122	-0.072
	(0.32)	(1.38)	(1.90)	(1.93)	(1.23)
Others' average last period		0.160	0.083	0.056	0.163
		(2.81)**	(1.85)	(0.91)	(2.91)**
Others' average two periods ago			0.164	0.153	
			(2.60)**	(2.56)*	
Others' average three periods ago				0.046	
				(0.67)	
Others' average next period					-0.035
					(0.61)
Constant	14.76	14.06	13.40	13.19	14.39
	(14.24)**	(11.58)**	(9.59)**	(8.39)**	(10.23)**
Number of observations	1572	1526	1480	1198	1461

Robust t statistics in parentheses. * significant at 5%; ** significant at 1%. Errors clustered at the player level.
Using rounds 3-8 of the no-information games

Table 4. Ejection Probabilities across Games.

Dependent variable: Ejected	(1)	(2)	(3)	(4)
Information game	-0.008	0.018	0.02	0.025
	(0.68)	(2.57)*	(2.53)*	(3.18)**
Individual information game			-0.006	-0.006
			(0.72)	(0.78)
Average individual contribution (last 2 rounds)		-0.012	-0.012	-0.012
		(17.19)**	(17.17)**	(16.95)**
Leader's contribution				-0.001
				(0.68)
Game order dummy				Y
Period fixed effects				Y
Number of observations	2591	2591	2591	2563

Robust z statistics in parentheses; * significant at 5%; ** significant at 1%. Errors clustered at the player level
Marginal effects computed at the average of independent variables from a probit estimation.
Mean of the dependent variable across all games is .071.

Table 5. The Sensitivity of Ejection to Contribution in Group Information Games

Dependent variable: Ejected	Contribution is measured by:		
	Deviation from expected contribution among 'returning' players of group	Deviation from average contribution in rest of group	Deviation from leader's contribution
Individual contribution	-0.012	-0.009	-0.006
	(10.33)**	(8.23)**	(4.51)**
Contribution * group info	0.000	-0.004	-0.005
	(0.15)	(2.45)*	(2.11)*
Contribution * individual info	0.001	-0.002	-0.003
	(0.70)	(1.03)	(1.10)
Information game	-0.018	-0.01	-0.015
	(1.66)	(0.85)	(1.06)
Group information game	0.008	-0.005	-0.005
	(0.79)	(0.40)	(0.30)
Number of observations	2591	2591	2563

Robust z statistics in parentheses; * significant at 5%; ** significant at 1%. Errors clustered at the player level.

Marginal effects computed at the average of independent variables from a probit estimation.

Mean of the dependent variable across all games is .071.

Table 6. Pure Moral Hazard Effects.

Dependent variable: Contribution	(1) OLS	(2) Player FE	(3) Player FE	(4) Player FE, collapsed
Games sequence : None-Group-Individual				
Information game	1.022	0.851	0.732	0.851
	(3.33)**	(2.98)**	(2.67)**	(2.46)*
Individual information game	-0.084	-0.084	-0.116	-0.084
	(0.42)	(0.41)	(0.60)	(0.34)
Games sequence : None-Individual-Group				
Information game	0.880	1.033	0.812	1.033
	(3.16)**	(3.98)**	(3.26)**	(3.29)**
Group information game	-0.117	-0.117	-0.159	-0.117
	(0.63)	(0.62)	(0.87)	(0.51)
Lagged group contribution[1]			0.027	
			(4.33)**	
Constant	16.251	16.251	14.182	16.251
	(59.13)**	(131.73)**	(27.19)**	(108.79)**
Observations	4260	4260	4260	426
R-squared	0.01	0.02	0.03	0.11
Number of players				
Test of equality for information game across sequences - pvalue	0.750	0.637	0.831	0.697

Robust t statistics in parentheses; * significant at 5%; ** significant at 1%. Errors clustered at the player level.

[1] Regressions include dummy variables for the first round of each game, thereby breaking the link between contributions across games.

Sample restricted to players that participated in all rounds of all games. Unit of observation in columns 1-3 is the player/round; column 4 collapses the data to the player/game level and therefore has three observations per individual.

Table 7. Differential Play by Demographic Characteristics

	Dependent variable:		
	Individual Contribution (Qz)		Ejects another player
Individual borrower in Genesis	0.657	0.802	0.077
	(1.28)	(1.55)	(1.02)
Female	0.590	0.489	-0.084
	(1.26)	(1.04)	(1.22)
Indigenous	0.255	0.331	-0.049
	(0.60)	(0.76)	(0.77)
Risk-lovingness	0.111		0.005
	(3.07)**		(0.98)
Number of observations	292	292	271
R-Squared:	0.04	0.01	0.02

Absolute value of t statistics in parentheses; * significant at 5%; ** significant at 1%

Dependent variables are individual-level averages over all games.

Table 8. Correlating Game Play with Real-World Borrower Behavior.

	Dependent variable:					
	Individual Contributions			Ejected		
	(1)	(2)	(3)	(4)	(5)	(6)
Any Genesis default	-1.738		-0.966	0.035		0.02
	(2.04)*		(1.09)	(1.21)		(0.69)
Information game	0.957	1.068	0.957	-0.017	-0.018	-0.017
	(4.24)**	(4.45)**	(4.24)**	(1.30)	(1.39)	(1.30)
Any Genesis default *		-1.029			0.016	
Information game		(1.73)			(0.32)	
Individual client of			1.016			-0.008
Genesis			(1.73)			(0.50)
Individual client *			-4.406			0.081
Default			(2.07)*			(0.96)
Player fixed effects	N	Y	N	N	Y	N
R-squared	0.03	0.09	0.05	0.03	0.01	0.01
Observations	615	615	615	615	615	615
Number of players		205			205	

Robust t statistics in parentheses; * significant at 5%; ** significant at 1%. Errors clustered at the player level.

Unit of analysis is the player/game average. All regressions include a dummy for the game played last.

Figures:
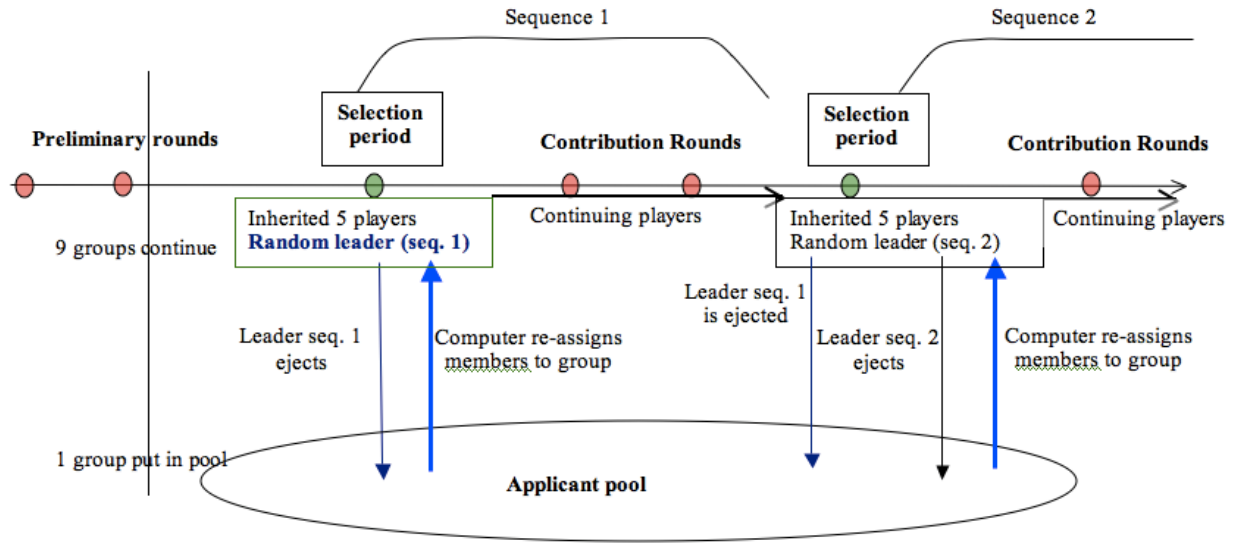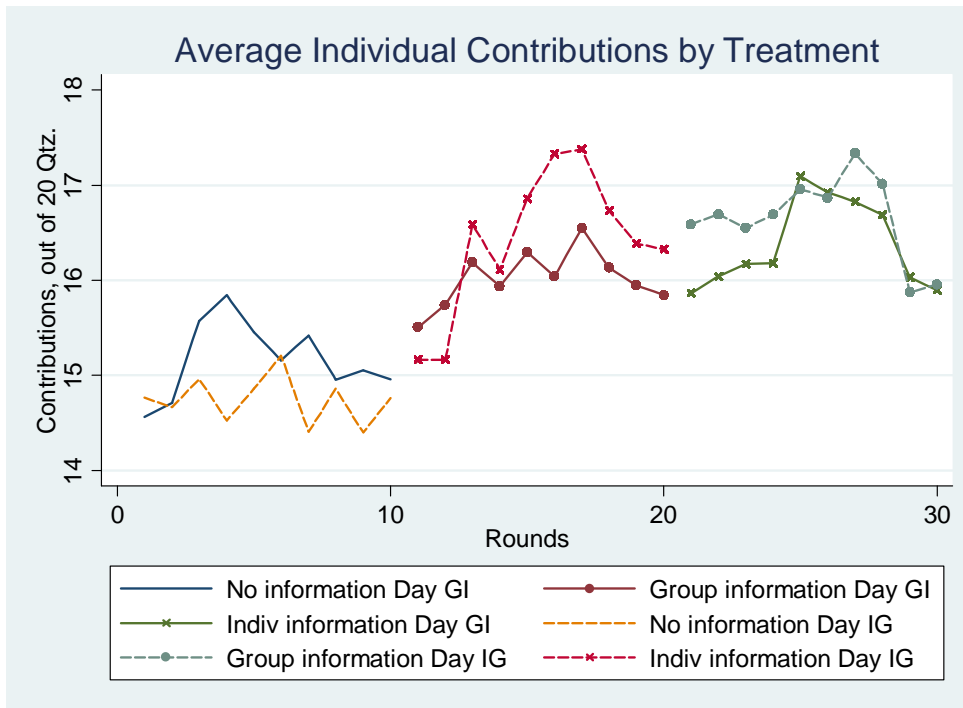**Figure 1. Description of the Game.**

Figure 2. Average Individual Contributions by Treatment

Day GI refers to days where the group-information game was played before the individual information game, Day IG when the order was reversed.

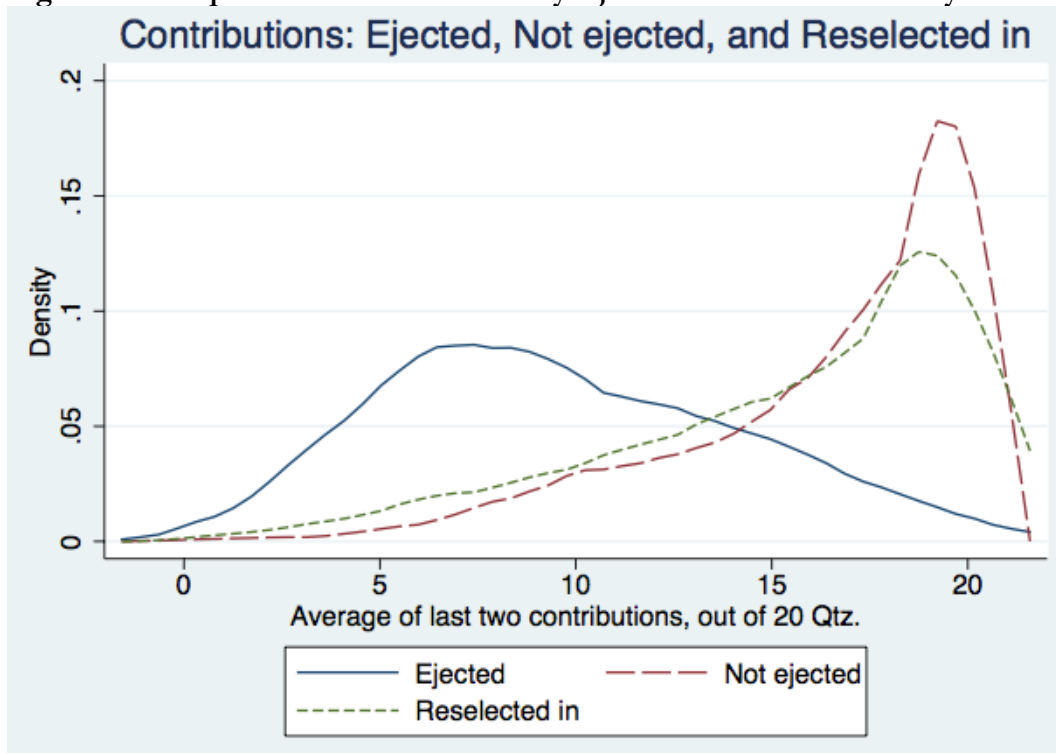**Figure 3. Comparison of Contribution by Ejected and Reselected Players**

Figure 4. Contributions of the Ejected