Peer Monitoring and Enforcement:

Long Term Evidence from Microcredit Lending Groups with and without Group Liability*

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ABSTRACT

The group liability contract feature is often named as key to the growth in lending markets for the poor. Group liability purports to improve repayment rates by providing incentives for peers to screen, monitor and enforce each other's loans. However, group liability may create excessive pressure and discourage good clients from borrowing, jeopardizing both growth and sustainability. A Philippine bank removed group liability from randomly selected group-screened lending groups. After three years, we find no increase in default and larger groups, thus showing that banks can do just as well as peers at monitoring and enforcing loans and generating high repayment rates.

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I. Introduction

Group liability is often cited as a key innovation responsible for the expansion of access to credit for the poor in developing countries (Morduch 1999; Armendariz de Aghion and Morduch 2005; Microcredit Summit Campaign 2005). This contract feature purports to solve a credit market failure by mitigating adverse selection and moral hazard problems. Under group liability, clients have an incentive to screen other clients so that only trustworthy individuals are allowed into the program. In addition, clients will make sure that funds are invested properly and effort exerted. Finally, enforcement is enhanced because clients face peer pressure, not just legal pressure, to repay their loans. Thus, by effectively shifting the responsibility of certain tasks from the lender to the clients, group liability claims to overcome information asymmetries typically found in credit markets, especially for households without collateral.

Group liability could also be seen as a tax, effectively increasing the net interest rate on borrowers. Little is known about sensitivity to interest rates at the household level (Attanasio, Goldberg and Kyriazidou 2000; Karlan and Zinman 2007a). Measuring the elasticity of demand with respect to group versus individual liability is important both in order to understand the net "demand" effect of this important loan characteristic, but also for forming credit market policy to help deepen the quantity and quality of access to finance for the poor.

The basic empirical question of the relative merits of group versus individual liability has remained unanswered for many reasons of endogeneity. Merely comparing performance of one product versus another, within or across lenders, fails to establish a causal relationship between the contract terms and outcomes such as repayment, selection, or welfare, due to countless unobserved characteristics that drive individual selection into one contract or the other, as well as institutional choices on what to offer, and how. Lenders typically chose the credit contract based on the context

in which they operate. Morduch (1999) and Armendariz de Aghion and Morduch (2005) point out in their microfinance reviews that the performance of group liability contracts in developing countries indeed has been very diverse.[1] Thus far, however, since most claims are supported with anecdotes, we still lack good evidence on the relative importance of group liability *vis a vis* the other mechanisms, such as dynamic incentives, regular public repayments, etc. found in "group lending" schemes. Quoting Armendariz de Aghion and Morduch (2005),

> "The best evidence would come from well-designed, deliberate experiments in which loan contracts are varied but everything else is kept the same."

This is precisely the goal of the paper. We use a randomized control trial conducted by the Green Bank of Caraga in the Philippines to evaluate the efficacy of group liability relative to individual liability on the monitoring and enforcement of loans. Half of Green Bank's existing group-lending centers in Leyte, an island in central Philippines, were randomly converted to individual liability. Note that this implies that the "baseline" clients, those already receiving loans at the time of the conversion, were already screened using *group liability*. We then examine whether, after the peer screening, group liability has any additional effect on the mitigation of moral hazard through improved monitoring or enforcement.

The separation of adverse selection from moral hazard is one of the most difficult empirical challenges when studying information asymmetries in credit markets.[2] The "surprise" factor of this design, created by generating a sample of borrowers that select under one contract regime but then monitors and enforces repayment under another, allows for a cleaner test of theory than offering one method to some individuals and another method to other individuals. This is useful both academically and practically in the design of products. However, it also limits the immediate

[1] See also Adams and Ladman (1979) and Desai (1983). On anecdotal evidence on the limits to joint liability, see Matin (1997), Woolcock (1999) Montgomery (1996) and Rahman (1999).
[2] See Karlan and Zinman (2007b) for an interest rate experiment which also separately identifies adverse selection and moral hazard in a South Africa credit market.

policy prescriptions since the treatment conducted here is not a viable long-term product for a lender (one cannot perpetually "surprise" borrowers). Individuals selected under group liability may be different (e.g., safer) than those selected under individual liability. Although we focus on baseline ("surprise") clients, we also present results from new members, that is, those that joined the program after the removal of the joint liability clause. This allows us to answer some (more limited) questions on selection as well, and we discuss this more in the conclusion.

After following participants in the study for three years, we find no change in repayment for those centers converted to individual liability. In earlier work, with one-year results, we also found no change in repayment (Giné and Karlan 2006). We also find higher client growth in converted centers, and evidence that it is because new clients are more likely to remain in the program (whereas the "baseline" clients, who have larger loans, are more likely to leave under the individual liability structure). In auxiliary data collected on internal procedures, we find direct evidence that individual liability leads to less monitoring of each other's loan (although as noted, this lowered monitoring does not lead to higher default). Lastly, we find that those with weaker social networks prior to the conversion are more likely to experience default problems after conversion to individual liability, relative to those who remain under group liability. In sum, as conversions from group to individual liability become more commonplace in the microfinance community, we take an important step towards understanding whether and how such conversions work.

The rest of the paper is organized as follows. Section II provides both the background for this paper, including a discussion of the importance of these issues in the microfinance industry as well as the relevant theoretical academic literature. Section III presents the experimental design and the administrative and survey data we collected. Section IV presents the empirical strategy and primary results on the impact of group versus individual lending on center and individual

performance. Then, section V presents results from three surveys conducted one year after the initial conversion in order to learn more about the mechanism through which changes did or did not occur. Section VI concludes.

II. Background

Microfinance Trends

In recent years, some micro-lenders, such as the Association for Social Advancement (ASA) in Bangladesh, have expanded rapidly using individual liability loans but still maintaining group meetings for the purpose of coordinating transactions. Others, like BancoSol in Bolivia, have converted a large share of its group liability portfolio into individual liability lending. Even the Grameen Bank in Bangladesh, whose founder Mr. Yunus won the 2006 Nobel Peace Prize, has recently relaxed the group liability clause in the Grameen II program by allowing defaulters to renegotiate their loans without invoking group pressure. Many of these groups (e.g., ASA) have made this shift while still keeping the "group" intact. Thus, while *liability* is individualized, the group process helps lenders lower their transaction costs (by consolidating and simplifying loan disbursal and collection logistics) while possibly maintaining some but not all of the peer screening, monitoring or enforcement elements due to reputation and shame. The shift to individual liability is not merely the Grameen Bank and a few other large, well-known lenders, but many lenders around the world are following the lead of the large, well-known lenders. Many policymakers have been advising lenders who seek to expand more rapidly (such as the Green Bank of Caraga, with whom we conducted this field experiment) to engage in individual liability rather than group liability.

This shift from group liability to individual liability loans has accelerated as the microfinance community learns about some of the pitfalls of group liability lending. First, clients dislike the tension caused by group liability. Excessive tension among members is not only responsible for voluntary dropouts but worse still, can also harm social capital among members, which is particularly important for the existence of safety nets. Second, bad clients can "free ride" off of good clients causing default rates to rise. In other words, a client does not repay the loan because she believes that another client will pay it for her, and the bank is near indifferent because it still gets its money back. Third, group liability is more costly for clients that are good risks because they are often required to repay the loans of their peers. This may lead to higher dropout and more difficulty in attracting new clients. Finally, as groups mature, clients typically diverge in their demand for credit. Heterogeneity in loan sizes can result in tension within the group as clients with smaller loans are reluctant to serve as a guarantor for those with larger loans. In sum, while repayment may improve under group liability, the client base may be smaller, so it remains unclear whether group liability improves the lender's overall profitability and the poor's access to financial markets.

Throughout this paper we maintain an important distinction between "group liability" and "group lending." "Group liability" refers to the terms of the actual contract, whereby individuals are both borrowers and simultaneously guarantors of other clients' loans. "Group lending" merely means there is some group aspect to the process or program, perhaps only logistical, like the sharing of a common meeting time and place to make payments. The heart of this paper is testing whether the removal of group liability from a "merely logistical" group lending program leads to higher or lower repayment rates, client retention and to changes in group cohesion.

Theoretical Background

The theoretical literature on joint liability builds on an earlier contract theory literature from the early 1990s that studies when a principal should contract with a group of agents to encourage side-contracts between them as opposed to contracting individually with each agent.[3]

In a survey article, Ghatak and Guinnane (1999) summarize the literature on joint liability by identifying four channels through which this contract feature can help institutions improve repayment: (i) *adverse selection:* ascertaining the riskiness of borrowers (Ghatak (1999; 2000), N'Guessan and Laffont (2000), and Sadoulet (2000)) or by the insurance effect that results from diversification even if borrowers do not know each other well (Armendariz de Aghion and Gollier (2000)), (ii) *ex-ante moral hazard:* ensuring that the funds will be used properly (Stiglitz (1990) and Laffont and Rey (2000)), (iii) *monitoring*: ensuring that the borrower tells the truth in case of default about her ability to pay, (iv) *voluntary default, or ex-post moral hazard*: enforcing repayment if the borrower is reluctant to pay (Besley and Coate (1995)). Group liability contracts in theory can lead to higher repayment because borrowers have better information about each other's types, can better monitor each other's investment, and may be able to impose powerful non-pecuniary social sanctions at low cost.

However, there are other theories that suggest that group liability may instead jeopardize repayment. For example, Besley and Coate (1995) point out that borrowers who would repay under individual liability may not do so under group liability. This situation may arise if members realize that they cannot repay as a group. In this situation, since no further loans will be granted (if rules are adhered to), members that could otherwise repay decide to default because the incentive of future credit is not longer present. This model also demonstrates that social collateral can help

[3] Examples of this literature include, but are not limited to Holmstrom and Milgrom (1990), Varian (1990) and Arnott and Stiglitz (1991).

make joint liability work better than individual liability (baring the strategic default situation mentioned above). However, Sadoulet (2000) argues that "social collateral" induced by group liability is not sufficient to ensure high repayment rates. Chowdhury (2005) develops a model that abstracts from adverse selection but shows that joint liability alone cannot mitigate an ex-ante moral hazard problem. In his model, either sequential lending as introduced by the Grameen Bank, where borrowers in a group do not all get the loan at the same time but sequentially, or monitoring by the lender combined with joint liability, makes group-lending contracts feasible. Despite being less efficient than peer monitoring, if monitoring by the lender is not too costly, then contracts that stipulate only monitoring by the lender may also be feasible, such as the individual liability contract of Green Bank of Caraga in the Philippines studied here (and put forward by ASA in Bangladesh, as discussed earlier), which keeps the group "logistical" aspects of the program but removes the joint liability.

Even if joint liability does not jeopardize repayment, theory also suggests it may do no better than individual liability. Rai and Sjostrom (2004) show that both individual and group liability alone can be dominated by a contract that elicits truthful revelation about the success of the peers' project. In their setup, high repayment is triggered by the ability of banks to impose non-pecuniary punishments to members according to their reports about their success and that of others. More importantly, if borrowers can write contracts with one another (i.e., side-contract), the effectiveness of group liability contracts will be limited.

Despite being the focus of much of the theoretical literature on group liability, repayment is only one outcome of interest to the lender, because its ability to retain good borrowers and attract

new ones is equally important to assess the overall profitability. Indeed, an institution with perfect repayment may be more profitable with lower repayment but a larger client base.[4]

III. Experimental Design and Data Collected

A. Experimental Design

The Green Bank of Caraga, a for-profit, regulated rural bank operating in central Philippines, conducted a field experiment in which they removed the group liability component of their Grameen-style[5] group liability program, called BULAK.[6] Typically a center starts with 15-30 individuals residing in the same barangay (community). Centers grow in size as demand increases, without predetermined maximum sizes. Within each center, members divide into groups of five. Under the normal group liability system, those in the group of five are the first layer of liability for any default. Only if those five fail to pay the arrearage of an individual is the center as a whole responsible for an individual.[7] New members joining an existing center are also assigned into groups after mutual agreement is reached. If at one point in time there are enough new members to form a new group of five, they may do so. Across the central Philippines, Green Bank has over 12,000 clients in over 400 BULAK centers in 27 branches. This study was conducted on the island of Leyte, and all 169 centers on the island were included in the sample frame.

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[4] In related papers, Madajewicz (2005) and Conning (2005) study when monitoring is best done by the lender and when it is best left to the peers. They both find that wealthier clients prefer individual liability loans. We cannot test the validity of this prediction because in this field experiment, loans are not backed by any form of physical collateral, so comparable (and relatively poor) borrowers are subject to one or the other form of liability.

[5] This is a Grameen "style" program since the bank conducts some basic credit evaluation, and does not rely entirely on peer selection. The bank's evaluation steps include essentially two components: physically visiting the business or home to verify the presence of the enterprise and its size, and an assessment of the repayment capacity of borrowers based on the client-reported cash-flows of their enterprise.

[6] Bulak means flower in Tagalog, but is also the acronym for Bangong Ug Lihok Alang sa Kalambuan, which means "Strive for Progress."

[7] Although many institutions that have this two-tier structure on paper do not enforce it in practice, Green Bank does enforce it. The payment of all members in a group is collected by the credit officer from group officials at the meetings. In addition, group members sign as co-makers for the rest of group members, thereby becoming the first to be liable if another group member is in default.

All loans under the BULAK program are given to micro-entrepreneurial women for their business expansion. The initial loan is between 1,000 - 5,000 pesos (roughly $18 - $90).[8] The increase in loan size depends on repayment of their last loan, attendance at meetings, business growth, and contribution to their personal savings. The interest rate is 2.5 percent per month, calculated over the original balance of the loan. The client has between 8-25 weeks to repay the loan, but payments must be made on a weekly basis during the center meeting.

As part of the BULAK program, clients are also required to make mandatory savings deposits at each meeting. At loan disbursal, each member deposits 100 pesos plus two percent of the loan amount into savings. In addition, each member must pay an additional ten percent of their weekly due amount (principal plus interest) into their individual savings account. Member savings may be used to repay debts and also act as collateral, although in this last case there are no fixed rules. Finally, 10 pesos ($0.18) per meeting are required for the group and center collective savings account. The center savings cover mostly the construction of the center meeting building (a small house or hut in the village) and other center activities, or as a last resort to repay member loans if the center is being dissolved and default remains.[9] The group savings is held as collateral to cover arrearage within each group.

In the experiment, the Green Bank randomly converted *existing* centers with group liability loans to individual liability loans. All other aspects of the program remain the same (including attendance at center meetings and weekly payment made in groups).[10] Hence, the only two features that changed are the group liability and the savings rules.[11] By removing the group liability, no

[8] Based on exchange rate of 56 Philippine Pesos = 1 US Dollar.
[9] In our observation, this never occurred.
[10] It is useful to note that although the choice was effectively voluntary (a group could, if they wanted, complain about the switch and remain with group liability), not a single group complained. Quite to the contrary, researchers typically observed groups clapping when the announcement was made.
[11] All other loan terms remained the same in both treatment and control groups, including the dynamic incentives, the interest rates, the lack of collateral, the length of the loan, the frequency of the payment, etc.

member is held liable for another member's default. Thus, members are no longer forced to contribute towards the repayment of other members in default and they are no longer required to sign as co-maker of loans for other group members. If Green Bank had enforced a stricter group liability rule, the change to individual liability would also have entailed the issuing of new loans when other clients were in default. In practice, however, loans were already being issued to clients in good standing even when other individuals were in default.

It is important to note that although this change removed the group liability rules, it did not remove all social influences on repayment. Group payments were still done at the weekly meeting. Although after the conversion group meetings did not include a discussion or review of who was in default, the fact that all were at the meeting provided ample opportunity for people to learn of each other's status. Thus, many clients may still repay not out of social pressure, but rather out of concern for their social reputation. One's reputation is important, for instance, in order to secure informal loans in the future from their peers, outside the scope of the lending program.

The second component of the treatment involved the savings policy. The group and center savings were dissolved and shifted into individual savings accounts. The total required savings deposits remained the same.[12] With the conversion of group and center savings into individual savings, there no longer were funds set aside to pay for center activities. Thus, all center activities in treatment groups were to be paid for out of individual accounts on a per-activity basis.

Critical to the design is the fact that treatment centers were converted from existing centers, and not newly created. By comparing the repayment behavior of *existing* clients in group-liability centers and converted centers, we are able to isolate the impact of group liability on employing peer pressure to mitigate moral hazard.

[12] The new Personal Savings quota will be the previous amount of Personal Savings (based on the loan amount), plus P20, the amount previously given for Center and Group savings.

Our sample includes 169 BULAK centers in Leyte, handled by 11 credit officers in 6 branches. Among these, 161 had been created before August 2004, when the experiment started. Green Bank's main competitors are NGOs (such as TSKI) which mostly offer group-liability loans and cooperatives (such as OCCCI) which offer individual liability loans. At the time of the first conversion, about 28 percent of the existing centers were located in barangays with no other competitor, 53 percent of the centers were in barangays with at least one NGO and 47 percent of the barangays with Green Bank presence had at least one individual liability lender.[13]

Figure 1 shows the timeline of the experiment and data collected. In August 2004, we implemented the first wave of conversions in 11 randomly selected centers (one center per field officer). Three months later, in November 2004, we randomly selected 24 more centers to be converted to individual-liability (wave two). In the sample frame for this randomization, we included 8 additional centers formed after August 2004. Finally, nine months after wave one, in May 2005 we randomly selected 45 more centers from the 125 remaining (wave three). As of May 2007, 34 months after the start of the experiment, the final month for which we have administrative data, there are 56 converted centers and 50 original (group-liability) centers (26 converted and 37 original centers were dissolved in the past three years). Conversions were done in the three waves because of operational and repayment concerns. In particular, Green Bank wanted to assess early results to ensure default did not rise substantially before converting all centers randomly assigned to treatment.[14] We stratified the randomization by the 11 credit officers in order to ensure a fair implementation across credit officers in terms of potential workload and risk and also orthogonality with respect to credit officer characteristics. In addition, we periodically checked with credit

[13] We run separate regressions for barangays with individual liability lenders and barangays with group liability lenders. The results do not differ significantly from those of Table 5 using all barangays and thus are not reported.
[14] Note that increased default is not necessarily bad for the bank, since the bank cares about profits not merely default.

officers and conducted surprise visits to center meetings and clients' homes to confirm that converted centers had individual liability and that control centers had group liability.

B. Data Collected

We use data from five sources. First and most importantly, we use the Green Bank's full administrative data on repayment and savings, loan sizes and client retention rates for all 3,272 clients who were active members of the 161 centers at the time of the first randomization in August 2004, as well as the eight new centers opened after August 2004. We have data from one year prior to the first wave of the experiment and 24 months after the last wave of experiment, thus enabling us to incorporate center-level fixed effects in our analysis with pre and post observations. Second, we use data from an activity-based costing exercise that credit officers conducted, where for a given week, they had to keep a log of how they allocated their time across the different tasks they typically perform (e.g., attending meetings, assessing new clients, enforcing repayments, etc). Third and fourth, we use a baseline and follow-up social network survey, conducted in November 2004 and January 2006.[15] Fifth, we use a survey of clients conducted in November 2005 (about one year after the start of the experiment) designed to understand the observed differences between converted and control centers. In this survey, we employed stratified random sampling from 1) baseline clients, 2) new clients who joined the program over the three months prior to the survey, and 3) clients who dropped out within the three months prior to the survey.

Table 1 presents summary statistics and some orthogonality checks that show that the randomization yielded observably similar treatment and control groups, when looking at the pooled treatment group. This holds when we examine group-level measures (Panel A) as well as individual level measures (Panel B).

[15] Note the social network baseline was conducted after the after the first wave of conversions but before the second and third waves, hence the social network analysis will not include the first wave of the sample frame.

IV. Empirical Strategy and Primary Results

We test several hypotheses that emerged above in the discussion of the relative merits of group versus individual liability. The first analysis uses the individual loan-borrower as the unit of observation, and examines the impact on key variables that affect bank profitability, such as repayment, savings deposits held at the Green Bank by borrowers, and loan size (Table 2), and client retention and success attracting new clients (Table 3). Then we analyze the same outcomes at the center level (Table 4). Next we will examine the costs to the bank from making this conversion (Table 5). Then we analyze the mechanisms through which activities changed within the bank; this provides evidence of the experimental design being implemented as instructed, and also evidence of specific peer screening, monitoring and enforcement activities (Tables 6 and 7). Last, we examine the social network data, examining heterogeneous treatment effects on default (Table 8) as well as impacts on social networks themselves (Table 9).

Throughout the analysis, we define a "treated" loan to be one that matures after the conversion from group to individual liability. In other words, we consider loans that have any exposure to individual liability as treated cycles.[16]

Table 2 Panel A presents the primary results. The specifications use individual level data, with standard errors clustered at the center level. The sample frame includes only clients that were borrowers at the time of the initial randomization. This allows us to focus analytically on the *ex-post* changes in behavior generated by group versus individual liability, holding constant a sample frame of individuals screened under a group liability regime.

[16] Alternatively, the treated cycle could be defined as all loans released after the conversion. Results are robust to this alternative definition of treated cycle.

Specifically, we estimate a difference-in-difference (using pre-post and treatment-control data) model using OLS:

$y_{igt} = \alpha + \beta T_{gt} + \delta_t + \theta_g + \varepsilon_{igt}$,

where the subscript *i* refers to the individual, *g* the group, and *t* the time period, *T* is an indicator variable if center *g* is under an individual liability regime at time *t*, δ_t are time fixed effects and θ_g are center fixed effects. Thus, β is the coefficient of interest.

Table 2 (Panel A, Columns 1, 2, 3 and 4) shows that the conversion to individual liability had no adverse effect on client repayment for the baseline clients. Given that the default rate is very low, the impact of conversion can be seen as a one-sided test, where at best there is no increase in default. Not only is the point estimate close to zero, but most economically significant effects can be ruled out: the 95 percent confidence bound on proportion of loan balances in default at the time of maturity (Column 3) is a mere -0.128 ± 0.239% and the 95 percent confidence bound on the likelihood of any default 30 days after maturity (Column 4) is 0.001% +/- 0.004%. Thus, we do not find strong enough evidence to support the "social collateral" story of Besley and Coate (1995) that predicts higher repayment for group liability loans on average.[17] However, as noted elsewhere, the "conversion" to individual liability does not remove all "social collateral" since repayment is still public, and someone may repay in order to protect their reputation in the community.

Table 2 Panel B shows similar results for the *new* clients. Thus in this sample frame, selection is confounded with monitoring and enforcement. Yet even here, those selected under individual liability and given individual liability loans are also no more likely to default than those selected under group liability and given group liability loans. The 95% confidence banks also

[17] Below, we will examine heterogeneous treatment effects (Table 9) where we will find evidence that default increases for those with lower baseline measures of social collateral.

allow us to rule out economically large effects, although they are slightly larger than those for the baseline clients in Panel A.

Table 2 Column 5 and 6 shows savings behavior and loan balances for both baseline and new clients. We find a reduction in savings, though statistically insignificant, and a reduction in loan size for all clients. One may have expected higher savings in individual liability since the savings deposits were not held as collateral for other people's loans, the expected return on savings is higher under individual liability (assuming there is some default in expectation under group liability).[18] Greater reduction in loan sizes on new clients under individual liability could be due to several mechanisms: an indication of the selection of new entrants (poorer individuals were screened out under group liability, and are now able to join), and/or more restrictive lending by credit officers in individual liability than in group liability centers with respect to approved loan sizes. In qualitative interviews, credit officers deny that they restrict loan sizes of clients under individual liability centers. However, we do not have quantitative data to provide strong evidence to support one or the other of these mechanisms.

Of course, the conversion to individual liability does imply both a reduction in peer pressure and a potential increase in bank pressure to repay (see Chowdhury, 2005). The empirical analysis addressed above concludes that the net effect is nil. To confirm that in fact the conversion was adhered to and group liability was not imposed in the treatment centers, we ask current members the reason why others dropped out. Appendix Table 1 shows these results. Under individual liability, individuals are less likely to be forced out of the center in net (Column 1), but importantly Column 2 shows that individuals are less likely to be forced out by their peers and more likely by the credit officer.

[18] This assumes the substitution effect is larger than any income effect in terms of the elasticity of savings with respect to return.

Table 3 uses a Cox proportional hazard model to estimate the likelihood of dropout in each given time period. While for baseline clients we find clients are slightly *more* likely to stop borrowing as a result of conversion to individual liability (but this is true only for those with above median loan sizes), for new clients we find the opposite, that those with above median loan sizes are *less* likely to stop borrowing. Dropout as an outcome variable is naturally ambiguous: from a borrower's perspective this could be a sign of success, that the loan successfully addressed their cash needs in the enterprise or their personal life and they no longer need credit. Or, alternatively, and specially for new clients, dropout could be a sign that once in the program, the client learned that it was not well suited to them, that it caused issues in their personal life, social life, or business to have the debt burden.

Table 4 examines the main outcomes at the center level. We estimate the following specifications using OLS:

(1) $y_{gt} = \alpha + \beta T_{gt} + \delta_t + \theta_g + \varepsilon_{gt}$,

where y_{gt} is either the proportion of missed weeks, center size, retention rate,[19] new accounts, number of dropouts or center dissolution for center g at time t, δ_t is an indicator variable equal to one for time period t (time fixed effect), θ_g is a center fixed effect, and T_{gt} is an indicator variable equal to one if group g at time t had been converted to individual liability. The time fixed effects refer to three-month time periods (since individuals within centers do not get issued loans at the same time). The coefficient of interest is β. We test whether the liability rule matters by examining whether the coefficient β is significantly different from zero. Note that here, since the unit of observation is the center (at a certain point in time), we use information from *all* clients who belonged at each point to the center between August 2004 and January 2006.

[19] The retention rate between t and t+1 is defined as the percentage of clients at t that are still clients at t+1.

As with the individual-loan specifications in Table 2, we also find no change in default at the center level (and with the sample frame effectively combining baseline and new clients). We also find that individual liability is much better at attracting new clients (Panel B, Column 3), leading to larger centers (Column 1) and that individual liability makes existing centers 13.70% points less likely to be dissolved (Column 6). This final result is the largest, and has important practical implications, since dissolution of groups after two to three years is a commonly cited concern among microfinance institutions.

V. Additional Results on Specific Mechanisms

We now turn to three sets of auxiliary data collected after the first year of the experiment.[20] First, we examine the results of the activity-based costing exercise completed by the credit officers in order to measure the change in their allocation of their time across centers. Second, we examine the results of a client follow-up survey conducted in November 2005 (over one year after the initial conversion) on clients in both the treatment and control groups. This survey includes several questions intended to tell us more about three possible mechanisms that could be influenced by the liability structure: center activities, selection and the flow of information (monitoring). The survey was conducted during center meetings and was administered to a sample of active members, including individuals who were members at the time of the conversion as well as new clients who entered afterwards.[21] Third, we use social network data collected before the intervention and again one year later to examine the impact on social networks, as well as heterogeneous treatment effects for groups with different preexisting levels of social networks.

[20] These results were also reported in an unpublished working paper (Giné and Karlan 2006), but are being combined into this paper in order to provide the richer context and understanding of mechanisms that are behind the results.

[21] Since meeting attendance is compulsory, we should not be concerned with having a bias sample of survey respondents. In any event, we compared past repayment between respondents and non-respondents in converted and control centers and found no statistical differences across samples (largest t-stat is 0.82).

A. Lender Costs: Activity-Based Costing Exercise

It is important from a sustainability perspective to examine the complete impact on the lender of such a change from group to individual liability. If the lender spends more money on credit officer labor in order to screen, monitor and enforce loans then this is a necessary component of the analysis. In order to evaluate to what extent this was true, we conducted an activity-based costing exercise in which each credit officer kept a detailed diary of all activities for one week in the month of August 2005. We then attributed their activities to either repayment (preparing for center meetings plus collection and processing of repayments outside of the meetings), center meeting, monitoring, enforcement and/or re-loan activities. Table 5 reports these results. We find no statistically significant differences in the way credit officers allocated their time, and furthermore the point estimates are actually the opposite of what one may have expected on enforcement. On approval and processing of new loans (Column 7), credit officers do spend more time under individual liability, although again this result is not statistically significant.

B. Center Activities

The client follow-up survey asked questions about center penalties for missing meetings, leaving early and missing payments as well as various activities such as anniversary, Christmas and snacks during the meeting. Table 6 reports changes in penalties (columns 1 and 2) and activities between treatment and control centers. We find that treatment centers impose lower penalties, possibly because meetings run smoother now that there is less need to enforce peer pressure among clients. However, the conversion to individual liability may have resulted in lower center cohesion as evidenced by the lower probability of social events (not significant) and the lower amount spent (significant for Christmas parties).

C. Selection and Monitoring

Four sets of analysis provide insight into the changes in the selection of clients and monitoring resulting from the change in liability. We asked each member how well they knew the new members that had joined the center since intervention began. Table 7 Columns 1 and 2 show these results. We find that the prior members are *more* likely to know new members well under individual liability than under group liability. This is striking, given the typical assumption that group lending programs encourage peers to screen each other. However, this is consistent with evidence that the depth of family relations within a group is correlated with default (Ahlin and Townsend 2007). Under individual liability, peers no longer fear the acrimony of having to punish someone close to them if there is default, and hence are more willing to invite in their closest friends and family. New members, on the other hand, are *less* likely to know the other new members. Since new members are typically not the ones who bring in new members, this indicates that groups are making fewer *group* decisions on whom to admit and instead individuals are inviting their close friends or family. Thus prior members are closer to the new members, and new members are more distant to the other new members. This is also consistent with the fact that new members in treatment centers are less concerned with screening and learning about other new clients.

Second, we examine how well individuals know the "type" of the other members in the group. We report these results in Table 7 Columns 3-12. We asked each individual five questions: (1) What is the business of person X? (Columns 3 and 4), (2) What is the required installment amount for person X? (Columns 5 and 6), (3) How many weekly installments did person X miss over the past three months? (Columns 7 and 8), (4) Did person X miss any payments over the past three months? (Columns 9 and 10), and (5) Do you think person X will miss some payments over

the next three months? (Columns 11 and 12). We do not find any change in ability to report the peers' businesses, but we do find *lower* levels of ability to report who has missed payments (hence suggestive evidence of reduced monitoring, although also explained by simply not having to participate in repaying that person's missed payments) and lower levels of ability to *predict* who will or will not default. Again, this is evidence of lower monitoring, since it implies individuals are less informed about the status of each other's business and lives and, hence, their ability to repay their loans.

The third result on selection looks at the distribution of ability to pay (rather than observed repayment) among existing clients and new clients in treatment and control centers. We asked how many times in the last 3 months they had difficulty in repaying the loan, regardless of whether or not they ended up completely repaying the loan installment. We believe that this measure (rather than observed default) captures the combination of "type" (selection) and ex-ante moral hazard (effort) that is generated from group versus individual liability because being in default is only observed when the member does not have enough cash *and* other members fail to contribute toward the installment. Since side contributions are compulsory in control centers but only voluntary in treatment centers, differences in default rate would come from not only different ability to repay but also different contribution levels from fellow group members.

In a world where creditworthiness is verifiable through a costly screening process, there are two groups of borrowers that would join only individual liability centers. On one end of the creditworthiness distribution, bad risks would be screened out and rejected from group liability centers, but could be allowed into individual liability centers because current borrowers lack the incentive to screen (and the lender may be unable to screen as effectively as the peers). On the other end of the distribution, good risks may have little to gain and much to lose from the implicit

risk-sharing agreement imposed by group liability. They decide not to join group liability centers because they fear being forced to help other members repay more frequently than they will receive help. Yet, they join individual liability centers because repayment only depends on their performance. The left panel of Figure 2 plots the distribution of the number of times new clients had difficulty making their payments, while the right panel plots the same distributions for baseline clients (those borrowing at the time of conversion, hence screened under group liability). Interestingly, the distributions of baseline clients in treatment and control centers look alike, but the distribution of new clients in treatment centers is more concentrated around zero than that for control centers. This suggests that good risks were reluctant to join group liability centers but do so after these centers are converted to individual liability. We do not find evidence of bad risks also joining individual liability centers. A Kolmogorov-Smirnov test of equal distributions between treatment and control centers is rejected at 10 percent for new clients but not for baseline clients.

The fourth and last result on selection focuses on the interaction between demand and the competitive setting. Did individuals increase or decrease their borrowing with other lenders after the Green Bank converted to individual liability? The results are reported in Table 8, where it is clear that the answer depends entirely on whether the other lender is a group or an individual liability lender. If we restrict the analysis to barangays in which the competition is engaged in *group* lending, then we find that baseline Green Bank clients are more likely to borrow from them after their group is switched to individual liability. This indicates perhaps that *some* individuals among baseline clients prefer group liability (perhaps for the risk-sharing component of group liability) and hence when the group liability is removed they remain with the Green Bank but also then seek a loan from a separate group liability program. On the other hand, when the competition only offers individual liability, we see a *reduction* in the likelihood that baseline clients seek a loan

(although this result is only significant in the tobit specification on loan size, and has a p-value of 0.17 for the probit specification). This indicates, again, that baseline clients prefer one or the other type of liability: when the Green Bank switches to individual liability, individuals who prefer it are more satisfied, and individuals who prefer group liability seek supplementary loans from other group lending programs. Results are less conclusive for the new clients, perhaps due to the lower sample size.

D. Heterogeneous Treatment Effects

Theoretically, the shift to individual liability may have worked better or worse in groups with different levels of preexisting social networks. If social collateral keeps repayment high, then "releasing" the collateral by converting to individual liability (and replacing the social collateral with bank pressure and mere public disclosure of default, but not group liability) may lead individuals with higher social capital to have lower repayment rates. On the other hand, if individuals have higher social capital because of their stronger and more trustworthy characters, then the shift to individual liability should be less likely to influence their decision to repay (since they are a "trustworthy" type, perhaps irrespective of whether social collateral is at stake or not).

We test the net effect of these possible mechanisms in Table 9 by interacting treatment with one of various social network measures. The social network data were collected during the center meetings in all centers in between the first and second wave of the randomization (for this reason, the first wave centers are removed from this analysis, since their "baseline" occurred *after* the treatment began). The survey procedure was simple: in public, in the meeting, a surveyor asked an individual to stand up and then asked all other members in the group to raise their hand if their answer to a specific question about their relationship with this person was "yes." This method prevents one from asking highly personal questions (e.g., "Would you lend to X if they asked

you?") but does allow for higher precision on questions which are of public knowledge (since one has the attention of everyone in the group to facilitate answering the questions). We categorize the social network questions as either "knowledge" or "trust". "Knowledge" includes: family, friend since childhood, buys products or services, or visits once a week for social purposes. "Trust" includes has given a loan to the other person outside of the Green Bank program, voluntarily helped them pay their Green Bank loan, or turns to this person for advice or help.

We then examine the primary repayment measure: percentage of loan past due at the time of maturity. We find that default is lower for those with *stronger* social networks relative to those with weaker social networks. This is true both for "knowledge" measures of social capital (Column 5) and the pooled aggregate index (Column 10), but not for the "trust" measures (Column 9).

These results may be an indication that those identified as having stronger "trust" social networks are in fact a more trustworthy "type," hence the shift to individual liability has no adverse effect on their likelihood of repaying. In other words, being "trustworthy" is a personal characteristic that determines ones social networks and also leads to higher repayment of loans. This is consistent with results from Karlan (2005), in which trustworthy behavior in a lab experiment in the field predicted repayment of loans one year later to a microcredit organization in Peru. An alternative hypothesis is that those with stronger social networks must repay their loan in both setups in order to protect their social networks. Those with weaker social networks have less to lose from the "shame" of being seen in default (less social collateral, in the model of Besley and Coate (1995)), and hence the shift to individual liability generates higher default. Of course, we cannot say conclusively why this result is heterogeneous, but it does suggest that the existing literature on the link between social capital and repayment within group lending is an important

literature, and that more needs to be learned about the circumstances under which social capital helps versus hurts both the repayment and growth in lending programs.

E. Changes in Social Networks

Next, we examine the results of the follow-up social network survey. In Table 10 we show these results. As we have both baseline and follow-up data on social networks, we are able to employ a difference-in-difference empirical specification. We find only one social network channel to have changed: likelihood to help another person with a side-loan in order to help her make her loan payment. Social networks should change under individual liability for many reasons. First, with fewer incentives to monitor, the *quantity* of interaction may fall. On the other hand, the *quality* of the interaction may increase since they no longer have to pressure each other to repay. From selection, as found earlier, we find groups more connected because individuals are inviting closer friends and family to join the center. However, in net, we find no significant impacts on social networks, barring the reduction in likelihood to make side-loans to each other.

VI. Conclusion

The choice of group or individual liability is perhaps one of the most basic questions lenders make in the design of loan products in credit markets for the poor. Despite the importance of this decision, past empirical research on group and individual liability has not provided policymakers and institutions the clean evidence needed to determine the relative merits of the two methodologies. In this study, we use a randomized controlled trial to evaluate the impact of group liability on the performance of clients and the profitability for the lending institution. Naturally, these are from one lender in one region of the Philippines, but this is a transition we are witnessing around the world; thus this is not a highly unusual lender for wanting to make this conversion. As with all empirical research, many questions persist as to whether these findings will hold in other

countries, in other cultures and with other lenders. Although this decision by the bank to shift from group to individual liability is not unusual, we still must ask whether the culture or macroeconomic conditions, for instance at the time of this study, led to similar outcomes for both individual and group borrowers, and whether under different external conditions differences in repayment would arise. Social science, just like physical sciences, needs replication in order to solve these issues.

The results are striking, however, in two respects. First, we find that individual liability compared to group liability leads to no change in repayment but did lead to larger lending groups, hence further outreach and use of credit. Second, we do find statistically significant evidence of some of the *mechanisms* discussed in the group liability literature, such as screening and monitoring, but we simply do not find that it adds up in an economically meaningful way to higher default.

One could argue that the results lend support to the screening story of Ghatak (2000) because the main subjects of the paper are borrowers who selected into the program under joint liability, and thus would tend to be safer. The finding that after the removal of group liability monitoring goes down but repayment improves, suggests, at the very least, that peer monitoring or peer pressure are unnecessary. However, the lack of default for *new* members too suggests that the answer is not that simple, that even new clients brought into centers built under group liability repay their loans. This could be a result of group liability creating well-functioning groups, and even new members adhere to the practices and policies of the pre-existing members.

The larger new centers, combined with the lack of increased default, suggests that the screening process has changed without worsening repayment. The findings seem consistent with the model of Chowdhury (2005), where the removal of group liability has probably resulted in an

increased monitoring and screening done by credit officers, although we did not find an increase in their workload.

Our findings are also consistent with the work of Greif (1994) in a rather different context. He suggests that collectivist societies, like joint liability institutions in our setting, are based on the ability to impose social sanctions to players that deviate from the agreed norms of conduct. But this requires a level of trust and knowledge among players that may hinder expansion of the set of players thus leaving efficient trades unrealized. A more individualistic society requires fewer exchanges of information among players and is thus able to grow faster. It does necessitate, however, well-functioning formal institutions to enforce contracts. In our context, shifting some of the burden from clients to credit officers strikes this balance successfully. The institutional enforcement is sufficient to recover loans without group liability, and the individual liability allows for more growth and outreach for the lender.

As mentioned, the cleanest analysis is on a sample of individuals who joined a group liability program. This has the advantage of allowing us to isolate moral hazard effects, but has the disadvantage of restricting our ability to predict whether peer screening, without monitoring and enforcement, is an effective tool for mitigating adverse selection. Furthermore, we cannot assess whether centers must achieve a certain age before the group liability can be successfully removed. Thus, while we contribute to understanding how such conversions work, and this allows us to test particular theories more precisely, a next step is imperative: to know whether groups can be sustainable if begun under individual liability.

In sum, the recent trend of microfinance institutions expanding their individual lending products (or in some cases, shifting from group liability to individual liability) may help deepen outreach and provide more flexible microfinance products for the poor. Our findings suggest that

the innovators finding methods of lending individually (and more flexibly) to the poor may be moving in the right direction. Certainly, as with all empirical research (experimental or non-experimental), replication is imperative for both policy and theory in order to learn when these findings hold and when they do not.

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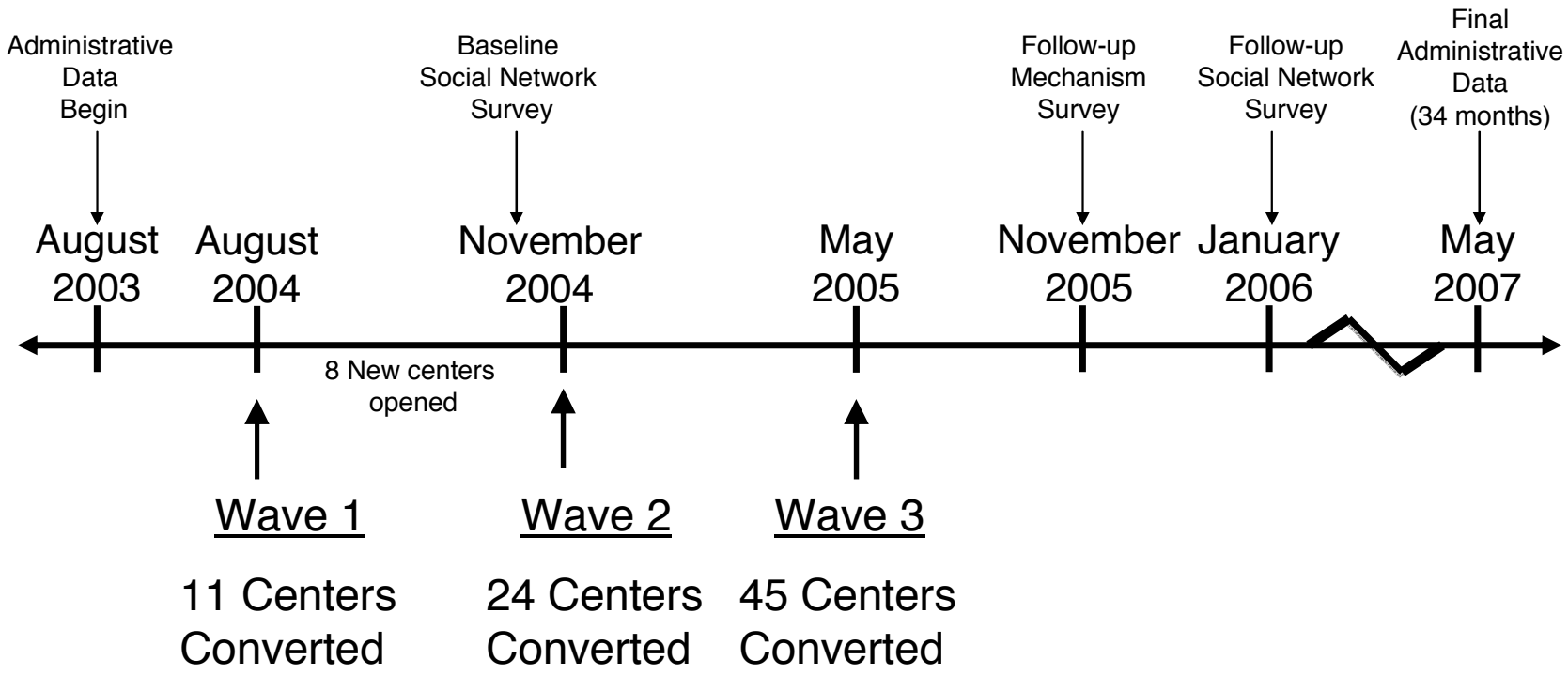
Figure 1: Experimental Design



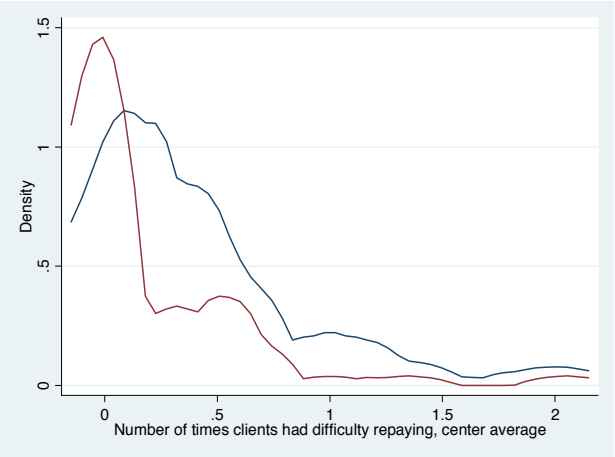
Total 169 Centers

80 Treatment

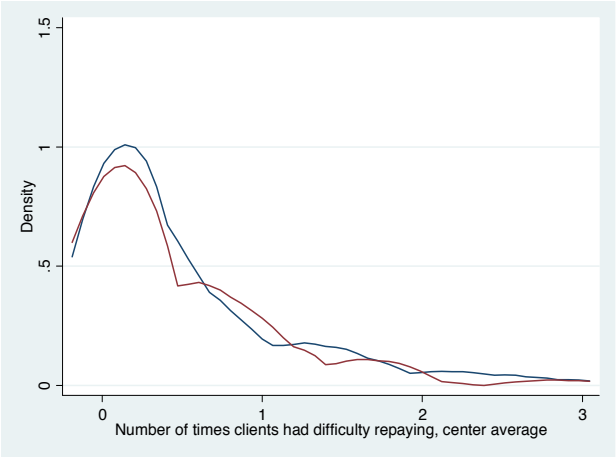
89 Control

Figure 2: Kernel Density: Number of weeks that clients had difficulty repaying
3 months prior to the November Survey, Center average

The left panel shows the kernel densities of the center average of the number of weeks in difficulty repaying over the three months prior of the survey in November 2005 for treatment centers (red) and control centers (blue). The right panel plots the same distribution for baseline clients. The sample includes clients who attended the center meeting when the survey was conducted.



New Clients



Baseline Clients

Kolmogorov-Smirnov Test

	New Clients	Baseline clients
P-value	0.109	0.556
(corrected value)	0.076	0.494

Table 1: Summary Statistics

	All	Control	Treatment	p-value on t-test of difference: (2) - (3)	Treatment			p-value on F-test for (5), (6) and (7)
					Wave 1	Wave 2	Wave 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Center Performance, pre-intervention (Aug 2004)								
Total number of active accounts	20.224	20.262	20.182	0.964	20.727	18.666	20.756	0.914
	(0.884)	(1.245)	(1.263)		(2.649)	(2.684)	(1.663)	
Number of new clients	3.159	3.641	2.644	0.190	2.800	1.350	3.209	0.274
(May-Aug 2004)	(0.380)	(0.594)	(0.460)		(1.459)	(0.509)	(0.655)	
Number of dropout clients	1.603	1.551	1.658	0.802	1.000	0.700	2.256	0.124
(May-Aug 2004)	(0.211)	(0.212)	(0.374)		(0.298)	(0.179)	(0.612)	
Retention	0.904	0.900	0.909	0.685	0.944	0.949	0.883	0.282
(May-Aug 2004)	(0.012)	(0.017)	(0.016)		(0.019)	(0.017)	(0.024)	
Proportion of missed weeks over cycle	0.060	0.054	0.068	0.332	0.113	0.054	0.063	0.264
(May-Aug 2004)	(0.007)	(0.009)	(0.011)		(0.049)	(0.016)	(0.013)	
Pastdue (maturity) / Scheduled total amortization due (in 100s)	0.092	0.000	0.193	0.258	0.005	0.329	0.000	0.397
	(0.085)	(0.000)	(0.178)		(0.005)	(0.304)	(0.000)	
Pastdue (30d) / Scheduled total amortization due (in 100s)	0.001	0.000	0.001	0.298	0.005	0.000	0.000	0.082
	(0.001)	(0.000)	(0.001)		(0.005)	(0.000)	(0.000)	
Pastdue (90d) / Scheduled total amortization due (in 100s)	0.000	0.000	0.000	--	0.000	0.000	0.000	--
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	
Total loan amount	122,922.4	124,142.9	121,590.9	0.853	110,636.4	108,500.0	130,377.8	0.771
	(6868.4)	(10580.5)	(8616.4)		(17828.1)	(15613.8)	(12075.5)	
Average Loan size	6,033.2	5,996.1	6,073.7	0.806	5,196.8	6,030.0	6,308.5	0.425
	(157.5)	(220.6)	(226.2)		(473.2)	(410.0)	(312.4)	
Number of active centers, August 2004	161	85	76		11	21	44	
Number of centers in the sample	169	88	81		11	24	46	
B. Individual-level Performance, pre-intervention (Aug 2004)								
Proportion of missed weeks over cycle	0.062	0.059	0.065	0.324	0.083	0.065	0.059	0.185
	(0.003)	(0.004)	(0.005)		(0.016)	(0.008)	(0.005)	
Indicator for having at least one missed week	0.483	0.467	0.501	0.190	0.343	0.557	0.537	0.000
	(0.013)	(0.018)	(0.019)		(0.040)	(0.045)	(0.024)	
Proportion of past due balance, at maturity date	0.080	0.040	0.125	0.439	0.000	0.062	0.184	0.674
	(0.055)	(0.022)	(0.115)		(0.000)	(0.055)	(0.184)	
Past due balance, 30 days past maturity date (binary)	0.001	0.000	0.001	0.286	0.000	0.008	0.000	0.010
	(0.001)	(0.000)	(0.001)		(0.000)	(0.008)	(0.000)	
Total excess savings	319,924.5	286,583.4	357,940.0	0.625	223,869.7	216,725.5	441,811.5	0.740
	(72780.0)	(82775.0)	(123967.1)		(74987.2)	(57842.1)	(197449.3)	
Loan amount	6,107.2	6,143.6	6,069.1	0.570	5,558.4	5,772.7	6,368.7	0.003
	(65.5)	(93.1)	(92.2)		(180.3)	(193.7)	(125.5)	
Number of active clients, August 2004	3,285	1,708	1577		298	394	885	

Standard errors in parentheses. In Panel A, the number of active centers is less than 169 in August 2004 because there are 8 centers that started after the first conversion and added to the sample. T-statistics reported in column (4) is the probability of (column (2) - column (3)) being zero. F-statistics in Column (8) is from a regression of the outcome variable of interest on a set of indicator variables for each of the treatment waves. The exchange rate at the time of the experiment was 52 pesos = US$1.

Table 2: Loan-level Impact on Default, Savings, and Loan Size by Conversion Waves

OLS

Dependent Variable:	Proportion of missed weeks	Indicator for having at least one missed week	Proportion of past due balance, at maturity date	Past due balance, 30 days past maturity date (binary)	Total excess savings	Loan Size
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Baseline clients						
Treatment	-0.010	-0.023	-0.128	0.001	-242.696	-643.713**
	(0.016)	(0.041)	(0.122)	(0.002)	(165.222)	(322.439)
Observations	14333	14333	14333	14333	14332	14333
R-squared	0.18	0.20	0.06	0.03	0.31	0.26
Mean of dependent variable	0.075	0.075	0.220	0.002	6844.599	6844.401
Panel B: New clients						
Treatment	0.000	-0.010	-0.001	-0.001	-342.842	-735.826***
	(0.010)	(0.036)	(0.002)	(0.003)	(255.235)	(215.034)
Observations	6049	6049	6049	6049	6046	6049
R-squared	0.02	0.05	0.01	0.01	0.04	0.05
Mean of dependent variable	0.069	0.385	0.008	0.006	5284.816	5284.345

Robust standard errors clustered by lending centers in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Treatment variable equals one if the loan cycle ends after the conversion in treatment centers; zero otherwise. All regressions use fixed effects for each lending center and month of the maturity date. The sample frame for Panel A is baseline clients, i.e., those who were active at the first conversion in August 2004; the sample frame for Panel B is new clients, i.e., those who joined the program after August 2004 in the control group or after the conversion in each of the treatment groups. Proportion of missed weeks is calculated by the number of weeks in which the client did not make the full installment divided by the number of installments. Total excess savings is defined by the excesss amount of savings that the client deposit beyond the required savings amount over a loan cycle (the value takes zero if the total deposit does not reach the required savings amount). The number of observations in Col (5) is smaller because there are 5 accounts for which the savings data in MIS cannot be matched with the loan data.

Table 3: Impact on Dropout

Cox proportional hazard model, failure = dropout

Dependent Variable: Binary variable equal to one if the client has dropped out

Sample frame: All clients

Sample Frame:	All	Loan size above median	Loan size below median
	(1)	(2)	(3)
Panel A: Baseline clients			
Treatment	1.121*	1.248***	0.832
	(0.071)	(0.087)	(0.113)
Observations	8310	5461	2849
Panel B: New clients			
Treatment	0.857***	0.711***	0.977
	(0.042)	(0.051)	(0.063)
Observations	7157	3643	3514

* significant at 10%; ** significant at 5%; *** significant at 1%. The model estimated is the Cox proportional hazard. Reported are hazard ratios and standard errors in parentheses, calculated assuming within-center clustering. Lower hazard ratio (<1) indicates that clients in Treatment centers stay longer in the program and that conversion into individual-liability is associated with lower likelihood of dropping out. Columns (2) & (3) have unequal sample sizes because 19% of the sample is at the median loan size, and these observations are arbitrarily included in column (2).

Table 4: Center-level Performance

OLS, Probit

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Center performance						
Dependent variable:	Proportion of missed weeks	Pastdue (at maturity) / Scheduled total amortization due	Pastdue (30d) / Scheduled total amortization due	Pastdue (90d) / Scheduled total amortization due	Total loan amount	Average loan amount
Specification:	OLS	OLS	OLS	OLS	OLS	OLS
Treatment	-0.013	-0.487	-0.379	-0.330	8,194.497*	-156.631
	(0.008)	(0.347)	(0.344)	(0.345)	(4,552.822)	(166.569)
Mean of dependent variable	0.07	0.35	0.28	0.21	98387.23	5418.58
Observations	1907	1941	1941	1941	2507	2507
Number of centers	169	169	169	169	169	169
R-squared	0.05	0.01	0.01	0.01	0.22	0.20
Panel B: Entry and dropout decisions						
Dependent variable:	Active accounts	Retention rate	New accounts	Number of dropouts	Dissolved center	
Specification:	OLS	OLS	OLS	OLS	OLS	Probit
Treatment	2.974***	0.032*	1.487***	0.197	-0.013	-0.137*
	(0.608)	(0.017)	(0.399)	(0.275)	(0.016)	(0.078)
Mean of dependent variable	15.36	0.80	2.51	3.16	0.03	0.37
Observations	2507	2017	2017	2017	2017	169
Number of centers	169	169	169	169	169	
R-squared	0.25	0.29	0.07	0.19	0.07	

Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. "Treatment" is an indicator variable equal to one if the center has been converted for a given observation. All regressions except Panel B, Column 6 use fixed effects for lending centers and maturity months, and every center has an observation on each outcome for every three month between August 2003 and May 2007. Panel B, Column 6 uses fixed effects for credit officers and reports the marginal effects for the coefficient on treatment. Total loan amount is the aggregated loan amount disbursed in a center, and average loan amount is the average loan size per client. Both numbers are in pesos (1 US $ = 42 pesos). Panel A, Columns 2-4 excludes centers that had been dissolved in the previous time periods; The sample for Panel A, Column 1 is active centers in which there are matured accouts in each time period.

Table 5: Activity-Based Costing Analysis: Time Spent on Different Activities by Center

OLS

	Total Time	Time on repayment activities	Time on center meeting	Time on loan monitoring	Time on loan enforcement	Time on following up with delinquent clients	Time on reloan
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-0.026	-0.004	-0.035	-0.079	-0.128	-0.072	0.191
	(0.261)	(0.142)	(0.071)	(0.062)	(0.084)	(0.069)	(0.154)
Observations	146	146	146	146	146	146	146
R-squared	0.34	0.24	0.13	0.09	0.08	0.07	0.11
Mean of dependent variable	2.95	1.94	0.66	0.17	0.20	0.16	0.49

Robust standard errors in paretheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions use fixed effect for credit officers. Each cell reports the average time in hours spent on indicated activity per center in a given week in January 2006. Repayment includes preparing for center meetings, travel time, and handling the collection; center meeting indicates the time spent on the actual meeting. Monitoring involves making reports, answering clients' questions; enforcement includes loan utilization check and following up with delinquent clients. Reloan includes conducting credit evaluation, filling/reviewing of loan forms, and releasing the loan.

Table 6: Center activities

Sample framework: Wave 2 and 3 Centers Only (because data collected during social network survey)

				Anniversary		Christmas parties	
	Total penalties	Total enforced penalties	No activity	Likelihood of having a party	Amount spent, conditional on having a party	Likelihood of having a party	Amount spent, conditional on having a party
	OLS	OLS	Probit	Probit	OLS	Probit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-10.095*	-9.548*	-0.004	-0.066	-582.518	-0.002	-695.057*
	(5.583)	(5.613)	(0.059)	(0.096)	(871.233)	(0.076)	(396.256)
Mean of dependent variable	47.85	47.58	0.12	0.46	2047.93	0.76	1218.34
Standard error of dependent variable	2.94	2.96	0.03	0.04	438.30	0.04	198.92
Observations	131	131	113	131	60	131	99
R-squared	0.19	0.20			0.30		0.14

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Penalties include not attending, leaving early from, being late to the meeting, and missing payments. All regressions use fixed effect for credit officers.

Table 7: Knowledge About Other Members of the Center

Clients were asked about (a) how well they knew incoming members who joined the center, and
(b) other members' performances over three months prior to the survey

Sample Frame: Clients who were present at the survey which took place during a center meeting in November 2005

	Knowledge about new members only		Knowledge about all other members									
Sample Frame:	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients
Dependent Variable:	Knew the new member well when they entered the center		Knew Business		Negative absolute value of difference between reported and actual amount of installment		Negative absolute value of difference between reported and actual number of defaults		Knew whether or not the client defaulted		Predicted default	
	Ordered probit (1)	Ordered probit (2)	Probit (3)	Probit (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	Probit (9)	Probit (10)	Probit (11)	Probit (12)
Treatment	0.317***	-0.278**	-0.000	0.018	-4.585	-1.970	-0.091*	-0.259**	-0.018	-0.019	-0.018	-0.059**
	(0.105)	(0.124)	(0.019)	(0.025)	(5.582)	(6.363)	(0.048)	(0.100)	(0.019)	(0.026)	(0.024)	(0.029)
Observations	1692	970	4015	1908	2902	1376	4128	2178	4161	2194	3684	1926
R-squared			0.06	0.08	0.03	0.06	0.29	0.19	0.12	0.15	0.11	0.09
Mean of Dependent variable	1.28	1.13	0.52	0.49	81.92	79.84	-0.67	-0.65	0.78	0.76	0.74	0.78

Robust standard errors clustered by respondents in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal coefficients reported for the probit specifications. All regressions use fixed effect for credit officers. Dependent variable for regressions in columns (1) and (2) is a categorical variable for how well the respondent knew the new member before she joined the program; 0 if did not know at all, 1 if knew a little, 2 if knew well, 3 if knew very well.

Table 8: Current Borrowing from Other Lenders

Sample Frame: Clients who were present at the survey which took place during a center meeting in November 2005

Sample Frame:	Barangays with NGOs offering group-liability loans only				Barangays with Coops offering individual-liability loans only			
	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients	Baseline Clients	New Clients
Dependent Variable:	Has loan from competitor		Loan size from competitor		Has loan from competitor		Loan size from competitor	
	Probit	Probit	Tobit	Tobit	Probit	Probit	Tobit	Tobit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.062*	-0.021	5,039.825***	-449.429	-0.049	-0.028	-8,703.439*	-5,887.80
	(0.034)	(0.051)	(1,907.141)	(1629.29)	(0.035)	(0.029)	(4,856.900)	(4340.99)
Observations	474	269	474	269	476	257	476	257
R-squared	0.07	0.14			0.07	0.10		0.09
Mean of dependent variable	0.11	0.16	653.38	912.64	0.10	0.06	1303.361	464.98

Robust standard errors clustered by lending center in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal effects reported for the probit specifications. All regressions have fixed effect for credit officers. Dependent variable for columns (1)-(2) are binary variable equal to one if the client currently has loans from NGOs; that of columns (3)-(4) are binary variable equal to one if the client currently has loans from COOPs.

Table 9: Impact of Social Network on Default

OLS

Dependent variable: Proportion of past due balance at the maturity date

Sample Frame: Clients who were present at the meeting during the baseline social network baseline survey

	Knowledge					Trust				
	Family	Friends	Buy products	Visit once a week	Knowledge index	Given loan	Voluntary help	Go for advice	Trust index	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment	0.326	0.086	0.621**	0.188	0.860**	0.346	0.277	0.096	0.116	0.871**
	(0.294)	(0.366)	(0.295)	(0.344)	(0.384)	(0.307)	(0.282)	(0.412)	(0.429)	(0.405)
Social network measure	0.123	-0.007	0.218	-0.434	0.331	0.099	1.850	-0.416	-0.143	0.277
	(0.541)	(0.568)	(0.271)	(0.402)	(0.255)	(0.583)	(1.357)	(0.377)	(0.452)	(0.246)
Treatment x Social network measure	-0.929	2.159	-0.980**	0.196	-1.197**	-2.077	-2.566	1.458	0.976	-1.170**
	(0.969)	(2.258)	(0.399)	(0.722)	(0.493)	(1.575)	(2.161)	(2.781)	(2.247)	(0.505)
Observations	4224	4224	4224	4224	4224	4224	4224	4224	4224	4224
Number of center fixed effects	154	154	154	154	154	154	154	154	154	154
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Mean of social network measure	0.111	0.046	0.291	0.132	0.411	0.363	0.015	0.072	0.093	0.419
Standard error of social capital measure	(0.003)	(0.002)	(0.006)	(0.004)	(0.006)	(0.006)	(0.001)	(0.003)	(0.003)	(0.006)

Robust standard errors clustered by lending centers in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions use fixed effect for time and centers. Social network variable is defined by the number of indegree links over maximum number of links possible. This measure reports how prestigious is the member in relation to the group size from a degree perspective (the member has more prestige if he/she receives many links). See below for the definition of social network indices

Social network variables are defined as below:

1 Family: Have known this person since either one was a child (grandparents, parents, siblings, spouses, children, grandchildren, and cousins).
2 Friends: Have known this person since either one was a child (non-family members/relative)
3 Bought products: Have bought products or services from this person
4 Visit once a week: Visit this person house for social purposes at least once a week.
5 Knowledge index: Aggregate of 1 through 4
6 Given loan: Have given this person a loan outside of Bulak.
7 Voluntarily helped: Have voluntarily helped this person repay loans in Bulak.
8 Go for advice: Turn to this person for advise or help for any type of life problem; health, financial, or emotional.
9 Trust: Aggregate of 6 through 8
All: Aggregate of 1through 4, and 6 through 8.

Table 10: Impact on Center-level Social Network

OLS, Difference-in-Difference

	Knowledge					Trust				
	Family	Friends	Buy products	Visit once a week	Knowledge index	Given loan	Voluntary help	Go for advice	Trust index	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment	-0.006	-0.001	-0.019	0.006	-0.018	0.017	0.022	0.011	0.005	-0.012
	(0.041)	(0.005)	(0.041)	(0.026)	(0.045)	(0.020)	(0.020)	(0.024)	(0.024)	(0.043)
Post	-0.015	0.054***	0.002	0.112***	-0.040	0.052***	0.004	0.072***	0.073***	0.066*
	(0.033)	(0.009)	(0.036)	(0.028)	(0.039)	(0.014)	(0.008)	(0.024)	(0.024)	(0.035)
Treatment x Post	-0.031	0.000	0.030	-0.048	0.018	-0.045*	-0.018	-0.035	-0.029	0.013
	(0.045)	(0.012)	(0.050)	(0.037)	(0.051)	(0.024)	(0.022)	(0.036)	(0.037)	(0.050)
Observations	273	273	273	273	273	273	273	273	273	273
R-squared	0.09	0.35	0.24	0.27	0.26	0.17	0.07	0.22	0.21	0.28

Robust standard errors clustered by lending center is in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Social network density is calculated by the number of links divided by the maximum number of possible links. Baseline social network data collected in November 2004. Follow-up data collected in January 2006. All regressions use fixed effect for credit officers.

Social network variables are defined as below:

1 Family: Have known this person since either one was a child (grandparents, parents, siblings, spouses, children, grandchildren, and cousins).
2 Friends: Have known this person since either one was a child (non-family members/relative)
3 Bought products: Have bought products or services from this person
4 Visit once a week: Visit this person house for social purposes at least once a week.
5 Knowledge index: Aggregate of 1 through 4
6 Given loan: Have given this person a loan outside of Bulak.
7 Voluntarily helped: Have voluntarily helped this person repay loans in Bulak.
8 Go for advise: Turn to this person for advise or help for any type of life problem; health, financial, or emotional.
9 Trust: Aggregate of 6 through 8
10 All: Aggregate of 1 through 4, and 6 through 8.

Appendix Table 1: Reasons for Dropout

Sample Frame Restricted to clients who dropped out from the program within the three months prior to the follow-up survey.

	Forced Out Probit (1)	Forced Out by Center or Credit Officer Multinomial Logit (2)
Dependent Variable: Forced Out		
Treatment	-0.089***	
	(0.006)	
Dependent Variable: Forced Out by Center Members		
Treatment		-0.521***
		(0.032)
Dependent Variable: Forced Out by Credit Officer		
Treatment		0.621***
		(0.060)
Observations	550	550
R-squared	0.007	0.016

Robust standard errors clustered by respondents in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Marginal coefficients reported for the probit specifications. The omitted variable for the multinomial-logit model in column (2) is voluntary dropout. "Forced out" and "Forced out by center members" include those clients who "voluntarily" dropped out because she was embarrassed for her bad performance. Dependent variable in column 1 is a categorical variable which equals to one if any respondent reported that the client was forced out by center members or by credit officers, and zero otherwise. Dependent variable in column 2 is a categorical variable which equals to one if any respondent reported that the client was forced out by center members, equals to two if anyone reported that the client was forced out by credit officer, and zero otherwise.