Group versus Individual Liability:

A Field Experiment in the Philippines

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ABSTRACT

Many cite group liability as the key innovation that led to the explosion of the microfinance industry, beginning with the Grameen Bank in the 1970s in Bangladesh and continuing on today in many countries around the world. Group liability is mostly credited with improving repayment rates and lowering the transaction costs of lending to the poor by providing incentives for peers to screen, monitor and enforce each other's loans. Thus group liability is believed to help overcome information asymmetries and thus solve credit market failures. However, some argue that group liability discourages good clients from borrowing, thus jeopardizing growth and sustainability. Therefore, it remains ambiguous whether the net effect of group liability will improve or worsen lender's profits and the poor's access to financial markets. We conducted a field experiment in the Philippines with a large rural bank to examine these issues. We randomly assigned half of the 169 pre-existing group liability "centers" of approximately twenty women to individual-liability centers (treatment) and left the other half as-is with group liability (control). We find that the conversion to individual liability does not change the repayment rate for pre-existing borrowers, and also leads to higher growth in center size by both keeping more pre-existing borrowers and attracting new ones.

I. Introduction

Many credit group liability as the key innovation responsible for the rapid growth of the microcredit movement because of its purported ability to overcome adverse selection and moral hazard problems in credit markets for the poor. In recent years, however, many micro-lenders, such as the Association for Social Advancement (ASA) in Bangladesh, have expanded rapidly using individual lending. The relative benefits and costs of group versus individual liability to both organizations and borrowers remain unknown. Working with a rural lender in the Philippines, we employ a randomized control trial to evaluate the relative merits of group versus individual liability lending. The experimental design allows us to separate selection from moral hazard effects in order to learn more precisely how group liability affects the lending process.

The Grameen Bank in Bangladesh developed a lending methodology based on group liability that is now employed by many NGOs and microfinance institutions around the world. The popularity of this approach can be linked to numerous perceived advantages. Group liability purports to use social capital to improve the screening, monitoring or enforcement abilities of the lender, thus overcoming information asymmetries in the credit markets. Because clients will be held liable for other members' loans, they have incentives to screen other clients so that only trustworthy individuals are allowed into the program. Secondly, repayment is also enforced through clients: they face peer pressure, not just legal pressure, to repay their loans. Another simpler story also explains the popularity: group lending requires lower operating costs (holding loan size constant) because many loans and transactions are consolidated into one.

Thus group liability claims to overcome both adverse selection and moral hazard problems. Yet separating adverse selection from moral hazard is one of the most difficult empirical challenges when studying information asymmetries in credit markets (see Karlan and Zinman (2005) for a

similar experimental separation of adverse selection from moral hazard). In this study we separate selection from moral hazard by "surprising" existing group liability (hence already peer-screened) lending circles and converting them to individual liability. Such conversions are becoming more commonplace in credit markets for the poor as microfinance institutions transition from group to individual liability. So whereas it is useful to understand from a policy perspective how whether such conversions work, it is also imperative to know whether centers can be sustainable if begun under individual liability.

The shift from group liability to individual liability loans has accelerated as the microfinance community learns about some potential pitfalls of group liability lending programs. First, clients dislike the tension caused by group liability. Excessive tension among members could not only trigger voluntary dropouts and deter entry, but worse still, it could harm social capital among members, which is particularly important for the existence of safety nets. Secondly, 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 the client believes that another client will pay it for them, and the bank will not care because they still will get their money back. Third, group liability is more costly for clients since they are often required to repay the loans of their peers. This may lead to higher dropout and more difficulty attracting new clients. Finally, as groups age individuals within the group typically diverge in their demand for credit. Heterogeneity in loan sizes can then create tension within the group, where members with small loans are reluctant to serve as a guarantor for those with large loans.

Empirical research on group versus individual liability lending has not provided policymakers and institutions the clean evidence needed to determine the relative merits of the two methodologies. In this study, we worked with the Green Bank of Caraga in the Philippines who

conducts a randomized control trial to evaluate the impact of group versus individual liability on client repayment and its profitability. The Green Bank randomly converted half of their existing group-lending centers in Leyte, an island in central Philippines, to individual liability in three waves between August 2004 and May 2005. Using this conversion methodology, we are able to evaluate specifically the benefit and cost of monitoring and peer pressure imposed by group liability, as well as some of the changes in the composition of the groups.

We find no change in repayment for those converted to individual liability, and higher growth both due to fewer dropouts and more new clients. In addition, we find that new entrants to the program had *closer* social ties to the prior members, suggesting that the fear of peer pressure was limiting the growth of the existing programs. We find direct evidence that individual liability leads to less monitoring of each other's loan performance (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.

The rest of the paper is organized as follows. Section II reviews the theoretical and empirical work on group versus individual liability lending programs. 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. Literature Review

As Morduch (1999) points out in his review of microfinance, the performance of group liability contracts in developing countries has been very diverse,[*] but more importantly, 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.[†]

From a theoretical standpoint, Ghatak and Guinnane (1999) suggest that group liability can help institutions improve repayment through four channels: (i) ascertaining how risky the borrower is (*adverse selection*), (ii) ensuring that the funds will be used properly (*ex-ante moral hazard*), (iii) ensuring that the borrower tells the truth in case of default about her ability to pay (*monitoring*), (iv) enforcing repayment if the borrower is reluctant to pay (*voluntary default, or ex-post moral hazard*). 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.

In theory, however, there are other stories that 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 "good" borrowers realize that some will not repay, and thus they must repay that much more in order to get their new loan. If the incentive of future credit is not strong enough, they then choose to default as well. This model also demonstrates that social collateral can help make joint liability work better than individual liability (baring the strategic default situation mentioned above). However, Sadoulet (1997) argues that

[*] See also Adams and Ladman (1979), Desai (1983). On anecdotal evidence on the limits to joint liability, see Matin (1997) and Woolcock (1999).

[†] 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 individuals' loans. "Group lending" merely means there is some group aspect to the process or program, perhaps merely logistical (as in, they share a common meeting time and place to make payments). The heart of this paper is testing whether a shift from group liability to "merely logistical" group lending leads to higher or lower repayment rates, client retention and social networks.

"social collateral" induced by group liability is not sufficient to ensure high repayment rates. Finally, 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 have the ability to write contracts with one another (i.e., side-contract), group liability contracts can be excessively burdensome.

This suggests that repayment is only one piece of the puzzle. The lender's ability to retain good borrowers and attract new ones is equally important to assess the overall profitability. Indeed, an institution with perfect repayment but few customers may be less profitable than another with lower repayment but a larger client base. Madajewicz (2003) argues for instance that under group liability, loan sizes are limited by what the group can jointly guarantee, so clients with growing businesses or those who get well ahead of their peers in scale may find that the group contract bogs everyone down. Below a certain scale, group liability dominates individual liability. But above a certain size of business, individual lending will be preferred by customers. One implication is that better-off clients tend to seek individual loans as they move forward and indeed, many institutions that offer group liability loans are now offering new individual-liability contracts for successful clients.

In the end, the relative contribution of group liability can only be determined empirically. Thus far, most of these theoretical propositions are supported with anecdotes, but for the most part have yet to be established with well-identified empirical research. Some studies have examined whether the social capital helps group liability programs improve repayment (hence overcome

information asymmetries)[‡], but this is a different question altogether than whether group liability is better than individual liability. Quoting Armendariz de Aghion and Morduch (2005),

> "in a perfect world, empirical researchers would be able to directly compare situations under joint-liability contracts with comparable situations under traditional banking contracts. The best test would involve a single lender who employs a range of contracts. But in practice most microlenders use just one main type of contract, leaving little variation with which to identify impacts. 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 this study.

III. Experimental Design and Data Collected

A. Experimental Design

The Green Bank of Caraga, a rural bank operating in central Philippines, conducted a field experiment in which they removed the group liability component of their Grameen-style group liability program[§], called "BULAK". 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. 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.

[‡] See Karlan (2005), a natural experiment in Peru in which groups with stronger social capital experience higher repayment than groups with weaker social capital. Ahlin and Townsend (2000), also an analysis of performance across different types of group lending (not group versus individual lending) find that stronger social ties lead to *higher* default rates.

[§] 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 a calculation fo the repayment capacity of borrowers based on the client-reported cash-flows of their enterprise.

All loans under the BULAK program are given to microentrepreneurial women for their business expansion. The initial loan is between 1,000 - 5,000 pesos (roughly $18 - $90).[**] The maximum loan size increases by 5,000 pesos after every loan cycle, such that the maximum loan size in the 5th cycle is 25,000 pesos. However, the 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% 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 may be used as collateral, although in this last case there are no fixed rules. Finally, 10 pesos ($0.72) 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.[††] 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 (*tapal-tapal* in tagalog) to individual liability loans. All other aspects of the program remain the same (including attendance at center meetings and weekly payment made in groups). Hence, the only two features that changed are the group liability and the savings rules. By removing the

[**] Based on exchange rate of 56 pesos = $1.
[††] In our observation, this never occurred.

group liability, no member is held liable for another member's default. Furthermore, new loans can be issued even if other individuals are in default. Normally, that would not be allowed. For the conversion, the group and center savings were dissolved and shifted into individual savings accounts. The total required savings deposits remained the same.[‡‡] 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 must be paid for out of individual accounts on a per-activity basis.

Critical to the design is the fact that existing centers were converted, and not newly created ones. This allows us to rule out selection stories when determining the causal relationship between group and individual liability. Comparing the repayment behaviors between the group-liability centers and converted centers, we are able to isolate the impact of peer pressure imposed through group liability on center performance. We do, however, also have data on new entrants to the centers after the conversion, and will be able to compare various outcomes. For these analysis, of course, the selection and ex-post monitoring and enforcement are confounded.

Our sample includes 169 BULAK centers in Leyte, handled by 11 credit officers in 6 branches. Among these, 161 had started before August 2004, when we implemented the first wave of conversion in 11 randomly selected centers (1 center per field officer). In November, we randomly selected 24 more centers to be converted to individual-liability. In the sample frame for this randomization, we included 8 additional centers formed after August 2004. Finally in May of 2005, we randomly selected 45 more centers from the 125 remaining. As of January 2006, the date of the data with which we conduct the impact analysis, there are 78 converted centers and 86 original (group-liability) centers (2 converted and 4 original centers were dissolved in the past 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.

months). Conversions were done in three waves because of the operational concern. Credit officers were initially unwilling to be responsible for more than one individual-liability center until successful repayment was observed. In order to minimize the pressure on the credit officers, and to assess early results to ensure default did not rise substantially, the conversion was completed in three waves.[§§]

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 3,343 clients who were active members of the 169 centers at the time of the first randomization in August 2004, as well as the 8 new centers opened after August 2004. 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, we use a baseline survey conducted in November 2004 regarding the social relationships in the treatment groups as well as control groups. Fourth, we use data from a follow-up survey on social networks, conducted in January 2005. Finally, we conducted a survey of clients in November 2005 (over one year after the start of the experiment) to understand better the observed differences between converted and control centers.

Table 1 presents some orthogonality checks and shows that the randomization yielded observably similar treatment and control groups. As of August 2004, prior to any center being

[§§] Note that increased default is not necessarily bad for the bank, since the bank cares about profits not merely default.

converted, there are no detectable differences in the main outcome variables between treatment and control centers.[***]

IV. Empirical Strategy and Primary Results

The experimental design described in Section III allows us to test several hypotheses that emerged above in the discussion of the relative merits of group versus individual liability. The primary goal is to measure the change in key variables important to bank profitability, such as (A) repayment, (B) savings deposits held at the Green Bank by borrowers, (C) loan size, and (D) client retention and success attracting new clients. We then will examine further questions about specific mechanisms such as selection, monitoring, enforcement, and changes in social networks.

Table 2 presents the primary results. Our empirical strategy takes into account the fact that not all centers were converted at the same time and that fifty percent remain in a control group throughout the study. The primary specifications are analyzed at the individual level, with standard errors clustered at the center level. The sample frame includes only clients that were borrowers at the time of each wave of the randomization. This allows us to focus analytically on the *ex-post* changes in behavior generated by group versus individual liability. We present the results of the three waves as if each were its own separate experiment (albeit sharing similar control groups[†††]). This is done as such in order to account cleanly for any timing effects. The three primary outcomes are client repayment, voluntary savings deposits and loan size.

[***] The orthogonality check verifies that the null hypothesis that there are no significant differences between the aggregated treatment and control groups cannot be rejected. When disaggregated, and examined at the individual level, the first wave of centers assigned to treatment are smaller than the other treatment centers and control centers. The primary specification controls for center-level fixed effects, so as long as this difference is not indicative of a difference in trends rather than levels, this imbalance is resolved in the fixed effect estimation model.

[†††] They only differ to the extent that an individual leaves the program after wave one but before wave two, for example, since this individual would be included in the Wave 1 experiment (Panel A) but not in the Wave 2 experiment (Panel B).

Specifically, restricting the sample to individuals who were clients as of August, 2004, the first conversion (hence these individuals all joined under a group liability regime), we estimate a difference-in-difference 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 Columns 1, 2 and 3 show that the conversion to individual liability had no adverse (or advantageous) effect on client repayment. Not only is the point estimate close to zero, but most economically significant effects can be rules out: the 95% confidence bound on default at the time of maturity (Column 2) is +/- 1.5% and 30 days after maturity (Column 3) is +/- 0.6%. 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[‡‡‡] (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 Column 4 shows that the savings behavior does not change after the conversion. 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).

Of course, the conversion to individual liability does imply both a reduction in peer pressure and an increase in bank pressure to repay. The empirical analysis addressed above

[‡‡‡] Below, we will examine heterogeneous treatment effects where we will find evidence for social collateral mattering for those with stronger levels of social networks. On average, however, the net effect is that repayment is not higher under individual rather than group liability.

concludes that the net effect is nil. To confirm that in fact the switch in punishment technology occurred, 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 forced out by their peers and more likely to be forced out by the credit officer.

We observe a (weak) reduction in loan size (Table 2, Column 6). This result is significant statistically only for the second wave of the experiment, although the point estimates for the other waves are similar in magnitude. The decrease is significant economically: a 958 peso reduction is 15.7% of the average loan size of 6,082. The bank reported to us that this drop is due to individuals withdraw their individual savings (since they are no longer held in "communal" savings accounts as joint collateral) rather than borrowing in order to obtain the needed cash for their enterprise.[§§§]

Table 3 shows the results for Table 2, but pooled in one regression. The results mimic those of Table 2, showing no effect on default and savings, and lower loan sizes. Note that these specifications include new entrants to the program and separate estimates of the treatment effects for them. We find that the lower loan sizes are driven by the pre-existing borrowers, which implies that either the change in liability structure led to lower loan sizes, or that those who dropped out in individual liability were on average larger borrowers (or, conversely, smaller borrowers are differentially more likely to remain in the program as a result of the shift to individual liability than large borrowers). This is in line with the earlier anecdotal discussion regarding tension between small and large borrowers: group lending programs often report difficulty over time because small

[§§§] Unfortunately, data are not available on savings withdrawals in order to test this hypothesis empirically. An alternative hypothesis is that the credit officers were stricter on loan sizes under the individual liability in order to protect the repayment performance of their centers. Anecdotally, no support was found for this.

borrowers resent being responsible for the large borrowers. We now turn to the analysis on dropout where we examine this and other hypotheses.

Table 4 uses a Cox proportional hazard model to estimate the likelihood of dropout in each given time period. We find a statistically insignificant effect for the sample as a whole. However, when we examine heterogeneous treatment effects we find that those with a prior history of missing payments and those with larger loan sizes are less likely to dropout. This implies that while on average individual liability lowers dropout, it does so adversely for the lender, attracting worse clients with lower loan sizes. We will examine the net effect on profitability below.

Table 5 examines the dropout and success at attracting new members at the center level. For the center-level analysis 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 average loan size, new accounts or center size 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 period is three months. The coefficient of interest is β. We test whether the liability rule matters by examining whether the coefficient β is significantly different from zero. Notice that information from *all* clients who belonged at some point to the center between August 2004 and January 2005 are used, and we then interact new entrant with treatment in order to estimate separately the effect on the baseline clients and the effect on new entrants.

We find that individual liability is much better at attracting new clients (column 3), and that individual liability makes existing centers 10% points less likely to be dissolved (column 5). In Panel B, we examine how the competitive environment interacts with these findings, and we find that the shift to individual liability attracts new clients in villages irrespective of the type of

competition the Green Bank faces in that village. Client retention and number of dropouts (column 2 and 4), however, are significantly higher (lower) under individual liability *only* when the Green Bank does not face any competition. This finding is slightly stronger when the competition is a group liability lender rather than an individual liability lender. This suggests that individuals have a *taste* for certain lending structures, and so changes made by the Green Bank have less of an effect on group composition because those with strong preferences for specific types of lending already exercised them by selecting the appropriate lender. Of course, the placement of programs to villages is not random, and so this finding could be about underlying differences in villages that have multiple lenders and not about the lenders themselves.

V. Auxiliary Results on Specific Mechanisms

We now turn to three sets of auxiliary data. First, we will examine the results of two activity-based costing exercises completed by the credit officers in order to measure the change in their allocation of their time across centers. Second, we will examine the results of a client-followup survey conducted in November, 2005 (over one year after the initial conversion) on clients in both the treatment and control groups. Third, we will 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.

A. Lender Costs: Activity-Based Costing Exercise

It is important from a sustainability perspective to examine to complete impact to the lender from such a change. If the lender is spending more money on credit officer labor in order to screen, monitor and enforce loans then this is a necessary component of the analysis. We conducted two activity-based costing exercises in which each credit officer for one week kept a detailed diary of all activities. We then attributed activities to either repayment (center meeting plus collection and

processing of repayments), center meeting, monitoring, enforcement and/or re-loan activities. Table 6 reports these results. We find no statistically significant differences in the way credit officers allocated their time, and furthermore the point estimates are the opposite of what one may have expected on enforcement: credit officers spent less time, not more, on loan enforcement and following up with delinquent clients. 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.

The client follow-up survey includes several questions intended to learn more about the mechanism through which we observe changes (or not) across the treatment and control groups. The survey instrument was designed to shed insight into four mechanisms that could be influenced by the liability structure: selection, the flow of information (monitoring), enforcement, and risk-sharing. The survey was conducted only on members in the program, including both members who were in the program at the time of the conversion as well as new clients who entered afterwards.

B. Selection Effects

Three sets of analysis provide insight into the differential selection effects. We asked each member how well they knew the new members that 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 not inconsistent with evidence that groups that are *overly* tight-knit tend to do poorly (Ahlin and Townsend, 2005). 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 as a whole groups are making fewer *group* decisions on who 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.

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 four questions: (1) What is the business of person X? (Columns 3 and 4), (2) How many weekly installments did person X miss over the past three months? (Columns 5 through 8), (3) Did person X miss any payments over the past three months? (Columns 9 and 10), and (4) Do you think person X will miss some payments over the next three month? (Columns 11 and 12). We do not find any change in ability to report the peers' businesses, but we do find *lower* abilities to report who has missed payments (hence evidence of reduced monitoring) and lower 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 available cash to repay their loans.

The third result on selection focuses on the interaction between demand and the competitive setting. Do individuals increase or decrease their borrowing with other lenders after the Green Bank converts to indivdiual liability? The answer depends entirely on whether the other lender is a group or an individual liability lender. If we restrict the analysis to barangay in which the competition is engaged in *group* lending, then we find that Green Bank clients are more likely to borrow from them after their group is switched to individual liability. This indicates perhaps that *some* individuals have a preference for group liability (perhaps for the risk-sharing component of group liability) and hence when the group liability is removed although they do not leave the Green Bank, they do seek another loan elsewhere that has the group liability component. On the other

hand, when the competition only offers individual liability, we see a *reduction* in the likelihood that individuals 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 on whether they are borrowing elsewhere or not). This indicates, again, that individuals have a *preference* for one or the other, and when the Green Bank switches to individual liability individuals who prefer individual liability are more satisfied, and individuals who prefer group liability seek supplementary loans from other group lending programs.

C. Heterogeneous Treatment Effects

The shift to individual liability may have worked better (or worse) in groups with different levels of preexisting social networks. If social collateral is keeping repayment high, then when the collateral is "released" by the conversion to individual liability, one may expect the individuals with higher social capital to have lower repayment. On the other hand, if those with higher social capital do so because of their stronger and more trustworthy character, 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 these hypotheses in Table 9 by interacting treatment with one of various social network measures. We categorize the social network channels twofold, "knowledge" and "trust", where "knowledge" includes: family, friend since childhood, buys products or services, or visits once a week for social purposes, and "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 advise or help.

We then examine two important repayment measures: proportion of missed weekly payments, and percentage of loan past due at the time of maturity. Note from earlier that missing weekly payments could be a sign of being trusted, not of being delinquent, since trusted individuals

are given more latitude during the term of their loan, in the case of a bad week or shock. Default at the end of the cycle, however, is more or less unequivocally avoided.

We find that for proportion of missed weeks is overall lower under individual liability (just as reported in Table 2), but is statistically significant for those with stronger social networks. If those with stronger social networks under group liability are given more latitude, because others are able to vouch for their intent to repay the following week, the shift to individual liability reduce the frequency of missing payments since this luxury is no longer available. This is similar to Karlan (2005), which uses data from a group lending program in Peru and finds evidence that those with higher social capital are able to default on loans and remain in the lending circle, whereas those with lower social capital are typically forced out after default.

Eventual default, however, is lower under individual liability for those with stronger social networks. This may be an indication that those identified as having stronger social networks are more trustworthy, hence the shift to individual liability has no adverse effect on their likelihood of repaying. Those with lower social networks, however, are in fact more likely to go into default on their loan under individual liability, relative to those who remain in group liability. 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 (less social collateral, in the model of Besley and Coate (1995)), and hence the shift to individual liability generates higher default.

D. Changes in Social Networks

Next, we examine the results of the follow-up social network survey. In Table 10 we show these results. We have both baseline and follow-up data on social networks, hence 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 them make their loan payment. Social networks should change under individual liability for many reasons. First, with fewer incentives to monitor, they may find the *quantity* of interaction falls. 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. 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 its importance, empirical research on group versus 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 control trial to evaluate the impact of group liability on the performance of clients and the profitability for the lending institution. We find that individual liability compared to group liability leads to no change in repayment but is better for attracting new clients and keeping existing ones.

It is important to note that the primary experiment 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 individual liability programs can work when the selection occurs under individual liability. In ongoing research with the Green Bank, we are working on an expansion of this program to new areas, hence will be testing whether the individual liability will succeed as well even when groups are formed initially under individual

liability. We also are introducing a hybrid design, in which centers start as group liability but are told that conditional on successful repayment, they will convert to individual liability in the future.

These findings are 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 less 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. Thus the recent shift of some microfinance institutions to expand individual lending products (or in some cases, shift away from group liability to individual liability) should help deepen outreach and provide more flexible microfinance products for the poor. Our findings suggest that the innovators finding methods of lending individually to the poor are moving in the right direction.

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Table 1: Summary Statistics

	All	Control	Treatment				T-stat Control vs Treatment
			All Waves	Wave 1	Wave 2	Wave 3	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Center Performance, pre-intervention							
Total number of accounts	20.500	20.253	20.253	23.600	18.333	21.218	0.774
	(0.924)	(1.261)	(1.367)	(4.017)	(2.653)	(1.742)	
Average Loan size	6079.383	6139.096	6009.355	4758.583	5997.003	6300.813	0.689
	(159.788)	(227.945)	(223.152)	(348.283)	(413.538)	(303.584)	
Proportion of missed weeks over cycle	0.079	0.078	0.083	0.059	0.067	0.079	0.926
(May-Aug 2004)	(0.011)	(0.015)	(0.019)	(0.034)	(0.022)	(0.017)	
Retention	0.904	0.901	0.906	0.933	0.930	0.892	0.758
(May-Aug 2004)	(0.011)	(0.016)	(0.015)	(0.020)	(0.022)	(0.022)	
Observations	169	89	80	11	24	45	
B. Individual-level Performance, pre-intervention							
Proportion of missed weeks over cycle	0.953	0.058	0.066	0.090	0.065	0.059	0.241
	(0.002)	(0.004)	(0.005)	(0.020)	(0.008)	(0.005)	
Loan amount in August 2004	6082.074	6123.237	6036.125	5165.354	5778.497	6399.568	0.503
	(64.944)	(90.359)	(93.072)	(180.301)	(193.300)	(125.040)	
Number of active clients, August 2004	3,308	1,744	1564	231	399	972	

Standard errors in parentheses. 52 pesos = US$1. t-statistics reported in column (7) is the probability of (column (2) - column (3)) being zero.

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

OLS

Sample frame: Baseline clients only

Dependent Variable:	Proportion of missed weeks	Percentage 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)
Panel A: Wave 1 Conversion (Aug 2004)					
Treatment	-0.017	0.051	0.004	9.679	-853.041
	(0.040)	(0.077)	(0.003)	(69.493)	(726.291)
Constant	0.916***	0.131***	0.000	44.712***	2,490.513***
	(0.006)	(0.021)	(0.000)	(16.487)	(84.169)
Mean of dependent variable	0.078	0.133	0.001	1.000	6395.923
Observations	9027	9027	9027	8097	9027
Number of group(branch center)	97	97	97	97	97
R-squared	0.07	0.01	0.01	0.01	0.17
Panel B: Wave 2 Conversion (Nov 2004)					
Treatment	0.017	0.070	0.002	-32.080	-962.557**
	(0.014)	(0.113)	(0.003)	(29.751)	(418.074)
Constant	0.831***	0.188***	0.002***	111.848***	354.202*
	(0.016)	(0.042)	(0.001)	(12.333)	(206.981)
Mean of dependent variable	0.075	0.179	0.002	2.000	6314.152
Observations	10557	10557	10557	9434	10557
Number of group(branch center)	112	112	112	112	112
R-squared	0.08	0.01	0.01	0.01	0.14
Panel C: Wave 3 Conversion (May 2005)					
Treatment	-0.029	0.029	0.003		-407.574
	(0.022)	(0.091)	(0.003)		(343.917)
Constant	0.008	0.094*	0.002***		2,724.253***
	(0.007)	(0.051)	(0.000)		(88.509)
Mean of dependent variable	0.076	0.131	0.001		6345.303
Observations	14189	14189	14189		14189
Number of group(branch center)	134	134	134		134
R-squared	0.08	0.01	0.01		0.12

Robust standard errors clustered by lending centers in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions use fixed effect for lending centers and time. 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. Savings data are only analyzed up to September 2005 because systematic savings policy changes for control centers occurred in September 2005 which effectively required higher savings in control centers than treatment centers. Treatment variable is one if the loan cycle ends after the conversion in treatment centers; zero otherwise.

Table 3: Cycle-level Impact on Default, Savings, and Loan Size, All waves combined

Sample frame: All clients (both baseline and new clients)

Dependent Variable:	Proportion of missed weeks	Percentage of past due balance, at maturity date	Past due balance, 30 days past maturity date (binary)	Total excess savings (pesos)	Loan Size (pesos)
	(1)	(2)	(3)	(4)	(5)
Treatment	-0.009	-0.146	-0.001	-19.397	-620.800**
	(0.016)	(0.106)	(0.002)	(22.184)	(264.535)
New member after Aug 04	-0.016	-0.067	-0.001	-23.194	-3,405.221***
	(0.010)	(0.095)	(0.001)	(21.267)	(257.466)
New member after Nov 04	-0.008	-0.057	-0.001	23.726	-964.930***
	(0.014)	(0.202)	(0.003)	(28.997)	(321.448)
New member after May 05	-0.049**	0.135	-0.001	-67.756	-1,542.772***
	(0.019)	(0.470)	(0.009)	(44.004)	(381.606)
Treatment x New member after Aug 04	0.003	0.788	0.011	41.056	975.684***
	(0.018)	(0.527)	(0.008)	(37.712)	(334.453)
Treatment x New member after Nov 04	-0.004	-0.792	-0.013	57.082	-775.486*
	(0.023)	(0.513)	(0.008)	(47.004)	(422.484)
Treatment x New member after May 05	0.051	0.194	0.009	-4.612	518.325
	(0.038)	(0.624)	(0.016)	(71.083)	(473.306)
Constant	0.624***	0.124***	0.001***	167.416***	1,176.215**
	(0.218)	(0.027)	(0.001)	(60.982)	(476.488)
Mean of dependent variable	0.080	0.184	0.002	253.021	6154.993
Observations	18217	18217	18217	18122	18217
R-squared	0.06	0.01	0.01	0.01	0.18

Robust standard errors clustered by lending center in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions use fixed effect for centers and time. 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. Savings data only analyzed up to September 2005 because systematic savings policy changes for control centers occurred in September 2005 which effectively required higher savings in control centers than treatment centers. Treatment variable is one if the loan cycle ends after the conversion in treatment centers; zero otherwise.

Table 4: Impact on Dropout

Cox proportional hazard model, failure = dropout

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

Sample frame: Baseline clients only

Sample Frame:	All	Never missed payment, pre-intervention	Missed payment, pre-intervention	Loan size above median	Loan size below median
	(1)	(2)	(3)	(4)	(5)
Panel A: Wave 1					
Treatment	0.841	0.811	0.881	0.760**	0.866
	(0.120)	(0.154)	(0.125)	(0.101)	(0.150)
Observations	2230	767	1463	1011	1219
Panel B: Wave 2					
Treatment	1.051	0.980	1.132	0.926	1.089
	(0.158)	(0.188)	(0.206)	(0.196)	(0.185)
Observations	2585	972	1613	1188	1397
Panel C: Wave 3					
Treatment	0.842	1.111	0.790*	0.769*	0.929
	(0.100)	(0.208)	(0.107)	(0.110)	(0.150)
Observations	2821	875	1946	1487	1334

* 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.

Table 5: Center-level Performance

	OLS					
	Proportion of missed weeks	Active accounts	Retention rate	New accounts	Number of dropouts	Dissolved center
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Basic model						
Treatment	0.006	1.826**	0.015	1.190**	-0.119	-0.106*
	(0.013)	(0.762)	(0.019)	(0.486)	(0.284)	(0.059)
Constant	0.078***	17.866***	0.922***	1.553***	1.376***	0.109
	(0.014)	(1.203)	(0.012)	(0.354)	(0.179)	(0.067)
Observations	1088	1498	1312	1294	1312	169
Number of centers	169	169	169	169	169	
R-squared	0.02	0.07	0.15	0.04	0.12	0.16
Panel B: Interacting treatment with the presence of other lenders						
Treatment	-0.011	0.534	0.094***	1.660***	-0.892*	
	(0.018)	(1.038)	(0.026)	(0.619)	(0.491)	
Treatment x Competition is group lender (NGO)	0.008	5.177***	-0.085**	-0.724	1.530**	
	(0.019)	(1.659)	(0.034)	(1.193)	(0.692)	
Treatment x Competition is individual lender (COOP)	0.033	2.881*	-0.071**	-0.913	1.053*	
	(0.034)	(1.574)	(0.032)	(0.939)	(0.615)	
Treatment x Competition is both group and individual (COOP & NGO)	0.029	-1.675	-0.196***	-0.424	0.905	
	(0.024)	(1.506)	(0.051)	(0.931)	(0.630)	
Constant	0.077***	17.938***	0.924***	1.549***	1.378***	
	(0.014)	(1.201)	(0.011)	(0.353)	(0.178)	
Observations	1088	1498	1312	1294	1312	
Number of centers	169	169	169	169	169	
R-squared	0.02	0.08	0.17	0.04	0.13	

Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. Columns (1) through (5) use fixed effect for centers and time, and every center has an observation on each outcome for every three month between August 2003 and November 2005. Column (6) uses fixed effect for credit officers. Number of observations for column (1) is smaller because the value is missing if there is no account whose maturity date falls in a given time period. "Treatment" is an indicator variable equal to one if the center has been converted for a given observation. "Competition is group lender" is a center-level binary variable for the presence of NGO in the same barangay in August 2004; "Competition is individual lender" is a center-level binary variable for the presence of COOP in the same barangay in August 2004. We label NGO as "Group lender" and cooperatives as "Individual lender" since 73% of reported NGOs offer group-liability lending programs and 80% of reported cooperatives offer individual-liability programs.

Table 6: 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	0.019	0.029	-0.033	-0.085	-0.145	-0.086	0.211
	(0.268)	(0.157)	(0.086)	(0.066)	(0.087)	(0.071)	(0.143)
Constant	1.640**	1.333**	0.487**	0.108	0.139	0.090	-0.020
	(0.267)	(0.164)	(0.089)	(0.074)	(0.097)	(0.070)	(0.120)
Observations	146	146	146	146	146	146	146
R-squared	0.32	0.22	0.09	0.06	0.06	0.05	0.15

Robust standard errors in paretheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Each cell reports the average time 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 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		Accuracy in reporting amount of installment		Accuracy in reporting 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	0.310***	-0.272***	-0.000	0.018	-4.585	-1.970	-0.091*	-0.259**	-0.018	-0.019	-0.018	-0.059**
	(0.104)	(0.023)	(0.019)	(0.025)	(5.582)	(6.363)	(0.048)	(0.100)	(0.019)	(0.026)	(0.024)	(0.029)
Constant			0.524***	0.323***	101.385***	81.935***	-0.933***	-0.787***	0.716***	0.285**	0.897***	0.888***
			(0.071)	(0.086)	(11.602)	(12.856)	(0.123)	(0.184)	(0.075)	(0.128)	(0.026)	(0.031)
Observations	1693	971	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

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. Columns (5) through (8) are equal to the negative of the absolute value of the difference between the reported figure (installment amount for 5 and 6, number of defaults for 7 and 8) and the actual figure.

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	5,039.823***	-455.887	-0.049	-0.028	-8,703.439*	-5,972.977
	(0.034)	(0.051)	(1,907.141)	(1,650.910)	(0.035)	(0.029)	(4,856.900)	(4,435.156)
Constant	0.125	0.000	-16,047.552***	-41,404.006	0.377**	0.006	-34,524.886***	-74,270.657
	(0.105)	(0.000)	(4,455.048)	(677,400.165)	(0.174)	(0.008)	(7,756.664)	(1415746.981)
Observations	474	269	474	269	476	257	476	257
R-squared	0.07	0.14			0.07	0.10		

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

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)
Mean of social network out-degree measure	0.110	0.045	0.291	0.131	0.410	0.036	0.015	0.071	0.092	0.418
	(0.003)	(0.002)	(0.005)	(0.004)	(0.005)	(0.002)	(0.001)	(0.003)	(0.003)	(0.005)
Panel A: Dependent variable is proportion of missed weeks										
Treatment	-0.036	-0.033	0.003	-0.029	0.000	-0.028	-0.035	-0.041*	-0.019	0.005
	(0.023)	(0.021)	(0.024)	(0.022)	(0.024)	(0.021)	(0.021)	(0.024)	(0.022)	(0.024)
Social network out-degree	-0.001	0.028	0.102***	0.067**	0.077***	0.128***	0.103	0.008	0.108**	0.082***
	(0.036)	(0.038)	(0.036)	(0.034)	(0.027)	(0.049)	(0.078)	(0.038)	(0.043)	(0.027)
Treatment x Social network out-degree	-0.023	-0.073	-0.114**	-0.064	-0.080**	-0.155*	-0.162	0.046	-0.145**	-0.087**
	(0.047)	(0.061)	(0.055)	(0.054)	(0.040)	(0.081)	(0.127)	(0.137)	(0.060)	(0.038)
Constant	0.085***	0.083***	0.038	0.072***	0.044	0.071***	0.080***	0.084***	0.066**	0.040
	(0.026)	(0.027)	(0.029)	(0.027)	(0.029)	(0.024)	(0.025)	(0.027)	(0.027)	(0.028)
Observations	2688	2688	2688	2688	2688	2688	2688	2688	2688	2688
Number of center fixed effects	157	157	157	157	157	157	157	157	157	157
R-squared	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Panel B: Dependent variable is percentage of past due balance at the maturity date										
Treatment	0.419	0.194	0.488	0.493*	0.728	0.466*	0.279	0.038	0.509*	0.765
	(0.285)	(0.321)	(0.431)	(0.297)	(0.562)	(0.272)	(0.262)	(0.505)	(0.283)	(0.574)
Social network out-degree	-0.550	-0.179	0.543	-0.043	0.046	0.160	0.342	-0.042	0.238	0.118
	(0.395)	(0.466)	(0.357)	(0.340)	(0.220)	(0.436)	(0.906)	(0.280)	(0.370)	(0.260)
Treatment x Social network out-degree	-1.617	0.913	-0.642	-1.908	-1.006	-3.703	-1.359	3.256	-2.312**	-1.050
	(1.227)	(1.768)	(0.848)	(1.678)	(1.007)	(2.412)	(1.480)	(5.341)	(1.094)	(0.987)
Constant	0.549***	0.459***	0.203	0.439***	0.348***	0.310**	0.432***	0.538**	0.362***	0.309**
	(0.143)	(0.127)	(0.174)	(0.125)	(0.133)	(0.134)	(0.121)	(0.207)	(0.115)	(0.148)
Observations	2688	2688	2688	2688	2688	2688	2688	2688	2688	2688
Number of center fixed effects	157	157	157	157	157	157	157	157	157	157
R-squared	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

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. Panel A reports the regressions on indegree 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); Panel B reports the regressions on outdegree over maximum number of links possible. This measure reports how central is the member in relation to the group size f.rom a degree perspective (the member is more central if he/she sends manylinks). 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 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 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	-0.004	-0.001	-0.021	-0.003	-0.024	0.016	0.022	0.010	0.004	-0.020
	(0.034)	(0.010)	(0.040)	(0.030)	(0.042)	(0.019)	(0.015)	(0.029)	(0.030)	(0.040)
Post	-0.013	0.054***	0.000	0.102***	-0.046	0.051***	0.003	0.070***	0.072***	0.057
	(0.030)	(0.009)	(0.035)	(0.027)	(0.037)	(0.017)	(0.013)	(0.026)	(0.026)	(0.035)
Treatment x Post	-0.034	0.001	0.032	-0.039	0.024	-0.044*	-0.018	-0.033	-0.029	0.022
	(0.043)	(0.013)	(0.052)	(0.039)	(0.054)	(0.025)	(0.020)	(0.038)	(0.038)	(0.051)
Constant	0.258***	0.041**	0.328***	0.058	0.512***	-0.001	0.012	0.033	0.052	0.442***
	(0.056)	(0.017)	(0.067)	(0.051)	(0.070)	(0.032)	(0.026)	(0.049)	(0.050)	(0.067)
Observations	273	273	273	273	273	273	273	273	273	273
R-squared	0.09	0.35	0.24	0.28	0.26	0.17	0.07	0.22	0.22	0.29

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.
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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 three months of follow-up survey.

	Forced Out Probit (1)	Forced Out by Center or Credit Officer Multinomial Logit (2)
Dependent Variable: Forced Out		
Treatment	-0.091***	
	(0.012)	
Dependent Variable: Forced Out by Center Members		
Treatment		-0.539***
		(0.056)
Dependent Variable: Forced Out by Credit Officer		
Treatment		0.599***
		(0.102)
Observations	520	520
R-squared	0.007	0.017

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.