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Grameen Bank Lending

Does Group Liability Matter?

Shahidur R. Khandker

Abstract

Competing theories increasingly support the positive role of social capital in small loan default costs of group lending; at the same time, potential group collusion may increase loan delinquencies. Findings from the available literature are mixed on the role of the various attributes of group lending. But past studies suffer from estimation bias due to the unobserved sorting behavior of group members and their other attributes. This paper attempts to resolve that estimation bias by utilizing longitudinal data from 297 Grameen Bank groups since their inceptions. A dynamic lagged dependent model with correction for time-varying heterogeneity of group and individual behavior is applied to estimate the effect of group liability in the Grameen Bank. The results suggest that group liability matters in both loan disbursement and repayment, with women less of a credit risk than men and women's groups more homogeneous than men's. Finally, the benefits of social capital outweigh the costs of group collusion, especially for women's groups, thereby reducing overall default rates. The risk-pooling behavior of diverse men's groups increases men's repayment behavior. Overall, group lending as practiced by Grameen Bank appears to increase repayment rates.

Grameen Bank Lending: Does Group Liability Matter?

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1.   Introduction

Over the past three decades, microfinance programs have emerged as a major tool for disbursing loans to the poor, especially women, who previously lacked access to institutional credit, owing mainly to a lack of physical collateral. Adoption of a group-lending mechanism accounts for much of the success of microfinance institutions (MFIs), in stark contrast to formal financial institutions, in reducing the costs of loan default and reaching the poor. A group-lending mechanism imposes peer screening, monitoring, and social sanction to enforce loan contracts of individual group members (e.g., Besley and Coate 1995; Ghatak 1999; Stiglitz 1990). However, it is unclear whether group incentive (i.e., not to default) overwhelms individual incentive (i.e., to default) and thus becomes a reflection problem (Manski 1993).[1]

A large theoretical literature has identified some of the credit-market failures that group-based lending may overcome (Besley and Coate (1995), Ghatak (1999), Varian (1990), Stiglitz (1990), and Armendariz de Aghion (1999). Group behavior is based on three major models: moral hazard (Stiglitz 1990; Banerjee, Besley, and Guinnane 1994), strategic default (Besley and Coate 1995), and adverse selection (Ghatak 1999). According to these models, group liability creates an incentive for group members to monitor and enforce contractual obligations. In addition, it is less costly to monitor group borrowers of the same social status living in close proximity, versus independent individuals who borrow from outside (formal) lenders. Joint liability creates the social collateral or capital, which substitutes for missing physical collateral. Conning (1999) considers the potential of group-based borrowing

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[1] According to Manski (1993) the reflection problem arises "when a researcher observing the distribution of behavior in a particular population tries to infer whether the average behavior in some group influences the behavior of the individuals that comprise the group" (p.532).

as one of several optimal strategies and whether joint liability contracts can be designed to create the social collateral required to replace physical collateral.

In attempting to verify the validity of alternative group-based lending models, Ahlin and Townsend (2003) have found evidence of certain features of the joint liability models. Many other empirical studies have also examined the role of a group mechanism—measured in terms of such attributes as peer screening, peer pressure, and social ties—on an individual member's loan repayment behavior (e.g., Bratton 1986; Wenner 1995; Wydick 1999; Zeller 1998). However, findings from the available literature have been mixed. Various studies have found a positive effect (Al-Azzam, Hill, and Sarangi 2011; Mehrteab 2004; Wenner 1995; Zeller 1998; Wydick 1999), while others have shown either no effect or a negative one (Bratton 1986; Diagne and Zeller 2001; Godquin 2004; Sharma and Zeller 1997; Xavier and Karlan, 2006; 2011; Karlan and Zinman 2009).[2]

The various studies looking at the role of various group attributes have failed to correct for the endogeneity of social capital. One exception is a study by Karlan (2006), which used an experimental design to test whether a group mechanism exploiting social connection works in an individual's financial decisions such as loan repayment behavior. Yet, like other studies, this study does not address: (i) the endogeneity of joint liability that is argued to replace individual liability in group lending and (ii) that group liability is jointly determined by the same set of factors governing group formation and its subsequent rules of governance, meaning that group behavior can be endogenous in determining individual behavior in a group. The empirical challenge is to identify the role of endogenous group

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[2] For example, Xavier and Karlan (2006) showed in a randomly assigned pre-existing group liability centers to individual liability centers that the conversion to individual liability does not affect the repayment rate, and therefore, group liability is not a superior method for attaining higher repayment rates.

behavior (social capital) in loan recoveries involving group lending as argued by Manski (1993).[3]

Those with the same loan-default preference are likely to join a particular group, in which case group liability essentially reflects individual liability, suggesting that a high repayment rate (e.g., the case of the Grameen Bank) is driven by unobserved individual and joint default-preference incentives. Estimating the dynamics of group liability in group lending requires controlling for this self-selection bias at both individual and group levels.

The Grameen Bank in Bangladesh, the world's pioneer in promoting group-based lending, is an ideal case for studying the role of group, versus individual, default incentives in a group-based lending scheme. To address this central issue, this paper uses a unique data set of the weekly borrowing and repayment history of all borrowers in some 297 Grameen Bank groups over a 7-year period (since their inceptions). The data was recorded and kept by Grameen's branch-level office but never released.[4] Group liability is defined as the cross-member effect of loan default rates, while individual liability is measured by an individual's past record of loan default. Thus, when an individual loan amount or the amount repaid depends on the behavior of group members as well the individual, the unobserved attributes of both individual and group-members are likely to influence the performance of group-based lending.

An individual fixed effects (FE) method that sweeps out group FE, as well the influence of area unobserved characteristics influencing credit demand and loan repayment, can correct for the endogeneity of certain individuals joining a group and certain groups

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[3] Karlan (2005) shows how experimental economics can be used to measure social capital and its role in loan repayment behavior. However, such an ideal experimental design is hardly possible in practice and certainly not possible within the context of Grameen Bank lending.
[4] However, because of branch-level computerization program, detailed group level data are not anymore recorded and kept for future reference since 2004.

performing differently from others. However, this method does not control for the possible influence of a common shock, such as a weather-related event or time-specific variability affecting loan performance or the amount borrowed, which affects all group members alike. Therefore, an individual FE method with a common time effect is a way to control for bias due to common shock effect, as well as unobserved individual and group heterogeneity.

But even then, the FE method with correction of initial conditions may not control for time-varying heterogeneity among the error terms. Assuming a serial correlation over time in a dynamic setting, we derive moments that allow for this as well as serial correlations due to time varying heterogeneity. We use the Generalized Method of Moments (GMM) to derive the appropriate standard errors.

The results suggest that both individual- and group-default incentives, along with initial conditions that sort individuals to form groups and group size, are key factors influencing individual loan repayment behavior, as well as the borrowing limits of group members. The findings suggest that, in a group-lending scheme, the default incentive depends as much on the group as the individual.

The paper is organized as follows. Section 2 provides an analytical framework of how group incentives influence an individual's loan repayment behavior. Section 3 presents an econometric framework to estimate individual and group default incentives in the loan disbursement and repayment behavior of group members. Section 4 discusses the data and key features relevant to studying the research questions of this paper. Section 5 presents the results, while Section 6 concludes.

2.   Group versus Individual Default Incentives: An Analytical Framework

Group responsibility ensures peer pressure and monitoring, thereby ensuring the lender of repayment. However, a joint default incentive is not necessarily better than an individual incentive since one group member's default may prompt other members to do likewise. But the social collateral of group lending might be strong enough to impose social penalties that deter the possible default of group members. However, in group-based lending, it is not easy to distinguish individual liability from group liability, when members belonging in a group reflect the average attributes of all members of that group.

Assume that in an individual-based loan-recovery scheme, the relationship between the probability of loan default and recovery is dictated by a repayment transformation curve, which measures the transaction cost of lending and the underlying technology and costs of loan recovery (Figure 1).

{INSERT FIGURE 1 HERE}

Together, these factors determine the rate at which the probability of a loan default transforms into the loan recovery. Given the transformation curve, the extent to which a loan default determines the rate of loan recovery depends also on a borrower's preference. We represent an individual's preference by the locus $I_O A I_O$, in which case, an individual's probability of loan default is D_O, which translates into R_O rate of recovery.

In the case of group-based lending—even a small one consisting of only five or so individual members—the observed loan repayment behavior of any member reflects unobserved underlying individual and members' default incentives. That is, group members influence an individual member's preference for loan default, and correspondingly, the expected rates of loan recovery (Figure 2).[5]

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[5] Group dynamics may also influence the curvature of the repayment transformation curve.

Assuming strong social sanctions against default, an individual's preference for loan default is represented by the curve I_GBI_G, instead of I_OAI_O, meaning a lower probability of default and a higher rate of recovery (Figure 2).[6] It thus follows that loan recovery is higher under a group-based, versus an individual, lending plan if the group incentive not to default helps to improve an individual member's loan recovery behavior.

However, the converse is also possible; that is, other group members' loan default may create a disincentive (group collusion) for an individual member to repay, resulting in a higher loan default and lower recovery rate (e.g., situation C, instead of B or even A) (Figure 2). In this case, the group loan default rate would be higher under group, versus individual, lending. It is also possible that the default incentive under group lending overwhelmingly reflects the default incentive observed under an individual lending scheme (e.g., situation A) (Figure 2). However, under group lending, it is expected that loan recovery will be determined by the default incentive of other group members, as well as that of the individual.

In theory, group lending could yield benefits of low loan-default cost via peer pressure, screening, and monitoring. In practice, however, documenting why loan repayment rates are higher or lower with group, versus individual, lending is not so easy, in part, because so few programs practice both group and individual lending. Not surprisingly, most empirical studies attempt to verify what makes group lending work in terms of group attributes, meaning that the group's role is assessed in terms of the effect of observed group characteristics on loan repayment rates. But conclusions can also vary widely on the effects of group composition. For example, group cohesiveness (a form of social capital measured

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[6] Strong social sanctions against loan default may prevail, for example, if group members see groups as a way to entitle institutional credit and its future access.

by group similarity, such as cultural similarity) and peer monitoring (as proxied by proximity of group members) have been argued as good predictors of repayment performance. However, group homogeneity may also create collusion (i.e., the probability of loan default by other members when one member defaults); this, in turn, increases loan default because members in close proximity or with similarity are unable to sanction against default or provide aid when they have similar economic conditions (Besley and Croate 1995). By contrast, a diverse group might have fewer such problems, which helps to reduce the chance for group collusion and, in the process, loan default. Greater diversity might also increase repayment rates because group members' incomes are less likely to vary together, implying a greater chance to provide mutual aid in times of need (Sadoulet 2003). On the flip side, diversity also means less peer pressure and monitoring, which can reduce, rather than increase, loan repayment rates.

In short, the question of whether group lending leads to higher loan recovery is an empirical issue. Since group attributes are themselves endogenous, empirical verification of whether group liability matters in group lending entails estimating a repayment function that includes not only the probability of individual loan default, but also that of other group members. The central problem in estimating the impact of group features in group-based lending, such as those of the Grameen Bank, is the self-selection of individuals into groups, as well as the joint probability of default by group members. There are unobserved characteristics of individuals that sort them into groups and affect their joint probability of default. Resolving endogeneity in estimation is key to determining whether group liability matters in Grameen Bank–type, group-based lending.

To resolve this issue, this paper proposes a quasi-experimental approach that relies on group panel data, including borrowing and repayment information for all members since

their groups' formation.[7] The data include variations in group and individual repayment rates, where the individual repayment is to be examined against both individual and group repayment data and other characteristics. To study group behavior over time, the paper relates variations in group behavior with variations in individual-level borrowing and repayment behavior after controlling for the sorting behavior of members into groups. The cross-member effect of individual-level behavior is measured as one of the effects of group liability on individual repayment behavior.

The question on the role of joint liability in group-based lending is thus answered by weekly loan disbursement and repayment data of group members from selected groups. For each group, the time series must start with the week of the first loan disbursement to any member of the group and end on the date when the data were collected. Using such data, we attempt to resolve the endogeneity of the basic group-based lending feature of the Grameen Bank.

The five-member group is the central pillar of Grameen Bank. Separate groups are formed for men and women. Group membership is strictly restricted to people of the same villages with similar economic resources, who own less than half an acre of land, and are not members of the same household as another microcredit program member. The group is also responsible for loan delinquency of group members (for details, see Hossain 1988; Khandker 1998).[8]

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[7] Simple group panel data, irrespective of when the groups were formed, are inadequate for resolving the endogeneity of why certain members join a group in the first place.
[8] However, in recent years some of these conditions are relaxed in Grameen's lending.

3. Model Specification and Estimation Strategy

In group-based lending, a group's characteristics determine, in part, a lender's perception of individual borrowers' credit risk. Thus, the actual amount of borrowing in a group-based lending scheme, such as that of the Grameen Bank, depends on borrowers' own and projected characteristics (X_{ij}), group characteristics (G_j), unobserved individual credit risk (μ_{ij}), and unobserved group credit risk (μ_j), where i represents a member of a group and j represents a group to which s/he belongs. The group characteristics (G) are represented by such variables as how long the group has been in operation and its size.[9]

In addition to unobserved individual- and group-level credit risks, common shocks may affect a group's performance over time. Shocks that affect all group members may generate a pattern of covariance in borrowing and repayment among members that is entirely unrelated to any of the incentives generated by the group's structure. Common shocks may induce all group members to behave in more or less the same way. For example, in the aftermath of a flood, rural households are often cash-constrained and are thus more likely to borrow than repay their loans. In such a case, individual borrowing and repayment behavior could be completely independent of group attributes and still strongly co-vary simply because of common time-specific shocks, having nothing to do with group behavior. Consistent with this hypothesis, we introduce group calendar-time FE η_{ij} common to all groups that influence borrowers' behavior.

We consider the demand for credit of a microcredit program (B_{ijt}) by the i-th member of the j-th group in period t, expressed as follows:

$$B_{ijt} = \alpha_b \tau + \beta_b X_{ijt} + G_{jt} \gamma_b + \mu_j^b + \mu_{ij}^b + \eta_{ij}^b + \varepsilon_{ijt}^b \qquad (1)$$

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[9] While group size is always 5, it may vary at times because of attrition.

where τ is the time trend, α, β, and γ are vectors of unknown parameters to be estimated, ε is a non-systematic error, and all other variables are as previously defined.[10]

However, in group-based lending, the loan amount disbursed is linked with the loan recovery rate. On the other hand, following Manski (1993), loan recovery, in turn, depends on the probability of loan default by other group members, as well as the individual, in accordance with the reflection embedded in group behavior. Assuming that the probability of loan default at a particular point in time is determined by past loan-default incentives of both individuals and their group peers, given the loan amount, and that reflections are at work but with a lag, we infer that loan recovery, as well as the amount disbursed, depends on past behavior of individual and group members' incentives to default.

In fact, in a dynamic model, individual borrowing within a group-based lending scheme in period t depends not only on current individual and group characteristics, but also past loan-repayment rates of the individual and other group members. The resulting dynamic borrowing equation is expressed as follows:

$$B_{ijt} = \alpha_b \tau + \beta_b X_{ijt} + \gamma_b G_{jt} + \delta_b^o R_{ij(t-1)} + \delta_b^g \Sigma R_{k(t-1)} + \mu_j^b + \mu_{ij}^b + \eta_{\tau j}^b + \varepsilon_{ijt}^b \qquad (2)$$

where δ^o measures the effect of own past repayment of an individual member and δ^g measures the estimates of loan repayments of *kth* group members. Similarly, the current loan repayment depends on the past repayment rates of the individual and other group members, with the dynamic loan repayment equation expressed as follows:

$$R_{ijt} = \alpha_r \tau + \beta_r X_{ijt} + \gamma_r G_{jt} + \delta_r^o R_{ij(t-1)} + \delta_r^g \Sigma R_{kj(t-1)} + \mu_j^r + \mu_{ij}^r + \eta_{\tau j}^r + \varepsilon_{ijt}^r \qquad (3)$$

Thus, the above sets of equations introduce two sources of liability: (i) individual loan liability, represented by the status of individual past repayment and (ii) joint liability,

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[10] It is possible to estimate separate group-duration and calendar-time effects since different groups formed at different points in time.

represented by the past repayment rates of group members and group characteristics (e.g., length of group existence since inception). We have also introduced two sources of unobserved, time-invariant heterogeneity: (i) individual and (ii) group.

With panel data of groups since inception, consistent estimates of the impact of past loan-repayment rates on current loan-repayment rates or disbursement to individual members of a group can be obtained using an individual-level FE method that sweeps out the role of both individual and group heterogeneity.[11] But this method cannot control for the common time effect. We therefore introduce both individual-level and time-period FE to estimate both the repayment and borrowing equations, by estimating the following differenced equations:

$$\Delta B_{ijt} = \alpha_b \Delta\tau + \beta_b \Delta X_{ijt} + \gamma_b \Delta G_{jt} + \delta_b^o \Delta R_{ij(t-1)} + \delta_b^g \Delta\Sigma R_{k(t-1)} + \Delta\varepsilon_{ijt}^b \qquad (4)$$

$$\Delta R_{ijt} = \alpha_r \Delta\tau + \beta_r \Delta X_{ijt} + \gamma_r \Delta G_{jt} + \delta_r^o \Delta R_{ij(t-1)} + \delta_r^g \Delta\Sigma R_{kj(t-1)} + \Delta\varepsilon_{ijt}^r \qquad (5)$$

But both individual and group heterogeneity may vary over time, in which case, the individual FE method does not control for time-varying unobserved heterogeneity of either individual or group behavior in a dynamic panel model (Arellano and Bond 1991).

Time-varying heterogeneity can be resolved by introducing a modified autoregressive distributed lag of order 1 or AD (1,1) model. But the OLS estimator of an autoregressive FE model is inconsistent for a typical panel where the number of periods is small and the asymptotics are driven by the number of cross-sections going to infinity (Hsiao 1986). The inconsistency arises because of the potential correlation between the lagged endogenous variables and the residuals in the transformed model. Thus, instead of using the standard difference-in-difference techniques used in Equations (4) and (5), we apply the dynamic

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[11] Note that the group heterogeneity gets absorbed in the fixed effect. Also note groups remained intact over the study period. Therefore, there was no inclusion of any new member that violates the initial conditions of sorting into groups.

lagged dependent-variable approach, proposed by Arellano and Bond (1991), to estimate

Equations (2) and (3). With serially uncorrelated error terms, ε_{it}, GMM methods are the

most efficient instrumental variables for estimating the parameters in Equations (4) and (5).

In estimating these equations, R_{ijt-2} or higher lagged levels of loan defaults are valid

instrumental variables for time-varying unobserved characteristics that affect current

outcomes (e.g., Jalan and Ravallion 1998, 2002).

It is a standard practice to test the relevance of GMM methods in terms of the

exogeneity of lagged values of dependent variables. As such, we present two sets of tests for

the dynamic panel models of Equations (4) and (5). The first one is the Arellano-Bond test

for auto-correlation, which has a null hypothesis of no auto-correlation and is applied to the

differenced residuals. The test for AR(1) in first differences usually rejects the null

hypothesis, which is expected since $\varepsilon_{ij(t-1)}$. is common to both $\Delta\varepsilon_{ijt} = \varepsilon_{ijt} - \varepsilon_{ij(t-1)}$ and

$\Delta\varepsilon_{ij(t-1)} = \varepsilon_{ij(t-1)} - \varepsilon_{ij(t-2)}$. The test for AR(2) in first differences is more important because

it can detect higher-order auto-correlation, namely between $\Delta\varepsilon_{ijt} = \varepsilon_{ijt} - \varepsilon_{ij(t-1)}$ and

$\Delta\varepsilon_{ij(t-2)} = \varepsilon_{ij(t-2)} - \varepsilon_{ij(t-3)}$. The GMM system estimator is consistent if there is no second-

order serial correlation in residuals.

The second set of tests is the Sargan and Hansen over-identification tests (the null

being that the instrument set is exogenous). The Sargan test is typically used with

unclustered standard errors, while the Hansen test is used when standard errors are

clustered. We present the Hansen test only since we cluster all standard errors at the village

level in all regressions.

The central tenet of the empirical model is that, if group incentive structure does not

matter in individual borrowing or loan repayment behavior in group lending, we will see no

cross-member effect, such as that of other members' past repayment on each member's loan repayment behavior or the amount s/he receives; that is, we test if $\delta_b^g = \delta_r^g = 0$. Similarly, if group pressure and monitoring are irrelevant, then the effects of such group characteristics as the length of its existence on individual repayment or borrowing will not be statistically significant (i.e., testing whether, $\gamma_b = \gamma_r = 0$).

4. Data Features

Determining whether the group incentive to default affects individual borrowing and the rate of loan repayment in the Grameen Bank group-based scheme requires data on the loan amount and payment for both individual and group members over time and across areas since joining the group.[12] But studying the role of group liability in group lending requires one to have data on variations in loan repayment rates across groups and group members. Since the Grameen Bank's loan repayment rates, which have been quite high, exhibit not much variation across branches, this study's data-collation effort was directed at those branches that witnessed at least some degree of variation. However, many branches computerized their data in 2001 and thus destroyed group records from earlier years detailing members' initial background information, plus weekly data on the amount of borrowing and loan-repayment behavior. As a result, the data collected was limited to those branches that had retained group records since the groups were formed.

The present study collated the uninterrupted weekly repayment history of some 297 groups from 9 branches representing all country regions since their inception in April 2004.[13] Except for the division of Rajshahi, a traditionally depressed northwest region, the loan

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[12] The Grameen Bank kindly agreed to provide such data from branches that retain it.
[13] Such a monumental data-collation effort would have been impossible without the Grameen Bank's invaluable assistance.

repayment behavior of microcredit borrowers varies little geographically throughout the country. Rajshahi has exhibited the worst loan recovery rates as evidenced by various microcredit program reports; thus, the study survey oversampled observations from this division to permit enough variation in data, particularly on loan repayment behavior, to conduct a sound analysis. But to ensure representativeness of the findings, all of the analyses conducted were appropriately weighted using the actual group distribution among branches.

As mentioned above, most of the groups in the survey sample were from Rajshahi since this division provided more variation in loan repayment data, as well as continuity of records over the 7-year period since group inception (Table 1). Out of the 297 groups, 271 were women only (women represented more than nine-tenths of all members), while the other 26 groups were men only (these were found only in Rajshahi and Khulna in only 4 out of the 9 branches covered).

{INSERT TABLE 1 HERE}

Although the Grameen Bank's practice is to hold 5-member groups jointly responsible for loan recovery, group size is not always limited to 5. The average size is larger for women-only groups (8.1 individuals) than for men (6.0 individuals) (Table 2). Over the study period (1994–2002), each member, whether male or female, borrowed up to 6 times on average; however, the average loan size was higher for men, with the highest loan amounts found in Khulna.

{INSERT TABLE 2 HERE}

As Table 2 shows, the repayment rates of women's and men's groups differ considerably. Rajshahi exhibits the highest default rates and thus the smallest average loan size, reflecting the fact that loan defaults influence the amount of individual borrowing. The

overall member repayment rate is nearly 73 percent, with the highest (92.6 percent) found in Dhaka and the lowest (70.3 percent) in Rajshahi. Disaggregating the repayment data by group gender reveals a sharp difference in loan recovery outcomes, with higher rates for women (79.0 percent) than men (56.4 percent).[14] Male-female differences are also exhibited in the rate of missed repayments, calculated as the number of missed repayments since group inception divided by the number of quarters. For men's groups, the quarterly rate for other members is 30.5 percent, compared to only 10.6 percent for women's groups. Both types of repayment data reveal that women are a better credit risk than men. But given that the men's group had been in existence for a longer period than the women's group (192 versus 173 weeks), the men's relatively poor loan-recovery performance could be related to the group's longer existence.

Overall the emphasis on male-only versus female-only group structures is based on the expectation that male group members behave differently than female group members, even if the same 5-member group structure and its design prevails for both groups. It is a matter of empirical evidence to suggest otherwise.

Figures 3 and 4 clearly show an inverse relationship between past loan default and both the loan amount received and recovery rate. But even if the inverse relationship holds for both male and female groups generally for the amount lent and its recovery, we find a sharp drop in the recovery rate, even with the past loan default of a few members compared to loan disbursement. This is not surprising, given that loan default is directly related to loan recovery, while past default is not necessarily the key factor for a lower disbursement rate.

{INSERT FIGURE 3 HERE}

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[14] It should be noted that these figures are based on a quarterly loan recovery rate. The annual rate is much higher for both men and women, given that a defaulted quarterly payment can be made later. For the sample observations, the annual loan recovery rate was 94.3 percent for women and 93.6 percent for men.

The issue is to determine whether group liability measured by the past loan default of other group members has any role in the observed inverse relationship between loan delinquency and individual liability, as measured by past loan default of individual members. As this is a reflection problem of group vis-à-vis individual incentives to default, we need to determine the independent role of group liability (if any) after sorting out the endogeneity of social capital as embedded in group lending in a dynamic setting.

5.   Hypothesis Testing and Results

The basic premise is to test whether group liability matters in the Grameen Bank. As the observed repayment rates vary by group gender, we utilize separate models for male and female groups, with the expectation that men and women will differ in their response to group incentives.[15] We also follow various model specifications for testing the basic hypothesis. Before discussing the results, we first turn to address the major assumption that Grameen Bank groups are cohesive in that individuals may reflect group behavior, including the group's incentive to default, exemplifying the reflection problem as discussed in Manski (1993).

5.1   Group Cohesiveness and Default Incentive

Both theory and various empirical studies indicate that loan default rates are lower under a group lending system because groups are homogeneous or cohesive, making it easier to enforce peer pressure and monitoring. In this paper, a relevant group-lending question is what makes individuals form groups when groups are self-selected and to what extent are

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[15] An additional reason for running separate models is that women's groups are more homogeneous than men's.

they cohesive or homogeneous, either culturally or otherwise; that is, what makes some members select one another to belong to a particular group and not other groups in the same village. One testable hypothesis underlying the Grameen Bank's group-based lending is that groups are similar and cohesive, thereby enhancing loan repayments via peer pressure and monitoring. The issue then is to discover whether the Grameen Bank's 5-member groups are indeed homogeneous or cohesive.[16] We examined members' individual and household characteristics, including observed educational attainment and landholdings at the time of joining a group, in an attempt to measure the "nearness" of those characteristics among group members and all members within a village. We assumed that these characteristics would vary less within than across groups since 5-member groups would likely be homogeneous to the extent possible, indicating that group cohesiveness is a factor that plays a positive role in group lending. We examined this factor for both men and women.

One way to test this hypothesis is to take standard deviations of all those relevant characteristics separately for each group in a village and then for all members in a village (Table 3). We find that women generally are more homogeneous than men in small groups, but men and women are more diverse across groups within a village. This is true for nearly all of the factors considered (e.g., age or education) except landholdings. For example, a younger member is likely to join a group with younger members and avoids groups with older members, suggesting simply that Grameen Bank group members are homogeneous.

{INSERT TABLE 3 HERE}

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[16] Grameen Bank groups are usually from the same village, where cultural variation within and across groups is minimal. Moreover, proximity of group members is not an issue for the common group size of 5 members, who are usually drawn from the same locality.

However, homogeneity varies by gender, with men's groups less so than women's, which may have implications for observed differences in loan default rates of male and female members. That is, observed loan recovery rates are higher for women than men presumably because women's groups are relatively more homogeneous (or similar in observed characteristics) than men's groups.

5.2   Testing the Relevance of Group Liability

Given the features of groups in the Grameen Bank, the most relevant issue is to test for the presence of "group effects" in a parsimonious model that includes rate of missed payments of other group members as of the week prior to any observation (i.e., rate of missed payments by other members of the group lagged one week) and the number of group members, in addition to controlling for weeks of group duration and other initial conditions. If individual borrowing or repayment behavior is unrelated to that of other group members, then the measure of past missed payment of other members, as well as the group characteristics, should not affect either current loan disbursements to an individual or his or her loan repayment behavior.

Two outcomes are considered in this paper: (i) member-level loan disbursement and (ii) loan recovery rate. The rate of missing weekly payments does not indicate whether the payment missed was actually due or how much was due at the time payment was missed. However, the rate of loan recovery is measured as the percentage of the amount due that was paid on time. Higher rates of missed payments mean lower rates of loan recovery, while lower rates of missed payments likely mean higher rates of loan recoveries. Thus, the rates of loan recovery and missed payments are interrelated measures of loan delinquency.

An application of the GMM method using a sample consisting of weekly observations invariably involves computational problems. As proposed in models (4) and (5), the endogenous variables used in lagged form as instruments do not provide enough variation with weekly observations, even when we use third, fourth, or fifth lag; that is, because loan repayment behavior is generally monotonic, with infrequent changes (occurring only once in a few weeks). For example, in the case of borrowers who usually miss a payment once every 2–3 months after having made consistent payments for 7–8 weeks, weekly observations, even using a fourth or fifth lag, may reveal no changes in behavior, while observations with a higher time unit (e.g., monthly or quarterly) may well capture the pattern with suitable lag variables.

We have thus arranged the sample by quarterly observations to carry out the GMM estimation. All variables are constructed at quarterly level to facilitate the estimation. More importantly, given the large sample size (about half a million for female borrowers) and time periods in the weekly data (more than 400), the GMM estimation process likely creates thousands of additional instruments, making it computationally impractical, even with the computer's high processing capabilities. Thus, it is more feasible to use a sample with quarterly observations.[17]

5.3   Does Group Liability Affect Grameen Bank Disbursement Behavior?

The GMM results of the group effects on individual loan disbursement are presented in Table 4 for three model structures: Model (1) considers only the effect of lagged missed payments of group members; Model (2) considers the effect of group, as well as individual,

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[17] However, when the individual-level FE method, including initial conditions to correct for time-varying heterogeneity, is applied to weekly repayment data, we find results that are quite compatible with the reported GMM results when the GMM method is applied to quarterly data. But since the GMM method is preferable to the FE method, only GMM results are shown here.

liability of past missed payments; and Model (3) includes both sets of liability and their interactions. In addition, all three models control for observed and unobserved conditions that led to the formation and existence of groups, as well as their performance. The test results of the loan disbursement equation for all three models reject the null hypothesis of no autocorrelation between differenced residuals, shown by the AR(1) and AR(2) tests. Also the assumption of exogeneity of the instruments as a group cannot be rejected by the Hansen test.

{INSERT TABLE 4 HERE}

We find that group duration (one measure of social capital) has a positive effect on loan disbursement for female members in the short run, with a marginal impact of Tk.75 per quarter (three months), according to Model 3 (Table 4), and a negative impact in the longer run.[18] That is, while an additional quarter initially brings more disbursement amount, the loan amount declines over a longer period. However, it is unclear whether this suggests graduation or credit constraint.[19] For women, the point at which disbursement starts decreasing is 37.5 quarters (9.4 years), according to Model 3 (Table 4), which controls for the interaction of group and individual past missed payments. For male borrowers, however, the disbursement reduces over time at a faster rate.

More importantly, past missed payments of other members reduce the amount of borrowing for both men and women members (Table 4). Thus, following Model 1, a 10 percent increase in the probability of loan default of group members reduces the amount of borrowing by 6.1 percent for male members, compared to 4.6 percent for female members. The cross-member effect for individual borrowing is negative for both male and female

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[18] Men's disbursement appears to respond negatively with length of group existence since inception.
[19] If duration of a group's existence implies emerging social capital, this may also mean a substitution of credit with social capital after a certain number of years of Grameen Bank membership.

members, suggesting that the Grameen Bank punishes both male and female members by giving out fewer amounts of loans to groups with records of past default (evidently, men's groups have a higher default cost).

Does missing payments of other group members still matter when the effect of an individual's own missed payment in the past is taken into account? According to Model 2, we find that group liability still matters significantly, although the coefficients reduced slightly in magnitude. For example, the cross-member effect on the amount of borrowing by female borrowers is 0.046 when the effect of own missed payment is not taken into account, versus 0.032 when it is considered. However, for men, group liability matters more than individual liability, while for women individual liability matters more than group liability. Thus, following Model 2 results, in the case of female members, one missed payment in the past quarters reduces her borrowing by Tk.76 for own default and by Tk.32 for other members' default.

The interaction among group members is seen as a positive attribute of group-based lending in terms of peer pressure. That is, peer pressure works positively for group members in terms of accessing loans. It works positively more for women members than men to access credit when they cannot obtain loans individually. Not surprisingly, we find that the interaction term of missed payments of individual and group members (per Model 3) has a positive effect, which helps somewhat to reduce the negative effect of own or group liability on the amount of loan disbursed. Thus, peer pressure works better for women than men, perhaps because, as previously observed, women's groups are more homogeneous.

5.4   **Does Group Liability Affect Grameen Bank Repayment Behavior?**

Table 5 summarizes results for estimating group effects in determining an individual's repayment behavior. As noted earlier, while missing payment does not indicate exactly how much of what was due was missed, loan recovery rate is defined as the proportion of the amount due that was paid during a quarter and thus is a good measure of loan default. Its value could range from 0 (when a borrower misses a payment) to 1 (when a borrower pays the full amount of the minimum payment due). Thus, the dependent variable captures regularity in loan repayment behavior of Grameen Bank group members.

{INSERT TABLE 5 HERE}

As in the case of loan disbursement, test results for all three models of the repayment equation indicate that we can reject the hypothesis of no autocorrelation between the differenced residuals in most cases (i.e., AR(1) and AR(2)).[20] As in the disbursement case, we cannot reject the hypothesis of exogeneity of instruments as a group (Hansen test).

The repayment recovery increases for both men and women borrowers the more years that groups have existed (according to model 1). For example, accordingly to Model 1, we find that an additional quarter of a group's duration increases women's payment recovery by 1.0 percentage points.

Interestingly, an individual's loan recovery decreases as the rate of missed payments of other members in the group increases. This is equally true for men and women. For a 10 percent increase in a group's missed payment, the recovery rate declines by 0.08 percentage points for men and 1.1 percentage points for women (Model 1).

Does group liability in loan repayment matter when we control for the effect of own missed payment? As Model 2 results show, group liability still matters significantly, although

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[20] As expected, the null hypothesis of absence of serial correlation (AR1) is rejected for both loan repayment equations for men and women; however, the null hypothesis of absence of second order serial correlation (AR2), while it is rejected for men's, is not rejected for women's loan recovery equation.

it is lower in magnitude. In the case of women's repayment behavior, the coefficient of cross-member effect is reduced from 0.011 to 0.004. More importantly, the significance of cross-member effect of missed payments is not eliminated even when we include an interaction term (Model 3) that captures the role of group externality/pressure in individual incentive to default. As a result, the negative effect of group liability is somewhat reduced when group externality is allowed.

Group externality in loan repayment is indeed positive for both men and women. That is, an individual group member is generally more likely to default (and thus lower the loan repayment rate) with higher probability of loan default of either his or her own or other group members' default. However, the presence of such group externality in the form of group peer pressure raises the coefficient of own past default. For example, for a 10 percent increase in women's own default rate, the average loan recovery rate rises by 3.7 percentage points with the presence of group interaction (Model 3) and decreases by 2.1 percentage points when such interaction is absent (Model 2). That is, while the default rates of other members reduce an individual's repayment rate, they can paradoxically increase the loan repayment rate simply because of group pressure.

More interestingly, the results are similar for men and women. A higher rate of past missed payments by own or group members decreases the current recovery of payments for men and women. According to Model 3, a 0.10 point increase in a group's missed payment rate decreases both men's and women's recovery by 0.007 percentage points, suggesting that men and women conform equally to group collusion behavior due to the default of other group members. Thus, even if women's groups are more homogeneous than men's, women and men tend to default equally by the probability of loan default of other group members.

As in loan disbursement, the interaction among group members is seen as a positive attribute of group-based lending in terms of peer pressure. That is, peer pressure works positively for group members of men and women in terms of repaying loans. It works positively and equally for men and women members to repay loans. Thus, we find that the interaction term of missed payments of individual and group members (per Model 3) has a positive effect, which helps somewhat to reduce the negative effect of own or group liability on the amount of loan repaid. Thus, peer pressure works both for women and men both in terms of accessing and repaying loans.

5.5   Does Group Size Matter in Group Lending?

We also examined the role of group size in the loan repayment behavior of Grameen Bank members, with the expectation of a negative effect on the amount of loan disbursement and the average loan repayment rate if diseconomies of scale of operation arise with large groups in group lending. Even though the Grameen Bank group size is usually in the 5–7 member range and does not exceed 8, it is still possible that an additional group member reduces both loan recovery and the amount of borrowing per member. A larger group size implies higher monitoring costs and thus higher loan-default costs and lower loan recoveries, meaning that members of larger groups are credit rationed; that is, they receive a lower amount of loan per member because of the higher probability of loan default rates.

The number of members in a group has a statistically negative effect on individual borrowing for both men and women members of the Grameen Bank (Table 4). Thus, according to Model 3 (Table 4), an additional group member reduces the borrowing amount by Tk.10 for men and Tk. 6 for women. Similarly, as Table 5 indicates, there is a statistically

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negative relationship between loan repayment rate and group size for women members. Thus, an additional member in a women's group with an average size of 6.3 members reduces the average loan recovery rate by 0.1 percent for women.

In Grameen Bank group-based lending, group attributes have both positive and negative effects on loan recovery rates. For example, an individual member's own past default behavior leads to lower loan recovery rates; similarly, past loan defaults of other members reduce loan recoveries due to group collusion. However, group pressure helps to reduce a member's loan default cost, thereby raising loan recovery. On the other hand, social capital, measured by length of group's existence, helps to increase the loan recovery rate. These results are independent of the initial conditions that helped to form groups and the underlying group dynamics that subsequently occurred

6. Summary and Conclusion

Whether the group matters in individual borrowing and repayment performance in a group-based lending scheme, such as that of the Grameen Bank, has long been a source of controversy. Although theories abound in the empirical literature, appropriate data for testing the validity of the key assumption have been lacking. Theories show various advantages that a group scheme offers, but results in the available literature are not conclusive. In fact, some studies have shown that certain group mechanisms and dynamics help to improve overall loan performance rates, while others find no such effect or even a negative one.

Past studies have often been contaminated by estimation which has not yielded satisfactory results. A major problem has been the use of cross-sectional data that is subject to unobserved group and individual endogeneity bias. That is, past studies have not

controlled for why an individual joins a group and why certain group features operate differently in a Grameen Bank type of group-lending system. In addition, many such studies have not distinguished the positive role of joint liability, which imposes sanctions on individual behavior as a way to reduce individual loan-default costs, from the potential negative role of groups, where one member's default can encourage that of other members. In short, past studies have failed to address the reflection problem of social capital as embodied in group lending.

This paper has exploited the unique group-level, panel data on the repayment history of 297 groups of the Grameen Bank since their inception and estimated a dynamic model using the GMM method to establish the causal effect of group incentive, after controlling for individual incentive to repay, on the amount of loan received and its repayment in the Grameen Bank system. The GMM results show that, after controlling for initial conditions and the common time effect, both the amount of loan and repayment respond negatively with both individual and group liability.

For example, group incentives to default (in terms of past quarterly loan repayment of group members) negatively affect the amount of current borrowing, at least for women borrowers of the Grameen Bank. That is, the higher the rates of missed payments among group members, the lower the amount of money a woman member obtains from the Grameen Bank. Group incentives thus matter in Grameen Bank lending, even after controlling for the potential role of individual default incentives and both observed and unobserved initial conditions that led to the groups' formation and existence.

Group incentives to default also matter in the Grameen Bank's loan recoveries, and are equally true for both women and men group members. This means that an individual

member is likely to default if other members do likewise, indicating the potential role of group collusion in group-based lending.

The group-based scheme evidently has the added advantage of promoting social capital above and beyond the pre-existing social capital that binds members to form groups. Thus, even after controlling for the initial social capital that helps to sort individuals into groups, we find that there is a positive role of an emerging social capital for women, even if their groups are more homogeneous than men's groups. This role is measured by the positive effect of an additional quarter of a group's existence since women's groups were formed; that is, the higher the number of quarters since women's groups were formed, the greater the incentive for women to repay. For men, the role of social capital does not work in the same direction, perhaps because men are from diverse groups or because the length of time a group has existed does not necessarily promote higher loan repayment rates or the amounts received by individual group members.

This study's findings thus confirm the central hypothesis of group-based lending: Groups, either through homogeneity or cross-member effect, matter significantly. At the same time, group-based lending is not a panacea for higher repayment rates because of the potential for collusion, which can negatively affect the repayment behavior of members, including those who are willing to repay, resulting in joint liability. Paradoxically, group-based lending can improve the rate of individual loan repayment and also reduce it by prompting an individual member to default when other members do so.

Yet this potential pitfall is neither predominant nor universal. The incentive structure we observe for men's groups does not create such collusion but is rather conducive to loan recovery. Owing to the diversity of men's groups, a member may repay even if others default, clearly indicating risk pooling across diverse groups of the Grameen Bank's

male members. Thus, even if men pose a greater credit risk than women, a group mechanism still works for men, explaining why the observed annual repayment rates for both men and women in Grameen Bank lending groups are about the same (close to 94 percent on an annual basis).

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Figures

Figure 1: Loan default and recovery probability under individual lending
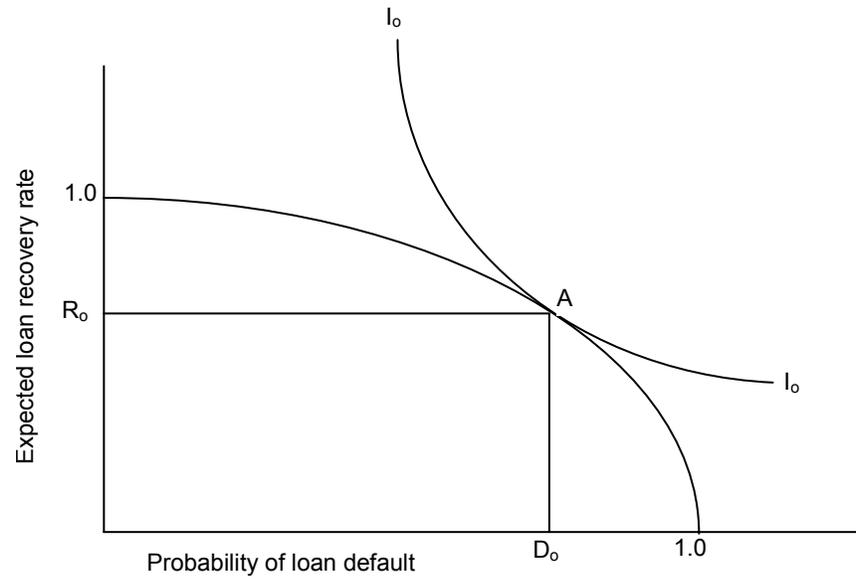
Figure 2: Loan default and recovery incentives under group lending

Expected loan recovery rate (y-axis)

Probability of loan default (x-axis)

I_G, I_o, I_G, I_o, I'_G, I'_G

1.0, R_G, R_o, R'_G
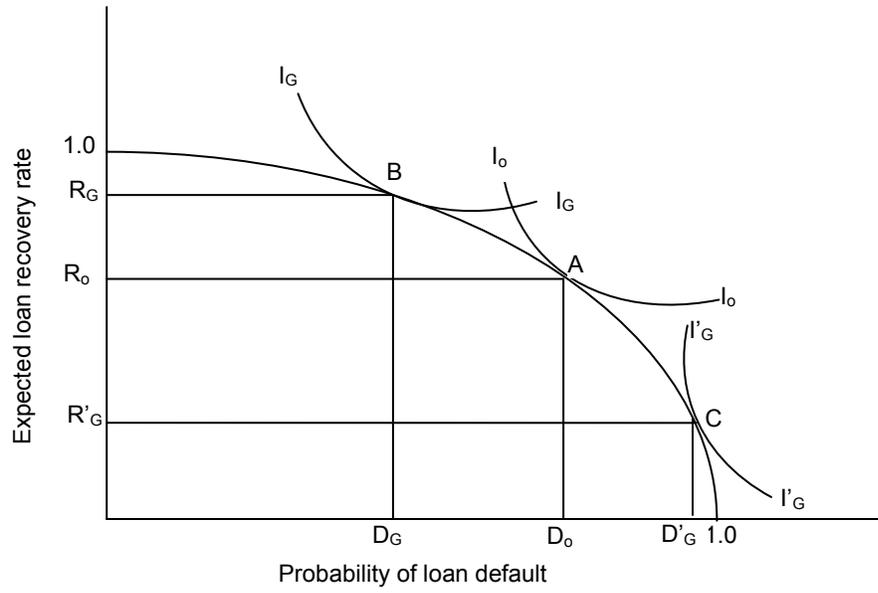
B, A, C

D_G, D_o, D'_G 1.0

Figure 3: Male-female trend in loan disbursement with changes in past loan default
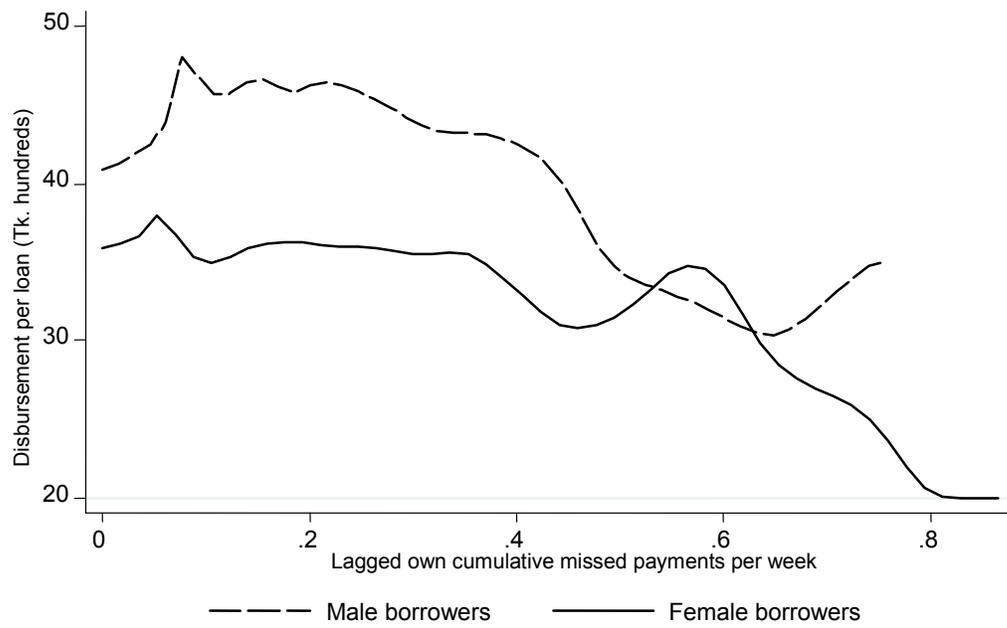
Figure 4: Male-female trend in weekly recovery rate with changes in past loan default
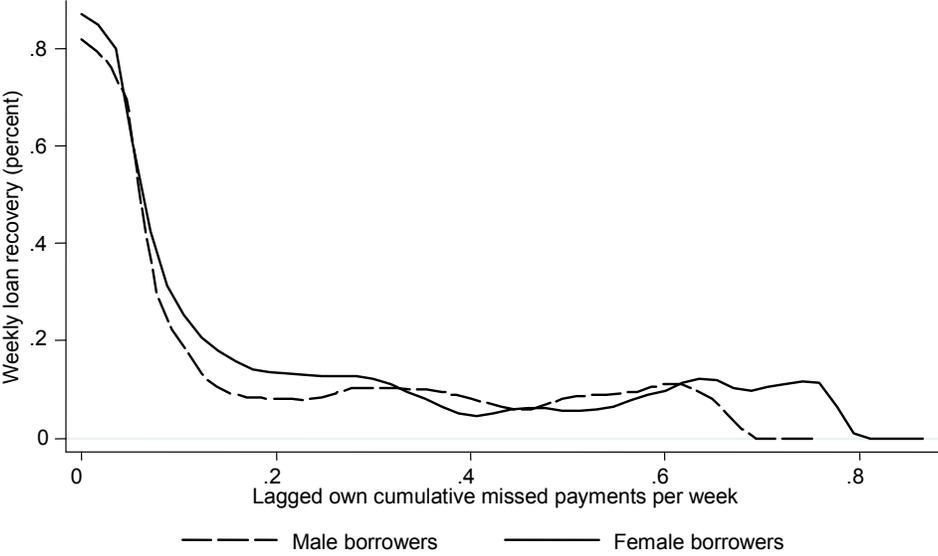
Tables

Table 1: Group and member distribution, by sex

Division	Branch name	Time frame	Group		Total group	Member		Total member	Male (%)	Female (%)
			Male	Female		Male	Female			
Rajshahi	Pairaband	1994-2002	1	14	15	6	79	85	7.1	92.9
Rajshahi	Dhaperhat	1994-2000	6	13	19	30	72	102	29.4	70.6
Rajshahi	Bamonerhat	1994-2001	0	42	42	0	229	229	0	100
Rajshahi	Joymonirhat	1994-2001	17	67	84	106	386	492	21.5	78.5
Rajshahi	Kamarpukur	1994-2001	0	57	57	0	334	334	0	100
Dhaka	Shovapur	1997-2001	0	33	33	0	165	165	0	100
Dhaka	Shovapur	1997-2001	0	16	16	0	80	80	0	100
Chittagong	Noapara	1996-2002	0	16	16	0	91	91	0	100
Khulna	Sutiakathi	1998-2002	2	13	15	10	78	88	11.4	88.6
Total			**26**	**271**	**297**	**152**	**1,514**	**1,666**	**9.1**	**90.9**

Table 2: Summary statistics for selected loan distribution variables, by division

Variable	Dhaka	Chittagong	Khulna	Rajshahi	All divisions
Amount disbursed per loan (Tk.)					
Male	-	-	9,263.8	3,359.4	4,169.1
Female	6,340.4	5,164.1	5,105.9	2,810.3	3,835.4
Total	6,340.4	5,164.1	5,590.4	2,867.6	3,861.7
Quarterly average of missing payments					
Male	-	-	0.004	0.169	0.146
Female	0.004	0.009	0.003	0.079	0.052
Total	0.004	0.009	0.003	0.089	0.060
Quarterly average of recovery rate of member's payment[1]					
Male	-	-	0.829	0.511	0.564
Female	0.926	0.844	0.903	0.726	0.790
Total	0.926	0.844	0.892	0.703	0.726
Rate of accumulated missed payments by member[2]					
Male	-	-	0.003	0.098	0.085
Female	0.004	0.006	0.003	0.045	0.026
Total	0.004	0.006	0.003	0.045	0.031
Rate of accumulated missed payments by other group members[2]					
Male	-	-	0.011	0.351	0.305
Female	0.015	0.026	0.012	0.156	0.106
Total	0.015	0.026	0.012	0.176	0.121
Number of weeks since group began x 10^{-1}					
Male	-	-	13.5	19.5	19.2
Female	11.9	16.5	13.2	18.4	17.3
Total	11.9	16.5	13.2	18.5	17.5
Number of group members					
Male	-	-	6.0	6.3	6.3
Female	8.1	7.2	7.9	5.9	6.3
Total	8.1	7.2	7.7	6.0	6.3
Number of loans per member					
Male	-	-	5.0	5.8	5.7
Female	5.0	6.0	6.1	5.8	5.8
Total	5.0	6.0	5.9	5.8	5.8
Observations					
Male	-	-	2,685	53,591	56,276
Female	57,749	29,435	20,354	393,163	500,701
Total	57,749	29,435	23,039	446,754	556,977

[1] If the member pays at least the amount due each week, this variable has a value of 1 and 0 otherwise.

[2] Number of missed payments since group inception divided by the number of weeks, lagged one week.

Table 3: Average standard deviations of member pre-participation characteristics within groups and villages, by gender

Variable	Within group		Within village	
	Male	**Female**	**Male**	**Female**
Age of member (years)	4.8	4.1	5.2	4.5
	(31.3)	(27.7)	(32.2)	(27.9)
Education of member (years)	2.4	1.5	2.7	1.6
	(4.9)	(1.5)	(4.8)	(1.6)
Maximum education of family	2.0	2.2	2.3	2.4
members (years)	(6.3)	(3.7)	(6.1)	(3.7)
Annual household	1,619.6	3,716.3	3,102.1	3,716.1
income (Tk.)	(10,605.3)	(14,154.3)	(14,363.2)	(14,704.1)
Household agricultural landholding	9.3	8.0	8.0	7.6
(decimals)	(17.5)	(10.5)	(12.1)	(8.0)
Household non-agricultural	4.1	3.7	4.4	4.0
landholding (decimals)	(11.1)	(8.6)	(10.0)	(8.5)
Housing structure (1 = tin roof and tin	0.03	0.06	0.06	0.05
wall)	(0.03)	(0.5)	(0.03)	(0.04)
Observations	26	274	6	106

Note: Figures in parentheses are mean values of the variable.

Table 4: Impacts of individual and group default on loan disbursement
(Tk. thousands) (GMM estimates)

Explanatory variable	Model 1		Model 2		Model 3	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Number of quarters since group began	-0.053 (-0.97)	0.111** (3.23)	-0.046 (-0.69)	0.103** (3.22)	-0.014 (-0.19)	0.075** (2.27)
Square of number of quarters since group began	-0.002* (-1.85)	-0.001** (-2.35)	-0.0001* (-1.83)	-0.0001** (-2.23)	-0.002* (-1.65)	-0.001** (-2.68)
Lagged average missed payments of own per quarter*	-	-	-0.020 (-0.65)	-0.076** (-4.33)	-0.081 (-1.05)	-0.144** (-4.96)
Lagged missed payments of other group members per quarter*	-0.061** (-2.70)	-0.046** (-3.58)	-0.058** (-2.76)	-0.032** (-3.37)	-0.068** (-2.37)	-0.033** (-2.79)
Lagged missed payments of own per quarter*Lagged missed payments of other group members per quater	-	-	-	-	0.007 (1.10)	0.016** (2.90)
Group size	-0.008** (-2.80)	-0.009** (-3.63)	-0.008** (-2.51)	-0.009** (-3.78)	-0.010** (-2.50)	-0.006** (-2.78)
Wald chi-sq	96.45	20,456.5	377.74	21,777.6	53.30	22,553.4
p > chi-sq	0.000	0.000	0.000	0.000	0.000	0.000
Hansen test of overid. restrictions	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 92.28$, $p > \chi^2 = 1.00$	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 96.86$, $p > \chi^2 = 1.00$	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 89.45$, $p > \chi^2 = 1.00$
Arellano-Bond test for AR(1)	z = -2.83, p > z = 0.005	z = -14.05, p > z = 0.00	z = -2.82, p > z = 0.005	z = -14.11, p > z = 0.00	z = -2.82, p > z = 0.005	z = -14.17, p > z = 0.00
Arellano-Bond test for AR(2)	z = 1.88, p > z = 0.061	z = 8.82, p > z = 0.00	z = 1.88, p > z = 0.061	z = 8.89, p > z = 0.000	z = 1.87, p > z = 0.061	z = 8.91, p > z = 0.00
Observations	4,609	40,925	4,609	40,925	4,609	40,925

Note: * and ** refer to significance levels of 10 percent and 5 percent (or better), respectively. Figures in parentheses are t-statistics based on clustered standard error at the village level. The initial characteristics controlled for are a member's age and education; a household's maximum education, yearly income, land and non-land assets, and structure (e.g., whether house has tin roof and walls). The mean values of these variables for other group members and group size (reported here) are also included. The Hansen test

* Number of missed payments since group inception, divided by the number of quarters lagged three quarters.

Table 5: Impacts of individual and group default on loan recovery
(GMM estimates)

Explanatory variable	Model 1		Model 2		Model 3	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Number of quarters since group began	0.008* (1.81)	0.010** (2.06)	0.009** (2.28)	-0.010** (-2.38)	0.009 (1.57)	0.011** (3.37)
Square of number of quarters since group began	0.0001 (0.79)	-0.0001 (-1.33)	0.0001 (0.82)	-0.00004 (-1.17)	0.00003 (0.42)	-0.0001* (-1.74)
Lagged average missed payments of own per quarter*	-	-	-0.025** (-4.01)	-0.021** (-3.36)	-0.049** (-4.45)	-0.037** (-3.92)
Lagged missed payments of other group members per quarter*	-0.008** (-2.22)	-0.011** (-5.23)	-0.004** (-2.88)	-0.004** (-2.37)	-0.007** (-4.08)	-0.007** (-3.70)
Lagged missed payments of own per quarter*Lagged missed payments of other group members per quater	-	-	-	-	0.003** (4.07)	0.003** (2.97)
Group size	-0.0003 (-0.71)	-0.001 (-1.44)	-0.0003 (-0.71)	-0.001* (-1.73)	-0.0002 (-0.99)	-0.001* (-2.04)
Wald chi-sq	11,899.79	7,074.59	39,994.59	20,072.90	5,789.2	29,440.2
p > chi-sq	0.000	0.000	0.000	0.000	0.000	0.000
Hansen test of overid. Restrictions	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 93.27$, $p > \chi^2 = 1.00$	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 86.20$, $p > \chi^2 = 1.00$	$\chi^2 = 0.00$, $p > \chi^2 = 1.00$	$\chi^2 = 86.37$, $p > \chi^2 = 1.00$
Arellano-Bond test for AR(1)	z = -5.45, p > z = 0.005	z = -16.89, p > z = 0.00	z = -2.82, p > z = 0.005	z = -17.91, p > z = 0.00	z = -6.20, p > z = 0.00	z = -17.79, p > z = 0.00
Arellano-Bond test for AR(2)	z = -2.28, p > z = 0.022	z = -0.41, p > z = 0.681	z = 1.88, p > z = 0.061	z = -0.21, p > z = 0.835	z = -2.29, p > z = 0.022	z = -0.26, p > z = 0.798
Observations	3,501	32,845	3,501	32,845	3,501	32,845

Note: * and ** refer to significance levels of 10 percent and 5 percent (or better), respectively. Figures in parentheses are t-statistics based on clustered standard error at the village level. The initial characteristics controlled for are a member's age and education; a household's maximum education, yearly income, land and non-land assets, and structure (e.g., whether house has tin roof and walls). The mean values of these variables for other group members and group size (reported here) are also included.

* Number of missed payments since group inception, divided by the number of quarters lagged three quarters.