

Title: Repaying Microcredit Loans: A Natural Experiment on Liability Structure

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Abstract: This paper utilises a natural experiment – the shift from individual to joint lending by a microfinance organization in Pakistan – to show significant improvement in borrower discipline under joint liability loans. I find that a possible mechanism for this impact is the degree of pre-existing social connection between the group members. For the mechanism analysis, I use the exogenous variation in the number of months borrowers had till the expiry of their individual liability loans at the time of the announcement of the shift to joint leading as an instrument for the degree of social connection of the group.

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I Introduction

Joint liability microcredit, considered to be the key innovation that allowed the extension of credit to the poor, overcomes information asymmetries by lending to groups of individuals jointly responsible for the loan. It alleviates some of the constraints in lending to the poor in developing countries such as the lack of collateral and poor contract enforcement, by relying on local information the borrowers possess (Gangopahyay, Ghatak & Lensink, 2005). Other issues include adverse selection, where borrowers who are better at repaying are not observable to the Microfinance Institute (MFI), and ex ante moral hazard where borrowers may take too much risk (Stiglitz, 1990). The effect of these can be mitigated by imposing strict joint liability so that borrowers have an incentive to choose safer borrowers and to monitor each other (Ghatak & Guinnane, 1999; Ghatak, 2000; Armendariz & Morduch, 2005). However, as Besley and Coate (1995) first pointed out, the burden of paying for others could, instead, lead to individuals defaulting on their own loans too. Hence, it is not immediately obvious which type of liability will result in better borrower discipline.

In this paper I use a natural experiment to compare performance of borrowers under individual and joint liability contracts. Akhuwat, an MFI operating in Pakistan, made an organization wide decision to offer all new loans as joint liability loans instead of as individual liability. This change was effective immediately (from the very next month) on all new loans being issued by the MFI and was not accompanied by any other changes to the loan contract. I find significant improvement in borrower discipline¹ under joint liability as compared to under individual liability loans for the group of borrowers who are observed borrowing under both individual and joint liability.

I explore the mechanism for this impact by using the variation in time left to the completion of the individual liability loan at the time of the announcement of the shift to joint liability as an instrument for social connection. The more time borrowers had, the more likely they were to form groups with people they interacted with socially. Groups with greater social connection, as measured by pre-existing characteristics², were better disciplined in making instalment payments. This provides evidence that in the absence of mandatory group meetings, groups with a higher proportion of members who interact socially³, do better. This could be a potential screen that MFIs use, particularly in urban areas, where group meetings are costly.

While early evidence from studies by Wydick (1999) and Sharma and Zeller (1997) showed that social capital is not correlated with better performance, the findings of this study are consistent with more recent robust studies that use exogenously formed groups (Karlan, 2007) or preselected groups (Feigenberg, Field & Pande, 2013), and find some evidence that social capital matters for repayment and default rates.

Recent years has seen a shift away from joint liability⁴ towards more flexible contracts with individual liability or group lending without imposing joint liability (see Gine & Karlan, 2014; de Quidt, Fetzter & Ghatak, 2016, 2018, for details). One reason for this shift is inconclusive evidence on whether joint liability helps improve borrower performance. The empirical evidence so far has been marred by design issues, leaving this an open question, but one that cannot be ignored as microcredit continues to be relevant with recent evidence showing that it has a significant effect on rural economies (Breza & Kinnan, 2018).

Studies have relied on carefully designed Randomized Control Trials (RCTs) to overcome these design issues. Gine and Karlan (2014) conducted two RCTs to study the impact of liability type on borrower behaviour. In one, they removed group liability from pre-existing groups and in the other, they utilised the expansion of a Philippine microfinance bank into new areas to randomly assign comparable villages to either receive group or individual liability loans. In both cases, weekly group meetings were continued. They find no difference in default rates in both existing and expansion areas between the individual and group borrowers. The lack of difference might be attributable to lending pattern adjustments whereby loans under individual liability were smaller (Banerjee, 2013). A similar criticism applies to the study in Mongolia by Attanasio, Augsburg, De Haas, Fitzsimons and Harmgart (2015) which also uses village level randomization on loans extended to first time women borrowers and find no significant difference in repayment rates.

On the other hand, Carpena, Cole, Shapiro and Zia (2013) utilising a very similar natural experiment setting to this study - the organization wide shift from individual to joint liability lending - find significant improvement in monthly repayment discipline in India under joint liability. The change was phased in so that borrowers mid cycle continued their individual liability loan. To avoid selection issues, they use a sample of 276 borrowers who had a loan before the switch and who got another loan (on joint liability) from the same organisation and compare monthly repayment performance under both types of liability structure for the same borrowers. I employ a similar empirical strategy, but my paper improves on their work in three important ways: no contract changes that confound identification; much larger sample with more detail on borrowers; and ability to explore mechanisms (for more detail see Table S1 in Supplementary Materials). The changes to loan contract in Carpena et al. (2013) made it difficult to disentangle the impact of the switch in liability structure from that of other changes to the loan, threatening clean identification. I also have a more comprehensive dataset to accurately define the main outcome variable of interest, borrower performance (more details in section 3). Finally, I can comment on a possible mechanism for the findings by showing that pre-existing group social connection effects borrower performance.

2 Natural Experiment Setting

The partner organisation is a non-profit MFI Akhuwat that started its operations from Lahore, Pakistan in 2001 with the objective of providing interest free credit to the poor. Apart from the zero-interest rate feature of the loans, the organization operates like any regular MFI. Prior to March 2011, Akhuwat extended loans on individual liability where each borrower had to be guaranteed by a person who was not allowed to borrow from the organization till the loan they had guaranteed finished. The primary motivation for shifting from individual to group liability loans was complaints from guarantors about not being able to borrow from Akhuwat during the period they had guaranteed a loan.

The transition from individual to joint liability was immediate and was simultaneously implemented in all branches. There were no accompanying changes to the loan contract with this shift - loan amount, duration, repayment frequency and the zero-interest rate remained the same as before. All loans continued to be repaid in equal monthly instalments at the MFI branches. Instalment payment for the entire group could be made by any member so long as the full amount due for the group was paid. However, this was not a strict requirement and so not a change to the loan contract. Akhuwat staff was given training to inform them about the additional procedures related to joint liability lending, such as the restrictions on group size and location of members. The organization did not rely solely on peer selection and so borrower appraisal and verification procedures continued as before.

Mandatory group meetings were not introduced with the shift since the organisation worried about the potential loss in income for the borrowers being away from their business. The borrowers are required to come together as a group twice, at the start of the loan, once when briefed about the terms and conditions of group liability and a second time when they formally sign the contract. There is no requirement for the groups to nominate a leader. This is to avoid one person dominating the group and potential issues with him/her resulting in the whole group defaulting.⁵

When the MFI announced the change in liability structure, there were outstanding individual liability loans. All these ongoing loans continued as individual liability till these loans were fully repaid.⁶ For this paper, I only use the sample of borrowers who had an ongoing individual liability loan at the time of the announcement and who after paying back their individual liability loan took out another loan under joint liability. Hence, only borrowers who I observe borrowing under both individual and joint liability in the dataset are included. This provides a natural control and treatment group to compare the performance under different liability conditions. Since we are comparing the behaviour of the same group of people, we do not have to worry about the issue of selection into a contract type.

It is important to note that the sample for the study only comprises of borrowers who ‘choose’ to borrow under joint liability. This is exactly the group I am interested in since only the performance of those who agree to borrow under joint liability is important. There are two main arguments in favour of joint liability. One, that it results in the selection of ‘safer’ borrowers and two, that it incentivises group members to monitor and exert pressure on each other (Ghatak & Guinnane, 1999). Since I am only looking at a selected ‘safer’ group, I can isolate the impact on borrower performance of the second channel - peer monitoring and pressure of group members.

3 Data

I use administrative data from the organisation for all loans issued between the 1st July 2010 and 30th June 2013 period in 14 branches in Lahore, Pakistan. At the time the data request was made to Akhuwat in 2013, these were the oldest branches of the organization allowing data for at least 3 years to be obtained for each branch. The dataset contains detailed information on the loan characteristics and month wise instalment payment by each borrower. A receipt is issued in the borrower’s name and recorded against the borrower’s unique identification number in the database for instalment payments under both individual and joint liability loans. Even if the borrower’s instalment payment is made from contributions by group members, it is recorded against the borrower’s identification number and a receipt is issued.

The sample for the study is comprised of all borrowers with an active individual liability loan in February 2011 who also go on to borrow under group liability. 30% of the borrowers⁷ who had an active individual liability loan in February 2011 go on to take another loan under joint liability once their individual liability loan is completely paid off. Table S2 in supplementary materials provides a comparison of the sample of borrowers who took another loan under joint liability and hence form the sample of for this study and those who didn’t borrow under joint liability. Quite expectedly, those who borrow again are more disciplined and more experienced. Interestingly, they are more likely to be female. Perhaps it was easier for women to form groups, for the same reasons that microfinance started by exclusively extending credit to groups of women (see D’espallier, B., Guerin, I., and Mersland, 2013 for a detailed discussion on this). Table 1 provides the summary statistics for the 2,048 borrowers who form the sample for the study. Each subsequent loan issued by Akhuwat to the same borrower is larger

and longer in duration and so the average loan size for individual liability loan is PKR12,743 and for group liability loan is PKR 18,637.

Table 1: Summary Statistics - Individual and Joint Liability Loans

| | Individual | Joint |
|---------------------------------|------------|--------|
| No. of loans taken from Akhuwat | 1.8 | 2.8 |
| Loan amount (PKR) | 12,743 | 18,604 |
| Loan duration (months) | 11.44 | 14.12 |

Note: Table reports summary statistics for individual and joint liability loan cycles of 2,048 borrowers who received both an individual and joint liability loan.

4 Comparison of Borrower Performance

4.1 Measuring Borrower Performance

‘Borrower performance’ is measured as the likelihood of the borrower missing a monthly payment. Borrowers can pay more than is due in any month and so even if they miss a payment, a borrower could still not be behind in making payments as long as the borrower had overpaid in the past.⁸ Hence, a payment is considered as missed only if the borrower did not make a payment and this results in the borrower being behind in making payments – defined as the variable ‘missed & behind’. Hence, for all analysis, I will use the ‘missed & behind’ variable.

A look at raw data shows a significant improvement for both measures of borrower performance after the shift to joint liability (Table 2). The likelihood of missing a payment is higher (the variable ‘missed’) when a similar definition to Carpena et al. (2013) is used. This is because this definition does not consider the possibility of over payment by borrowers in previous periods.

Using missed payments as a measure for borrower performance has been criticized by Banerjee (2013) on account of these payments eventually being made up. He argues that it might be that loan officers are more tolerant of missed payments as compared to fellow group members. However, in the case of Akhuwat, missed payments were taken very seriously even under individual liability and loan officers had to investigate the reasons for payment being missed and contact the guarantor. Hence, these were costly for the organization. While Akhuwat provides loans at zero interest, the actual cost of capital is higher than zero which means that delayed repayment increases the cost of the subsidy that the organisation is providing on the loans. Further, given the extremely low levels of default experienced by microfinance organizations at large and by Akhuwat in particular (under 0.2%), delayed payments are a more relevant measure of borrower performance than default rates.

Table 2: Average Borrower Performance (%)

| | Individual | Joint | Individual – joint p value |
|-----------------------|------------|--------|-------------------------------|
| Missed | 10.18 | 5.98 | <0.001 |
| Missed & behind | 6.33 | 4.02 | <0.001 |
| Observations (months) | 22,318 | 23,337 | |

Note: Table reports average performance for the 2,048 sample of borrowers who received both an individual and joint liability loan.

4.2 Empirical Specification and Results

The following equation is used to study the impact of switch from individual to joint liability loans for borrowers who received both individual and joint liability loans:

$$Y_{ilt} = \alpha + \beta T_{il} + X\pi + \gamma_i + \tau_t + \varepsilon_{ilt} \quad (1)$$

Where Y_{ilt} is a dummy variable to capture loan repayment discipline in month t , for individual i , loan l . T_{il} is a dummy variable =1 if loan l for individual i is a joint liability loan and 0 otherwise. The coefficient of interest is β which captures any differences between behaviour of borrowers on individual and joint liability loans. X_{il} is vector of borrower and loan characteristics (number of previous loans, loan age), γ_i are the time-invariant characteristics of the borrower, τ_t are time fixed effects. ε_{ilt} is the error term. This set up does not allow the identification of the change in contribution of the borrower to repayment but rather the effect, on average, on the likelihood of repayment being made on time with the shift from individual to joint liability, irrespective of the source of the funds. These might be contributed by other group members because of strict joint liability.

4.2.1 Results

There is significant improvement in borrower performance, measured as missed payments ('missed & behind') that make the borrower behind in their payment schedule under joint liability (the group dummy coefficient is negative and significant in Table 3 for all specifications). All coefficients reported are from ordinary least squares (OLS) (results are comparable when a logit model is used – column (1) in Table S3 in supplementary materials). Results in column 1 use individual borrower monthly loan cycle data and results in columns 2 are with standard errors clustered at the borrower level. To account for intra-group correlation in performance of borrowers who belong to the same group, standard errors clustered by the group are in column 3. The results are consistent across all specifications.

Table 3: Borrower Performance: Missed Payments

| | (1) | (2) | (3) |
|---|----------------------|----------------------|----------------------|
| Group dummy | -0.025*** (0.002) | -0.025*** (0.003) | -0.025*** (0.003) |
| Loan age | 0.011*** (0.001) | 0.011*** (0.001) | 0.011*** (0.001) |
| Loan age squared | -0.001*** (0.000) | -0.001*** (0.000) | -0.001*** (0.000) |
| Mean of dependent var. for individual liability loans | 0.063 | 0.063 | 0.063 |
| Number of borrowers | 2,048 | 2,048 | 2,048 |
| Number of observation months | 45,655 | 45,655 | 45,655 |

Note: Table reports results from an OLS regression with dependent variable equal to one if the borrower has missed instalment payment in that month making him/her behind schedule, zero otherwise. The sample includes all loans irrespective of whether the loan had been fully repaid or not by the end of the sample period. Group dummy is equal to 1 if the loan is joint liability and 0 if individual liability. Loan age is the number of months since loan was issued. All regression includes control for individual fixed effects and calendar month. Standard errors clustered by the borrower in column (2) and by the group in column (3). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The estimates in Table 3 uses the entire sample of borrowers irrespective of whether their joint liability loan had expired or not by the end of the sample period. Since, borrowers tend to miss more payments during the latter months of a loan cycle, I might be overestimating the impact of switch to joint liability

by not considering the months near maturity for borrowers whose loans had not expired. To check if this is the case, I estimate equation 1 for only the sample of borrowers for whom the joint liability loan had also expired by the end of the sample period. I still find a significant reduction in missed payments (results in columns (2) to (4) in Table S3 in supplementary materials) and so the estimates in Table 3 are not driven by the behaviour of individuals who borrowed close to the shift to joint liability.

It appears that the pressure exerted by joint liability is leading to a beneficial improvement for the organization without investing in the administrative cost of group meetings. To measure borrower discipline, if I use a definition like that of Carpena et al. (2013), the estimates are larger.⁹ By not considering the possibility of overpayment by borrowers, they seem to have overestimated the magnitude of the impact. I also considered a measure based on ‘intensity’ i.e. the percentage of cumulative payment due that the borrower has missed. The results are like those obtained with the measure used in Table 3 and are available upon request.

4.3 Robustness Checks

Next, I check the internal validity of the results following Carpena et al. (2013) study which uses two tests. One is a ‘learning test’ where by restricting the sample to borrowers with two individual liability loans, they test if merely having a second loan leads to improvement in discipline. They find no significant effects on missed payments of having a second loan. The sample period for the data that I have starts less than a year before the switch to joint liability loans, so I cannot use two consecutive individual liability loans of a borrower to formally check for learning effect. Instead, I consider two complete joint liability loan cycles of borrowers. Individual liability loan cycle of the borrowers is excluded from the analysis. If the improvement in borrower discipline is due to the experience of having borrowed before, then borrower performance should also significantly improve between two cycles of joint liability loans. ‘Second joint loan’ is a dummy that takes on a value of 1 for the second round of borrowing under joint liability and is 0 for the first round of joint liability loans. I estimate equation 1 with the sample of borrowers with two complete joint liability loans using the ‘second joint loan’ dummy instead of the group dummy. Results in Table 4 show that the coefficient on the variable of interest (second joint loan) is insignificant.

Table 4: Borrower Performance over two joint liability loan cycles

| | (1) | (2) |
|------------------------------|-------------------|-------------------|
| Second joint loan | -0.014 (0.009) | -0.014 (0.011) |
| Number of observation months | 1,962 | 1,962 |

Note: Table reports results from an OLS regression with dependent variable equal to one if the borrower has missed instalment payment in that month making him/her behind schedule, zero otherwise. The sample only includes two consecutive complete joint liability loan cycles of borrowers. Group dummy is equal to 1 if the loan is joint liability and 0 if individual liability. All regression includes individual fixed effects and controls calendar month, loan age (the number of months since loan was issued) and loan age squared. Standard errors clustered by the borrower in Column (2). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

It is important to note that 43% of the individual liability loans were a second or higher loan cycle so any discontinuous learning effect between first and second loan cycle would not be expected to drive the results that we see once the borrowers switch to joint liability. When we restrict the sample to experienced borrowers, that is those who were on a second or higher individual liability loan, we still

obtain similar results (see Table 5). Hence, it is unlikely that the results are merely due to a learning effect.

Table 5: Borrower Performance of Experienced Borrowers: Missed Payments

| | (1) | (2) | (3) |
|---|----------------------|----------------------|----------------------|
| Group dummy | -0.034*** (0.003) | -0.034*** (0.004) | -0.034*** (0.004) |
| Loan age | 0.011*** (0.001) | 0.011*** (0.002) | 0.011*** (0.002) |
| Loan age squared | -0.001*** (0.000) | -0.001*** (0.000) | -0.001*** (0.000) |
| Mean of dependent var. for individual liability loans | 0.071 | 0.071 | 0.071 |
| Number of borrowers | 877 | 877 | 877 |
| Number of observation months | 20,296 | 20,296 | 20,296 |

Note: Table reports results from an OLS regression with dependent variable equal to one if the borrower has missed instalment payment in that month making him/her behind schedule, zero otherwise. The sample includes all loans of experienced borrowers (those on a second or higher individual liability loan) irrespective of whether the joint liability loan of these borrowers had matured or not by the end of the sample period. Group dummy is equal to 1 if the loan is joint liability and 0 if individual liability. All regression includes individual fixed effects and control for calendar month and loan age (number of months since loan was issued) and loan age squared. Standard errors clustered by the borrower in Column (2) and by the group in Column (3). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Since joint liability loans are a completely new experience, borrowers may be on their best behaviour due to this ‘honeymoon’ period. The second test in Carpena et al (2013) tests this by comparing the performance of first-time borrowers from the organisation under individual liability and under joint liability and still find that those on joint liability are significantly more disciplined. Using a similar strategy, I restrict the sample to first-time borrowers from the organisation on individual liability loan and first-time borrowers from the organisation on joint liability loan. For the sample of 13,053 first time joint liability loans, I find that borrowers miss 4% of the payments while the 5,139 borrowers on a first-time individual liability loan miss significantly more (6%).¹⁰ It might be argued that even if the borrower is taking out a loan for the first time, the experience of others in the group may be important and contributing to better performance. To check for this, I restrict the sample to first time borrowers who are in a group with all other members also on a first-time loan. I still find that these borrowers miss fewer payments as compared to those on a first-time individual liability loan.¹¹ This test relies on the assumption that there are no systematic differences in people who begin borrowing from the MFI at two different points in time and their performance can be compared (referred to as the ‘timing of decision’ issue in Karlan, 2001). This is of course a strong assumption and so the results from the test should be interpreted with caution. However, note that the test also has support from results for ‘learning effect’ above (in table 4) since borrower's performance did not get worse during the second round of joint liability loans. If borrowers did well under joint liability loan only because it was a new experience, then it would be expected that their performance also gets worse under a second joint liability loan.

5 Mechanism Analysis

I now turn to the question of what leads to better borrower discipline under joint liability. The degree of social capital is proposed in literature as one possible explanation for this (Cassar, Crowley &

Wydick, 2007). Measuring social capital is challenging and in the context of microfinance, quantifying its impact on group performance is further complicated by the formation of groups based on self-selection. Hence, any analysis is subject to issue of endogeneity: individuals are likely to sort themselves into groups with certain characteristics which may be unobservable. The evidence from empirical studies is mixed. Karlan (2007) using exogenously formed groups by an MFI in Peru found that stronger social connections as measured by geographic and cultural proximity lead to higher repayment and savings while Wydick (1999) and Ahlin and Townsend (2007) found that stronger the social ties, the poorer the group performance due to these hindering social sanctions.

Another possible channel through which joint liability loans may lead to improvement in discipline is mandatory group meetings. Meetings help foster linkages and the development of an informal insurance network amongst borrowers. A series of experiments have been conducted to try to understand how repayment frequency correlates with the formation of social capital and default.¹² However, there are no mandatory group meetings in the setting of this paper, and so this is not a relevant channel.

5.1 Measuring social connection

I measure social capital as the pre-existing connection between the group members. This is likely to have evolved through the loan cycle, but due to its endogenous formation, ex-post levels of it cannot be used for analysis. Also, I am unable to measure and comment on the channels through which social capital may impact repayment – whether it is peer monitoring or enforcement or both.

To measure this pre-existing social capital, I look at different dimensions of connection highlighted in literature as important. These include the borrowers knowing each other, frequency of meeting, being neighbours and belonging to the same caste. To capture informal insurance link, I ask a hypothetical question about borrowing from a group member in a time of need and if they have ever, or are currently, doing business together.

Some studies have also highlighted the importance of the group leader's social ties and quality in running the group for repayment performance and reducing moral hazard (Paxton, Graham and Thraen, 2000; Hermes, Lensink & Mehrteab, 2005, 2006). However, Akhuwat does not require any group member to act as a leader and so we cannot look at this. Similarly, we cannot explore the geographic variation highlighted by Karlan (2007) to be important since this has been enforced by the organization.¹³ All groups used in this analysis were formed for the first time and so their prior experience of borrowing with each other cannot be considered. Their experience of borrowing in groups in other microfinance organizations may be important but I cannot control for it.

5.2 Survey

Group formation is based on self-selection and can comprise of three to six members. An important condition is that immediate family members cannot be in the same group. However, unlike conventional microfinance organizations, Akhuwat does not place any minimum requirement on the number of women in a group. Hence, there are all three types of groups – all female, all male and mixed groups.

To obtain data on the degree of social connection of the borrower with the group, a short telephone survey with a sub-sample of the borrowers was conducted. The survey was carried out between August and September 2014 with a stratified random sample of borrowers. The sample was stratified on both the gender mix of the group and the loan cycle of the borrower to have a proportionate representation

of borrowers with prior experience of borrowing. The selected borrowers were asked questions about each group member in turn.

Men have been oversampled from within the mixed groups leading to a larger proportion of men (71%) as compared to the full sample (63%).¹⁴ This can be explained by the cultural make-up of Pakistani society where women are more reluctant to talk to strangers on the phone or may not be in possession of the mobile phone number provided. This is a downside of carrying out a telephone survey, such that the surveyed women are a special group who are different from the overall group of female borrowers. However, a comparison of individual and loans characteristics of the sample with the overall sample of women reveals that there is no significant observable differences except for a slight age difference (see Table 6).

Table 6: Comparison of Individual and Loan Characteristics of Female Borrowers

| | Full sample | Survey sample | Mean difference p-value |
|-------------------------------|-------------|---------------|----------------------------|
| Age | 42.9 | 41.61 | 0.011 |
| Personal loan (=1) | 8.37% | 8.47% | 0.954 |
| All female group (=1) | 50.66% | 53.03% | 0.414 |
| Loan amount | PKR 18,164 | PKR18,139 | 0.923 |
| No. of previous loans | 2.58 | 2.51 | 0.234 |
| Monthly donation | PKR57.78 | PKR57.64 | 0.951 |
| On time in paying instalments | 94.88% | 95.24% | 0.773 |
| Observations | 726 | 215 | |

Note: The table reports summary statistics for the full sample of female borrowers who received both an individual and joint liability loan and for the sub-sample of them who were surveyed. The variable age has missing values, so it is based on 705 observations for the full sample and 207 for the survey sample.

While the refusal rate was quite low (3.5%), there were a large number (around 30%) of calls that were either not picked up or the number was not responding.¹⁵ This may result in borrowers who had taken out a loan more recently being oversampled since they are less likely to have changed their number. To counter this, all replacements borrowers were drawn from the same month of loan issue and so the survey sample is representative of the full sample (Table 7 gives a month wise distribution of loans confirming that the survey sample month wise distribution is the same as the full sample).

Table 7: Month wise Distribution of Loans in the Full and Survey Sample

| Year | Month | Full Sample | | Survey Sample | |
|------|-------|-------------|-------|---------------|-------|
| | | No. | % | No. | % |
| 2011 | March | 19 | 1.12% | 8 | 1.23% |
| 2011 | April | 34 | 2.01% | 15 | 2.31% |
| 2011 | May | 59 | 3.49% | 12 | 1.85% |
| 2011 | June | 36 | 2.13% | 10 | 1.54% |

| | | | | | |
|------|-----------|-----|--------|-----|--------|
| 2011 | July | 137 | 8.11% | 45 | 6.93% |
| 2011 | August | 140 | 8.28% | 61 | 9.40% |
| 2011 | September | 139 | 8.22% | 49 | 7.55% |
| 2011 | October | 9 | 0.53% | 1 | 0.15% |
| 2011 | November | 284 | 16.80% | 106 | 16.33% |
| 2011 | December | 262 | 15.50% | 104 | 16.02% |
| 2012 | January | 247 | 14.62% | 101 | 15.56% |
| 2012 | February | 138 | 8.17% | 61 | 9.40% |
| 2012 | March | 83 | 4.91% | 32 | 4.93% |
| 2012 | April | 49 | 2.90% | 18 | 2.77% |
| 2012 | May | 33 | 1.95% | 16 | 2.47% |
| 2012 | June | 21 | 1.24% | 10 | 1.54% |

Note: The table reports the month wise disbursement of joint liability loans for the full sample of borrowers who received both an individual and joint liability loan and for the sub-sample surveyed.

Finally, I check to make sure that the survey sample is representative of the full sample (in table 8). The survey sample is slightly more experienced, with a larger loan size, than the full sample. This is driven by greater number of borrowers with 5 or more loans in the survey sample than in the full sample. This should not be a threat to the analysis since this difference is due to borrowers who are all very experienced borrowers and the effect on them on key outcomes like their discipline is not significantly different.

Table 8: Comparison of Individual and Loan Characteristics of Borrowers

| | Full sample | Survey sample | Mean difference p-value |
|-----------------------|-------------|---------------|----------------------------|
| Age | 40.82 | 40.47 | 0.108 |
| Personal loan (=1) | 5.91% | 5.45% | 0.823 |
| Loan amount | PKR18,605 | PKR19,088 | 0.001 |
| No. of previous loans | 1.79 | 1.88 | 0.085 |
| Monthly donation | PKR 41.13 | PKR 41.14 | 0.494 |
| Borrower discipline | 87.49 % | 87.70% | 0.948 |
| Observations | 2,048 | 755 | |

Note: The table reports summary statistics for the full sample of borrowers who received both an individual and joint liability loan and for the sub-sample of them who were surveyed. Borrower discipline is measured by being on time in paying instalments.

5.2.1 Survey Data

Data on 1,821 group members collected from 755 borrowers reveals that a large number (87%) knew their group members from before the group was formed. Of the group members they knew from before, they met 82% of them weekly. While more than 70% of all male and all female groups are comprised of people the borrower knew from before and met weekly, in mixed groups this ratio drops to 52%. This might be attributable to the rarity of unrelated men and women interacting with each other in

Pakistan and these groups are formed with the spouse or sibling of someone of the same gender that they know rather than a direct connection.

Since there is only have one exogenous variable (time borrowers had to form a group) and several group characteristics, these need to be combined into a single index. To do this, the weight to be given to each characteristic must be decided. As Filmer and Pritchett (2001) pointed out, while using equal weights is the simplest solution, there is no justification for doing this. Since there are no theoretical grounds to assign the weights, Principal Component Analysis (PCA) is used to obtain them. The first principal component is a linear combination of the original variables with the weights based on the correlation matrix that captures the largest amount of information in the variables used (PCA factor weightings are in Table S4 in supplementary materials). The index obtained based on the first principal component is a continuous scale of the relative social connection of the group.

5.3 Empirical Strategy and Results

5.3.1 Identification Strategy

Self-selection into a group is a serious challenge to measuring the effect of group characteristics on borrower performance. To overcome this issue of endogeneity, I use the exogenous variation in the time the borrowers had to form a group to borrow again at the time of the announcement of the switch to joint liability as an instrument for group characteristics. Due to the staggered nature of introduction of group loans, borrowers who had just started their individual liability loan at the time of the announcement of shift to joint liability lending, had much more time to look for potential group members. On the other hand, borrowers whose individual loans were close to expiry had far less time. In fact, in the sample, borrowers had between 0 and 18 months to the expiry of their loan with the average borrower having around 7 months.

To be valid, the instrument z_i should meet two conditions (Angrist & Pischke, 2009):

- i. *Instrument Exogeneity: $Cov(z_i, \varepsilon_i) = 0$*

The instrument should be exogenous and not affect the dependent variable, in this case borrower performance, directly. There are two possible threats to the validity of this exclusion restriction. One, if the borrowers knew in advance of the shift to joint liability, they may be able to adjust their borrowing accordingly. However, discussions with Akhuwat management reassured me that the decision to shift was made by the Head Office and implemented across all branches simultaneously. It is therefore unlikely to be endogenous to borrower characteristics. It can be argued that borrowers had the option of delaying borrowing again and so this time they had till expiry of their loan is not important. However, I find that the average amount of time borrowers takes to re-borrow is between one and two months and with more experience, this time decreases. While borrowers had the option to delay re-borrowing, this is not something that I observe them doing. This might be attributable to them relying on these loans to finance their working capital and so any delay in borrowing again is costly for their enterprise

Figure 2: Average Missed Payments - Joint Liability Loans Only

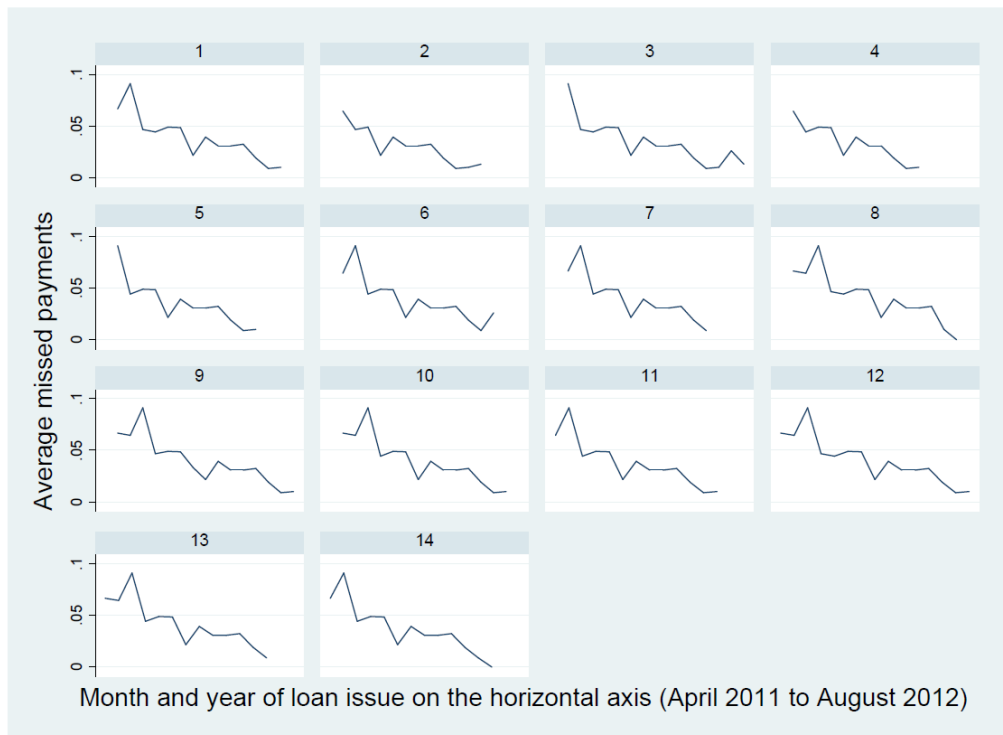


Note: It is a plot of the average missed payments over a complete loan cycle of all loans issued in the same month and year. It is based only on the performance of the sample of borrowers on joint liability loans who had an outstanding individual liability loan at the time of the announcement of the switch to joint liability.

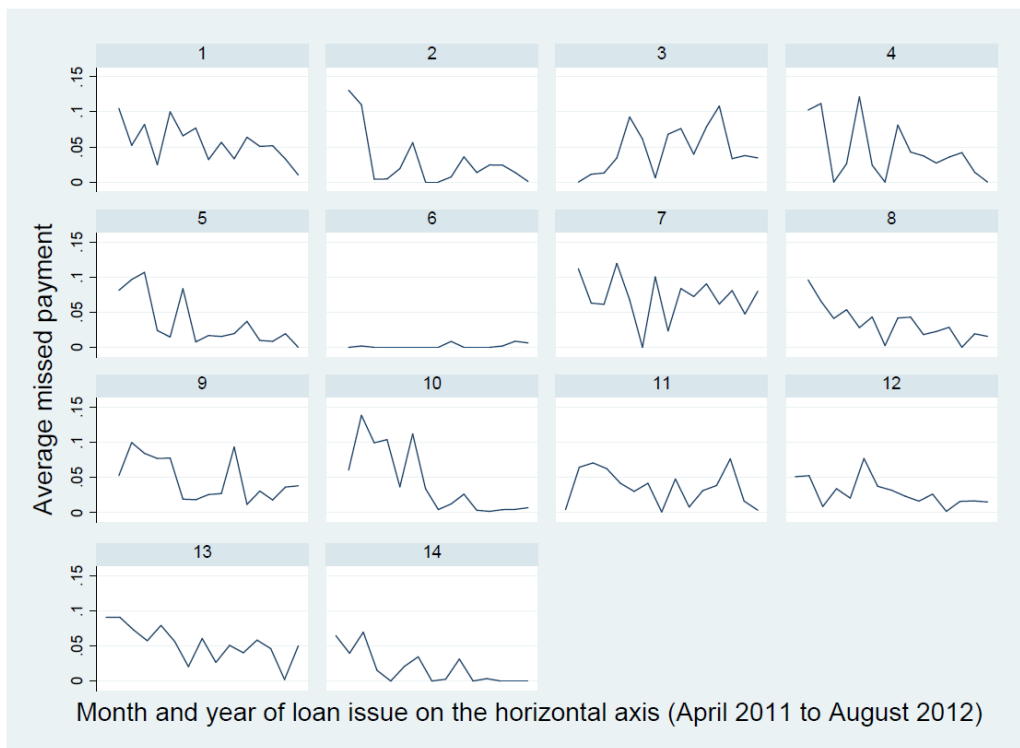
Second, I observe that borrower performance of those on joint liability improves with time after the shift was made to joint liability (see Figure 2 for sub-sample of borrowers who are observed borrowing under both individual and joint liability). This could be due to organization side learning where with experience they improve and develop a better understanding of the kind of monitoring required for joint liability lending. If this is the case, then with time, there should be an improvement in performance of all borrowers and not just the sub-sample being studied. A branch wise look at borrower performance reveals that it is only this special group who had an outstanding individual liability loan at the time of the announcement for whom there was a consistent decline in average missed payments (See Figure 3a). For other borrowers, who did not have an outstanding individual liability loan at the time of the announcement, this is not the case for all branches (See Figure 3b).

Since the time they had till the expiry of their individual liability loan is a constraint only for the group of borrowers who had an outstanding loan at the time of the switch, I argue that the improvement in borrower performance with time is likely to be driven by the choice of group members. It is possible that borrowers who had longer till the expiry of their individual liability loan

Figure 3: Branch wise Average Missed Payment by Month and Year of Loan Issue
(a) Switch



(b) Others



Note: The figure above is a plot of the average missed payments over a complete loan cycle of all loans issued in the same month and year in each of the fourteen Akhuwat branches that form the sample for this study. ‘Switch’ refers to borrowers issued a joint liability loan who we observe taking out both an individual and joint liability loan and ‘others’ to all other borrowers who did not have an outstanding individual liability loan at the time of the announcement of the shift.

at the time of the announcement of the shift had more time to think carefully about who to form groups with instead of being rushed into it. More time also means that they had the time to convince the people they consider more trustworthy to form a group with them. On the other hand, borrowers who were

short on time, likely made compromises. This may explain why repeat borrowers, who had less time, had a higher proportion of first-time borrowers in their group.

ii) *Instrument Relevance: $Cov(X_i, z_i) \neq 0$*

For the instrument to be relevant, it should be correlated with the endogenous variable group characteristics. I present results in the next section from the first stage (equation 2 below) of the two stages least squares (2SLS) estimation procedure to show that the instrument is significantly correlated with group characteristics.

I employ the 2SLS estimation procedure, the first stage for which is as follows:

$$GC_i = \pi_0 + \pi_1 T_i + X_i \delta + \sum_{m=2}^{14} \theta_m + \omega_i \quad (2)$$

where GC_i is the measure for group characteristics of borrower i , T_i is the instrument - number of month to expiry of the loan at the time of the switch. To confirm instrument relevance, first stage coefficient π_1 , which measures how people's choice varies depending on time they had to form group, should be significant. X_i is a vector of controls like gender, number of previous loans, loan age and loan age squared. θ_m are the branch fixed effects.

The second stage is: $Y_i = \alpha + \beta \widehat{GC}_i + X_{it} \gamma + \sum_{m=2}^{14} \theta_m + \varepsilon_i \quad (3)$

where Y_{it} is the average number of instalments missed in a loan cycle. The coefficient of interest is β on \widehat{GC}_i which is the instrumented group characteristics. The rest are as defined above for equation 2.

5.3.2 Results

Table 9 reports the first stage results (estimates for equation 2) using the number of months till the expiry of the individual liability loan at the time of the announcement of the switch to joint liability as the instrument. Results without controls and branch fixed effects are in column 1. The power of the instrument is lowered when controls and branch fixed effects are added but the strategy is not invalidated. The coefficient on the instrument is positive and significant across all specifications showing that when people have more time, they are more likely to form a group with people with whom they have stronger social connection. It looks like when people didn't have time to plan and coordinate with people they know, they turned to other people, possibly introduced to them by a mutual connection or by the MFI. Once borrowers had time to plan, they coordinated with people they knew to ensure that they are ready to borrow with them in a group.

The 2SLS estimates for 755 borrowers from whom primary data was collected are in column (4)-(6) in Table 9. These show that being in a group with stronger social connection has a positive impact on group performance, lowering the likelihood of missing a payment across all specifications. I also present OLS results in column (1) – (3) for comparison, which while negative and significant are smaller in size, most likely due to reverse causation.

Next, I try to unbundle the impact by looking at each characteristic separately instead of combining them in an index. I find, as expected, that the instrument is much weaker when used separately for each characteristic. For most, it is too weak to be credible and so I present second stage results for impact of the group characteristic on borrower performance (in table S5 in supplementary materials) only for the two characteristics where it is relatively strong. These two characteristics are the borrower knowing

groups members from before and being neighbours. This shows that knowing each other well is driving the results rather than other factors like informal insurance network (measured by borrowing in time of need) or cultural similarity (measured by being from the same caste). It may be that being neighbours allows for easier monitoring and potentially enforcement, but I do not have the data to be able to test this.

Table 9: Group Characteristics: First Stage OLS Estimates

| | (1) | (2) | (3) |
|----------------|---------------------|---------------------|---------------------|
| No. of months | 0.063*** (0.019) | 0.058*** (0.020) | 0.056*** (0.020) |
| Controls | No | No | Yes |
| Branch FEs | No | Yes | Yes |
| IV F statistic | 10.45 | 8.43 | 7.55 |
| Pr> F | 0.001 | 0.003 | 0.005 |
| Observations | 755 | 755 | 755 |

Note: Instrument ‘No. of months’ is the number of months till the expiry of the individual liability loan at the time of the announcement of the switch to joint liability. The dependent variable is an index based on the first principal component from PCA of level of social connection in the group. Controls are for gender (male = 1), number of previous loans, loan age in months and loan age squared. Robust standard errors clustered by the group in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Effects of group characteristics on borrower performance

| | OLS regression coefficients | | | IV regression coefficients | | |
|-------------------------|-----------------------------|--------------------|--------------------|----------------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Group social connection | -0.004** (0.002) | -0.003* (0.002) | -0.003* (0.002) | -0.036** (0.018) | -0.039** (0.020) | -0.039* (0.021) |
| Branch FEs | No | Yes | Yes | No | Yes | Yes |
| Controls | No | No | Yes | No | No | Yes |
| Observations | 755 | 755 | 755 | 755 | 755 | 755 |

Note: Group social connection in column (1)-(3) is an index based on the first principal components of PCA on various measures of group connection and in column (4)-(6) is instrumented by the number of months till the expiry of the individual liability loan at the time of the announcement of the switch to joint liability. The dependent variable is borrower discipline which is the average number of missed payments for a group over the loan cycle. Controls are for gender (male = 1), number of previous loans, loan age in months and loan age squared. Robust standard errors clustered by the group in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

6 Conclusion

Using a natural experiment setting, I find significant improvement in borrower performance under joint liability loans as compared to individual loans in a setting with no mandatory group meetings and individual loans with guarantors. The findings are in line with those of Carpena et al. (2013) from a similar setting where the organisation shifted from individual to joint liability but differ from Gine and Karlan (2014) and Attanasio et al. (2015) who found no effect from RCTs. These studies have been criticized due to the loan contract terms not being the same for individual and joint liability loans, making it hard to disentangle the effect of the change in terms from the impact of type of liability. This is not a concern in the setting of this paper where there were no other changes to the contract. There is

however external validity concern, both due to the zero-interest nature of the contracts and due to the evidence coming from a large metropolitan city.

The study finds evidence of the importance of social connections, discussed in literature on joint liability lending, as a possible mechanism for improvement in borrower performance. The variation in the time people had to form groups is used to show that when they have time to think carefully about the formation of the group, borrowers choose based on existing social ties such as knowing people from before and being neighbours. The results suggest that encouraging borrowers to take time to form groups and choosing members that they interact with frequently may be advantageous for MFIs. This is particularly relevant for those who don't want to bear the cost of arranging mandatory group meetings which de Quidt et al, 2016 show is as an alternative insurance strategy to be used with individual liability lending.

It is important to note an important limitation: since I only have information on the person who was interviewed, I am unable to control for how other group members interacted with each other. Due to the strict joint liability nature of the contracts, interaction of others in the group with each other may also be important, and so this study at best presents a partial picture of group interaction. I am also unable to comment on how these connections evolved through the course of the loan cycle and the mechanism for impact such as whether it was peer monitoring or enforcement that impacted borrower performance.

¹ Default rates are extremely low (less than 0.2%) making missed payments a more relevant measure for borrower performance in this setting. Missed payments are costly for the organisation since the loan officer must investigate the reason for non-payment and follow up to ensure payment.

² Borrowers were asked whether they knew their groups members, met them weekly or sometimes, would borrow in times of need, are neighbours, are of the same cast and if they had done business together before the group was formed to borrow together.

³ As measured by the borrower knowing the group members from before, meeting weekly and being neighbours.

⁴ MFIs such as the BancoSol in Bolivia and the ASA in Bangladesh have converted a large part of their portfolios to individual lending and even the Grameen Bank has relaxed the strict joint liability clause for defaulters.

⁵ This information was obtained in a meeting with Akhuwat Regional Manager Mr. Aftab Hussain in August 2014. He was part of the core team at the time changes were introduced in 2011.

⁶ These borrowers with ongoing individual liability loans could not borrow under joint liability until their entire individual liability loan was paid back.

⁷ This rate of 30% is consistent with the rate of re-borrowing for other months for the organisation when it was business as usual and is not specific for this period when there was a switch to joint liability lending.

⁸ Borrowers have the option of paying more than the instalment amount due in any month. It is possible that they don't trust themselves with any extra money that they may have so prefer to overpay.

⁹ Results available on request.

¹⁰ The t-test on the mean difference has a value of -15.38.

¹¹ The sample decreased to 7,128 borrowers and the t-test on the mean difference has a value of -13.86.

¹² Feigenberg et al. (2013), Feigenberg, Field, Pande, Rigol and Sarkar. (2014), Field and Pande (2008).

¹³ Borrowers have to be from the same neighbourhood and preferably live not farther away than one lane from each other.

¹⁴ Full sample here refers to the borrowers who we observe taking out a loan under both individual and joint liability.

¹⁵ Possible reasons for this might be that the borrower has several SIMs or a switch in network used. Within the income group under study, these are common practices.

References

- Ahlin, C. & Townsend, R. M. (2007). Using repayment data to test across models of joint liability lending. *Economic Journal*, 117(517), F11-F51.
- Angrist, J. D. & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton, NJ: Princeton University Press.
- Armendariz, B. & Morduch, J. (2005). *The economics of microfinance*. Cambridge, MA: MIT Press.
- Attanasio, O., Augsburg, B., De Haas, R., Fitzsimons, E., & Harmgart, H. (2015). Group lending or individual lending? Evidence from a randomised field experiment in Mongolia. *American Economic Journal: Applied Economics*, 7(1), 90-122.
- Banerjee, A. V. (2013). Microcredit under the microscope: What have we learned in the past two decades, and what do we need to know? *Annual Review of Economics*, 5(1), 487-519.
- Besley, T. & Coate, S. (1995). Group lending, repayment incentives and social collateral. *Journal of Development Economics*, 46(1):1-18.
- Breza, E., & Kinnan, C. (2018). *Measuring the equilibrium impacts of credit: Evidence from the Indian microfinance crisis*. (NBER Working Paper No. w24329). Cambridge, MA.
- Carpena, F., Cole, S., Shapiro, J., & Zia, B. (2013). Liability structure in small-scale finance: Evidence from a natural experiment. *World Bank Economic Review*, 27(3), 437-469.
- Cassar, A., Crowley, L., & Wydick, B. (2007). The effect of social capital on group loan repayment: Evidence from field experiments. *Economic Journal*, 117(517), F85-F106.
- D'espallier, B., Guerin, I., & Mersland, R. (2013). Focus on women in microfinance institutions. *Journal of Development Studies*, 49(5), 589-608.
- de Quidt, J., Fetzer, T., & Ghatak, M. (2016). Group lending without joint liability. *Journal of Development Economics*, 121, 217-236.
- de Quidt, J., Fetzer, T., & Ghatak, M. (2018). Commercialization and the decline of joint liability microcredit. *Journal of Development Economics*, 134, 209-225.
- Feigenberg, B., Field, E., & Pande, R. (2013). The economic returns to social interaction: Experimental evidence from microfinance. *Review of Economic Studies*, 80(4), 1459-1483.
- Feigenberg, B., Field, E., Pande, R., Rigol, N., & Sarkar, S. (2014). Do group dynamics influence social capital and female empowerment? Experimental evidence from microfinance. *Journal of Policy Analysis and Management*, 33(4), 932-949.
- Field, E. & Pande, R. (2008). Repayment frequency and default in microfinance: evidence from India. *Journal of the European Economic Association*, 6(2-3), 501-509.
- Filmer, D. & Pritchett, L. H. (2001). Estimating wealth effects without expenditure data or tears: An application to educational enrollments in states of India. *Demography*, 38(1), 115-132.
- Gangopadhyay, S., Ghatak, M., & Lensink, R. (2005). Joint liability lending and the peer selection effect. *Economic Journal*, 115(506), 1005-1015.
- Ghatak, M. (2000). Screening by the company you keep: Joint liability lending and the peer selection effect. *Economic Journal*, 110(465), 601-631.
- Ghatak, M. & Guinnane, T. W. (1999). The economics of lending with joint liability: Theory and practice. *Journal of Development Economics*, 60(1), 195-228.
- Gine, X. & Karlan, D. S. (2014). Group versus individual liability: Short and long term evidence from Philippine microcredit lending groups. *Journal of Development Economics*, 107, 65-83.
- Hermes, N., Lensink, R., & Mehrteab, H. T. (2005). Peer monitoring, social ties and moral hazard in group lending programs: Evidence from Eritrea. *World Development*, 33(1), 149-169.
- Hermes, N., Lensink, R., & Mehrteab, H. T. (2006). Does the group leader matter? The impact of monitoring activities and social ties of group leaders on the repayment performance of group-based lending in Eritrea. *African Development Review*, 18(1), 72-97.
- Karlan, D. S. (2001). Microfinance impact assessments: The perils of using new members as a control group. *Journal of Microfinance*, 3(2), 75-85.
- Karlan, D. S. (2007). Social connections and group banking. *Economic Journal*, 117(517), F52-F84.
- Paxton, J., Graham, D., & Thraen, C. (2000). Modelling group loan repayment behavior: New insights from Burkina Faso. *Economic Development and Cultural Change*, 48(3), 639-655.
- Sharma, M. & Zeller, M. (1997). Repayment performance in group-based credit programs in Bangladesh: An empirical analysis. *World Development*, 25(10), 1731-1742.
- Stiglitz, J. E. (1990). Peer monitoring and credit markets. *World Bank Economic Review*, 4(3), 351-366.
- Wydick, B. (1999). Can social cohesion be harnessed to repair market failures? Evidence from group lending in Guatemala. *Economic Journal*, 109(457), 463-475.

Supplementary Material

Table S1: Comparison of current study with the study ‘Liability Structure in Small-Scale Finance: Evidence from a Natural Experiment’ by Carpena et al., 2013.

| | Carpena et al. (2013) | This study |
|--|---|---|
| <i>Comparable study setting with a much larger sample</i> | | |
| Country | Ahmedabad, India | Lahore, Pakistan |
| Sample of borrowers | 276 | 2,048 |
| No. of branches | 2 | 13 |
| Group meetings | No | No |
| Switch direction | Individual to joint | Individual to joint |
| <i>Key improvements</i> | | |
| Improved measure of borrower performance | Using an accounting dataset with limited information: <ul style="list-style-type: none"> i. does not contain information on maturity dates, instalment amounts, and outstanding loan amounts. ii. Can only observe whether a payment was made – don’t know if payment made is on overdue loan amount or a prepayment. | A database with rich information: <ul style="list-style-type: none"> i. contains information on loan amount, maturity date and instalment amount paid each month. ii. Can construct an accurate measure of a borrower missing a payment, accounting for any over payment in the past (as detailed in Section 4.1.). |
| Contract change does not threaten identification | Changes to the contract with switch to joint liability: <ul style="list-style-type: none"> i. The instalment amount to be paid every month became fixed. ii. Interest rate increased from 18 to 24 percent. iii. All members to maintain compulsory savings accounts. | No change to the loan contract with the switch from individual to joint liability. |
| Can comment on mechanism of change | Study did not provide any empirical evidence on why borrower performance improves with a switch to joint liability. | Use primary data and instrumental variable strategy, to show that pre-existing group social connection could explain why borrower performance improves |

Table S2: A comparison of the borrower characteristics of all borrowers with an ongoing individual liability loan at the time of the announcement of the switch to joint liability who take out another loan under joint liability with those who do not borrow again from the organisation.

| | Borrowed under joint liability (1) | Did not borrow under joint liability (2) | Difference: (1) – (2) (p-value) |
|--------------------|---|---|--|
| Gender (male=1) | 0.632 | 0.769 | -0.095 (0.010) |
| Age [†] | 39.29 | 38.76 | 0.327 (0.416) |
| Personal loan (=1) | 10.8% | 14.3% | -0.034 (0.008) |

| | | | |
|--------------------------|--------|--------|-------------------|
| Number of previous loans | 1.79 | 1.60 | 0.200 (0.000) |
| Loan amount (PKR) | 12,674 | 12,475 | 199 (0.352) |
| Loan duration (months) | 11.44 | 11.33 | 0.088 (0.344) |
| Borrower discipline (%) | 72.60 | 61.86 | -0.086 (0.065) |
| Joint F-test | | | 118.38 (0.000) |
| # of observations | 2,048 | 4,894 | |

[†]Age data is only available for 4,186 (86%) of those who did not borrow under JL and 1,821 (89%) of those who did borrow under JL. Note: The table reports summary statistics for the sample of borrowers who had an outstanding individual liability loan at the time of the announcement of the switch, separately for those who also took another loan under joint liability (1) and those who did not borrow under joint liability (2). Borrower discipline is measured as the average number of months the borrower was on time in paying instalments.

Table S3: Logit and OLS estimates for performance of borrowers with completed loans

| | (1) Logit | (2) OLS | (3) OLS | (4) OLS |
|---|---------------------|----------------------|----------------------|----------------------|
| Group dummy | 0.569*** (0.026) | -0.023*** (0.002) | -0.023*** (0.003) | -0.023*** (0.003) |
| Loan age | 1.33*** (0.031) | 0.013*** (0.001) | 0.013*** (0.001) | 0.013*** (0.001) |
| Loan age squared | 0.990*** (0.002) | -0.001*** (0.000) | -0.001*** (0.000) | -0.001*** (0.000) |
| Mean of dependent var. for individual liability loans | | 0.062 | 0.062 | 0.062 |
| Number of borrowers | 1105 | 1693 | 1693 | 1693 |
| Number of observation months | 25,210 | 38,106 | 38,106 | 38,106 |

Note: Column (1) reports odds ratio from estimation of a logit model with dependent variable equal to one if the borrower has missed installment payment in that month making the borrower behind schedule, zero otherwise. A value of less than one for the odds ratio for the group dummy means individuals in groups are less likely to miss a payment. The sample includes all loans irrespective of whether the loan had matured or not by the end of the sample period but drops observations where there is no variation. In columns (2) – (4), are results from an OLS regression with the same dependent variable but with the sample restricted to loans that have been completed (i.e. the sample of borrowers who have fully paid their joint liability loan). Group dummy is equal to 1 if the loan is joint liability and 0 if individual liability. Loan age is the number of months since loan was issued. All regression includes control for individual fixed effects and calendar month. Standard errors clustered by the borrower in column (3) and by the group in column (4). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table S4: Factor weights for characteristics used in Principal Component Analysis

| | |
|------------------|-------|
| Knew from before | 0.515 |
| Meet weekly | 0.564 |
| Same caste | 0.147 |

| | |
|-----------------------------------|-------|
| Would have borrowed | 0.324 |
| Neighbour | 0.469 |
| Had done business together before | 0.265 |

Note: The table reports the weighting assigned to each factor by PCA. The factors are indicator variables for if all group members met each of the following criteria: knew from before is a measure for if the borrower knew group members from before the group was formed, met weekly is if they met at least once a week, same caste is if they belong to the same caste, borrowed refers to if the borrower would have borrowed from the group member in time of need, neighbour refers to if the group member is a neighbour and had done business together before the group was formed.

Table S5: 2SLS estimates for each group characteristic shown separately. Second stage results are only showed when the first stage is significant.

| Dependent variable | Knew each other | Met weekly | Neighbours | Did business together | Same caste | Would borrow in time of need |
|---------------------------|---------------------|-------------------|---------------------|-----------------------|------------------|------------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| <i>First Stage</i> | | | | | | |
| No. of months | 0.013*** (0.005) | 0.011* (0.006) | 0.017*** (0.006) | 0.007* (0.004) | 0.001 (0.004) | 0.010* (0.006) |
| <i>Second Stage</i> | | | | | | |
| | -0.176* (0.091) | | -0.134* (0.073) | | | |
| IV F statistic | 7.37 | 3.63 | 7.77 | 2.92 | 0.128 | 2.92 |
| Pr> F | 0.007 | 0.057 | 0.005 | 0.088 | 0.720 | 0.088 |
| Observations | 755 | 755 | 755 | 755 | 755 | 755 |

Note: Instrument ‘No. of months’ is the number of months till the expiry of the individual liability loan at the time of the announcement of the switch to joint liability. Knew before is a measure for if the borrower knew group member from before the group was formed, met weekly is if they met at least once a week, same caste is if they belong to the same caste, borrowed refers to if the borrower would have borrowed from the group member in time of need and neighbour refers to if the group member is a neighbour. Robust standard errors clustered by the group in parenthesis. *** p<0.01, ** p<0.05, * p<0.1