Charitable Giving, Signalling and Microcredit*

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Abstract

We investigate charitable giving in an unusual setting: by clients of a non-profit microfinance organisation in a developing country. The organisation charges no interest, but encourage borrowers to contribute any amount of their choosing when making instalment payments for returning the principal. These voluntary contributions result in an implicit interest rate of around 4.5%. We develop a theory where voluntary contributions by borrowers can provide them with ('warm glow') utility but also signal to the lending organisation their level of success with existing loans. Analysis of monthly data on voluntary contributions shows that there is divergent behaviour towards the end of the loan cycle between borrowers who go on to take another loan and those who do not. In the case of joint liability loans, we find that borrowers in poorly performing groups make higher contributions. This is consistent with a signalling motive – where individual contributions are being used to over-ride a group-level signal – but inconsistent with purely altruistic motives for giving. We argue that this mechanism can provide the basis for a potential innovation in providing financial services in the presence of informational asymmetries regarding the ability of potential clients.

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1 Introduction

Charitable giving to organisations constitutes a significant expenditure out of individual disposable incomes in developed countries, and a significant source of revenue for these organisations (Andreoni, 2006; Andreoni and Payne, 2013). The practice of giving is far more extensive than what would be predicted by models of pure altruism (Andreoni, 1989), and the recent literature provides evidence consistent with a variety of other motives, including social prestige (Harbaugh, 1998), wealth signalling (Glazer and Konrad, 1996) and social pressure (DellaVigna et al., 2012). In the case of developing countries, while there is extensive research on charitable giving within the extended family and social networks (reviewed, for example, by Cox and Fafchamps (2007)), relatively little is known about charitable giving via organisations. In this paper, we investigate voluntary giving in an unusual setting – by clients of a microfinance institution (MFI) in Pakistan. The organisation charges no interest on loans but invites borrowers to make voluntary contributions of any amount they choose when making the installment payments for returning the principal. The setting is distinctive not only in terms of the relation of the donor to the receiving organisation but also due to the fact that the donors come from a socio-economic class that is often the recipient of charity. These voluntary contributions result in an implicit interest rate of around 4.5%[1]. For comparison, the interest rates charged by South Asian MFIs are estimated to be around 15-20%[2]. Therefore, while these voluntary contributions are not generating the same kind of revenues as the typical fixed interest loan products used by MFIs in the region, they are not trivial either. Monthly data on voluntary contributions by the borrowers through the loan cycle, together with data on repayment and repeat borrowing provides a rich source of information to investigate possible motives behind their giving to the organisation.

We develop a theory where voluntary contributions by borrowers can provide them

[1] Annualized monthly implicit rate calculated as the ratio of average monthly contribution amount to monthly principal instalment amount.

[2] Microfinance Information Exchange.

with ('warm glow') utility but also signal to the lending organisation their level of success with existing loans. The organisation updates its beliefs about the borrower's ability based on voluntary contributions which, in turn, affects repeat lending decisions. One of the key predictions from the theory is that, in a signalling equilibrium, voluntary contributions by borrowers in a joint liability loan is higher when the group is likely to default.

The empirical analysis shows that, towards the end of the loan cycle, there is divergence in voluntary contributions behaviour between borrowers who go on to take another loan and those who do not. We hypothesise that a signalling motive dominates giving in this period whereby those who have been successful in their investment projects give more to signal their quality. In the case of borrowers on joint liability loans, we also find those in a poorly performing group make, on average, larger voluntary contributions. This is consistent with our theoretical result that voluntary contributions provides a way to signal individual quality independently of their group but difficult to explain in terms of either 'warm glow' or pure altruism. Finally, for those on a joint liability loan, the data shows that higher voluntary contributions in a previous loan cycle correlate with a higher proportion of months in which the borrower is on time in making payments in a subsequent loan cycle (controlling for borrower discipline in the previous loan cycle[3]). Thus, consistent with a signalling story, voluntary contributions in previous loan cycles provides the lending organization with information that can be used to identify better quality borrowers, above what can be inferred from information on borrower discipline alone.

The signalling mechanism we describe is driven by borrower self-interest, but the theory indicates that borrowers who are more motivated to give anyway find it less costly to make the additional voluntary contributions required for signalling. Therefore, signalling is more likely to happen when the lender has a 'mission' of helping the poor and borrowers have aligned preferences. Thus, both individual and corporate social responsibility (Bénabou and Tirole, 2010) and the matching between the motivation of

[3]As measured by the percentage of instalments paid on time by the borrower in the last loan cycle.

agents and the mission of the firm (Besley and Ghatak, 2005) are important elements of the story.

While the existing literature has identified situations where charitable giving is used to signal wealth and acquire prestige, we are not aware of existing evidence on charitable giving serving as a signal of productive ability. The mechanism suggests a potential innovation in providing financial services in the presence of informational asymmetries regarding the ability of potential clients. In the recent microfinance literature, Khwaja et al. (2013) argue that providing the borrowers the opportunity to credibly send a signal can be useful for the screening process. Opoku-Agyemang and Foltz (2012) consider behaviour in a traditional savings product as a signal for loan size. While savings behaviour typically serves as a one-time signal, we argue that a system of voluntary contributions provides scope for borrowers to signal their quality in each loan cycle. In the conventional 'Grameen' style microcredit model which is based on a continued relationship with the borrower, discipline exhibited in a loan cycle arguably provides such a signal and is, typically, critical to the decision to give out another loan. But this lending model has been the subject of significant criticism in recent times due, at least in part, to excessively high interest rates and the coercive methods often used to elicit repayment[4]. Our analysis suggests that a mechanism of voluntary contributions (coupled with lower interest rate charges) can provide a more precise signal of borrower ability to the lender and produce cross-subsidisation between high ability and low ability borrowers. Additionally, such a mechanism can reduce the cost of collecting information to assess the quality of potential clients, which can have significant implications for the interest rates that MFI's charge (Banerjee and Duflo, 2010).

The rest of the paper is organized as follows. The next section provides details about the lending organisation. Section II looks at existing theories on voluntary contributions and develops a model of the credit market where such contributions can potentially have a signalling motive. The data is presented in section III and

[4]See Bateman and Chang (2012) for a comprehensive review.

the empirical strategy is described in section iV. We discuss the results in section V, and provide robustness checks in section VI on the basis of survey data. Section VII provides explanations for the patterns of contributions we observe based on the theoretical framework and section VIII contains the concluding discussion.

2 Organizational Background

In this section, we provide a brief description of the lending organization, Akhuwat – in particular, its history, current lending practices and philosophy – based on information provided by branch office staff.

Akhuwat is a non-profit organisation which began its operation from the city of Lahore in 2001. The organization has a simple product modelled around 'qarz-e-hassna' which are essentially loans – as opposed to charity – to help the poor. The loan product is a small interest free loan to be returned in equal monthly instalments[5]. In the initial years, Akhuwat was essentially a philanthropic exercise to see how interest free microfinance would fare. As the loan portfolio grew, the organisation was formalised and registered under the Societies Registration Act of Pakistan. Today, the organisation funds its operations through donations and holds several fund-raising events across the country (and also in several other parts of the world).

Apart from the zero interest feature, the organization operates like a regular MFI. The organization had an individual lending model till March 2011 where borrowers had to have a person from the neighbourhood as a guarantor. This meant that the guarantor could not borrow till the loan cycle of the person he/she had guaranteed was complete. Complaints from the guarantors regarding this led to the organization switching to a group lending model. The borrowers form the groups themselves and while there is no restriction on their gender composition, the groups should have between three and six members and no members should come from the immediate family. All loans are disbursed simultaneously to members of a group and there is strict joint liability such

[5]This means is that if a loan of Rs.10,000 is made out for 10 months then the amount due each month would be Rs.1,000 and if this is paid regularly for 10 months then the loan cycle is considered complete. There is no fixed charge over and above these monthly payments.

that instalments for principal repayment are only accepted if it is the full amount due for the entire group. All instalments, whether individual or group, have to be paid at the local Akhuwat branch. The organization gives loans for what they define as 'productive' and 'non-productive' reasons. Loans given for non-productive reasons include all loans for personal expenditures (such as education or health) and loans taken out by people selling fruits and vegetables on carts which the organization believes does not have the potential to grow. Clients are permitted to borrow once only for a non-productive reason.

The loans are given after a thorough check of both the household and enterprise of the applicant. All applications have to be accompanied by each borrower's National Identity Card, pictures and a recent utility bill. Once the application is complete, Akhuwat staff goes for a visit to the household where a Social Appraisal Form is filled. This serves as a verification of the address of the person and also informs the family members that a loan is being taken out. The organization ensures that the spouse or the parent of the borrower countersigns on the application so that the entire family is involved. If the loan is for a productive reason, then a business appraisal is also done and detailed information on fixed and working capital is collected in order to assess the repayment ability of the applicant. Also, an expected breakdown of the exact utilization of the loan amount is recorded. The most salient eligibility criteria are the viability[6] of the proposed use of the loan and the household having some level of income such that it does not fall into the category of very poor[7].

One aspect in which the organization strives to be different is that it emphasizes inclusion. The word 'akhuwat' translates to brotherhood and the organization's philosophy, as explained by its staff, is built on this concept. They look to foster a feeling of unity among the community and of belonging to the organization. They keep their offices deliberately simple with staff sitting on the floor working on low tables in order to be low cost and welcoming for the borrowers who are poor and feel

[6]This is based on checks of the breakdown of the utilization of the loan such as a check on the cost of any asset that the borrower has proposed to purchase.

[7]In our conversations with the organization, we did not find this to be strictly defined and likely to vary by branch.

comfortable sitting on the floor.

In line with this philosophy, they encourage borrowers to give something every month to the organization. These are given individually so group members may or may not know about them. Also, there is no compulsion to make these contributions at the time of giving the installment payment or in the presence of the loan officer. However, the norm is for these contributions to be given together with the installment payments every month. Even if one group member brings to the branch the contributions by all members of the group, an individual receipt for the exact contribution by each member is issued. Viewed in this manner, according to the organization, these voluntary contributions are a final step in their partnership with the borrowers. They motivate borrowers by requesting them to contribute towards the running of the organization which will enable them to help others like themselves.

3 A Model of Voluntary Contributions

We develop a model of the credit market in which borrowers may have incentives to pay the lender (MFI) beyond the market interest rate to signal their skill level. The argument is akin to that in Spence's signalling model (Spence, 1973) where workers invest in education to signal their ability to potential employers. Only borrowers who are able to earn a return above a certain threshold are able to make these contributions, thereby signalling their quality. They have an incentive to do this so as to obtain a larger repeat loan from the lender. MFIs have an incentive to screen on the basis of voluntary contributions as the process allows them to identify potential repeat borrowers who can take on larger projects at low risk.

Formally, consider a population which can pursue a range of different projects indexed by $j = 1, 2, ..., n$. A project of type j requires a total investment of size X_j and we assume that $X_j > X_{j-1}$ for each $j > 1$. Each individual in the population has an attribute we call 'skill', given by $k \in \mathbb{Z}$.[8] When an individual with skill level k invests in a project of type j, there are three possible outcomes as shown in the table below:

[8]Here $\mathbb{Z}$ denotes the set of all integers.

	prob. of outcome	
	$k \geq j$	$k < j$
High Output, $Y = Y_j^h$	π_j^h	0
Low Output, $Y = Y_j^l$	π_j^l	$\hat{\pi}_j$
Failure, $Y = 0$	0	$1 - \hat{\pi}_j$

where $\pi_j^h = 1 - \pi_j^l$. For ease of notation, let $Y_j = \pi_j^h Y_j^h + \pi_j^l Y_j^l$, and $\hat{Y}_j = \hat{\pi}_j Y_j^l$. We assume that $Y_j > X_j > \hat{Y}_j$. In the absence of any investment project, an individual earns $Y_0 < Y_1$ in any given period from a riskless activity. Our reasoning applies so long as the probability of high output is greater – and the probability of failure lower – when skill level $k \geq j$ but the zero probabilities assumed in the table above make the reasoning clearer.

We assume that potential borrowers have no liquid assets of their own that can be invested in the project and that they are unable to save from one period to the next. This assumption can be justified based on the argument and related evidence that poor households have difficulty saving up for lumpsum investments, due to temptations or pressures arising from social obligations(e.g. Banerjee and Mullainathan, 2010; Baland et al., 2011). So, for a project j, a borrower needs a loan of size X_j. Each period's income is allocated between consumption (C) and charitable giving (A), with preferences represented by the following Cobb-Douglas utility function:

$$U(C, A) = C^{1-\alpha}(A)^{\alpha} \tag{1}$$

The utility derived from charitable giving may be due to pure altruism or the 'warm-glow effect', a case of impure altruism (Andreoni, 1989). We assume that the lender has knowledge of the distribution of α in the population but does not observe α for individual borrowers.

As individuals are unable to accumulate savings from one period to the next, they need a loan to invest in any project. The potential borrower's skill level is not directly observed by the lender. However, when an individual with skill level k applies for a loan, the lender performs a background check which returns a signal $\theta = k + \varepsilon$

where ε is a discrete random variable drawn from $\mathbb{Z}$, with cdf $F(.)$. In this situation, the lender offers her a menu of loan contracts of the form $(X_j, R_j(\theta))$ for $j = 1, 2, ..$ where X_j denotes the size of the loan and $R_j(\theta)$ is the gross interest rate. At the end of a project, the lender can observe success and failure but, in the event of a successful project, cannot distinguish between low output and high output.

At the end of the project, a borrower also has the opportunity to make voluntary contributions to the lender.[9] To the extent that the lender is viewed as providing a charitable function within the community, such contributions may be motivated by pure altruism or the 'warm-glow effect'. But, in addition to these motives, a borrower who achieves high output with a project of type j, can attempt to signal this to the lender through her contribution. For example, if she makes a contribution $\tau > \underline{\tau}_j$ where $\underline{\tau}_j = Y_j^l - X_j R_j(\theta)$, this will suffice to convince the lender that she achieved high output and that her current skill level is, therefore, at least equal to j. This is because a borrower with low output could not afford to make such a voluntary contribution and only borrowers with $k \geq j$ can achieve high output.

Equilibrium interest rates: We derive interest rates based on the assumption that, in equilibrium, the lender makes zero profits. This would hold true both for a for-profit firm operating in a competitive market with free entry as well as a non-profit firm which is not permitted to make positive profits. We further assume that there is limited liability, such that the lender cannot recoup the loan if the project ends in failure. Let R_0 be the (gross) cost of capital for lenders.

Let us consider a borrower for whom the background check has revealed a signal $\theta = k + \varepsilon$. If the borrower is awarded a project of type j there are two possible cases. We have $j > k$ with probability $1 - F(\theta - j)$.[10] In this case, the project is successful with

[9]Note that in the data (discussed in Section III), we observe borrowers making contributions *throughout* the loan cycle. In the model, we focus on contributions *after* the realisation of the project outcome for ease of analysis. Since contributions made prior to project realisation have to be made from existing resources, these are akin – within the theoretical model – to contributions in the preceding period.

[10]To see this note that $j > k$ implies

$$j > \theta - \varepsilon$$
$$\Longrightarrow \varepsilon > \theta - j$$

Using the cdf of ε, the probability of this last inequality can be written as $1 - F(\theta - j)$

probability $\hat{\pi}_j$. Otherwise, we have $j \leq k$ with probability $F(\theta - j)$. In this case, the project is successful with probability 1. In the latter case, the borrower may achieve high output and therefore signal his skill level by making a contribution $\tau > \underline{\tau}_j$.[11] Based on this reasoning, we have the following equation for the equilibrium interest rate:

$$\hat{\pi}_j \left[1 - F(\theta - j)\right] \left[X_j R_j(\theta) + \overline{\tau}_j^l\right] + F(\theta - j) \left[X_j R_j(\theta) + \pi_j^h \underline{\tau}_j\right] = X_j R_0 \qquad (2)$$

where $\overline{\tau}_j^l$ is the expected contribution from a borrower has achieved low output.[12] Substituting for $\underline{\tau}_j$ in (2), and rearranging terms, we obtain

$$R_j(\theta) = \frac{R_0 - F(\theta - j)\,\pi_j^h \left(Y_j^l / X_j\right) - \hat{\pi}_j \left[1 - F(\theta - j)\right] \left(\overline{\tau}_j^l / X_j\right)}{\hat{\pi}_j + F(\theta - j)\left(1 - \pi_j^h - \hat{\pi}_j\right)}$$

Using this last expression, it can be shown that the equilibrium interest rate is decreasing in the value of the signal θ.[13] For repeat borrowers, the lender may have three types of additional information in addition to the signal θ.

1. Consider a borrower who previously invested in a project of size j_{-1}, repaid the loan and made a voluntary contribution of $\tau > \underline{\tau}_j$. Then, the probability that the borrower has skill level $k \geq j$ is given by $F\left(\theta - j | \tau > \underline{\tau}_j\right) = F(\theta - j | \varepsilon \leq \theta - j_{-1}) > F(\theta - j)$. In particular, the borrower clearly has skill level at least equal to j_{-1}. Thus, a borrower who has achieved high output can signal her quality to the lending organization by making a voluntary contribution $\tau > \underline{\tau}_j$, which in turn lowers the lender's perception of the risk associated with the borrower for any given project type.

2. If the loan is repaid, and $\tau \leq \underline{\tau}_j$, then the probability is given by

[11] To be precise, the contribution τ will be only infinitesimally more than $\underline{\tau}_j$ as there is no additional informational content in a larger contribution.

[12] Note that, if the lender is a for-profit firm, a borrower with low output (who has no signalling motive) may opt to donate to a different organisation such as a charity. In this case, the equilibrium interest rate will be higher but the reasoning and conclusions otherwise remain the same.

[13] Thus, the framework implies that, for a given loan size, borrowers perceived as higher risk are offered a loan at higher interest rates. In practice, interest rate regulations, limited liability due to lack of collateral and poor contract enforcement can make this an infeasible option.

$\frac{\pi_j^l F(\theta-j)}{\hat{\pi}_j+F(\theta-j)\left(\pi_j^l-\hat{\pi}_j\right)}$.[14] If all borrower types have similar chances of achieving low output on the project, i.e. $\pi_j^l \approx \hat{\pi}_j$, then $F\left(\theta-j|\tau \leq \underline{\tau}_j\right) = \frac{\pi_j^l F(\theta-j)}{\hat{\pi}_j+F(\theta-j)\left(\pi_j^l-\hat{\pi}_j\right)} \approx F(\theta-j)$. In other words, if all types of borrowers are equally likely to achieve low output, there is no informational content even in the largest transfer that a borrower with low output can afford. Therefore, these borrowers have no signalling motive to make a transfer. But, depending on their preferences, they may have an altruistic motive to do so.

3. If the project ended in failure, then it must be that $k < j_{-1}$. Therefore, the probability that the borrower has skill level $k \geq j$ to undertake project of size j is given by $F(\theta-j|\varepsilon > \theta-j_{-1})$ which is smaller than $F(\theta-j)$. Thus, failure acts as a clear negative signal.

Optimal Choice of Loan and Voluntary Contributions: Consider an individual with skill-level k for whom a background check has revealed a signal θ. Then, the menu of contracts available to her is given by the set $\{(X_j, R_j(\theta))\}_{j=1}^n$. The following table shows her expected payoff from choosing the different types of contracts available to her:

project type	expected payoff
$j \leq k$	$Y_j - X_j R_j(\theta)$
$j > k$	$\hat{Y}_j - \hat{\pi}_j X_j R_j(\theta)$

Let us denote by $V(k,\theta,h)$ the expected continuation payoff to a borrower of skill level k, with signal θ and loan history h from making the optimal loan choice and voluntary contributions in each period. The history h indicates for each of the previous loans

[14] To see this, note that

$$\begin{aligned}
\Pr(k \geq j|\text{low output}) &= \frac{\Pr(k \geq j, \text{ low output})}{\Pr(\text{low output})} \\
&= \frac{\pi_j^l F(\theta-j)}{\pi_j^l F(\theta-j) + \{1-F(\theta-j)\}\hat{\pi}_j} \\
&= \frac{\pi_j^l F(\theta-j)}{\hat{\pi}_j F(\theta-j)\left(\pi_j^l-\hat{\pi}_j\right)}
\end{aligned}$$

whether the borrower was successful and how much voluntary contributions were made. Then the optimal loan choice can be represented by the following Bellman equation:

$$\max_{j,c,\tau} V(k,\theta,h) = \mathbf{E}U(c,\tau) + \beta V(k,\theta,h') \tag{3}$$

$$\begin{aligned} \text{s.t. } c+\tau &\leq Y - X_j R_j(\theta,h) \text{ if project succeeds} \\ c,\tau &= 0 \text{ otherwise} \end{aligned}$$

where β is the discount factor; $R_j(\theta,h)$ is the equilibrium interest rate for a borrower with signal θ and history h; and h' is next period's history, including h and information about project success and voluntary contributions for the present loan. Note that Y is a random variable whose realisation depends on k as per the table in Section 3. Let $j^*(k,\theta,h)$ be the loan choice obtained from the optimisation problem in (3). Note that the borrower may opt for a project that is beyond her 'skill level' – i.e. $j^*(k,\theta,h) > k$ – if the expected return on the project is sufficiently high. On the other hand, she may opt for a project that is below her skill level – i.e. $j^*(k,\theta,h) < k$ – if the signal θ is low relative to her skill level and, consequently, she needs to pay higher interest rates for larger projects.

As discussed above, when a borrower achieves low output with a project of type j, even the maximum possible contribution $\underline{\tau}_j$ has no signalling effect. Therefore, she would choose a transfer based on her altruism. Using the Cobb-Douglas utility function in (1), we obtain $\tau = \alpha(Y - X_j R_j) < \underline{\tau}_j$. However, when a borrower achieves high output, she can signal her skill level by choosing $\tau > \underline{\tau}_j$, which would increase the probability (as perceived by the lender) that she has the 'requisite' skill to undertake some project j' (i.e. $k \geq j'$) to be updated from $F(\theta - j')$ to $F(\theta - j' | k \geq j)$. That, in turn, would increase her continuation payoff $V(k,\theta,h')$. Formally, we have the following result (the proof is provided in the Theoretical Appendix).

Proposition 1: *Consider a borrower with altruism parameter α, skill level k, signal θ and credit history h who has taken a loan for a project of type j. There is a separating equilibrium in which she makes a voluntary contribution $\tau_j^l(\alpha)$ for low output and a*

contribution τ_j^s *for high output if and only if*

$$U\left(\Pi_j^h - \tau_j^h(\alpha), \tau_j^h(\alpha)\right) - U\left(\Pi_j^h - \tau_j^s, \tau_j^s\right) < \beta\left[V(k,\theta,h_s) - V(k,\theta,h_a)\right] \tag{4}$$

where $\Pi_j^x = Y_j^x - X_j R_j(\theta)$, $\tau_j^x(\alpha) = \alpha\Pi_j^x$ for $x \in \{h,l\}$, $\tau_j^s = \min(\underline{\tau}_j, \Pi_j^h]$, $h_s = \left(h, \tau_j^s\right)$ *and* $h_a = \left(h, \tau_j^h(\alpha)\right)$. *If the condition in (4) does not hold, there is an equilibrium in which her contribution is* $\tau_j^h(\alpha)$ *for high output, and* $\tau_j^l(\alpha)$ for low output.

The proposition implies that (i) when a borrower achieves low output, her voluntary contributions are motivated by altruism alone; (ii) when she achieves high output, if the gain in terms of future loan prospects from signalling her skill level is sufficiently high, she will make a larger voluntary contribution which has a signalling motive.

When is the type of signalling described in Proposition 1 more likely to happen? First, if α is sufficiently large such that $\tau_j^h(\alpha) \geq \tau_j^s$, the utility cost of signalling high output is equal to zero and so borrowers in this category will always signal when they achieve high output. Borrowers with smaller α will have a higher utility cost of signalling as the additional contribution required for signalling – equal to $\left\{\tau_j^s - \tau_j^h(\alpha)\right\}$ – is decreasing in α. Therefore, it is the more altruistic borrowers – i.e. those with higher values of α – who will find it worthwhile to signal.

Second, note that α captures, in effect, the borrower's intrinsic motivation to make contributions to the lending organisation. Therefore, if the lender places less emphasis on helping the poor and more focused on making profits, then α should be lower across all potential borrowers. As a result, voluntary contributions are lower and the lender has to charge a higher interest rate to break even. This lowers the cost of signalling for borrowers with low values of α but increases it for those with high values of α, i.e. those borrowers who, as per the reasoning above, are most likely to signal.

3.1 Joint Liability Loans

Next, we discuss the possible motives for making voluntary contributions in the case of joint liability loans: i.e. a contract in which a group of borrowers receive loans of the same size and they are jointly liable for repayment. The advantage of a joint

liability loan is that the group members can share risk which reduces the probability of default.[15] However, because the lender observes only the group's repayment behaviour, the repayment outcome reveals less information about individual borrowers than in the case of individual liability loans.

Specifically, suppose the group consists of two borrowers with skill levels k_1 and k_2, individual signals θ_1 and θ_2, and each receive a loan for a project of type j at an interest rate $R_j(\theta_1, \theta_2)$.[16] Given that each borrower can have three possible outcomes (high output, low output and failure), there are nine different scenarios to consider. We assume that $Y_j^h > 2X_j R_j(\theta_1, \theta_2) > 2Y_j^l$ (which allows for an illustration of a wide range of cases). Then a borrower with high output can afford to repay for a group member with a failed project but a borrower with low output cannot. Recall our assumption that there is no ex-post moral hazard which, in this context, implies that the joint liability loans get repaid if and only if at least one borrower has achieved high output. Then, the repayment outcomes can be summarised as in the table below.

Borrower 1\2	High Output	Low Output	Failure
High Output	Repayment	Repayment	Repayment
Low Output	Repayment	Repayment	Default
Failure	Repayment	Default	Default

When both borrowers have achieved at least low output, the signalling motive for voluntary contributions is similar to that in the case of individual loans: a voluntary transfer larger than $\underline{\tau}_j$ signals high output and, consequently, a skill level $k \geq j$.

If a borrower's own project has failed, there is no scope for voluntary transfers and signalling. This leaves just two cases: the borrower in question has achieved either low or high output while the other project has failed.

In the first of these cases (without loss of generality, suppose borrower 1 achieves low

[15] Besley and Coate (1995) demonstrate how, in the case of ex-post moral hazard, joint liability can also *increase* the risk of default under certain conditions. But, in the model under consideration, we have assumed that borrowers can always be made to repay if they have the resources to do so (i.e. there is no ex-post moral hazard).

[16] In principle, the interest rate for the joint liability loan should depend on the signals obtained from both borrowers through the background check. But, the following argument does not depend on the exact expression for it.

output while borrower 2 has a failed project), the group will default. Therefore, in the absence of any other information, the lender will downgrade beliefs about the skill levels of *both* group members. More precisely, $\Pr(k_i \geq j|\theta, \text{failure}) < \Pr(k_i \geq j|\theta)$ for $i = 1, 2$ and $j = 1, 2, ..., n$. In this situation, any positive contribution from borrower 1 signals that his project has not failed. Therefore, voluntary contributions can have a signalling effect which they do not in the case of a borrower with a low output in an individual loan contract.

In the second of these cases (borrower 1 achieves high output while borrower 2 has a failed project), the group will repay. As in the case of individual liability loans, borrower 1 can signal that he has achieved high output by making a voluntary contribution $\tau > \underline{\tau}_j$ but, since he is repaying both loans, this is affordable if and only if $Y_j^h - Y_j^l > X_j R_j(\theta_1, \theta_2)$. Formally, we can show the following (the proof is provided in the Theoretical Appendix):

Proposition 2: *Consider two borrowers with skill levels* k_1 and k_2*, signals* θ_1 and θ_2*, and credit histories* h_1 and h_2*, who have taken a joint liability loan for a project of type* j*. Let* $\hat{\Pi}_j^h = Y_j^h - 2X_j R_j(\theta_1, \theta_2)$*. (i) Suppose the condition in (4) holds for some borrower* $i \in \{1, 2\}$ and for both Π_j^h and $\hat{\Pi}_j^h$*. Then the voluntary contributions behaviour described in Proposition 1 holds true for borrower* i *whenever there is group repayment. (ii) If borrower* i has low output and *the group has defaulted, then voluntary contributions have a signalling effect in the sense that* $V(k_i, \theta_i, h_{is}) > V(k_i, \theta_i, h_{i0})$ for any $h_{is} = (h_i, \tau_s)$, $h_{i0} = (h_i, \tau_0)$, $\tau_s > \tau_0 = 0$.

4 Data

The data for this study comes from the Akhuwat database which contains information on the loan amount, credit period, issue and expiry date and the timing and amount of the instalment for principal repayment that is made each month for all loans issued. In addition, it has information on each voluntary contribution made by a borrower. A receipt is issued every time a voluntary contribution is made which is then used to

record the date and amount of the contribution in this database against the borrower's unique identification number. This provides a unique and distinctive dataset of monthly borrower voluntary contributions behaviour.

4.1 Sample Selection

For our analysis, we restrict the sample to the city of Lahore[17], and to branches that have been in operation for at least 3 years. The organization began its operations in Lahore, and so its oldest and largest branches are located in this city. These restrictions ensure that the selected sample has a mix of first time and repeat borrowers, and the time span is sufficiently long to observe borrowers over several loan cycles. At the time of the data request in 2013, the organisation had 30 branches in Lahore, of which 14 met the criterion of having been in operation 3 or more years. These branches are spread around the city and their ages at the end of the sample period in July 2013, range from just over 3 years to 10 or more years.

4.2 Sample Description

Between July 2010 and June 2013, there were 46,535 loans that were issued by these 14 branches. The relevant sample are the 27,427 loans issued after 1st July 2010 for which the loan cycle is complete by 30th June, i.e. for which the loan principal has been repaid within the maximum duration of the loan[18]. We are restricting the sample to borrowers with a complete loan cycle since borrowers may behave differently (both in terms of their giving behaviour and installment payments) over the loan cycle and incomplete loan cycles will not allow an analysis of repeat borrowing. Table 1 gives a distribution of these loans by loan cycle; 66% of the sample consists of first time loans, and loan size and duration increase in subsequent loan cycles.

Looking at the distribution of these loans across branches (Table 2) reveals that while the overall male-female proportion are slightly dominated by men, there are some

[17]Lahore is a provincial capital and the second largest city in the country with an estimated population of around 12.5 million.

[18]Default rate is under 0.2% and borrowers who defaulted are not part of the analysis.

branches where a particular gender dominates. For example, the Walton and Badar Colony branches, which are residential areas, are female dominated with over 70% female borrowers. On the other hand, Madhulal Hussain and Daroghawala branches based in commercial centers have less than 35% female borrowers.

The 27,427 complete loans that we observe gives us a total sample of 314,291 monthly observations[19] months. Borrowers on average make a voluntary contribution between 65-70% of the months that their loan is active; in other words, for a 10 month loan, a borrower will make a contribution in about 7 months (Table 3). The sample period is one of high inflation in Pakistan with monthly inflation rate close to 1%. Therefore, to allow comparisons over time, all data has been adjusted using the monthly Consumer Price Index (CPI)[20].

Voluntary contributions made by the borrowers translate into an implicit interest rate[21] of between 4 and 4.5% for the sample with a standard deviation of around 4.2%. The implicit interest rate declines in subsequent loans [22]: although borrowers increase voluntary contributions in these loan cycles, these amounts decline as a proportion of the loan amount from one loan cycle to the next.

Next, we look at the voluntary contributions made by the borrowers over the course of the loan cycle. Figure 1 is a plot based on the behaviour of 10,007 first time borrowers on a 10 month loan and 2,231 second time borrowers on a 12 month loan. We find significant variation in giving behaviour over the course of the loan cycle. As the loan matures, borrowers are less and less likely to give. The amount given initially declines with loan age, but picks up towards the end of the loan cycle although the amounts given never return to their initial levels. These variations suggest that the organisation does not coerce borrowers into giving at some fixed rate that serves as an implicit interest payment. The rise in giving towards the end of the loan cycle – when borrowers may be considering a repeat loan – suggests an alternative motive for giving.

[19]The top 0.05% of the sample has been trimmed for outliers.

[20]Data series obtained from Reuters EcoWin.

[21]This is a nominal rate and is calculated as the annualized average monthly voluntary contribution taken as a ratio of the instalment amount.

[22]The difference is 0.25% and is statistically significant.

We look at these relationships in more detail in the next section.

5 Voluntary Contribution Behaviour over the Loan Cycle

To analyze borrower behaviour over the loan cycle we specify the following equation:

$$Y_{it} = \alpha + \mathbf{X}_i\beta + \mathbf{Z}_i\gamma + \mathbf{K}_i\tau + \sum_{m=2}^{14}\theta_m + \varepsilon_{it} \tag{5}$$

where Y_{it} is the total voluntary contribution made by individual i in month t. For each individual, t will depend on the number of months for which the loan is active: $\mathbf{X}_i$ is a vector of loan contract characteristics - amount and duration of loan, loan cycle and whether the loan was given under group or individual liability; and $\mathbf{Z}_i$ is a vector of borrower characteristics - gender (= 1 if male), age, loan purpose (= 1 if loan taken for a personal reason rather than for an enterprise). As there is a high correlation between loan size and loan cycle – loan size increases each time a borrower takes out another loan – we include only the size of the loan in the specification. The summary statistics for these characteristics are shown in Table 4.

The vector $\mathbf{K}_i$ contain a set of variables aimed at investigating changes in borrower behaviour over the course loan cycle. They include dummies for both the first quarter (= 1 if it is one of the first three months after taking out a loan) and last quarter (= 1 if it the last three months of the loan cycle). We also include a dummy variable which equals 1 if all loan installments up to and including month $t-1$ were paid on time and zero otherwise. This serves as a proxy for any financial hardship faced by the borrower (or group in the case of a joint liability loan).

Banerjee (2013) in a recent review article discusses in detail the importance of reputation and the related durability of MFIs. Borrowers are much more likely to repay when they expect to get another loan if they do. Therefore, it is important that the MFI is expected to stay in business. We use age of business as a proxy for perceived durability of the MFI which can potentially affect the borrower's decision to make

voluntary contributions to the organisation.

Finally, the location of the branch may play a key role in giving behaviour, depending on how integrated a neighbourhood is or whether it is predominantly a residential or commercial area. Besides the location of the branch, certain branch staff may work better than others or be more effective. They may be better able to motivate people and communicate the principles of the organization. Alternatively, they may be more coercive. The θ_m variables denote branch specific dummies that are intended to capture these effects.

5.1 Empirical Specification

The nature of the dependent variable is such that it takes a value of 0 for a non-trivial proportion of the population (see Figure 2). These are the months in which the borrower decides to not make a voluntary contribution. Therefore, we have a distribution with a corner at zero and is continuous for strictly positive values. An obvious choice for modelling such a distribution is a Tobit model. However, a Tobit model assumes that the same mechanism determines the choice between $Y_{it} = 0$ and $Y_{it} > 0$ and the value of Y_{it} conditional on $Y_{it} > 0$, such that it constrains the partial effects $\partial P(y > 0|x)/\partial x$ and $\partial E(y|x, y > 0)/\partial x$ to have the same sign. However, it is possible that the same characteristics have a different impact on $Y_{it} = 0$ versus $Y_{it} > 0$ since a choice of 0 represents a distinct decision making process from that of choosing the amount to be given.

A corner solution may also raise concerns about selectivity. However, it is important to note that the outcome is always observed. We cannot think of a counter-factual for the observed 0 - what would the voluntary contribution amount be if no voluntary contribution had been made. Therefore, the need for a Heckman selection model does not arise[23].

We want to model observed voluntary contributions and not what contributions potentially could have been. Therefore, we are interested in $E[Y|X]$ and not $E[Y^*|X]$.

[23]This argument is based on the discussion in Wooldridge (2010).

We use a two part Hurdle Model which has been used in the literature on health and education to model similar types of decisions; for example, the decision whether or not to smoke and then – conditional on a decision to smoke – how much to smoke (see, for example Aslam and Kingdon (2008) and Madden (2008)). The first hurdle in our case is the decision to make a voluntary contribution and then, conditional on this decision, borrowers will proceed to the next stage which is the decision on how much to give. This will take following form:

Stage:1

$$Pr\left[Y_{it} > 0\right] = \alpha + \mathbf{X}_i\beta + \mathbf{Z}_i\gamma + \mathbf{K}_i\tau + \sum_{m=2}^{14}\theta_m + \varepsilon_{it} \tag{6}$$

where $Y_{it} = 1$ if borrower makes a voluntary contributions in month i and 0 otherwise. The rest of the variables are as defined in equation 5. Since it is a binary outcome, this is estimated using a standard Probit Model.

Stage:2

Conditional on $Y_{it} = 1$, we estimate the following using Ordinary Least Square (OLS):

$$log\left(Y_{it}\right) \mid \left(Y_{it} > 0\right) = \alpha + \mathbf{X}_i\beta + \mathbf{Z}_i\gamma + \mathbf{K}_i\tau + \sum_{m=2}^{14}\theta_m + \varepsilon_{it} \tag{7}$$

5.2 Findings

Table 5 contains the results for the estimation of equations 6 and 7 with and without controls for individual and loan characteristics. Since we are interested in the 'average' behaviour rather than how behaviour of a specific borrower varies over the loan cycle, these are results for the pooled sample with errors clustered at the borrower level. As expected, estimates of the first stage (in column 1 and 2) show that not being on time in making instalment payments has a negative impact on a borrower's likelihood of donating. Consistent with Figure 1, borrowers on average are significantly more likely to make a voluntary contribution in the first three months as compared to the rest of the loan cycle while the opposite is true for the last three months.

While not being on time was a negative predictor of making a voluntary contribution, it does not affect the amounts actually given once we control for individual and

loan characteristics (in column (4) in Table 5). There is also no longer a significant difference in behaviour between the start and end of the loan cycle. Hence, these factors only impact the decision to make a voluntary contribution and not the amount given.

5.3 Joint Liability Loans

Incentives for making contributions may be different in the case of joint liability loans since these can be observed by the organisation at the individual level while loan repayment can only be observed at the group level. To test if this is the case, we estimate equation 6 using the sample of joint liability loans only. Results in Table 6 show that, akin to the results for the full sample (in table 5), borrowers are on average less likely to make voluntary contributions when they are lagging behind in their instalment payment (in column 1). However, those who do give, make larger voluntary contributions when their group is not on time in making their instalment payment (in column 3). Hence, borrowers appear to be compensating for the poor performance of their group by donating larger amounts individually.

Next, we look at if group performance (measured by whether the group is on time in making instalment payments or not) impacts the individual's voluntary contributions differently as the loan matures. For this purpose we introduce an interaction between loan age and borrower discipline and find that borrowers are less likely to donate as loans age and are also less likely to give if they are lagging behind in making instalment payments (in columns (2) and (4) of Table 6). However, the amounts they give are significantly larger as the loan ages if they are behind in making payments, although the impact of borrower discipline itself is negative. Thus, individuals in poorly performing groups who do make a voluntary contribution give larger amounts as the loan ages.

6 Signalling Behaviour

To investigate whether borrowers' behaviour is consistent with a signalling motive, we look at how these contributions relate to repeat borrowing. We also evaluate the quality of this signal by checking the correlation between contributions made in one loan cycle and borrower discipline in a subsequent cycle.

6.1 Repeat Borrowing

To look at whether the pattern of voluntary contributions are related to the likelihood of borrowing again, we estimate the following equation:

$$Repeat_{it} = \alpha + \mathbf{X}_i\beta + \gamma AvgDon_i + \tau + \sum_{m=2}^{14} \theta_m + \varepsilon_{it} \tag{8}$$

where $Repeat_{it}$ is a dummy = 1 if the borrower takes out another loan within a specific time period after the expiry of the last loan and 0 otherwise. The coefficient of interest is γ which measures the impact of average monthly voluntary contributions ($AvgDon_i$) made in a particular loan cycle on borrowing again; $\mathbf{X}_i$ is a vector of borrower characteristics (gender, whether part of a group, reason for borrowing) and of performance during the loan cycle (a variable that measures the proportion of months that the borrower was not on time in making the instalments).

Equation 8 is estimated only for first and second time borrowers since the sample size is insufficient to carry out this exercise for higher loan cycles. An important point to consider here is the length of time after the expiry of the last loan that should be considered sufficient to observe repeat borrowing. For example, since the data period ends in June 2013, should a loan that expired in March 2013 be considered as part of the sample? In other words, is a window of three months after the expiry of a loan sufficient for observing repeat borrowing? To decide on the duration, we calculate the average time it takes first and second time borrowers to take out another loan after expiry of the last loan. We find that 75% of the first time borrowers take out another loan within 2 months and 60% of second time borrowers take out another loan

within 1 month of the expiry of the last. We use these as the cut off points and hence $Repeat_{it} = 1$ for a first time borrower if s/he takes out another loan within 2 months of the expiry of the last loan and 0 otherwise. All loans expiring within 2 months of the end of our sample period are excluded. Similarly, for second time borrowers all loans expiring within the last month of the sample period are excluded. The results are robust to the use of the median time it takes borrowers to take out another loan instead of the average time.

6.1.1 First time borrowers

Before we turn to results from the estimates of equation 8 for all first time borrowers who complete their loan cycles by April 2013, we look at the voluntary contribution behaviour of the two groups - those who borrow again and those who do not. Figure 3 shows how first time borrowers with a 10 month loan make voluntary contributions over their loan cycle. We see very clearly the stark difference in the behaviour of those who go on to borrow again and those who do not. For those who do not borrow again, there is a steady decline in the likelihood of giving as the loan matures. However, for those who do borrow again, the likelihood of making a voluntary contribution on average remains constant and actually increases in the last months of their loan. The amounts given by both groups are quite similar till the last 4 months of the loan cycle which is when they diverge. While there is also an upward trend in the amounts given by the group who do not borrow again, the increase is much steeper for those who do. This pattern is evidence against voluntary contributions being motivated purely by altruism in which case we would expect consistent behaviour across the two groups and over the loan cycle. However, we see clear differences in the behaviour of the two groups over the loan cycle in both the decision to make a voluntary contribution and the amount given[24].

[24]We compared the behaviour of borrowers who take out another loan within 2 months of the expiry of their last loan with those who take out a loan between 3 to 6 months after the expiry of their last loan. We find that though their behaviour is similar (both donate more towards the end), those who borrow 3-6 months after are both less likely to donate and donate lesser amounts than the group that borrows again within 2 months. This points to the likelihood of planning on the part of borrowers and so those who are surer about taking out another loan donate even more towards the end.

Results from Probit estimates of equation 8 in Table 7 for first time borrowers confirm the pattern displayed by the raw data. Average monthly voluntary contributions made in the last loan cycle consistently has a positive impact on the likelihood of borrowing again in addition to that of borrower discipline in the last loan cycle. As expected, borrowers with poor repayment discipline as measured by proportion of months they were not on time in making payments are less likely to borrow again.
We find that how much a borrower gives on average in the previous loan cycle increases the likelihood of borrowing again and we explore next if the timing of voluntary contributions made over the loan cycle is also important. For this purpose, we introduce a dummy variable that takes a value of 1 if a borrower makes larger voluntary contributions in the last quarter than the first quarter. We find that those who give larger amounts in the last quarter are more likely to borrow again.
For those borrowing in a group, we also explore if giving behaviour of others in the group matter. Keeping the same set of controls as in column 2, we replace individual monthly voluntary contributions made in the loan cycle by the average of those made by the rest of the group. We find that like individual voluntary contributions, it is also a positive indicator of borrowing again (in column 3).

6.1.2 Second time borrowers

Turning to the sample of second time borrowers, those who borrow for a third time within 1 month of the expiry of their second loan are consistently more likely to make a voluntary contribution over their loan cycle as compared to the borrowers who do not (Figure 4). Also, the decline towards the end is much steeper for the non-repeater group of borrowers and that widens the gap between the likelihood of donating by the two groups (repeaters and non-repeaters). The amounts given also diverge much earlier in the loan cycle as compared to the case of first time borrowers (Figure 3).
Estimates of equation 8 in Table 8 for second time borrowers show very similar results to those obtained for first time borrowers. There is no statistically significant difference in the magnitude of the impact of average monthly donations between first and second

time borrowers on the likelihood of borrowing again[25]. It suggests that borrowers continue to behave in a strategic manner after paying off their first loan, i.e. those borrowing a second time who go on to borrow again also tend to give larger amounts at the end of their loan as compared to at the start. Consistent with findings for first time borrowers, we find that voluntary contributions by the rest of the group members are also a positive predictor of the likelihood of borrowing again.

6.2 Voluntary contributions and borrower discipline

We found that voluntary contributions impact the likelihood of borrowing again even when controlling for the discipline displayed by borrower in the last loan cycle. But do these voluntary contributions in fact predict superior borrower performance? This is important since identifying good quality borrowers in microfinance is considered to be a difficult and costly exercise. In the conventional microfinance model, it is common to rely primarily on information on borrower discipline in a last loan cycle to make this assessment. To test if average voluntary contributions made by borrowers in the loan cycle relate to borrower performance in a subsequent loan cycle, we estimate the following specification:

$$Borrowerdiscipline_{il} = \alpha + \mathbf{X}_i\beta + \gamma AvgDon_{l-1} + \sum_{m=2}^{14} \theta_m + \varepsilon_{it} \tag{9}$$

where $Borrowerdiscipline_{il}$ is measured as the proportion of months for which borrower i was ***not*** on time in making instalment payments in a loan cycle l. The coefficient of interest here is γ which captures whether voluntary contributions in the last loan cycle ($AvgDon_{l-1}$) predict borrower discipline in the subsequent loan cycle; $\mathbf{X}_{il}$ is a vector of controls for individual and loan characteristics of borrower i for loan l.

Since the dependent variable, $Borrowerdiscipline_i$ is a proportion, it is restricted to the unit interval $[0, 1]$ and predicted values from the OLS regression may not

[25]The coefficient on the interaction of second time borrower dummy and average donations made is 0.000 with a p-value of 0.818 when Equation 8 is estimated for the combined sample of first and second time borrowers.

always lie between these values much like in the case of binary data. A traditional solution is to use a logs-odds transformation but that leads to boundary values (0 and 1) to be dropped since no transformation is possible for them. Instead, we use a Generalized Linear Model (GLM) to estimate equation 9 with a logistic function where the dependent variable in this case can be any value in the interval $[0, 1]$, as proposed by Papke and Wooldridge (1996).

There are 3,939 borrowers who we observe over more than one complete loan cycle and the majority of these (70%) are first time loans. We find that the higher the average voluntary contributions made during the last loan cycle, the better the borrower discipline in the next loan cycle (see Table 9). This is robust to the inclusion of borrower discipline in the last loan cycle and so voluntary contributions do in fact provide additional information about the 'quality' of the borrower. Interestingly, when we limit the sample to previous loans being individual liability loans, we find that the effect of voluntary contributions is insignificant (in column 4).

7 Robustness Checks

The empirical result that the likelihood of borrowing again is increasing in the average level of voluntary contributions in the preceding loan cycle may be confounded by individual characteristics not included in the organisational data, such as income levels, social capital and religiosity. For example, higher income levels may translate into larger voluntary contributions and individuals with higher incomes may also have better chances of getting another loan. If so, the effects of this omitted variable will be confounded with that of voluntary contributions. Similarly, borrowers with stronger ties to the neighbourhood may be inclined to make voluntary contributions more often; and, for the same reason, they may be able to form groups more easily and therefore be more likely to borrow again.

In order to address these alternative hypotheses, a survey was conducted with a sub-sample of the organisation's clients. Given budgetary and time constraints, we opted

for a telephone survey through which we collected information from 1,350 borrowers. Basic information on individual characteristics as well as on household financial condition was collected through a telephone survey in August 2014. A random sample stratified by the branch, gender and loan cycle of the borrower was drawn to have a proportionate representation of the main sample. While the refusal rate was low (3.5%), a significant fraction of calls to borrowers (about 30%) received no reply or reached dis-activated telephone numbers. In this situation, there is a potential risk that borrowers who took out loans further back in time, and consequently were more likely to have changed their telephone numbers, are under-represented in the final sample. To mitigate this problem, we ensured that, for every unsuccessful call, the replacement borrower for the telephone survey was picked from the same period. The final sample, after accounting for missing values, is 1280 (summary statistics are shown in Table 10). We estimate equation 8 for the combined sample of first and second time borrowers[26] controlling for age, education and marital status. In the first column in Table 11, we include borrower characteristics without introducing average monthly donations. To capture the financial condition of the household, we include a measure of the dependency ratio in terms of the number of people dependent on those earning[27] and a binary variable to indicate whether the borrower lives in his or her own house. We collected information on the involvement of the borrower in any community organizations and a small number (15%) report being part of one. We also construct a variable based on the fraction of his or her life a borrower has been living in the locality. Assuming that social connections grow over time, this measure can serve as a proxy for social capital. Finally, we collected information on the borrowers' income levels. As some respondents refused to disclose this information, the sample becomes slightly smaller when we introduce monthly per capita income in the regression (in column 2 in Table 11).

Nearly all borrower characteristics are insignificant in explaining the likelihood of

[26] As discussed above, we found no significant difference in the average contributions made and likelihood of borrowing again between first and second time borrowers.

[27] Dependency ratio = (Total number of people - number of working people)/no of people working.

repeat borrowing. It is possible that the relevant characteristics are used in the screening process when the organisation evaluates first-time loan application and so they do not predict subsequent borrowing. The important determinants are whether the borrower experienced an improvement in his or her financial condition during the loan cycle and was disciplined in making instalment payments. Most importantly for our analysis, the average donation amount continues to be a strong significant predictor of repeat borrowing. This gives support to the hypothesis that donation amounts are not merely serving as a proxy for borrower characteristics that we are unable to control for in our main analysis.

The size and frequency of voluntary contributions may be impacted by the degree of religiosity of the borrower given that the organisation is seen to conform to Islamic principles of the prohibition of interest charges. Any direct questioning on obligatory religious practices may be deemed offensive and unlikely to elicit an honest response. Therefore, we asked the respondents whether they perform any non-obligatory prayers (e.g. *tahajud*) or engage in fasting outside of the month of Ramadan. This question was included only during the second half of the survey period and therefore the information is available for just a subset of the sample. We introduce a dummy variable which equals 1 if the borrower responded with a yes to this question in column 3. While it has a marginally significant effect, the average contributions variable continues to be an important predictor of repeat borrowing.

8 Explaining Voluntary Contribution Patterns

In this section, we discuss potential explanations for the patterns in voluntary contributions identified in the empirical analysis and investigate, in particular, whether they are consistent with altruism (of either the 'pure' or 'warm-glow' type) and signalling behaviour by borrowers.

Discipline in Repayment Behaviour and Voluntary Contributions: We showed in Section 5.2, for the full sample of borrowers, that not being on time in making

instalment payments has a negative impact on a borrower's likelihood of donating but it does not affect the amounts actually given once we control for individual and loan characteristics. In Section 5.3, we found that borrowers in joint liability contracts are also, on average, less likely to make voluntary contributions when they are lagging behind in their instalment payment. However, conditional on giving, they make larger voluntary contributions when their groups are not on time in making their instalment payment.

Explanations: In terms of the theoretical model, we can explain these patterns as follows. If a borrower is not on time in making instalment payments, we can assume that the project is not performing well. In terms of the theoretical model in Section II, the project is likely headed for 'failure' or 'low output'. In both instances, the borrower cannot afford to make the transfer required for signalling. But it is also consistent with a scenario where donations are motivated purely by altruism as the borrower anticipates having less resources to spare for charity.

Those who are not on time in paying instalments but nevertheless make voluntary contributions may be anticipating a successful project but are not able to make instalment payments on time because of liquidity constraints. They may be motivated to give by either altruism or signalling. In either case, contributions will be correlated with expectations of project income. But the presence of liquidity constraints weakens the relationship between timeliness in instalments payments and expectations of project income.

In the case of joint liability loans, the lender receives only a group-level signal from repayment behaviour. So, if the group is struggling to repay but individual borrowers have done well, they have strong reasons to signal this by making voluntary contributions. As shown in terms of the theoretical model (Proposition 2(ii)), in this case voluntary contributions effectively enables the borrower to override the negative group signal. Altruism alone cannot explain why borrowers make larger voluntary contributions when their groups are behind in making payments.

Voluntary Contributions over the Loan Cycle: In Section 5.2, we found that,

borrowers are significantly more likely to make voluntary contributions during the first three months, and significantly less likely to do so during the last three months, compared to the rest of the loan cycle. Similarly, for joint liability borrowers, we found that (a) borrowers are less likely to donate as loans age; (b) conditional on giving, the amount given declines with loan age; but (c) the latter effect is absent for borrowers in groups which are not on time (Section 5.3).

Explanations: At the beginning of the loan cycle, investors cannot know how their project will turn out. Moreover, any voluntary contributions they make must be drawn from existing resources prior to their receipt of income from the project.[28] So, contributions towards the beginning of the loan cycle cannot have a signalling purpose. They are more likely to be motivated by social pressure (as loan officers talk to borrowers about donating at the time of loan disbursement, emphasizing that they should give whatever possible to help others like themselves) or altruism based on expected profits from their projects. Towards the end of the loan cycle, investors should have more information about how their projects will turn out. The altruistic motive alone cannot explain the decline in contributions unless project realisations systematically turn out to be worse than their expectations. However, the social pressure ought to be weaker by the end of the loan cycle (the effects of the loan officers' emphasis on charity wearing off over time) and the signalling motive is present only for those who have achieved high output.

In the case of joint liability loans, as loans age, the signalling motive for any individual borrower becomes weaker in groups which are on schedule in making payments and therefore unlikely to default. The opposite is true for groups which are behind in payments and this can explain (c) above.

Repeat Borrowing and Voluntary Contributions: [1] Among first-time borrowers, there is a stark difference in contributions over the loan cycle depending on whether or not they go on to borrow again. For those who do not borrow again, there is a steady decline in the likelihood of giving as the loan matures. However, for

[28] We assume here that they cannot borrow from other sources against expectations of future income.

those who do borrow again, the average likelihood of making a voluntary contribution remains constant and actually increases in the last months of their loan (Figure 3). [2] Results from the Probit estimates for first time borrowers (Section 6.1.1) showed that average monthly voluntary contributions made in the last loan cycle consistently has a positive impact on the likelihood of borrowing again in addition to that of borrower discipline in the last loan cycle.

[3] We also found that borrowers with poor repayment discipline, as measured by proportion of months they were not on time in making payments, are less likely to borrow again. And those who give larger amounts in the last quarter of the loan cycle than in the first quarter are more likely to borrow again (Section 6.2). [4] In the case of borrowers in joint liability groups, giving by others in the group has a positive effect on borrowing again (Section 6.2).

[5] Finally, the higher the average voluntary contributions made during the previous loan cycle, the better the borrower discipline in the next loan cycle. This holds true under joint liability but not under individual liability (Section 6.2).

Explanations: [1] As shown in the theoretical analysis, voluntary contributions can contain information about the borrower's skill level beyond that which is contained in loan repayment. Therefore, when a borrower makes a voluntary contribution of sufficient size, the lender positively adjusts beliefs about his/her skill-level. Then the lender should be more willing to offer the borrower a repeat loan. Likewise, borrowers interested in a repeat loan will be more inclined to make a voluntary contribution. [2] First-time borrowers who make larger voluntary contributions are providing a stronger signal about their skill level (Proposition 1). Therefore, they are more likely to receive a loan.

[3] In the theoretical analysis, we do not formally model poor repayment discipline. But it is plausible that such behaviour provides a signal about the borrower's ability, distinct from final repayment status and voluntary contributions. If so, the lender would be less likely to approve a loan for borrowers with poor repayment discipline. Similarly, these borrowers would be less inclined to apply for a repeat loan. We argued,

above, that contributions in the last quarter are more likely to include a signalling element. Therefore, those aiming to borrow again will have a stronger incentive to give in the last quarter than in earlier quarters. Likewise, the lender will assess repeat loan applications more favourably when the applicant has made a relatively large contribution in the last phase of the previous loan cycle. [4] The theory provides no direct mechanism for this result. But there may be an indirect mechanism – the lender would like to lend again to those group members who make voluntary contributions and they have a high likelihood of choosing the borrower in question in their next joint liability group. Note that the coefficient for group contributions is smaller than that for individual contributions in Table 8 which is consistent with the idea that the former coefficient is capturing only an indirect effect.

[5] As discussed in the theoretical section, a large voluntary contribution can be a positive signal of the borrower's skill level, while a smaller one, motivated by the borrower's altruism, is not. Therefore, conditional on receiving a repeat loan, borrowers who made a large contribution in the previous loan cycle should perform better and exhibit better loan discipline. However, this is more likely to hold true in the case of joint liability than in the case of individual liability because, in the latter case, borrower discipline in the previous loan cycle (included in the regression) is also, potentially, a good predictor of the borrower's ability. By contrast, in the case of joint liability, repayment is observed at the group level and, therefore, voluntary contributions provide an extra layer of useful information.

In summary, the signalling model can provide consistent explanations for the empirical patterns on voluntary contributions, repayment behaviour and repeat borrowing. Some key patterns in voluntary contributions and repeat borrowing are difficult to explain in terms of the altruistic motive alone: for example (i) that joint liability borrowers make larger donations when their groups are behind in making payments; (ii) that borrowers in joint liability loans who donated more during the previous loan cycle exhibit better borrower discipline in the next loan cycle. But these patterns are consistent with signalling behaviour.

9 Conclusion and Discussion

In this paper, we investigated charitable giving in an unusual setting – by clients of a microfinance institution in a developing country. The organisation offers interest free microcredit loans and invites borrowers to make a voluntary contribution of any amount of their choosing at the time of making instalment payments (for repaying the principal) each month. We find that borrowers are less likely to make contributions as their loans mature. While the amount given does not vary significantly over the loan cycle in our overall sample, it declines significantly towards the end of the loan cycle for joint liability loans. However, for those who go on to borrow again from the same organisation, the amount of voluntary contributions towards the end of the loan cycle is higher. This differential pattern of giving is difficult to explain in terms of an altruistic motive alone. Karlan (2007) highlights how the promise of repeat lending as a repayment incentive is a key element of mechanism designs inherent in microcredit practices today. Our empirical findings suggest that borrowers are responding to this incentive and signalling their quality for a repeat loan when the outcome of their current project becomes evident.

To explain these patterns, we develop a theory where voluntary contributions by borrowers can provide them with ('warm glow') utility but also signal to the lending organisation their level of success with existing loans. The organisation updates its beliefs about the borrower's ability based on voluntary contributions which, in turn, affects repeat lending decisions. One of the key predictions from the theory is that, in a signalling equilibrium, individual voluntary contributions made by borrowers with a joint liability loan are higher when the group is likely to default. This is because voluntary contributions provides borrowers a way to signal individual quality independently of their group.

Consistent with this prediction, we find that joint liability borrowers in poorly performing groups make, on average, larger voluntary contributions. In the standard model of delivering microcredit, the discipline displayed by the borrower in repaying

the last loan is considered important when evaluating repeat loan applications. This discipline is measured by the timeliness in making payments in the previous loan cycle. We find that even after controlling for the timeliness in making payments, the amount of individual voluntary contributions made in the previous loan cycle has a strong significant impact on the likelihood of borrowing again. Furthermore, in the case of joint liability loans, the larger the voluntary contributions made by a borrower during one loan cycle, the more likely he or she is to be disciplined in a subsequent loan cycle. Thus, these voluntary contributions can serve as an additional source of information when repeat loan applications are being evaluated – particularly for borrowers who were previously in a poorly performing group – and the evidence on repeat borrowing suggests that the information is being used for this purpose.

While there may be some external validity concerns[29] regarding the results, our findings can be useful for the ongoing debate on alternative models of microfinance. Our analysis suggests that, compared to the conventional interest-only contracts in microcredit, a mechanism of voluntary contributions (coupled with lower interest rate charges) can provide a more precise signal of borrower ability to the lender. It lowers the risk of default as resource-constrained borrowers need pay back only the principal. And, because high ability borrowers pay more than low ability borrowers, it leads to cross-subsidisation across these two types of borrowers.

We also contribute to the literature on charitable giving by identifying a motive for giving that has hitherto received little attention in the literature, namely to signal one's own productive ability to an organisation so as to sustain the relation into the future.

[29]Our sample is drawn from a single large metropolitan city and therefore it raises questions about whether these results will be valid in other settings. The dynamics in smaller cities or rural areas might be different as would be the case if we are to use a similar model in a setting with different culture and/or religion.

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Tables

Table 1: Distribution of loans by loan cycle

Loan Cycle	No. of loans	Average Loan Period (months)	Average Loan Size (Rs.)
First	18,192	11.73	13,088
Second	5,454	13.12	16,345
Third or more	3,781	14.39	19,262

Note: The table above reports the summary statistics by loan cycle for the sample of 27,427 loans that we observe over a complete loan cycle.

Table 2: Branch wise distribution of borrowers

Name of Branch	No. of Loans	% of total	Male	Male (%)	Female	Female (%)
Green Town	2,611	10%	1,559	60%	1,052	40%
Samanabad	2,241	8%	1,254	56%	987	44%
Township	2,058	8%	1,325	64%	733	36%
Hall Road	1,435	5%	751	52%	684	48%
Mian Meer	2,056	8%	925	45%	1,131	55%
Badar Colony	1,961	7%	594	30%	1,367	70%
Walton	1,903	7%	491	26%	1,412	74%
Firdaus Market	1,663	6%	866	52%	797	48%
Shah Jamal	1,796	7%	1,064	59%	732	41%
Wassan pura	1,694	6%	1,045	62%	649	38%
Data Sahab	2,002	7%	1,247	62%	755	38%
Madhulal Hussain	2,751	10%	2,023	74%	728	26%
Daroghawala	2,164	8%	1,490	69%	674	31%
Nain Sukh	1,092	4%	444	41%	648	59%
Total	27,427		15,078	55%	12,349	45%

Note: The table above reports the gender wise distribution of 27,427 loans issued in the 14 branches that form the sample for study.

Table 3: Summary Statistics - Voluntary contributions

Loan Cycle	Proportion of months (%)	Average Contribution (Rs.)	Standard Deviation	Implicit Interest Rate (%)
First	66.79	39.60	68.28	4.51
Second	72.33	47.47	67.18	4.29
Three or more	71.43	52.84	85.81	4.11

Note: The table above reports the summary statistics for voluntary contributions made by borrowers over the loan cycle. It is based on 27,427 complete loans that form the sample for this study. 'Proportion of months' is the number of months the borrower makes a voluntary contribution out of the total number of months the loan is active.

Table 4: Summary Statistics - Loan and borrower characteristics

Variable	Obs	Mean	Std. Dev.	Min	Max
Loan Characteristics					
Loan Amount (Rs.)	27427	14586.63	5067.01	4000	1000000
Loan Duration (months)	27427	12.37	2.39	8	35
Loan Cycle	27427	1.58	1.05	1	9
Group Loan (=1)	27427	0.70	0.46	0	1
Borrower Characteristics					
Gender (Male=1)	27427	0.55	0.50	0	1
Age at borrowing	24504	39.55	10.13	18.15	78.63
Non-productive reason (=1)	27427	0.09	0.28	0	1

Note: The table above reports the summary statistics for the loan and borrower characteristics of the sample for this study.

Table 5: Voluntary Contribution Behaviour - Full Sample

	First stage: Decision to Give		Second Stage: Amount Given	
	(1)	(2)	(3)	(4)
First Quarter	0.028***	0.032***	0.009***	-0.003
	(0.002)	(0.002)	(0.003)	(0.003)
Last Quarter	-0.034***	-0.033***	-0.029***	-0.002
	(0.002)	(0.002)	(0.003)	(0.003)
Not on time at t-1	-0.147***	-0.110***	0.021***	0.004
	(0.004)	(0.004)	(0.007)	(0.006)
Controls	No	Yes	No	Yes
Observations	314,291	314,291	215,686	215,686

Note: Dependent variable in Columns (1) and (2) is equal to one if borrower makes a voluntary contribution in that month and zero otherwise. Marginal effects are reported. In Columns (3) and (4) dependent variable is the log of the amount of voluntary contribution made. First quarter, last quarter and not on time at t-1 are all dummy variables. Controls include for gender, reason for borrowing, loan size, age of branch and branch fixed effects. Robust standard errors clustered by the borrower in parenthesis. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 6: Voluntary Contribution Behaviour - Joint Liability Loans Only

	First Stage: Decision to give		Second Stage: Amount Given	
	(1)	(2)	(3)	(4)
First Quarter (=1)	0.056***		-0.003	
	(0.002)		(0.003)	
Last Quarter (=1)	-0.032***		-0.007**	
	(0.002)		(0.003)	
Not on $time_{t-1}$	-0.152***	-0.032***	0.035***	-0.064***
	(0.005)	(0.008)	(0.008)	(0.015)
Not on time*loan age		-0.012***		0.022***
		(0.000)		(0.001)
Loan Age		-0.015***		-0.022***
		(0.000)		(0.000)
Observations	218,267	218,267	155,499	155,499

Note: Dependent variable in Columns (1) and (2) is equal to one if borrower makes a voluntary contribution in that month and zero otherwise. Marginal effects are reported. In Columns (3) and (4) dependent variable is the log of the amount of voluntary contribution made. All regression include controls for gender, reason for borrowing, loan size, age of branch and has branch fixed effects. Robust standard errors clustered by the individual in parenthesis. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 7: Voluntary Contributions and Repeat Borrowing (1st Time Borrowers)

	(1)	(2)	(3)
Avg. Monthly Contribution	0.003***	0.003***	
	(0.000)	(0.000)	
Avg.Monthly Contribution by Group			0.001***
			(0.000)
Proportion of months not on time	-0.235***	-0.229***	-0.431***
	(0.015)	(0.015)	(0.023)
Greater contribution in last quarter		0.113***	
		(0.008)	
Observations	16,540	16,540	11,529

Note: Dependent variable is equal if a first time borrower takes out another loan; zero otherwise. Marginal effects reported. All regression include controls for gender, reason for borrowing, dummy for borrowers on joint liability loan and has branch fixed effects. In column 3 the sample is restricted to joint liability loans. Robust standard errors in parenthesis.$***p < 0.01, **p < 0.05, *p < 0.1$.

Table 8: Voluntary Contributions and Repeat Borrowing (2nd Time Borrowers)

	(1)	(2)	(3)
Avg. Monthly Contribution	0.003***	0.003***	
	(0.000)	(0.000)	
Avg.Monthly Contribution by Group			0.001***
			(0.000)
Proportion of months not on time	-0.246***	-0.246***	-0.458***
	(0.031)	(0.031)	(0.057)
Greater contribution in last quarter		0.123***	
		(0.015)	
Observations	5,035	5,035	3,416

Note: Dependent variable is equal if a first time borrower takes out another loan; zero otherwise. Marginal effects reported. All regression include controls for gender, reason for borrowing, dummy for borrowers on joint liability loan and has branch fixed effects. In column 3 the sample is restricted to joint liability loans. Robust standard errors in parenthesis.$***p < 0.01, **p < 0.05, *p < 0.1$.

Table 9: Impact of Voluntary Contributions and Borrower Discipline in the Next Loan Cycle

	(1) Full Sample	(2) Full Sample	(3) Joint Liability	(4) Individual Liability
Average contributions$_{t-1}$	-0.0033***	-0.0033***	-0.0041**	-0.0026
	(0.001)	(0.001)	(0.002)	(0.002)
Borrower discipline$_{t-1}$		0.619***	0.769***	0.414***
		(0.08)	(0.10)	(0.134)
Observations	3,939	3,939	2,037	1,092

Note: Dependent variable is proportion of months borrower was *not* on time in making installment payments. Column (1) and (2) are estimates using the full sample, Column (3) with sample restricted to borrowers for whom the last loan was on joint liability and Column (4) with sample restricted to borrowers for whom the last loan was individual liability. All regression include controls for gender,loan amount and number of previous loans of the borrower. Robust standard errors in parenthesis.$***p < 0.01, **p < 0.05, *p < 0.1$.

Table 10: Summary Statistics - Survey Data

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	1280	38.66	9.29	18	73
Education	1280	5.87	4.49	0	16
Married (=1)	1280	0.90	0.29	0	1
Proportion of years lived in the area	1280	0.55	0.33	0	1
Own house (=1)	1280	0.75	0.43	0	1
Part of an organization (=1)	1280	0.16	0.36	0	1
Income	1227	22947.43	11417.82	1000	150000
Dependency Ratio	1280	2.87	2.03	0	29
Condition improved (=1)	1280	0.84	0.37	0	1
Extra religious rituals	976	0.33	0.47	0	1

Note: Table above reports the summary statistics for the sub-sample of borrowers that were surveyed.

Table 11: Repeat Borrowing and Voluntary Contributions with Additional Borrower Characteristics

	(1)	(2)	(3)
Age	-0.001	-0.002	-0.002
	(0.002)	(0.002)	(0.002)
Education	0.00318	0.00410	0.00398
	(0.003)	(0.003)	(0.003)
Married	0.069	0.063	0.035
	(0.0479)	(0.0494)	(0.0575)
Proportion of years lived	-0.0294	-0.016	-0.077
	(0.045)	(0.047)	(0.052)
Own house (=1)	0.00555	0.0141	-0.0106
	(0.034)	(0.035)	(0.038)
Part of comm org (=1)	-0.0145	-0.020	-0.034
	(0.038)	(0.039)	(0.042)
Monthly per capita income		-0.001	
		(0.001)	
Extra religious rituals			0.058*
			(0.0344)
Dependency Ratio	-0.005	-0.006	-0.004
	(0.008)	(0.008)	(0.009)
Financial condition improved (=1)	0.062*	0.067*	0.057
	(0.037)	(0.038)	(0.041)
Proportion not on time	-0.446***	-0.358***	-0.537***
	(0.107)	(0.108)	(0.142)
Average monthly donation		0.0021***	0.002***
		(0.001)	(0.001)
Observations	1,276	1,217	968

Note: In the table above the dependent variable =1 if borrowers takes out another loan and 0 otherwise. It is based on the sub-sample of first and second time borrowers that were surveyed. Monthly per capita income is scaled by 1000. Robust standard errors in parenthesis. $***p < 0.01, **p < 0.05, *p < 0.1$

Figure Legends

Figure 1: The figure is a plot of the likelihood of making a voluntary contribution and the average amount given over the loan cycle for borrowers on first and second loan cycles of duration 10 and 12 months respectively.

Figure 2: The figure is a plot of monthly voluntary contributions for the full sample.

Figure 3: The figure is a plot of the likelihood of making a voluntary contribution and the average amount given over the loan cycle for first time borrowers on a loan of 10 month duration. Those who go on to take a second loan and those who don't are plotted separately.

Figure 4: The figure is a plot of the likelihood of making a voluntary contribution and the average amount given over the loan cycle for second time borrowers on a loan of 12 months duration. Those who go on to take a third loan and those who don't are plotted separately.

Figures

Figure 1: Voluntary Contribution Behaviour over the Loan Cycle

(a) Likelihood of giving

(b) Average Amount Given

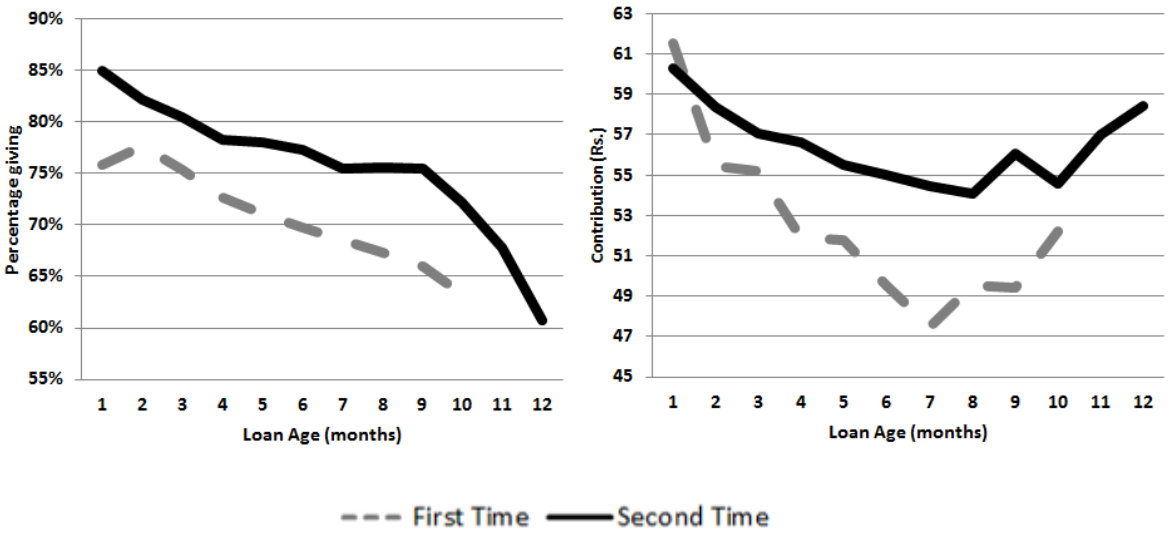


Figure 2: Histogram of Monthly Voluntary Contributions

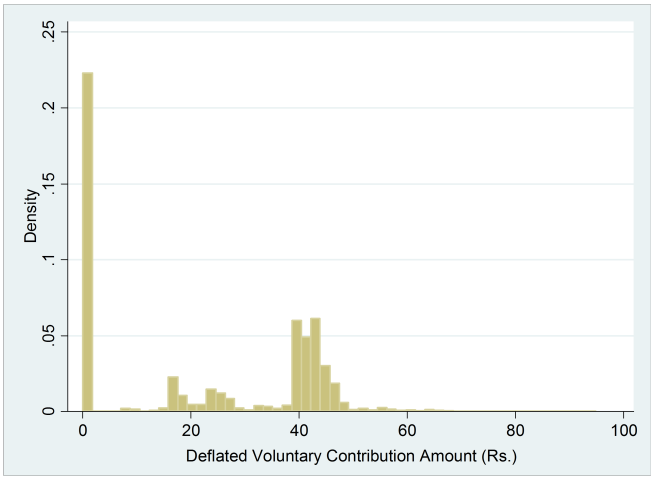
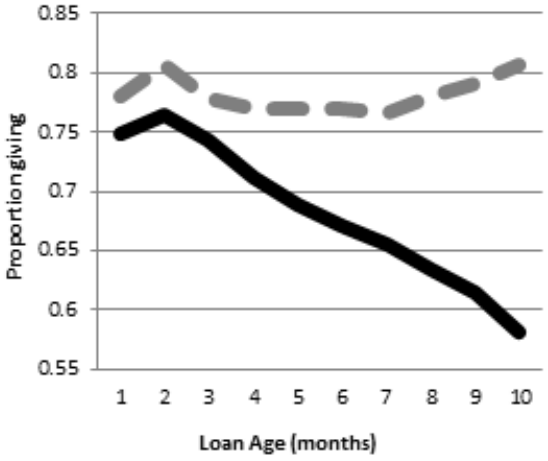


Figure 3: Voluntary Contribution Behaviour - First Time Borrowers

(a) Likelihood of giving



(b) Average Amount Given

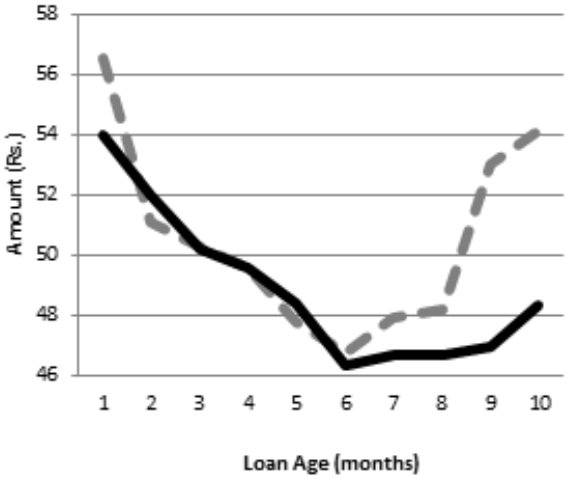
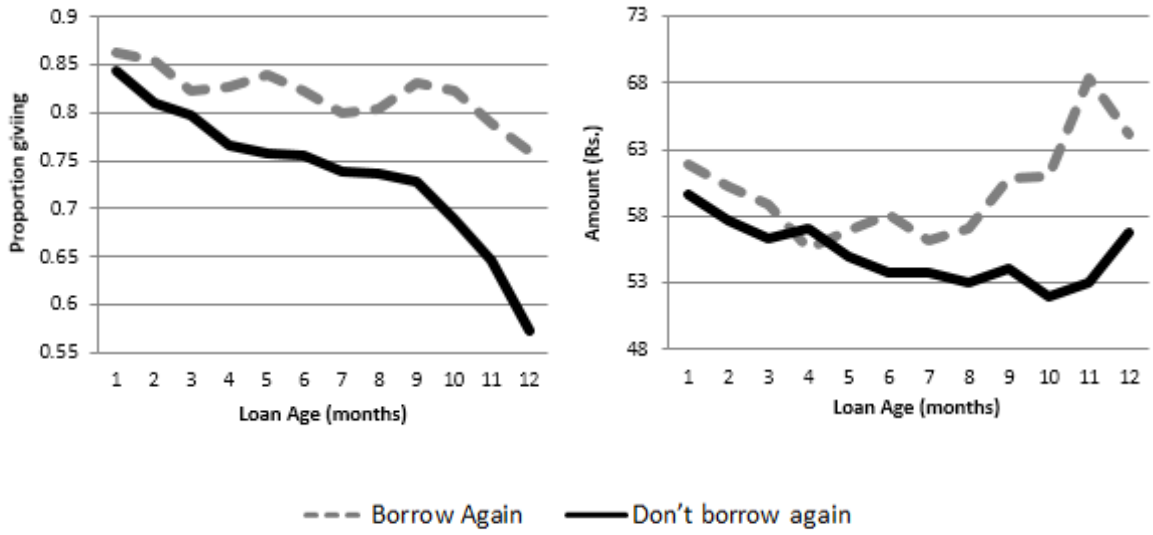


Figure 4: Voluntary Contribution Behaviour over the Loan cycle - Second Time Borrowers

(a) Likelihood of giving

(b) Average Amount Given



A Theoretical Appendix

Proof. (**for Proposition 1**): By construction, a borrower who achieves low output on a project of type j cannot afford a contribution of size τ_j^s. Therefore, a borrower who makes a contribution of this size must signal high output to the lender. In the absence of signalling, the borrower's best alternative is to make a contribution based on altruism which yields $\tau_j^h(\alpha)$ based on utility maximisation. The right-hand side of (4) represents the future expected utility gain from making this contribution in the current period over a contribution of $\tau_j^h(\alpha)$. The left-hand side represents the utility cost of making this contribution in the current period. Therefore, if the condition in (4) holds, a contribution of τ_j^s is incentive compatible for a borrower who has achieved high output. A contribution of τ_j^s is infeasible for a borrower with low output. In the absence of signalling, the best action available to a borrower with low output is to make a contribution based on altruism which is $\tau_j^l(\alpha)$. This establishes that the proposed strategy profile constitutes an equilibrium.

Next, consider a strategy profile in which the borrower contributes $\tau_j^h(\alpha)$ when output is high and $\tau_j^l(\alpha)$ when output is low. A borrower with high output can signal this by making a contribution of τ_j^s but, if the condition in (4) does not hold, such a contribution is not incentive compatible. A borrower with low output cannot make a contribution which has a signalling effect and, therefore, has no profitable deviation from $\tau_j^l(\alpha)$. Therefore, the proposed strategy profile constitutes an equilibrium. ■

Proof. **(for Proposition 2)**: (i) If borrower i has achieved high output, group repayment will occur because of the assumption $Y_j^h > 2X_jR_j(\theta_1, \theta_2)$. Then if the condition in (4) holds for both Π_j^h and $\hat{\Pi}_j^h$, borrower i has sufficient incentive to make the transfer τ_j^s to signal high output. (ii) Suppose the group has defaulted. Since a group does not default when at least one borrower has achieved high output, it must be that, for both borrowers, the project has failed or resulted in low output. Therefore, a borrower who makes a positive contribution unambiguously signals low output. A borrower who makes no contribution must have a positive probability of failure as

those with failed projects necessarily make zero contributions. Then, for any project type j', the probability that i has skill level $k_i \geq j'$ conditional on group default and a positive individual contribution, denoted by $F(\theta_i - j|\text{group default}, \tau_i > 0)$, is greater than $F(\theta_i - j|\text{group default}, \tau_i = 0)$. Therefore, $V(k_i, \theta_i, h_{is}) > V(k_i, \theta_i, h_{i0})$. ■