

**BANKER MY NEIGHBOUR: MATCHING
AND FINANCIAL INTERMEDIATION
IN SAVINGS GROUPS**

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Banker my neighbour: matching and financial intermediation in savings groups*

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Abstract

Efforts to promote financial inclusion have tended to focus on microcredit and micro-savings separately, but not on the possibility of promoting financial intermediation across poor borrowers and savers. “Self-Help Groups” such as Village Savings and Loan Associations (VSLAs) have the features of both a borrowing and a commitment savings technology, potentially enabling savers and borrowers to serve one another’s needs. On the other hand, such intermediation may be impeded by limited liability and imperfect information. To test for evidence of intermediation, we use a large-scale survey of mature VSLA groups in rural Malawi to analyse how members sort across groups. We find that present-biased members tend to group with time-consistent members, suggesting that commitment savers may be gaining a commitment savings technology by lending to time-consistent borrowers. In contrast, members of the same occupation sort into groups together, indicating unrealised intermediation possibilities between farming and non-farming households. This has implications for the design of such groups, in terms of efficiency and risk mitigation.

Keywords: Microfinance, commitment savings, savings groups, financial inclusion

JEL codes: O1, O12, O16

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1 Introduction

Two billion adults worldwide are still unbanked (Demirgüç-Kunt et al., 2015). Recent evidence suggests that efforts to financially include the poor via mainstream microfinance produce little or no impact on welfare (Banerjee et al., 2015). In contrast, access to formal savings products appears to be beneficial (Ashraf et al., 2006; Dupas and Robinson, 2013). Yet it is difficult to find sustainable ways to offer savings accounts to the poor, and particularly ones which carry favourable interest rates. One possible solution is to foster peer-to-peer saving and lending institutions, such that the cost of providing a savings technology is borne by borrowers, and the interest charged on loans is reaped by savers. ROSCAs can be seen as a basic and ubiquitous version of this idea. Building on this, practitioners have promoted more sophisticated institutions known as Village Savings and Loan Associations (VSLAs) or Self-Help Groups (SHGs),¹ which now have over 100 million members worldwide (Greaney et al., 2016). Recent impact evaluations have shown positive effects of access to VSLAs on household food security (Beaman et al., 2014; Ksoll et al., 2016).² Researchers have also showed how such groups might screen credit risk (Greaney et al., 2016), and how there is a trade-off between inclusion of poorer individuals and a reduction in groups’ capacity to lend (Burlando et al., 2017). However, very little is known about whether and how such groups promote efficient financial intermediation between savers and borrowers. Instead, it may be that limited liability or broader social frictions lead groups to focus either entirely on saving or entirely on borrowing, limiting efficiency and the potential welfare benefits to both savers and borrowers.

In this paper, we therefore ask whether VSLAs bring together individuals with a demand for a savings technology and individuals with a demand for credit, enhancing financial intermediation in communities with low access to formal banking. To do so, we use novel data from a census of all members of mature VSLA groups in a region of Malawi. We test two hypotheses. First, we examine whether those engaged in agriculture sort into groups with those engaged in non-farm activities. This would allow farmers to save harvest income across the year, whilst enabling those engaged in small business to take short-term loans for investment. The results indicate that they do not, implying that VSLAs may be heavily exposed to covariate shocks such as a bad harvest. A possible policy implication is that VSLAs should be linked into a larger credit system, to allow funds to flow across groups and mitigate “bank runs”. Second, we highlight how VSLAs have the features of a multi-faceted commitment savings technology. We therefore ask whether present-biased individuals join VSLAs and form groups with time-consistent individuals who desire access to low-interest borrowing. The results provide evidence that this is the case. This highlights an important way in which these groups may enhance efficiency, albeit only within occupational groups, and the welfare of both savers and borrowers.³

¹Other names for such groups include VSLs, SBGs, SILCs, and SfCs depending on the NGO responsible.

²Ksoll et al. (2016) suggest that this may be linked to increased agricultural investments. Similar to evaluations of formal microfinance, neither of these studies finds significant effects of VSLAs on business profits, health, education or female empowerment. However, both sets of authors note that this may be an artefact of short evaluation time-frames, as most of those who joined Self-Help Groups had completed at most one savings cycle by the time of the endline surveys.

³NGOs and policymakers may nonetheless be concerned about the distribution of these welfare gains across commitment savers and borrowers. Indeed, since present-biased sophisticates are willing to pay for commitment,

The two papers most closely related to ours are [Greaney et al. \(2016\)](#) and [Burlando et al. \(2017\)](#). [Greaney et al. \(2016\)](#) use a field experiment to show that groups who pay for their own training do better than groups whose training is NGO-funded, across a number of group-level indicators including loan repayment rates and average member business profits. They model borrowing motives for joining Self-Help Groups, and argue that making groups pay for their own training reduces adverse selection by making high-risk individuals select out of membership. Meanwhile [Burlando et al. \(2017\)](#) find that groups who are randomly assigned a high proportion of ultra-poor members exhibit significantly lower total savings and borrowing midway through the cycle, although these differences disappear by the end of the cycle. This is suggestive of a trade-off between including ultra-poor members and increasing credit constraints at the group level, because ultra-poor members contribute fewer savings to the group’s fund.

This paper complements those papers in two ways. First, we consider the related but separate question of how, conditional on participating, members sort across groups in equilibrium. As outlined above, sorting may be crucial in determining how well these groups can fulfil a financial intermediation role between members with different financial needs. Second, we highlight the nature of these groups as offering a commitment savings technology. As we argue, the fact that many individuals join such groups out of a demand for commitment has important implications in terms of interest rates, lending dynamics, and the distribution of welfare gains.

Our motivation is conceptually similar to a broader body of work that examines sorting in informal financial institutions more broadly: for instance, [Ghatak \(2000\)](#) and [Ahlin \(2016\)](#) develop theoretical models of how sorting might enable the efficient pricing of risk in the context of joint-liability microfinance; [Banerjee et al. \(1994\)](#) study a similar problem in the design of credit cooperatives; and [Eeckhout and Munshi \(2010\)](#) examine sorting for credit motives across chit funds in India. Our contribution differs insofar as we examine sorting in groups when opportunities for financial intermediation exist: that is, when some members are primarily interested in saving while others are interested in borrowing.

Our empirical strategy uses a dyadic regression framework to test for the determinants of two members being members of the *same* group, conditional on being members of *some* group. This builds on work by [Arcand and Fafchamps \(2012\)](#) who use dyadic regressions to study sorting and inclusiveness in community-based organisations. Other authors have used dyadic analysis to examine sorting on risk preferences for risk-sharing games ([Attanasio et al., 2012](#); [Barr et al., 2012](#)). Our approach adds to this literature in that we study sorting on time preferences. We also do so in the context of a fully-fledged programme setting, rather than a framed field experiment.

The remainder of the paper is organised as follows. Section 2 explains the design of VSLAs in more detail. Section 3 makes predictions about the sorting of members across groups. Section 4 outlines the survey design. Section 5 describes key aspects of the data. Section 6 details the empirical strategy and results. Section 7 provides robustness checks. Section 8 concludes.

they may accept a low interest rate when lending out to borrowers, who would essentially be paid to keep VLSA funds away from temptation. In section 5.1 we offer evidence that this is not the case: interest rates on lending are in line with the “fair” benchmark of members’ average long-run monthly discount rates.

2 VSLAs as a commitment savings and a credit technology

The design of self-funded microfinance groups and the procedures used to train members is similar across NGOs and countries. The VSLA intervention that we study — run by the NGO SOLDEV in northern Malawi — is representative of industry standards. The NGO first holds an initial information meeting in each targeted community. Interested participants are then invited to self-select into groups of 15-25 members. With the help of the NGO, each group purchases a cash box with three separate locks, and elects three different members to act as key-holders. This is to reduce the probability that any funds placed into the box are subject to theft. The NGO or an NGO-trained field agent then assists the group in writing a constitution, and trains the group in financial literacy and account-keeping over a period of several weeks.

At the end of the training period, the group begins to hold weekly meetings. In each meeting, individual group members must save by purchase between one and five “shares” in the group, the price of which is fixed beforehand and set at a relatively low level.⁴ After a month of meetings, members can begin requesting loans, to be repaid at a fixed monthly rate of interest. At the end of each cycle — usually a year — the group’s total savings funds plus the successfully-recovered loan principals and interest are “shared out” in proportion to individual members’ savings (hence the term “shares”).

Comparing the structure of VSLAs to that of other savings and credit institutions, VSLAs lie somewhere between credit cooperatives and ROSCAs. VSLAs have a similar function to credit cooperatives and credit unions, but are much smaller and less formalised. For example, VSLAs typically have no legal status, unlike some of the larger rural credit unions. As a consequence, VSLAs rely exclusively on interpersonal relationships for monitoring and enforcement of loan repayment — a feature that may have both advantages and disadvantages. Insofar as VSLAs are informal savings and credit groups embedded in social ties between villagers, they are close in spirit to ROSCAs. However, they are more sophisticated in that they allow more flexibility. On the savings side, each member can choose to buy between one and five shares each week, rather than committing to a fixed payment identical for all members and all weeks. On the lending side, members can affect the size and timing of the loans they receive, rather than having to wait for their turn in a rotation.⁵ VSLAs also differ from joint-liability microcredit groups insofar as they combine a pure savings technology with credit to members.

VSLAs typically offer access to credit at a lower interest rate than both traditional moneylenders and microfinance lenders, making them attractive to potential borrowers. VSLAs can also be seen as a multi-faceted commitment savings technology, making them attractive to individuals with a demand for commitment. First, there is a deposit commitment, since all members

⁴In principle each member is also required to make a small weekly contribution to the group’s insurance fund, to cover events such as illness or death of a group member’s relatives. However, in practice we found that most groups set the level of such contributions to be very small: around 20 Malawi Kwacha (MK) or \$0.06. Some groups dropped this component altogether, citing past disagreements about payouts.

⁵Bidding ROSCAs do allow members some choice over when they receive the pot. However, each member can only receive the pot once, and cannot choose the pot size.

are required to purchase at least one share per week.⁶ Second, VSLAs enforce a withdrawal commitment, since savings made into the box (i.e. all shares purchased) cannot be liquidated until the end of the savings cycle.⁷ Third, group meetings may operate as additional “soft” deposit commitment device, harnessing active peer pressure to save (Gugerty, 2007), a desire to save in order to appear reliable to peers (Breza and Chandrasekhar, 2015), and reminders to save (Kast et al., 2012). Indeed, there is evidence that similar features of microfinance may enable individuals to use microcredit as a commitment savings device (Bauer et al., 2012; Afzal et al., 2017). Fourth, any member requesting a loan must demonstrate that it is for a good purpose, and the whole group must agree for the loan to be granted. It is therefore unlikely that members can undo the commitment savings feature of the VSLA by borrowing for consumption, except in cases of demonstrable emergencies. VSLAs may therefore offer an attractive package to individuals who have problems with self-control, or who wish to shield resources from their spouse and relatives, as long as they are sophisticated enough to recognise the value of commitment devices.⁸ Finally, VSLAs may also be attractive even for savers without a demand for commitment devices. This is because interest charges paid by borrowers constitute a return on investment for those who save.

3 Testing strategy

The extent to which VSLAs generate financial intermediation depends on the extent to which they are able to recruit each of these types of members — commitment savers, ordinary savers, and borrowers — and the extent to which they are able to sort into groups with one another. This is ultimately an empirical question. For example, if limited liability concerns prove too strong, then VSLAs may end up consisting only of savers. Alternatively, there may be some all-commitment-saver groups where members are unwilling to lend out their savings, and some all-borrower groups where members are willing to take the risk of depositing a minimum amount in order to gain access to credit. The purpose of our paper is therefore to investigate whether, four years after their introduction, VSLAs in Malawi have blossomed into organizations capable of providing proper financial intermediation. We consider two types of financial intermediation: neoclassical financial intermediation without demand for commitment; and financial intermediation in the presence of the existence of demand for commitment saving.

⁶In practice we see that some groups occasionally relax this requirement, allowing individuals to purchase zero shares in certain weeks. It is likely that the groups strike a balance between commitment and liquidity to cover shocks, by relaxing the deposit commitment but keeping the withdrawal commitment strong.

⁷There is a provision that individuals can withdraw a small number of their own shares in the case of a medical emergency or similar. However, we see very few instances of this in individual account records.

⁸Anecdotally, members do seem sophisticated in this way: when asked about the reasons for joining, many individuals say that being in a VSLA “overcomes the temptation of spending savings kept at home”, or “addresses the problems encountered within the household”.

3.1 Neoclassical financial intermediation

In the first case, the role of the financial intermediary is to match ordinary savers with borrowers. Savers are individuals willing to save in exchange for a return on their savings; borrowers are individuals willing to pay interest in order to finance a high return investment opportunity. Within the context of our study, the most salient need for neoclassical financial intermediation is between individuals with different occupations. People in the study area are primarily engaged in two occupations with different cash-flow profiles: agriculture, and small entrepreneurship (including selling vegetables and goods from nearby markets, bricklaying and carpentry, driving bicycle taxis, and sewing). Farming households have a large outflow of funds for investment during the planting season in January, and they receive one major inflow of funds just after the maize and rice harvest in April.⁹ In contrast, households engaged in business and other non-farm activities typically have frequent monetary inflows, but they require access to capital whenever a business opportunity with a large upfront investment cost arises, which can happen at any time of the year.

If VSLAs serve a neoclassical financial intermediation purpose, we would therefore expect sorting of members across groups to display negative assorting on occupation: namely, farmers sorting into groups with small entrepreneurs. Farmers would act as savers for most of the cycle, except for occasional agricultural investments and emergencies. Meanwhile entrepreneurs would borrow out of the farmers' savings, thereby generating dividends through loan interest repayments. Sorting could be achieved through a wide variety of ways, e.g. through direct bargaining between villagers, or through the guidance of an 'enlightened' local leader. It could also arise over time as the result of a tatonnement process: competition for borrowing funds amongst entrepreneurs within a given VSLA would bid up the interest rate on lending, pushing some of them to leave for another VSLA with more savers and available funds per borrower.

However, the fact that most VSLA lending is done on a limited-liability basis may prevent efficient sorting from occurring.¹⁰ If members can better screen, monitor and punish delinquent borrowers when they have the same occupation, this reduces the benefit of negative assorting and favours instead positive assorting on occupation. A similar argument applies if transaction costs are lower among those with the same occupation, or if individuals derive larger social benefit from interacting with others in the same occupation. Positive assorting on occupation implies that the groups are less diversified against the risk of common shocks, and hence less sustainable. Moreover, in such cases members would join VSLAs almost exclusively a savings technology, virtually eliminating the mutual gains from financial intermediation.

⁹There is also a second, smaller harvest for cassava which takes place in November. This is mainly used to supplement household consumption during the lean season of December-February.

¹⁰A member's own shares can be seized as collateral in the case of non-repayment, but these may not be enough to cover the value of the loan.

3.2 Commitment saving

As detailed above, VSLAs also offer a commitment savings technology, which has the potential to attract sophisticated present-biased individuals. Two scenarios are possible ex ante: pure commitment saving; and a combination of commitment saving and borrowing. Each scenario has different implications for the composition of VSLA membership, and thus on sorting into groups

VSLAs can generate potentially large welfare gains by attracting not only commitment savers but also members who wish to borrow and can be trusted to repay. These typically are time-consistent individuals with an investment opportunity. Present-biased individuals would also wish to borrow, but they are more likely to be denied credit given that they are more likely to default. Hence VSLAs that sustainably combine borrowing and commitment saving should be composed of a mix of members: some with a demand for commitment; and others with a solvent demand for credit. The first group should contain more present-biased individuals than the second group. Hence we should observe negative assorting on present-bias.

On the other hand, if reliable borrowers cannot be found, then VSLAs are capable of operating purely as a savings organization: collecting savings and returning them to members at the end of the cycle. Membership in such a group would appeal to individuals with a strong demand for commitment, e.g., individuals who are present-biased and aware of it. Because a group composed of such members would make few if any loans, no interest would be paid on savings, which means that savers with no demand for commitment have no reason to join: they can do better by saving more flexibly on their own.¹¹ This means that VSLAs that do not lend should only attract present-biased individuals: we should observe positive assorting on present-bias.

3.3 Testable predictions

The purpose of this paper is hence to test for the presence of negative assorting on occupation and present-bias. Evidence of negative assorting on occupation is an indication that borrowing frictions are low and VSLAs can perform a standard financial intermediation role between time-consistent savers and borrowers. In contrast, positive assorting would suggest the existence of frictions on borrowing across occupations, e.g., because of monitoring or enforcement issues. Evidence of negative assorting on present bias is an indication that VSLAs serve a demand for commitment while at the same time serving a group of (primarily time-consistent) borrowers. This indicates that VSLAs provide a financial intermediation service, albeit not of the pure neo-classical variety. In doing so, VSLAs would serve borrowers but also serve the needs of commitment savers without imposing a financial cost on them, a feature that distinguishes VSLAs from MFIs that only offer credit to their members, and from costly commitment de-

¹¹Time-consistent individuals may nonetheless join for “other-control” motives, or indeed as a way to undertake precautionary savings. It is also theoretically possible that they might engage in speculative behaviour, if they seek to “pile in” towards the end of the savings cycle in an attempt to suck out any profits from lending up until that point. However, the scope for such behaviour is limited by the purchase limit of five shares per week.

vinces. In contrast, positive assorting on present-bias would again indicate that information or enforcement frictions were too high to support this type of intermediation between savers and borrowers.

4 Survey design

In order to test these predictions empirically, we surveyed in the Summer of 2013 some 150 VSLA groups in Karonga District, northern Malawi (Figure 1). These VSLAs were originally formed as part of a cluster-randomised controlled trial, which ran from 2009 to 2011. The intervention was implemented by the Rockwool Foundation and CCAP Synod of Livingstonia Development Department (SOLDEV). The results of the impact evaluation are detailed in [Ksoll et al. \(2016\)](#).¹²

Figure 1: Location of Karonga District within Malawi



Given that we surveyed the groups two to four years after the groups were initially trained, our data is uniquely suited to studying the long-run equilibrium sorting of members across groups, and the long-term functioning of the groups more generally. Surveyed individuals had enough time to learn about the savings and borrowing technologies provided by VSLAs and the benefits

¹²The training of these groups was funded by the Rockwool Foundation, rather than by members themselves. [Greaney et al. \(2016\)](#) show that whether the NGO or members pay for training affects who participates in VSLAs. Thus our empirical results on sorting may only be representative of groups in which the NGO pays for the training. However, this is still by far the most widely-used model for Self-Help Group interventions.

of grouping with different members. They also had a chance to join different VSLA groups, switch across groups at the end of savings cycles, or indeed drop out of groups altogether.

Forty-six villages were included in the initial study, half of which were invited to form groups and began receiving VSLA training in late 2009-early 2010. The other half only received training in late 2011. In [Ksoll et al. \(2016\)](#) these are referred to as treated and control villages, respectively. Since we visited the area two years after the control villages were phased into treatment, our sample covers all VSLA groups that were eventually trained by SOLDEV in both treatment and control villages.¹³ Given that all villages had been phased into treatment by the time of our survey, we do not exploit the initial randomisation. Two remote control villages dropped out of the programme in 2011 and never established any groups. Our 2013 sample covers the remaining 44 villages.

The survey protocol was as follows. We contacted each group via the NGO, who invited all group members to a meeting at the group’s usual meeting place. We first explained the purpose of our survey, and obtained the consent of all group members to share their information. The data collection then proceeded in three steps. First, we used the set of individual account books to construct a roster of all group members, past and present. We then elicited basic demographic information for each member as well as their membership history, by reading out each member’s name to the group and then asking a series of questions about that individual. This constitutes the census data, which is the main focus of the analysis in this paper.

In addition, we conducted a short group survey covering the group’s history and practices, such as the typical use of savings and loan funds, the interest rate charged on loans, and the typical punishment for late loan repayments. Finally, we photographed each individual’s account book, which details their weekly savings decisions and their borrowing behaviour for the current cycle. In what follows we use the group survey and account books as sources of supplementary data, for example to document the use of funds or the interest rates set by VSLAs on borrowed funds.

To test whether members sort on present-bias, we use a measure of individuals’ time preferences elicited in the 2009-11 panel dataset which was collected for the initial impact evaluation. This measure was elicited largely prior to members joining VSLAs;¹⁴ hence using it helps rule out possible reverse causation, if being members of the same group leads individuals to have a greater similarity or differences in their choices over time. To do so, we matched the members of our 2013 census by name and village back to the 2009-11 panel survey. The 2009-11 panel covers a stratified random sample of households from the treatment and control villages.¹⁵ Since

¹³Anecdotally, we learned that a number of “replication” groups did form without SOLDEV training, either autonomously or with the help of members of SOLDEV-trained groups who had been encouraged to teach others.

¹⁴We report time preference values from the 2010 wave, since the 2009 wave did not include the far frame for female respondents. Only a very small number of the VSLA groups had begun to form by early 2010, and thus time preferences are still plausibly exogenous to the characteristics of other group members.

¹⁵By construction, the 2009-11 panel therefore includes some individuals who after baseline went to become members of VSLAs and whom we match to our 2013 member census, and others who did not and who therefore do not appear in our 2013 member census. The 2009 baseline was stratified insofar as households who declared an interest in joining VSLAs were over-sampled. For us this simply increases the probability that we are able to match members of our 2013 census to the 2009-11 panel.

the 2009-11 panel contains only a random subsample of each village’s population — whereas our 2013 member census covers all members — many members in our member census were not interviewed as part of the 2009-11 panel. Overall we are able to match around a fifth of the members from our 2013 census (722 out of 3,801) to the 2009-11 panel. From now on we refer to this subsample as “panel individuals”.¹⁶ These individuals are evenly spread across groups: we matched at least one member in 95.3% of the groups, and on average we match 4.7 members out of an average group size of 25.3 members. Of these, 352 randomly received the full time preference module (which for budgetary reasons was only administered to a subset of the 2009-11 panel sample) and so can be used to test the predictions of sorting on present-bias.

5 Data

Since our data provide a particularly rich characterisation of mature VSLA groups, we begin with descriptive statistics on saving and borrowing in VSLAs, and on individual VSLA members. We then present summary statistics for the variables used in the analysis.

5.1 Group-level data on saving and borrowing

From the group survey, we see that the median price of a “share” was 100 MK in 2013, equivalent to around \$0.30. Members of the median group could therefore save between \$0.30 and \$1.50 per week, or \$16-\$80 per year. For comparison, Malawi’s GNI per capita in 2013 was \$390 (<http://data.worldbank.org>); hence these modest amounts represent a significant fraction of household income. Loan sizes vary greatly, but typical amounts for larger loans are between 5,000 MK and 10,000 MK (\$15 or \$30).

The patterns of how savings and loan funds are used is quite distinct. The predominant use of savings is for agricultural inputs, with 58% of groups reporting that this is one of the three largest uses of saved funds. Indeed, the groups all choose to share out in January, which is during the planting season.¹⁷ The other most prominent uses of savings are food — since the January share-out also coincides with the lean season — and durable household items, such as kitchenware.

Loans on the other hand are highly concentrated on trading and business purposes: 74% of groups say this is the most important use of loaned funds, and altogether 95% say this is among

¹⁶The panel members should be more representative of the villages’ populations than the census of all members is. For example, whilst only 25% of members in our 2013 member census are male, since women disproportionately join VSLA groups, close to 50% of the respondents in the 2009-11 survey were male due to it being representative. Thus we are disproportionately likely to match a male 2013 member back to the 2009-11 survey compared to a female 2013 member. Section 7 describes how all of our results are robust to re-weighting to take account of this.

¹⁷This choice of timing itself may reflect sophistication about the effect of having cash-in-hand just before input purchase is required (Brune et al., 2011; Duflo et al., 2011).

the three most important uses of loaned funds. The other most commonly-reported uses of loan funds are education, emergencies, and purchasing food. Thus at first sight there does seem to be some financial intermediation taking place within groups: some members save for the planting and lean season, whilst their savings are lent out to members who engage in trading/business activities or who need to smooth consumption after a shock.

Turning to interest rates, the average monthly interest rate on borrowed funds was set to 17% in 2013. Whilst this may seem high, it is close to the most natural benchmark for a “fair” interest rate available in the data: namely, individuals’ average monthly discount rate in the long term. The latter is estimated to be 20% with linear utility, or lower if the curvature of the utility function is taken into account; see Section 5.2.2 for details.¹⁸ At the same time, this suggests that borrowers are not taking advantage of commitment savers’ willingness to pay for commitment by giving them a low return on their savings. Indeed, savers appear to earn a healthy return on their shares: the median monthly return on savings is approximately 3%, as calculated from each group’s reported annual return per share at the end of the cycle.¹⁹

5.2 Individual member characteristics

5.2.1 Census of members

Table 1 presents some of the key demographic characteristics of the 3,801 individuals in our member census. 73% of members report farming as their primary economic activity, whilst 21% report working in a business (mainly a family business) as their main activity. Although the NGO imposes no rules on the gender of participants, 75% of the members are female.

The data document a large degree of churning in individual membership, which points to sorting across groups over time: almost a third of members (1,262 out of 3,801) join sometime after the first cycle, and 521 members have left the group at some point by 2013.

¹⁸Inflation in 2010 versus 2013 should of course be taken into account in order to compare in real terms the interest rates in 2013 to the discount rates measured in 2010. Inflation in Malawi was fairly stable at around 8% y-o-y (corresponding 0.64% per month) from the beginning of 2009 until the beginning of 2012. After a devaluation of the Kwacha by 33% in May 2012, inflation spiked and ran at an average of 28% in 2013 overall (corresponding to 2.1% per month). Groups do not appear to have taken this into account in the nominal loan interest rate set at the beginning of the 2013 cycle, which in most groups remained unchanged from previous cycles. However, even the high 2013 inflation rate is still negligible on a monthly basis compared to such a high monthly loan interest rate. Thus accounting for monthly inflation does not alter our conclusion that the interest rate on loans appears to be broadly in line with monthly discount rates.

¹⁹This is straightforward to reconcile with a monthly interest rate on borrowing of 17%, since only a fraction of the group’s funds are lent out at any given time. The median annual return per share is 45%, equating to 3% monthly interest compounded on shares purchased right at the beginning of the year. However, this is a conservative approximation — given that individuals save throughout the year rather than just at the beginning, the true effective monthly interest rate will be higher.

Table 1: Individual member characteristics – 2013 member census

| | Full CSAE Sample | | | | |
|---|-------------------------|---------|------|------|------|
| | Mean | Std dev | Min | Max | N |
| Occupation | | | | | |
| Farmer | 0.73 | (0.44) | 0.0 | 1.0 | 3801 |
| Businessperson | 0.21 | (0.41) | 0.0 | 1.0 | 3801 |
| Other | 0.06 | (0.23) | 0.0 | 1.0 | 3801 |
| Demographic Variables | | | | | |
| Male | 0.25 | (0.43) | 0.0 | 1.0 | 3799 |
| Female-headed household | 0.21 | (0.41) | 0.0 | 1.0 | 3796 |
| Age | 36.15 | (12.05) | 12.0 | 83.0 | 3785 |
| Education | | | | | |
| Some primary educ. (only) | 0.76 | (0.43) | 0.0 | 1.0 | 3801 |
| Some post-primary educ. | 0.18 | (0.39) | 0.0 | 1.0 | 3801 |
| Literate (read & understand newspaper) | 0.83 | (0.38) | 0.0 | 1.0 | 3795 |
| Wealth | | | | | |
| Father well-off in village (scale 1-5) | 3.34 | (1.31) | 1.0 | 5.0 | 3573 |
| Spouse's father well-off in village (scale 1-5) | 3.42 | (1.32) | 1.0 | 5.0 | 3566 |
| Income Poverty Indicators | | | | | |
| Household well-off in group (scale 1-9) | 7.52 | (1.28) | 1.0 | 9.0 | 3770 |
| HH owns a bicycle | 0.51 | (0.50) | 0.0 | 1.0 | 3796 |
| # Goats | 1.29 | (2.59) | 0.0 | 40.0 | 3792 |

Notes: All variables as measured during the 2013 member census, N=3,801 members. 519 members were no longer active, but are included to avoid selection bias. Analysis is conducted with and without these individuals, see Section 7. Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual’s primary economic activity, if engaged in multiple activities.

Table 2: Individual economic activity & schooling – 2013 member census

| Category | N | % of re- sponses |
|-------------------------------|-------------|---------------------|
| Occupation | 3780 | 100% |
| Farmer | 2,786 | 73.34% |
| Business | 793 | 20.87% |
| <i>Self-employed</i> | 108 | 2.84% |
| <i>Family business worker</i> | 685 | 18.03% |
| Fishing | 61 | 1.61% |
| <i>Fishing, employed</i> | 17 | 0.45% |
| <i>Fishing, self-employed</i> | 44 | 1.16% |
| Employee | 89 | 2.34% |
| Casual labour (ganyu) | 24 | 0.63% |
| Student | 4 | 0.11% |
| Unemployed, not seeking work | 9 | 0.24% |
| Other | 14 | 0.37% |

Notes: All variables as measured during the 2013 member census, N=3,801 members. 519 members were no longer active, but are included to avoid selection bias. Analysis is conducted with and without these individuals, see Section 7. Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual’s primary economic activity, if engaged in multiple activities.

5.2.2 Time preference data

As described above, we matched 722 individuals by name to the baseline data of the 2009-11 impact evaluation. Merging with this additional dataset yields richer information on individual characteristics for panel individuals, as summarized in Table 3. In particular, activities to measure time preferences were administered to both the head and the spouse in a random subset of the panel data households in 2010, and can be matched to 352 individuals.

The time preference activities took the form of multiple price lists. Participants were first asked whether they would prefer to receive 2000 Kwacha (approximately \$13 in 2010) now or increasing amounts in one month.²⁰ This constitutes the near frame. Participants were then asked whether they would prefer to receive 2000 MK in one year or the same increasing amounts in one year and one month. This constitutes the far frame. The average respondent prefers 2000 MK now to 2332 MK in one month, and 2000 MK in one year to 2402 MK in one year and one month. If participants answered these questions without considering their background consumption, and if utility was linear, this would imply an average near-frame monthly discount rate of 17% and an average far-frame monthly discount rate of 20%. However, taking into

²⁰Due to practical constraints, responses were unincentivized. The limited evidence comparing incentivized and unincentivized responses to time preference questions suggests that unincentivized responses are unbiased, although they may be more noisy (John, 2017).

account any curvature of the utility function implies a lower discount rate (Andersen et al., 2008).

We classify an individual as “present-biased” if she makes a more impatient choice in the near frame than in the far frame. The choices of members classified as “present-biased” imply an average near-frame discount rate of 16% with linear utility, and an average far-frame monthly discount rate of close to zero. This is consistent with the idea that present-biased individuals exhibit excessive short-run discounting but modest long-run discounting.²¹ Overall, 11% of individuals are classified as “present-biased”. This is very similar to the rate of 10% found by Brune et al. (2011) in rural Malawi. Other estimates from developing countries find a larger proportion of individuals to be “present-biased” (Ashraf et al., 2006; Giné et al., 2016; Janssens et al., 2017). However, estimates of “present-bias” over money may be exaggerated at times of tight liquidity constraints (Carvalho et al., 2016; Cassidy, 2018). Tight liquidity constraints are much less of a concern here, since the 2009-11 survey was conducted shortly after the harvest. If anything, we may under-estimate the number of present-biased individuals, if some present-biased individuals have enough liquidity to arbitrage experimental payments (Augenblick et al., 2015). This would reduce our chances of observing assortative matching, positive or negative, on this measure. Similarly, our measure does not proxy whether individuals categorised as “present-biased” are sophisticated or not. If only a subset of individuals classified as “present-biased” are sophisticated and have a demand for commitment, then this would also reduce our chances of observing assortative matching on this measure.

The fact that the far frame refers to one year after the near frame eliminates concerns that seasonality in consumption and liquidity constraints may act as a confound in the measure of “present-bias” (Epper, 2015). Nonetheless, individuals may still spuriously appear “present-biased” if they are expecting a decrease in the marginal rate of intertemporal substitution next year compared to this year – for example if this year’s harvest was particularly bad for their household. We therefore employ a number of tests to check whether measured “present-bias” appears to be capturing a decreasing marginal rate of intertemporal substitution, rather than truly present-biased preferences.

First, if individuals who appear “present-biased” are actually those facing a higher marginal rate of intertemporal substitution than they expect to face in one year’s time, we expect the measure of “present-bias” to be correlated with low recent consumption. Vice versa, we expect individuals classified as “future-biased” (26% of the sample) to exhibit high recent consumption. In fact, the measures of “present-bias” and “future-bias” in early 2010 are completely uncorrelated with individuals’ 2009 consumption. Moreover, whilst “future-bias” is correlated with better food security in 2009 (the household is 8.9 percentage points less likely to have had fewer than two meals per day on average in the last week, p-value 0.025), “present-bias” is also marginally correlated with better food security (14.0 percentage points, p-value 0.112). This suggests that it is those individuals who appear “time-consistent” – not those who appear

²¹Again, the estimate of 16% is an approximation if utility is linear, but is an upper bound if utility is concave. Those classified as “time-consistent” actually exhibit far-frame switch-points consistent with a higher far-frame discount rate than those classified as “present-biased”. However, these “time-consistent” individuals appear equally impatient in the near and the far frames.

“present-biased” – who have experienced recent hardship.

Data on saving and borrowing also militates against the idea that “present-biased” individuals are systematically expecting to be better off next year. If this were the case, we expect these individuals to exhibit higher recent borrowing and lower saving. Instead, we observe a strong negative correlation between appearing “present-biased” in 2010 and data on borrowing from 2009 and 2010: in 2009, individuals categorised as “present-biased” are 13.7 percentage points less likely to have asked for a loan in the past year, 7.3 percentage points less likely to have any current loans, and have 746 MK fewer in outstanding loans; whilst in 2010 they are 16.8 percentage points less likely to have asked for a loan in the past year, and have 4957 MK fewer in outstanding loans, although the latter is marginally insignificant (p-value 0.134). All of this is more consistent with the idea that “present-biased” individuals are not deemed credit-worthy, or avoid borrowing because they are aware of their own tendency to over-consume. “Present-biased” individuals also have higher total savings from 2009 (4468 MK, p-value 0.075), which further goes against the idea that individuals appear “present-biased” because they are liquidity-constrained now but anticipate higher income in the future.²² Meanwhile, the measure of “future-bias” is uncorrelated with measures of saving and borrowing from the 2009-10 data.

We do however find that the measure of “present-bias” is marginally correlated with subjects’ subjective report that they have had a bad harvest in 2010 compared to the past decade (correlation of 0.292 on a 1-5 Likert scale, p-value 0.101). We thus cannot entirely rule out that the measure of “present-bias” may in part be capturing individuals’ expectations that they will be better off in a year’s time. Therefore, in Section 6 we run a further set of tests to check that our results on sorting are driven by true present-bias rather than by a decreasing marginal rate of intertemporal substitution. The 2009-11 panel dataset further provides measures of the matched individuals’ risk aversion — elicited using standard Binswanger lotteries — intra-household bargaining power, and more detailed measures of consumption and food security. These are also summarised in Table 3, and are used as additional controls in robustness checks.

5.3 Group composition by member characteristics

Table 4 describes the distribution of groups across villages. Thirty-five villages have at least two groups — hence sorting is identified in these villages — and some villages have up to fourteen. The presence of more than one group per village is itself suggestive of inefficiency: there is no secondary market for capital in these villages, and so VSLAs with excess capital cannot lend to other VSLAs. Having one large VSLA per village would maximise the scope for lending out savings deposits and alleviating credit constraints. However, transaction costs and ability to monitor and sanction borrowers likely become too large over a certain group size, explaining why we observe multiple groups per village. Given this, sorting across groups becomes a key

²²The fact that “present-biased” individuals may be able to save outside of VSLAs is still consistent with them having a demand for VSLAs as a commitment savings device, since VSLAs may offer a better return than other forms of saving such as cash-under-the-mattress. Moreover, exercising self-control by oneself may be costly (Gul and Pesendorfer, 2001; Toussaert, 2015).

Table 3: Individual member characteristics – matched subsample

| | Matched individuals | | | | |
|---|---------------------|-----------|-------|--------|-----|
| | Mean | Std dev | Min | Max | N |
| Time Preferences | | | | | |
| Present-biased | 0.11 | (0.31) | 0.0 | 1.0 | 350 |
| Future-biased | 0.26 | (0.44) | 0.0 | 1.0 | 350 |
| Minimum switch-point, near frame | 2332.36 | (369.62) | 1900 | 2800 | 352 |
| Minimum switch-point, far frame | 2401.39 | (378.38) | 1900 | 2800 | 352 |
| Risk Preferences | | | | | |
| Risk-neutral | 0.11 | (0.32) | 0.0 | 1.0 | 330 |
| Intra-Household Bargaining | | | | | |
| Ever hides money from spouse | 0.44 | (0.50) | 0.0 | 1.0 | 307 |
| Female HH decision-making power (index 0-8) | 2.87 | (1.81) | 0.0 | 8.0 | 377 |
| Social Variables | | | | | |
| HH important in village decisions (scale 1-6) | 3.27 | (1.14) | 1.0 | 6.0 | 721 |
| HH ever speaks at village meetings | 0.57 | (0.50) | 0.0 | 1.0 | 718 |
| Income | | | | | |
| Monthly consumption per capita, MK | 2176.95 | (973.09) | 648.7 | 7811.1 | 721 |
| Food security poor (dummy) | 0.28 | (0.45) | 0.0 | 1.0 | 722 |
| Credit | | | | | |
| HH asked for credit in last year | 0.15 | (0.36) | 0.0 | 1.0 | 383 |
| HH has any loans outstanding | 0.09 | (0.29) | 0.0 | 1.0 | 383 |
| Total value of loans outstanding, MK | 779.90 | (4238.64) | 0.0 | 45000 | 383 |

Notes: N=722 individuals are matched from the 2013 census to the 2009-11 panel data. N=383 of these individuals are matched to the longer panel survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. Present-biased (future-biased) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Minimum switch-point is the lower bound of the interval in which the respondent switched to preferring the one-month-later payment compared to a 2000 MK payment on the earlier date. 150 MK \approx 1 USD at the time of the 2009 and 2010 surveys. Risk-neutral is a dummy equal to one if the respondent prefers a 50-50 lottery to its expected value for certain, and thus could indicate risk-neutral or risk-seeking behaviour. Female HH decision-making power is constructed from questions over four types of economic decisions, scoring one if the female has some say in the decision and two if she has complete control. Malawi’s GNI per capita in 2009 was \$26.6/month, but these are particularly poor households in a very remote region. Food security poor is equal to one if the household reports consuming fewer than three meals yesterday.

determinant of efficiency.

Table 4: VSLA groups per village

| # groups | # villages | % of villages |
|--------------|------------|---------------|
| 1 | 9 | 20.5% |
| 2 | 17 | 38.6% |
| 3 | 4 | 9.1% |
| 4 | 4 | 9.1% |
| 5 | 3 | 6.8% |
| 6 | 2 | 4.6% |
| 7 | 2 | 4.6% |
| 11 | 1 | 2.3% |
| 13 | 1 | 2.3% |
| 14 | 1 | 2.3% |
| Total | 44 | 100% |

Notes: From the 2013 member census, N=150 groups, N=44 villages. Eight of these groups were no longer active, but were included in the survey to avoid selection bias. Analysis is conducted with and without these groups, see Section 7.

Table 5 describes how groups are composed in terms of member characteristics. The average group size is 25 members, although groups range in size from 10 to 45 members. Groups also range in gender composition from all-male to all-female, although most groups (i.e. groups within one standard deviation of the mean) are mixed but with a majority of female members. In some groups, as many as 62% of members come from female-headed households.

There is also clear heterogeneity across groups in terms of occupational composition: some groups consist purely of farmers, whereas others contain almost no farmers. However, dyadic regression analysis is needed to determine whether such heterogeneity is evidence of individuals sorting across groups within villages, or whether it represents differences in population characteristics across villages.

Table 5: Group composition by member characteristics

| Variable | Average | Std. Dev | Min | Max |
|-------------------------------|---------|----------|------|-------|
| # members | 25.34 | 5.69 | 10 | 45 |
| % members farmers | 74.2 | 26.3 | 3.3 | 100.0 |
| % members businesspeople | 20.2 | 22.2 | 0.0 | 93.3 |
| % members fisherman/woman | 1.6 | 5.5 | 0.0 | 30.4 |
| % members female | 74.9 | 19.0 | 0.0 | 100.0 |
| % members female-headed HH's | 20.9 | 13.0 | 0.0 | 61.9 |
| Mean age of members | 36 | 4.6 | 23 | 49 |
| % members literate | 82.5 | 12.2 | 40.9 | 100.0 |
| % members some primary only | 81.6 | 11.4 | 38.7 | 100.0 |
| % members own bicycle | 52.1 | 18.6 | 0.0 | 95.0 |
| Mean # goats owned by members | 1.32 | 0.98 | 0.04 | 7.48 |

Notes: From the 2013 member census, N=150 groups, N=44 villages. Eight of these groups were no longer active, but were included in the survey to avoid selection bias. Analysis is conducted with and without these groups. Similarly, 519 of these members were no longer active, but were included in the survey for completeness. Analysis is conducted with and without these members, see Section 7.

5.4 Dyad characteristics

For the analysis, we construct all possible pairs – dyads – of members in the same village from the 2013 member census.²³ Of these dyads, 17% comprise two individuals who are both members of the same group, whereas the other 83% comprise two individuals who are members of different groups in the same village. Table 6 describes the dyads in more detail.

When we restrict attention to the dyads in which both individuals are matched to the full version of the 2009-11 panel dataset, including the time preference modules, this gives us a sample size of 1,641 dyads.²⁴ Table 7 highlights key additional data for the matched dyads.

6 Empirical strategy and results

6.1 Dyadic regression framework

To test the predictions on sorting, we employ a dyadic regression framework (Fafchamps and Gubert, 2007). The intuition behind this approach is as follows: if there are multiple groups in a village, and if there is *positive* sorting on a given characteristic, then in equilibrium two members who are less similar on that characteristic are, *ceteris paribus*, less likely to be observed as members of the same group. Vice versa, if there is *negative* sorting on a given characteristic, then two members who are less similar on that characteristic are more likely to be members of the same group.

Our main estimating equations are undirected dyadic logit models, with observations at the dyad level. These take the following form:

$$\begin{aligned} \Pr(D_{ijv} = 1 | D_{iv} = 1 \ \& \ D_{jv} = 1; \mathbf{Z}_{iv}, \mathbf{Z}_{jv}, \mathbf{W}_{ijv}, v) \\ = \Pr(\alpha + \beta|\mathbf{Z}_{iv} - \mathbf{Z}_{jv}| + \gamma(\mathbf{Z}_{iv} + \mathbf{Z}_{jv}) + \delta\mathbf{W}_{ijv} + \mu_v + \varepsilon_{ijv} > 0) \end{aligned} \quad (1)$$

where D_{iv} and D_{jv} denote dummies equal to one if i and j are members of some VSLA group,²⁵ and D_{ijv} is a dummy equal to one if i and j are members of the same group. \mathbf{Z}_{iv} and \mathbf{Z}_{jv} are vectors of i 's and j 's individual characteristics, in which we include measures of present-bias. We minimize omitted variable bias by controlling for a rich set of characteristics that may affect

²³In practice we found it to be extremely rare that an individual would join a group outside of his or her village of residence. Thus *de facto* only the other members from an individual's village of residence are candidates to be members of the same group as that individual.

²⁴Table 12 shows that the dyads which can be matched to the full version of the panel survey have small but significant differences from the whole universe of dyads from the 2013 member census. Therefore, we later re-run all of our time preference specifications weighting each dyad by the inverse probability of that dyad being matched to the full 2009-11 survey. This does not change our results; see Section 7.

²⁵This is for notational completeness: by construction both dummies will always be equal to one in our analysis, since our data contains only members.

Table 6: Dyad characteristics – 2013 member census

| | Mean | Std dev | Min | Max | N |
|---|-------------|----------------|------------|------------|----------|
| Membership | | | | | |
| Same VSLA group | 0.17 | (0.37) | 0.0 | 1.0 | 289914 |
| Occupation | | | | | |
| Same economic activity | 0.56 | (0.50) | 0.0 | 1.0 | 289914 |
| Absolute differences - Demographic Variables | | | | | |
| Male | 0.38 | (0.48) | 0.0 | 1.0 | 289467 |
| Female-headed household | 0.32 | (0.47) | 0.0 | 1.0 | 288740 |
| Age | 12.64 | (10.25) | 0.0 | 65 | 286763 |
| Absolute differences - Education | | | | | |
| Some post-primary educ. | 0.33 | (0.47) | 0.0 | 1.0 | 289914 |
| Literate (read & understand newspaper) | 0.26 | (0.44) | 0.0 | 1.0 | 288342 |
| Absolute differences - Wealth | | | | | |
| Father well-off in village (scale 1-5) | 1.41 | (1.10) | 0.0 | 4.0 | 253041 |
| Spouse's father well-off in village (scale 1-5) | 1.43 | (1.13) | 0.0 | 4.0 | 252485 |
| Absolute differences - Income and Poverty | | | | | |
| Household well-off in group (scale 1-9) | 1.40 | (1.15) | 0.0 | 8.0 | 284485 |
| HH owns a bicycle | 0.46 | (0.50) | 0.0 | 1.0 | 288740 |
| # Goats | 1.84 | (2.73) | 0.0 | 40 | 288240 |
| Sum - Occupation | | | | | |
| Farmer | 1.37 | (0.70) | 0.0 | 2.0 | 289914 |
| Businessperson | 0.48 | (0.63) | 0.0 | 2.0 | 289914 |
| Sum - Demographic Variables | | | | | |
| Male | 0.53 | (0.63) | 0.0 | 2.0 | 289467 |
| Female-headed household | 0.40 | (0.57) | 0.0 | 2.0 | 288740 |
| Age | 72.12 | (16.69) | 24.0 | 163 | 286763 |
| Sum - Education | | | | | |
| Some post-primary educ. | 0.43 | (0.58) | 0.0 | 2.0 | 289914 |
| Literate (read & understand newspaper) | 1.68 | (0.52) | 0.0 | 2.0 | 288342 |
| Sum - Wealth | | | | | |
| Father well-off in village (scale 1-5) | 6.76 | (1.85) | 2.0 | 10.0 | 253041 |
| Spouse's father well-off in village (scale 1-5) | 6.85 | (1.88) | 2.0 | 10.0 | 252485 |
| Sum - Income and Poverty | | | | | |
| Household well-off in group (scale 1-9) | 15.04 | (1.83) | 3.0 | 18.0 | 284485 |
| HH owns a bicycle | 0.99 | (0.73) | 0.0 | 2.0 | 288740 |
| # Goats | 2.44 | (3.38) | 0.0 | 70 | 288240 |

Notes: All variables as measured during the 2013 member census, N=3,801 members. 519 of these members were no longer active, but are included to avoid selection bias. Analysis is conducted with and without these individuals, see Section 7. All possible dyads in which both individuals live in the same village are constructed, N=289,914. Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual’s primary economic activity, if engaged in multiple activities.

Table 7: Dyad characteristics – matched subsample

| | Matched dyads | | | | |
|---|---------------|----------|------|------|------|
| | Mean | Std dev | Min | Max | N |
| Absolute differences | | | | | |
| Present-biased | 0.16 | (0.37) | 0.0 | 1.0 | 1641 |
| Future-biased | 0.37 | (0.48) | 0.0 | 1.0 | 1641 |
| Minimum switch-point, near frame | 366.05 | (321.43) | 0.0 | 900 | 1655 |
| Minimum switch-point, far frame | 351.92 | (337.30) | 0.0 | 900 | 1651 |
| Risk-neutral | 0.20 | (0.40) | 0.0 | 1.0 | 1513 |
| Ever hides money from spouse | 0.45 | (0.50) | 0.0 | 1.0 | 1269 |
| Female HH decision-making power (index 0-8) | 1.95 | (1.57) | 0.0 | 8.0 | 1914 |
| HH important in village decisions (scale 1-6) | 1.08 | (1.11) | 0.0 | 5.0 | 7314 |
| HH speaks at village meetings | 0.47 | (0.50) | 0.0 | 1.0 | 7266 |
| Sums | | | | | |
| Present-biased | 0.19 | (0.42) | 0.0 | 2.0 | 1641 |
| Future-biased | 0.53 | (0.64) | 0.0 | 2.0 | 1641 |
| Minimum switch-point, near frame | 4761.51 | (558.00) | 3800 | 5600 | 1655 |
| Minimum switch-point, far frame | 4908.17 | (563.28) | 3800 | 5600 | 1651 |
| Risk-neutral | 0.22 | (0.44) | 0.0 | 2.0 | 1513 |
| Ever hides money from spouse | 0.79 | (0.71) | 0.0 | 2.0 | 1269 |
| Female HH decision-making power (index 0-8) | 5.90 | (2.71) | 0.0 | 16.0 | 1914 |
| HH important in village decisions (scale 1-6) | 6.54 | (1.69) | 2.0 | 12.0 | 7314 |
| HH ever speaks at village meetings | 1.16 | (0.71) | 0.0 | 2.0 | 7266 |

Notes: N=722 individuals are matched from the 2013 census to the 2009-11 panel data. N=383 of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, N=7,314 for the general survey and N=1,641 for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. Present-biased (future-biased) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Minimum switch-point is the lower bound of the interval in which the respondent switched to preferring the one-month-later payment compared to a 2000 MK payment on the earlier date. 150 MK \approx 1 USD at the time of the 2009 and 2010 surveys. Risk-neutral is a dummy equal to one if the respondent prefers a 50-50 lottery to its expected value for certain, and thus could indicate risk-neutral or risk-seeking behaviour. Female HH decision-making power is constructed from questions over four types of economic decisions, scoring one if the female has some say in the decision and two if she has complete control. Food security poor is equal to one if the household reports consuming fewer than three meals yesterday.

sorting and are possibly correlated with occupation and present-bias. Sections 6 and 7 detail the full set of controls used in the main specification and in the robustness checks. \mathbf{W}_{ijv} is a vector of characteristics of the dyad, including whether i and j share the same category of occupation. μ_v is a village fixed effect. It controls for the average probability of matching in the village, which depends on the number of groups and the relative size of each group. It also absorbs a range of factors that affect the probability of being in the same group but remain constant at the village level: for example, whether the village is served by other NGO programmes. ε_{ijv} is a dyad-specific error term, which we assume takes a logistic distribution. We cluster standard errors at the village level in all estimations.²⁶

It follows from the logic outlined above that an estimate of $\hat{\beta} < 0$ indicates positive assortative matching on the characteristic in question, whilst an estimate of $\hat{\beta} > 0$ indicates negative assortative matching on that characteristic. Since we estimate Equation 1 on a sample which only includes individuals who are members of at least one group, an estimate of $\hat{\gamma} > 0$ indicates that, conditional on being member of at least one group, individuals with a high value of that particular variable are more likely to be members of more than one group.²⁷ This is important to control for since it increases the probability that such individuals are in the same group as a randomly-chosen other member, simply because such individuals are members of multiple groups.

6.2 Sorting on occupation

We begin by estimating Equation 1 on the full 2013 member census.²⁸ Table 8 describes the results. Most strikingly, there is evidence of strong *positive* assortative matching on occupation: if two individuals share the same occupation then they are 8.6 percentage points more likely to be members of the same group (p-value < 0.01). This is a large effect, equivalent to 53% of the baseline probability of being in the same group (16.1%). It therefore appears that the full potential of financial intermediation across farmers and non-farmers is not being realised. This is despite evidence that farmers do, as predicted, have a greater demand than non-farmers to use VSLAs as a savings technology: farmers save 17.5 more shares than non-farmers over the cycle (p-value 0.079). Instead, positive assorting suggests that informational or enforcement frictions are lower among members of the same occupation, or that the social benefits of participating in VSLAs are higher within occupational groups than across them. Moreover, there is no evidence that these frictions diminish as the groups mature: the interaction between whether two members share the same occupation and whether their village was assigned to treatment in 2009 under the original RCT — as opposed to being held as a control until 2011 — is insignificant (see Online Appendix).

²⁶This is more conservative than the method of clustering by dyad (Fafchamps and Gubert, 2007).

²⁷We observe 146 individuals who are members of more than one group in the 2013 member census.

²⁸To avoid selection bias, in our main analyses we include all individuals who have ever been a member including those who have left by 2013, and all groups including the eight groups which had disbanded by 2013. However, our results are all robust to including only those individuals who are still current members in 2013, and only those groups which had not disbanded; see Section 7.

Table 8: Dyadic regressions – 2013 member census

| | (1) Full member census Mfx / (s.e.) |
|---|--|
| Occupation | |
| Same economic activity | 0.086*** (0.008) |
| Absolute differences | |
| Male | -0.053*** (0.015) |
| Female-headed household | -0.012*** (0.004) |
| Age | -0.001*** (0.000) |
| Some post-primary educ. | -0.008 (0.005) |
| Literate (read & understand newspaper) | -0.013* (0.007) |
| Father well-off in village (scale 1-5) | -0.013*** (0.002) |
| Spouse's father well-off in village (scale 1-5) | -0.013*** (0.003) |
| Household well-off in group (scale 1-9) | -0.010*** (0.002) |
| HH owns a bicycle | -0.003 (0.003) |
| # Goats | -0.006*** (0.001) |
| Sums | ✓ |
| Village f.e.'s | ✓ |
| Observations | 219747 |
| Pseudo R^2 | 0.129 |
| Baseline predicted probability | 0.161 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. All variables from the 2013 member census, $N=3,801$ members. 519 of these members were no longer active, but are included here to avoid selection bias. Results are robust to excluding these individuals, see Section 7. All possible dyads in which both individuals live in the same village are constructed, $N=289,914$. Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual's primary economic activity, if engaged in multiple activities. Reported effects are marginal effects estimated at the mean.

The other large effect in terms of size is the positive assortative matching on gender: *ceteris paribus*, a male and a female are 5.3 percentage points less likely to be members of the same group than an all-male pair or an all-female pair (p-value < 0.01). Female-headed households are also more likely to group together, although the effect size is just 1.2 percentage points (p-value < 0.01). A number of other characteristics are highly significant, although the estimated marginal effects are small. Specifically, we observe positive assorting on: age; whether a member’s spouse’s father is relatively well off and whether a member’s own father is relatively well-off compared to the rest of the village (proxies of exogenous wealth, or social class more generally); the number of goats the member’s household possesses and whether her household owns a bicycle (standard poverty indicators for this region of Malawi); and whether a member’s household is reported to be well-off at least compared to the rest of the group.²⁹ Such positive assorting may take place purely due to homophily, i.e., if people prefer to be in a group with people like them. Alternatively, it may be that members with similar social characteristics have similar financial needs, and so can more easily agree on the value of weekly shares, the size of the interest rate, and so on.

6.3 Sorting on time preferences

To test for evidence of sorting on present-bias, we re-estimate Equation 1 for the subsample of matched individuals whose time preferences are measured in the 2009-11 panel data. Table 9 shows the effect of adding the measure of “present-bias” for these individuals. The key result is that we see strong evidence of *negative* assorting on “present-bias”: the absolute difference between two members’ “present-bias” carries a large, positive coefficient of 16.6 percentage points (p-value 0.013). This is consistent with the idea that present-biased individuals who seek a commitment savings device sort into groups with time-consistent individuals who seek access to credit. Indeed, looking at the individual VSLA account books, time-consistent members are 40.3 percentage points more likely to have taken a loan in the last cycle than other members (p-value 0.043).³⁰ The result is particularly striking given that we observe positive assortative matching on almost every other characteristic.

We still observe a large, positive effect of two individuals having the same primary occupation: 18.1 percentage points (p-value 0.019), which is again equivalent to over half the baseline probability of two members being in the same group in this subsample. The pattern of coefficients for the other controls is also similar to that obtained in the full sample. Table 13 in Appendix 9 formally tests for equality of coefficients across the full sample and the matched subsample (excluding the measure of “present-bias” since it is not available for the full sample) and finds few significant differences. Thus it appears that assorting in the matched subsample is broadly representative of assorting in the full census. In Section 7 we further show that the results

²⁹Given that “household well-off in group” is a within-group ranking, we would expect its coefficient to be biased towards a positive value. The negative coefficient therefore suggests that individuals understood this question to be more about absolute consumption.

³⁰There is no correlation between time-consistency and the total amount borrowed; however, the data on loan amounts are very noisy, given different accounting systems across groups.

on “present-bias” are robust to re-weighting the estimations in order to make the matched subsample exactly representative of the full sample.

Columns (1)-(5) of Table 10 confirm that the negative assorting on “present-bias” is not driven by matching on short-run or long-discount rates (or marginal rates of inter-temporal substitution).³¹ Column (1) repeats the preferred specification shown in Table 9 for comparison. Columns (2) and (3) show that we observe no sorting on the respondent’s switch-point in the near or the far frame respectively. Similarly, column (4) shows that there is no evidence of sorting on whether the respondent is below or above the median patience in the near frame or the far frame. Since by definition “time-consistent” individuals’ are equally impatient in the near and the far frame, sorting appears driven by the fact that the long-run choices of “present-biased” individuals’ are more patient than their short-run choices, as opposed to the idea that “present-biased” individuals have impatient short-run choices or patient long-run choices.

However, as discussed in Section 5.2.2 it remains possible that our measure of “present-bias” is instead capturing individuals expecting to have a lower marginal rate of intertemporal substitution in the future. Such individuals should have had a demand for borrowing, at least when the VSLAs were first formed. Conversely, individuals classified as “future-biased” may in fact have been anticipating a higher marginal rate of intertemporal substitution in the future, and thus may have had a demand for saving. If so, we would expect to observe two empirical regularities. First, in terms of who sorts into groups with “time-consistent” individuals, we would now expect those individuals spuriously classified as “future-biased” to do so. This is because individuals classified as “future-biased” are now the ones providing savings, which “time-consistent” individuals borrow when investment opportunities arise. We should therefore observe negative assorting on “future-bias”. Second, we would expect to see the strongest matching between “present-biased” individuals, who in fact are individuals with a demand for credit, and “future-biased” individuals, who in fact are individuals with a demand for saving. That is, we would observe negative assorting “present-bias” when “time-consistent” individuals are dropped from the sample.

Columns (5)-(7) of Table 10 show that neither of these empirical regularities are observed in the data. Column (5) shows that, unlike “present-bias”, there is no observed sorting on “future-bias”. Column (6) reports the results when “time-consistent” individuals are dropped from the sample, and thus only “present-biased” and “future-biased individuals” remain. There is no significant evidence of negative assorting within this subsample, i.e. no evidence that “present-biased” individuals sort into groups with “future-biased” individuals. In contrast, column (7) reports the results when “future-biased” individuals are dropped, leaving a sample of only “present-biased” and “time-consistent” individuals. The estimated coefficient on “present-biased” remains large and highly significant. Thus there is strong evidence that “present-biased” individuals are matching with “time-consistent” individuals. This pattern of results is more in line with the predictions of Section 6.3, and thus with the idea that our measure of “present-bias” truly captures individuals with present-biased preferences.

³¹Table 15 in Appendix 9 confirms that the results in Table 10 also hold when the subsample is re-weighted.

Table 9: Dyadic regressions – matched subsample

| | (1) Matched subsample Mfx / (s.e.) |
|---|--|
| Occupation | |
| Same economic activity | 0.181** (0.077) |
| Absolute differences | |
| Present-biased | 0.166** (0.067) |
| Male | -0.004 (0.035) |
| Female-headed household | -0.176** (0.070) |
| Age | -0.006** (0.003) |
| Some post-primary educ. | -0.038 (0.054) |
| Literate (read & understand newspaper) | -0.033 (0.042) |
| Father well-off in village (scale 1-5) | -0.020 (0.012) |
| Spouse's father well-off in village (scale 1-5) | -0.043*** (0.014) |
| Household well-off in group (scale 1-9) | -0.044** (0.019) |
| HH owns a bicycle | 0.008 (0.030) |
| # Goats | -0.013* (0.007) |
| Sums | ✓ |
| Village f.e.'s | ✓ |
| Observations | 1292 |
| Pseudo R^2 | 0.222 |
| Baseline predicted probability | 0.296 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. $N=722$ individuals are matched from the 2013 census to the 2009-11 panel data. $N=383$ of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, $N=7,314$ for the general survey and $N=1,641$ for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. Time preferences are taken from the 2010 survey, wave since the 2009 wave did not include the far frame for females. Present-biased (future-biased) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Reported effects are marginal effects estimated at the mean.

Table 10: Dyadic regressions – time preference measures, matched subsample

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|------------------|--------------------|
| | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) |
| Occupation | | | | | | | |
| Same economic activity | 0.181** (0.077) | 0.175** (0.081) | 0.180** (0.079) | 0.187** (0.079) | 0.178** (0.077) | 0.108 (0.073) | 0.145 (0.106) |
| Absolute differences | | | | | | | |
| Present-biased | 0.166** (0.067) | | 0.179** (0.073) | 0.175** (0.072) | 0.168** (0.067) | 0.055 (0.060) | 0.195** (0.083) |
| Future-biased | | | | | -0.017 (0.036) | | |
| Minimum switch-point (MK), far frame | | 0.000 (0.005) | 0.001 (0.005) | | | | |
| Minimum switch-point (MK), far frame | | -0.003 (0.006) | -0.005 (0.007) | | | | |
| Patience above median, near frame | | | | 0.011 (0.036) | | | |
| Patience above median, far frame | | | | -0.032 (0.031) | | | |
| Wealth & income controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Demographic controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sums | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Village f.e.'s | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1292 | 1292 | 1292 | 1292 | 1292 | 184 | 665 |
| Pseudo R^2 | 0.222 | 0.220 | 0.225 | 0.226 | 0.224 | 0.331 | 0.233 |
| Baseline predicted probability | 0.296 | 0.296 | 0.296 | 0.296 | 0.296 | 0.273 | 0.293 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. $N=722$ individuals are matched from the 2013 census to the 2009-11 panel data. $N=383$ of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, $N=7,314$ for the general survey and $N=1,641$ for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. Present-biased (future-biased) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Minimum switch-point is the lower bound of the interval in which the respondent switched to preferring the payment dated one month later compared to a 2000 MK payment on the earlier date. $150 \text{ MK} \approx 1 \text{ USD}$ at the time of the 2009 and 2010 surveys. Patience above median is a dummy for having a switch-point below the median in that frame. Column (6) restricts the sample to “present-biased” and “future-biased” individuals, dropping “time-consistent” individuals. Column (7) restricts the sample to “present-biased” and “time-consistent” individuals, dropping “future-biased” individuals. Reported effects are marginal effects estimated at the mean.

7 Robustness

Additional controls: The coefficients on economic activity and “present-bias” are robust to the inclusion of a host of additional controls from the 2009-11 panel survey, as shown in Table 11. Column (1) repeats the preferred specification shown in Table 9 and is included for reference only. Column (2) shows that negative assorting on present-bias holds unconditional on occupation. Columns (3) and (4) show no evidence of sorting on being risk-neutral as compared to risk-averse, or indeed on the degree of risk-aversion. Columns (5) and (6) show no evidence of sorting on measures of intra-household bargaining, either unconditionally or conditional on present-bias. This suggests that participants do not sort on “other-control” motives, in contrast to the strong sorting on “self-control” motives proxied by present-bias.³² Finally, column (7) shows that there is significant evidence of negative assorting on whether the individual comes from a household that speaks at village meetings — a proxy of how active or powerful the household is in local civil society. This is consistent with the idea that certain “leaders” encourage their “followers” to join their group. However, adding this control does not change the estimated effect of present-bias, suggesting the two effects are uncorrelated.

Weighting: As explained in Section 4, the 2009-11 panel survey was conducted on a random sample of the population in each of the surveyed villages. This does not mean that the subset of 2013 members that can be matched back to the 2009-11 panel are a random subset of all 2013 members. Table 12 in Appendix 9 shows that matched dyads are slightly unrepresentative of the full population of 2013 dyads. However, Table 13 shows that only the estimated coefficients on gender and female-headed household are significantly different between the full sample and the matched subsample, and they maintain the same sign and significance. Nevertheless, as a robustness check, we re-weight the regressions to estimate the effect sizes we hypothetically would obtain if the matched subsample were a fully random subsample of all 2013 members. To construct the weights, we first estimate a probit equation on the probability of each dyad in the 2013 data also appearing in the 2009-11 data, as a function of the full set of dyad characteristics listed in Table 6 and of village fixed effects.³³ We then use the estimated coefficients to generate the predicted probability that each 2013 dyad is matched to the 2009-11 data, and we take the inverse of this predicted probability as the dyad-specific weight. We then re-estimate the various columns of Table 11 with these weights. Tables 14, 15 and 16 in Appendix 9 show that re-weighting slightly reduces the size of the estimated coefficients on occupation and present-bias — albeit never significantly so — and that they always maintain the same level of significance.

³²The coefficients on the dyadic sums of “ever hides money from spouse” and “female HH decision-making power” are also insignificant (not shown). Thus there is no evidence that women with lower or higher household bargaining power join more groups conditional on being a member of at least one group — our best proxy of the strength of demand for VSLA participation. Other literature has examined effects of the square of household decision-making (Anderson and Baland, 2002). However, this does not make sense in a dyadic setting, as the sum or difference of two individuals’ squared decision-making has no natural interpretation.

³³This is not equivalent to the the product of the separate probabilities that individual i and individual j are matched to the 2009-11 data, because of differences in the number of groups per village and members per group, and hence in the number of dyads across villages and groups.

Table 11: Dyadic regressions – effects of controls, matched subsample

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|--------------------|---------------------|--------------------|--------------------|--------------------|--------------------|---------------------|
| | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) |
| Occupation | | | | | | | |
| Same economic activity | 0.181** (0.077) | | 0.204** (0.097) | 0.207** (0.096) | 0.150** (0.075) | 0.154** (0.072) | 0.181** (0.075) |
| Absolute differences | | | | | | | |
| Present-biased | 0.166** (0.067) | 0.164*** (0.063) | 0.107* (0.055) | 0.115** (0.050) | | 0.188** (0.077) | 0.167*** (0.064) |
| Risk-neutral | | | 0.016 (0.058) | | | | |
| Risk aversion above median | | | | -0.019 (0.039) | | | |
| Ever hides money from spouse | | | | | -0.006 (0.029) | -0.017 (0.027) | |
| Female HH decision-making power (index 0-8) | | | | | 0.006 (0.011) | 0.006 (0.012) | |
| HH important in village decisions (scale 1-6) | | | | | | | -0.038** (0.019) |
| HH speaks at village meetings | | | | | | | 0.009 (0.031) |
| Wealth & income controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Demographic controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sums | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Village f.e.'s | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1292 | 1292 | 1031 | 1031 | 980 | 958 | 1277 |
| Pseudo R^2 | 0.222 | 0.212 | 0.214 | 0.216 | 0.194 | 0.206 | 0.228 |
| Baseline predicted probability | 0.296 | 0.296 | 0.285 | 0.285 | 0.294 | 0.295 | 0.292 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. $N=722$ individuals are matched from the 2013 census to the 2009-11 panel data. $N=383$ of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, $N=7,314$ for the general survey and $N=1,641$ for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. Present-biased (future-biased) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Risk-neutral is a dummy equal to one if the respondent prefers a 50-50 lottery to its expected value for certain, and thus could indicate risk-neutral or risk-seeking behaviour. Female HH decision-making power is constructed from questions over four types of economic decisions, scoring one if the female has some say in the decision and two if she has complete control. Reported effects are marginal effects estimated at the mean.

Other robustness checks: We run a set of further robustness checks on both the full sample and the matched subsample (see Online Appendix for tables). Results do not significantly change if we restrict the sample to current members only (i.e., dropping individuals listed as past members in the 2013 census) and if we drop the eight groups which had disbanded by 2013. Nor do the results significantly change if we restrict attention to dyads in which both members are female; the pattern of sorting holds irrespective of gender. If we split “same occupation” and separately estimate the effect of both members being farmers, or of both being engaged in business, the coefficients remain positive and significant and do not differ significantly between the two occupations. Thus the effect of “same occupation” is not being driven by farmers or non-farmers in particular.

For the subsample of matched individuals we run additional robustness checks including controls for income and food security from the 2009-11 panel (see Table 3). We also re-estimate the main specifications using individual occupation recorded in the 2009 baseline instead of the 2013 member census. The coefficients on same occupation and the absolute difference in “present-bias” remain positive and highly significant. Finally, we re-run the model without individuals who never choose a late amount in one or both time frames of the time preference elicitation activity. Indeed, these individuals may either fail to understand the activity, or distrust the enumerators. Dropping these individual does not affect our results: the coefficient on “present-bias” remains positive and highly significant.

8 Conclusion

This paper has highlighted the potential role of VSLAs in providing financial intermediation, especially in communities with low access to formal financial services. VSLAs offer not only a source of credit, but also a commitment savings technology. In light of this, we have investigated whether individuals with a demand for saving, and in particular commitment saving, successfully sort into groups with individuals with a demand for borrowing. This issue has largely been overlooked in the literature on savings groups, but is crucial in determining the efficiency of the financial outcomes that they generate.

Contrary to what efficient financial intermediation would require, we find positive assorting on occupation: a finding that could be due to high costs of screening, monitoring and enforcing loans to individuals with a different occupation. This limits the scope for VSLAs to provide financial intermediation across occupational groups, taking advantage of variation in seasonal cash-flow profiles. Furthermore, positive assortative matching on occupation leaves VSLA groups exposed to common shocks that affect one occupation, most notably farmers.³⁴ A common shock would increase competition for emergency consumption loans while increasing the probability that borrowers default, thereby endangering the sustainability of the group. A possible solution is to integrate VSLAs into a larger credit union, or to provide stop-gap finance

³⁴Of course, the exposure of households themselves to common shocks depends not only on the diversification of VSLA groups but also on the diversification of household members across occupations.

to VSLAs from other channels. The former is indeed the approach taken with Self-Help Groups in India, although more research is needed to demonstrate whether it has been successful. It also remains to be shown whether VSLAs fund the local projects with the highest returns. Given the relative absence of mixed-occupation groups in our study population, we suspect that the potential gains from financial interventions are not maximized.

More promisingly, we observe negative assorting on present-bias, indicating that VSLAs attract both commitment savers and time-consistent individuals who are prospective borrowers. This should enhance efficiency by allowing funds saved by commitment savers to be put to productive use. Equity may nonetheless be a concern, if willingness to pay for commitment leads present-biased individuals to accept low interest rates on loaned funds. There is nothing wrong *per se* in allowing sophisticated present-biased individuals to pay for commitment, in this case by accepting a lower interest rate.³⁵ However, if savers receive a zero or negative return, or experience high default rates, this would be cause for concern.³⁶ Reassuringly, this is not what we find: monthly interest rates on loaned funds are broadly in line with elicited discount rates, and savers earn a positive nominal interest on their savings. Thus VSLAs do appear to promote a degree of efficient financial intermediation between commitment savers and borrowers, albeit only within occupational groups.

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³⁵Heidhues and Koszegi (2010) show that lenders can exploit partial naifs. However, in the context of VSLAs such exploitation of partial naiveté is less of a concern, since there are no penalties for failing to meet the minimum share-purchase requirement each week.

³⁶On the other hand, it is not clear what commitment savers’ outside option would be in the absence of VSLAs, and thus what the correct counterfactual is in assessing whether commitment savers are receiving “too low” an interest rate.

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9 Appendices

Table 12: Test of representativeness – matched dyads vs. 2013 census dyads

| | Mean All Dyads | Mean Matched Dyads | Diff. | Std. Error | T stat | Full N | Matched N |
|---|----------------|--------------------|----------|------------|--------|--------|-----------|
| Group membership | | | | | | | |
| Same VSLA group | 0.17 | 0.30 | -0.13*** | (0.01) | -24.27 | 289914 | 7309 |
| Occupation | | | | | | | |
| Same economic activity | 0.56 | 0.71 | -0.15*** | (0.01) | -27.11 | 289914 | 7309 |
| Absolute differences | | | | | | | |
| Male | 0.38 | 0.39 | -0.02** | (0.01) | -2.89 | 289467 | 7309 |
| Female-headed household | 0.32 | 0.34 | -0.03*** | (0.01) | -4.64 | 288740 | 7309 |
| Age | 12.64 | 12.17 | 0.46*** | (0.12) | 3.94 | 286763 | 7309 |
| Some post-primary educ. | 0.33 | 0.26 | 0.07*** | (0.01) | 13.29 | 289914 | 7309 |
| Literate (read & understand newspaper) | 0.26 | 0.29 | -0.03*** | (0.01) | -5.12 | 288342 | 7309 |
| Father well-off in village (scale 1-5) | 1.41 | 1.42 | -0.00 | (0.01) | -0.12 | 253041 | 6415 |
| Spouse's father well-off in village (scale 1-5) | 1.43 | 1.40 | 0.03* | (0.01) | 2.44 | 252485 | 6954 |
| Household well-off in group (scale 1-9) | 1.40 | 1.29 | 0.11*** | (0.01) | 8.31 | 284485 | 7309 |
| HH owns a bicycle | 0.46 | 0.46 | 0.01 | (0.01) | 1.21 | 288740 | 7309 |
| # Goats | 1.84 | 2.30 | -0.45*** | (0.04) | -11.14 | 288240 | 7309 |
| Sums | | | | | | | |
| Farmer | 1.37 | 1.61 | -0.24*** | (0.01) | -33.75 | 289914 | 7309 |
| Businessperson | 0.48 | 0.32 | 0.16*** | (0.01) | 24.67 | 289914 | 7309 |
| Male | 0.53 | 0.55 | -0.02** | (0.01) | -2.68 | 289467 | 7309 |
| Female-headed household | 0.40 | 0.45 | -0.05*** | (0.01) | -6.69 | 288740 | 7309 |
| Age | 72.12 | 77.04 | -4.92*** | (0.19) | -25.52 | 286763 | 7309 |
| Some post-primary educ. | 0.43 | 0.31 | 0.11*** | (0.01) | 18.76 | 289914 | 7309 |
| Literate (read & understand newspaper) | 1.68 | 1.63 | 0.04*** | (0.01) | 6.87 | 288342 | 7309 |
| Father well-off in village (scale 1-5) | 6.76 | 6.64 | 0.12*** | (0.02) | 5.11 | 253041 | 6415 |
| Spouse's father well-off in village (scale 1-5) | 6.85 | 6.87 | -0.02 | (0.02) | -0.84 | 252485 | 6954 |
| Household well-off in group (scale 1-9) | 15.04 | 15.41 | -0.37*** | (0.02) | -18.06 | 284485 | 7309 |
| HH owns a bicycle | 0.99 | 1.09 | -0.10*** | (0.01) | -12.09 | 288740 | 7309 |
| # Goats | 2.44 | 3.32 | -0.89*** | (0.05) | -16.90 | 288240 | 7309 |

Notes: All variables from the 2013 member census, N=3,801 members. N=722 of these members could be matched by name to the 2009-11 panel dataset. All possible dyads in which both individuals live in the same village are constructed for the full sample (N=289,914) and for the matched subsample (N=7,301). Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual’s primary economic activity, if engaged in multiple activities.

Table 13: Dyadic regressions – 2013 member census and matched subsample

| | (1) Full CSAE sample Mfx / (s.e.) | (2) Matched subsample Mfx / (s.e.) | P-value $\beta_1 = \beta_2$ |
|---|---|--|--------------------------------|
| Occupation | | | |
| Same economic activity | 0.086*** (0.008) | 0.206*** (0.045) | 0.132 |
| Absolute differences | | | |
| Male | -0.053*** (0.015) | -0.034 (0.028) | 0.054* |
| Female-headed household | -0.012*** (0.004) | -0.065*** (0.023) | 0.034** |
| Age | -0.001*** (0.000) | -0.001 (0.001) | 0.629 |
| Some post-primary educ. | -0.008 (0.005) | -0.005 (0.021) | 0.724 |
| Literate (read & understand newspaper) | -0.013* (0.0067) | -0.009 (0.018) | 0.417 |
| Father well-off in village (scale 1-5) | -0.013*** (0.002) | -0.025*** (0.010) | 0.577 |
| Spouse's father well-off in village (scale 1-5) | -0.013*** (0.003) | -0.030** (0.012) | 0.379 |
| Household well-off in group (scale 1-9) | -0.010*** (0.003) | -0.020** (0.010) | 0.659 |
| HH owns a bicycle | -0.003 (0.003) | 0.009 (0.009) | 0.159 |
| # Goats | -0.006*** (0.002) | -0.012*** (0.004) | 0.407 |
| Sums | ✓ | ✓ | |
| Village f.e.'s | ✓ | ✓ | |
| Observations | 219747 | 5878 | |
| Pseudo R^2 | 0.129 | 0.142 | |
| Baseline predicted probability | 0.161 | 0.168 | |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. All variables from the 2013 member census, $N=3,801$ members. $N=722$ of these members could be matched by name to the 2009-11 panel dataset. All possible dyads in which both individuals live in the same village are constructed for the full sample ($N=289,914$) and for the matched subsample ($N=7,301$). Missing observations reflect answers of “do not know” or “not applicable”. Occupation denotes an individual's primary economic activity, if engaged in multiple activities. Reported effects are marginal effects estimated at the mean.

Table 14: Dyadic regressions – 2013 member census, weighted

| | (1) Matched subsample Mfx / (s.e.) |
|---|--|
| Occupation | |
| Same economic activity | 0.098*** (0.035) |
| Absolute differences | |
| Present-biased | 0.096*** (0.032) |
| Male | 0.000 (0.014) |
| Female-headed household | -0.094*** (0.032) |
| Age | -0.004*** (0.001) |
| Some post-primary educ. | -0.013 (0.025) |
| Literate (read & understand newspaper) | -0.035 (0.028) |
| Father well-off in village (scale 1-5) | -0.009 (0.006) |
| Spouse's father well-off in village (scale 1-5) | -0.016** (0.007) |
| Household well-off in group (scale 1-9) | -0.027*** (0.008) |
| HH owns a bicycle | 0.008 (0.016) |
| # Goats | -0.005 (0.004) |
| Sums | ✓ |
| Village f.e.'s | ✓ |
| Observations | 1280 |
| Pseudo R^2 | 0.280 |
| Baseline predicted probability | 0.197 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. $N=722$ individuals are matched from the 2013 census to the 2009-11 panel data. $N=383$ of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, $N=7,314$ for the general survey and $N=1,641$ for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. Time preferences are taken from the 2010 survey, wave since the 2009 wave did not include the far frame for females. “Present-biased” (“future-biased”) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Reported effects are marginal effects estimated at the mean.

Table 15: Dyadic regressions – time preference measures, matched subsample, weighted

| | (1) | (2) | (3) | (4) | (5) |
|---------------------------------------|---------------------|--------------------|---------------------|---------------------|---------------------|
| | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) |
| Occupation | | | | | |
| Same economic activity | 0.098*** (0.035) | 0.093** (0.038) | 0.098*** (0.034) | 0.102*** (0.034) | 0.097*** (0.035) |
| Absolute differences | | | | | |
| Present-biased | 0.096*** (0.032) | | 0.099*** (0.031) | 0.097*** (0.030) | 0.096*** (0.032) |
| Future-biased | | | | | 0.002 (0.015) |
| Minimum switch-point (MK), far frame | | 0.000 (0.002) | 0.001 (0.002) | | |
| Minimum switch-point (MK), near frame | | 0.000 (0.003) | -0.001 (0.003) | | |
| Patience above median, near frame | | | | 0.015 (0.017) | |
| Patience above median, far frame | | | | -0.022 (0.016) | |
| Wealth & income controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Demographic controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sums | ✓ | ✓ | ✓ | ✓ | ✓ |
| Village f.e.'s | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1280 | 1280 | 1280 | 1280 | 1280 |
| Pseudo R^2 | 0.280 | 0.272 | 0.282 | 0.286 | 0.281 |
| Baseline predicted probability | 0.197 | 0.196 | 0.197 | 0.197 | 0.197 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. N=722 individuals are matched from the 2013 census to the 2009-11 panel data. N=383 of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, N=7,314 for the general survey and N=1,641 for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. “Present-biased” (“future-biased”) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Minimum switch-point is the lower bound of the interval in which the respondent switched to preferring the payment dated one month later compared to a 2000 MK payment on the earlier date. 150 MK \approx 1 USD at the time of the 2009 and 2010 surveys. Patience above median is a dummy for having a switch-point below the median in that frame. Reported effects are marginal effects estimated at the mean.

Table 16: Dyadic regressions – effects of controls, matched subsample, weighted

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---------------------|---------------------|--------------------|--------------------|--------------------|---------------------|---------------------|
| | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) | Mfx / (s.e.) |
| Occupation | | | | | | | |
| Same economic activity | 0.098*** (0.035) | | 0.117** (0.049) | 0.119** (0.050) | 0.088** (0.038) | 0.094*** (0.035) | 0.098*** (0.035) |
| Absolute differences | | | | | | | |
| Present-biased | 0.096*** (0.032) | 0.093*** (0.028) | 0.052** (0.022) | 0.057** (0.023) | | 0.117*** (0.035) | 0.096*** (0.031) |
| Risk-neutral | | | 0.026 (0.036) | | | | |
| Risk aversion above median | | | | -0.020 (0.015) | | | |
| Ever hides money from spouse | | | | | -0.002 (0.019) | -0.005 (0.015) | |
| Female HH decision-making power (index 0-8) | | | | | 0.005 (0.007) | 0.003 (0.007) | |
| HH important in village decisions (scale 1-6) | | | | | | | -0.013 (0.009) |
| HH speaks at village meetings | | | | | | | -0.001 (0.012) |
| Wealth & income controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Demographic controls (abs. diffs) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sums | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Village f.e.'s | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 1280 | 1280 | 1021 | 1021 | 969 | 947 | 1265 |
| Pseudo R^2 | 0.280 | 0.264 | 0.270 | 0.271 | 0.242 | 0.268 | 0.285 |
| Baseline predicted probability | 0.197 | 0.191 | 0.189 | 0.189 | 0.193 | 0.197 | 0.194 |

Notes: *, ** and *** represent $p < 0.10$, $p < 0.05$ and $p < 0.01$ respectively. $N=722$ individuals are matched from the 2013 census to the 2009-11 panel data. $N=383$ of these individuals are matched to the longer panel survey including preference modules. All possible dyads in which both individuals live in the same village are constructed, $N=7,314$ for the general survey and $N=1,641$ for the full survey including preference modules. Missing values reflect “do not know”, “not applicable”, or inconsistent answers in the case of risk preferences. All variables presented here were measured in the 2009 wave of the panel survey, except time preferences, which are taken from the 2010 survey wave since the 2009 wave did not include the far frame for females. “Present-biased” (“future-biased”) is a dummy equal to one if the response to the near frame is more impatient (patient) than the response to the far frame. Risk-neutral is a dummy equal to one if the respondent prefers a 50-50 lottery to its expected value for certain, and thus could indicate risk-neutral or risk-seeking behaviour. Female HH decision-making power is constructed from questions over four types of economic decisions, scoring one if the female has some say in the decision and two if she has complete control. Reported effects are marginal effects estimated at the mean.