



## **Behavioral Foundations of Microcredit: Experimental and Survey Evidence From Rural India**

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### **Abstract**

We use experimental measures of time discounting and risk aversion for villagers in south India to highlight behavioral features of microcredit, a financial tool designed to reduce poverty and fix credit market imperfections. The evidence suggests that microcredit contracts may do more than reduce moral hazard and adverse selection by imposing new forms of discipline on borrowers. We find that, conditional on borrowing from any source, women with present-biased preferences are more likely than others to borrow through microcredit institutions. Another particular contribution of microcredit may thus be to provide helpful structure for borrowers seeking *self*-discipline.

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Microcredit is the broad label for small-scale loans provided to under-served populations, often using innovative contracts (Muhammad Yunus 2002). The Nobel Peace Prize in 2006 celebrated the potential of microcredit to unleash the productivity of small-scale entrepreneurs in need of capital. The popularity of microcredit, though, poses a puzzle: if the untapped economic returns to borrowing are so high, why don't households save their way out of credit constraints? New work in behavioral economics suggests that part of the answer rests with self-control difficulties that undermine individuals' efforts to save, coupled with a lack of devices to compensate for behavioral weaknesses (Nava Ashraf, Dean Karlan, and Wesley Yin 2006; Mary Kay Gugerty 2007; Daryl Collins et al. 2009).

We build on these studies by arguing that behavioral insights suggest an alternative view of microcredit as well. The existing literature interprets microcredit as a novel strategy to overcome agency problems and reduce transaction costs in credit markets (Beatriz Armendáriz and Jonathan Morduch 2005). The focus is on ways that microcredit institutions discipline borrowers who might exert too little effort or take excessive risks. We argue that microcredit innovation may also work by allowing customers to foster *self-discipline* in financial behavior. We draw potential links between features of microcredit loans and problems posed by present-biased preferences—i.e., by choices that emerge when, intellectually, people value future consumption but they nonetheless give in to immediate

temptation (Laibson 1997). We show that, among women who borrow, those with present-biased preferences are particularly likely to be microcredit borrowers.

We study villagers in India who are the target customers of microcredit providers. The microcredit banks in the villages are run on a “self-help group” (SHG) model promoted by the Government of India and inspired by Grameen Bank of Bangladesh, the co-winner of the 2006 Nobel Peace Prize. A series of “lab experiments in the field” were designed to elicit measures of discounting and risk aversion for a random sample of 573 villagers spread across eighteen villages in two regions of Karnataka, a coastal state in South India.<sup>1</sup> The experiments concerned choices over relatively large, real stakes, as large as a week’s wage (as in Tomomi Tanaka, Colin Camerer, and Quang Nguyen 2010; Hans B. Binswanger 1980). Roughly one third of the population exhibited choices consistent with present-bias, a fraction similar to those found in studies in the Philippines and the United States (Ashraf, Karlan and Yin 2006; Stephan Meier and Charles Sprenger 2010).

The central result is a robust positive correlation between having present-biased preferences and selecting microcredit as the vehicle for borrowing. As in Ashraf, Karlan, and Yin (2006), the result holds only for women. The result provides the foundation for a complementary interpretation of microcredit which highlights the ways that microcredit provides structure and support for people with self-discipline problems, echoing features of contractual savings devices. The interpretation hinges on particular microcredit innovations, such as the social elements embedded in group-based lending (weekly group meetings and public transactions) and the near-universal requirement that loans be repaid in regular, frequent, fixed installments over time. In linking microcredit to behavioral approaches to savings, our interpretation also aligns with the common practice of continual, repeat borrowing by customers. Once a loan is repaid in full, microcredit borrowers are generally

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<sup>1</sup> Related approaches include Binswanger (1980), who elicits individual attitudes to risk and observe correlations with agricultural behavior. Tanaka, Camerer, and Nguyen (2010) take an approach similar to ours. John Ameriks et al. (2007) relate survey measures of self-control difficulties to wealth.

provided with another, larger loan immediately, such that nearly all the time borrowers have outstanding credit. Over time, the process of repaying loan installments and receiving disbursements is observationally similar to the process of building up savings in regular increments followed by regular lump-sum withdrawals (although with different cost implications since borrowing requires interest payments). To draw the link, Stuart Rutherford (2000) describes traditional saving behavior as “saving up” and borrowing in this form as “saving down.” In both cases, borrowers are able to achieve a goal usually associated with contractual saving: to exchange a steady series of small fixed payments for a substantial amount of income obtainable at a future date.

Our interpretation is suggestive, however, and needs to be confirmed by studies that establish causal links. The empirical patterns, when taken as a whole, however, cannot be easily explained by neo-classical assumptions, transactions costs, or intrahousehold conflicts. The results are robust to controlling for individuals’ baseline degree of time discounting and a range of observable individual characteristics, attitude towards risk, village-level fixed effects, seasonal income patterns, health-related income shocks, and measures of intra-family decision-making power (i.e., “spousal control” difficulties). We cannot, however, rule out that the results arise from an unobserved shock to income affecting experimental measures of discounting as well as financial behavior. We discuss the concern in later sections and describe design features and robustness checks that frame the issue.

The next section describes links between present-biased preferences, self-discipline problems, and features of microcredit borrowing. Section II describes the sample, experimental design for eliciting discount rates, and the survey data. Section III discusses how the experimental choices correlate with observed borrowing behavior and Section IV describes supporting evidence and alternative hypotheses. Section V concludes.

## **I. Present-bias and microcredit innovation**

Behavioral economists have made much of experimental evidence showing that the rate at which individuals discount future consumption often varies with the time frame (Shane Frederick, George Lowenstein, and Ted O'Donoghue 2002). In particular, people are often more impatient with regard to current trade-offs than with regard to future tradeoffs (Strotz 1955; Ainslie 1992), a notion termed “present-bias” and reflected in hyperbolic (or “quasi-hyperbolic”) time discount functions (Laibson 1997).

Present-biased preferences create a tension between future plans and current actions, and create a time inconsistency problem. For example, present-biased individuals may look to the future and determine that in one year's time, it would be best to put aside some money for saving. But when the next year arrives and the choice is revisited, their decision may be reversed, over-powered by the temptation to consume immediately. If individuals anticipate this kind of preference reversal (a self-awareness often termed “sophisticated”), they may demand a commitment to “tie their hands” now, locking in the original choice to save (Sendhil Mullainathan 2005).

One way to do that is to create a public commitment to save or to enter into an explicit saving contract. In richer countries, common mechanisms include direct-deposited pension accounts and stop orders. In poorer communities, a range of informal devices share these features, including community-run savings clubs and rotating savings and credit associations (Gugerty 2007). But such informal devices can be unreliable (prone to fall apart and at risk of theft), and they tend to work better for raising small sums than for large (Collins et al. 2009).

Ashraf, Karlan and Yin (2006) test new saving accounts that allow customers in the Philippines to commit to deposit money until either a given date or a given sum was saved. In all other regards, including the interest rate, the new accounts were identical to those already held by the sample. The researchers find that 28 percent of customers offered the

“commitment” product accepted it and having access to the account increased their short-term saving by about 80 percent. Women with present-biased preferences in hypothetical questions were more likely than other women to take up the product. Gugerty (2007) similarly interprets the widespread use of informal rotating savings and credit associations (ROSCAs) as a commitment device to address present-bias faced by savers, based on interviews focusing on motivations to join a ROSCA. As one ROSCA participant puts it, “you can’t save alone.”<sup>2</sup> Similarly, Collins et al. (2009, p. 114) cite a member of a neighborhood saving club who highlights the social elements: “You feel compelled to contribute your payment. If you don’t do that, [it] is like you are letting your friends down.”<sup>3</sup> We extend these ideas and argue that women who are unable to save enough may take up microcredit products to attain helpful structure. We build on Gugerty (2007) and Ashraf, Karlan and Yin (2006) by showing that, when they borrow, women with present-biased preferences (as measured here by experiments with real money) are more likely than others to borrow through a microcredit organization.

The finding suggests that, given limited saving options, microcredit borrowing may be seen as an alternative mechanism to make steady payments now in order to assure cash flow in the future, enhanced by innovations that mirror mechanisms highlighted in behavioral approaches to saving, including repaying in public and in regular, frequent, and small installments.<sup>4</sup> Microcredit programs that are focused on the poorest customers typically lend

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<sup>2</sup> Tanaka, Camerer and Nguyen (2010) find that present-biased individuals are more likely to participate in ROSCAs with more frequent meetings (i.e., daily or weekly) than in ROSCAs that are held monthly. In their data, present-biased women are more likely to join bidding ROSCAs and less likely to join ROSCAs with a fixed disbursement order. In some of the Indian villages we studied, ROSCAs (known locally as chit funds) had once been quite popular, but our respondents reported that the organizers sometimes just ran away with the money. In the end, villagers stopped using the devices. Post office savings accounts are another alternative mechanism, but the facilities are in towns, making frequent, small transactions difficult.

<sup>3</sup> Present-biased preferences have been invoked to other economic puzzles in poor countries, such as, for example, low fertilizer adoption (Esther Duflo, Michael Kremer and Jonathan Robinson 2009) or simultaneous borrowing and saving (Karna Basu 2008).

<sup>4</sup> We note that people without better options are willing to incur costs to obtain savings products with disciplining features. The saving device tested in the Philippines, for example, offered no extra compensation for the associated illiquidity yet was still taken up. Similarly, local deposit collectors are a common part of the informal financial sector, charging customers a substantial fee for a simple, secure, disciplined way to save. One

to customers through community organizations, with groups of neighbors formed to provide “solidarity” and transactions made at weekly meetings.

In India, these organizations are most commonly “Self-help groups” (SHGs). SHGs are the major providers of financial services in our sample as well, although moneylenders, banks, and postal savings schemes also operate in the communities. SHG expansion has been driven by an initiative of the government’s National Bank for Agriculture and Rural Development (NABARD) to encourage linkages between non-governmental organizations and commercial banks. By March 2009, 10.3 million SHGs were providing services to 86 million members (Bhadra 2009).

In our sample, two thirds of SHG participants have a loan, with an average size of Rs. 6,708 (about \$170). The interest rate charged by banks to SHGs is about 20 percent annually; the interest rate for individual loans is at the discretion of SHGs and varies. Recent surveys of SHGs show that more than 80 percent of loans were self-reported as being used for production or other purposes—notably agricultural production, animal husbandry, and microenterprise—rather than consumption (Consultative Group to Assist the Poor 2007; Jean-Marie Baland, Rohini Somanathan, and Loren Vandewalle 2008). We show below that people who are more patient borrow more, a pattern consistent with the notion that the loans are mainly used for productive investments and other forward-looking purposes.

Inspired by Grameen Bank, SHGs are based on groups of low-income individuals formed voluntarily in communities, often facilitated by NGOs. The groups comprise 10-25 people, and groups gather regularly, typically every week, to pool their savings and lend from their accumulated pot to members at an interest rate designed to cover costs (Hans Dieter Seibel and Stephan Karduck 2005). Attendance is compulsory. The members select a group president and book-keeper who help lead sessions. All transactions are made publicly in front

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calculation shows that in South India, a deposit collector charges depositors a fee equivalent to 30 percent of deposits on an annualized basis (Rutherford 2000).



of the entire group. The SHGs obtain bank loans and the whole group is responsible for the loan repayment.<sup>5</sup>

Such “joint-liability” provisions in group lending contracts can mitigate moral hazard and adverse selection in situations characterized by agency problems (Maitreesh Ghatak and Timothy Guinnane 1999). The focus of applications of agency theory has been on group-based contracts, not group meetings, so it is notable that when Grameen Bank dropped joint-liability contracts under their Grameen II re-formulation, they nevertheless kept group meetings (Collins et al. 2009). Group meetings have the advantage of reducing transactions costs for loan officers by gathering customers in one place at one time to quickly complete business, and the public aspect can also create social stigma for defaulters, which may induce customers to repay on time. In finding that people with time-inconsistent preferences are more likely to borrow from microcredit organizations than other providers, the data suggests that purely social elements may also explain the persistence of group-based lending with public repayments (even after the joint-liability elements of contracts are dropped). Time-inconsistent individuals may value the implicit social pressure from other group-members as a way to discipline their own choices.

A second less-noted feature of microcredit contracts is that borrowers must typically repay loans in weekly installments beginning at the very start of the loan, well before investments can be expected to bear fruit (Rutherford 2000). In a (neoclassical) textbook contract for a business loan, by contrast, the principal and interest are paid in a single, large

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<sup>5</sup> SHGs are based around “internal” and “external” accounts. The internal accounts are formed from members’ pooled savings; the external accounts are financed by loans from commercial banks. Funds are lent to members from both accounts, and members monitor and enforce diligent repayment. For “internal” loans, incentives are given by the risk of losing savings and for “external” loans incentives are created by explicit joint liability mechanisms. We also note that all SHG members must deposit regularly into compulsory savings accounts (deposits average Rs. 40 per month; at the time of our study, the official exchange rate was 40.6 Indian rupees per US dollar). These accounts have tight withdrawal restrictions: savings may only be withdrawn when a member leaves a group or if there are exceptional circumstances. This kind of forced saving aids the SHG by creating collateral that can be tapped in times of trouble, but it is of limited immediate value as savings for customers.

payment after profits are reaped.<sup>6</sup> This microcredit feature cannot be explained by simple efforts to reduce transactions costs since the practice increases costs. The structure is particularly surprising under the traditional explanation that microcredit loans are made to support business investment<sup>7</sup>. The weekly structure implies that payments for early installments typically come, at least in part, from other income earned by households, such as from wage work. This part of the repayment process thus looks and feels much like the process of saving in regular increments from earned income, and the regularity and frequency of the small installments provides far more structure than a typical business loan. Such repayment structure is potentially beneficial in fostering discipline among present-biased clients and accommodates present-biased borrowers who would have difficulty saving for less frequent, larger installments. In the face of temptations, committing to fixed, frequent repayments can be an effective way to better control one's future self, reducing cash in hand, and it may foster helpful financial habits like saving regularly. The practice also means that, as with saving, borrowers effectively exchange a structured set of small current payments for the expectation of reliable access to lump sums received at a later date (since the size and timing of future microcredit loans follow clear expectations and are usually disbursed immediately after an existing loan is paid off, with the cycle of repayment and disbursement repeated through time).

## **II. Experimental and survey design**

### *A. Sample selection*

The survey design generated a varied sample of the rural population of Karnataka. Data were

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<sup>6</sup> See Armendáriz and Morduch (2005) on the logic of microcredit repayment schedules, and Erica Field and Rohini Pande (2008) for a field experiment from urban India.

<sup>7</sup> Such repayment process could be explained only if the majority of investments funded via microcredit were immediately productive. We thank an anonymous referee for this point.

collected in June 2007 in cooperation with BPKS, an Indian NGO<sup>8</sup> in Honavar and Haliyal taluks (a taluk is akin to a county, part of a larger district within a state). Nine villages were selected from each taluk, and 35 people were selected in each village using a random walk method.<sup>9</sup> Those identified were invited to participate in the study, and 90 percent did. The total number of participants was 573, with no fewer than 25 participants per village. (Most of our results pertain to the 266 women in the sample with consistent information.) We used village meeting halls, typically schools, as field labs.

Table 1 compares the sample characteristics with Karnataka averages from 2001, restricted to the population older than 15 years. The average age and education levels are nearly equal, the proportion of illiterate respondents is slightly lower in our sample (40 percent compared with 43 percent in the entire state) and our respondents are more likely to be married.

### *B. Measuring discount rates and risk aversion*

We used a simple protocol to elicit discount rates, drawing on established methods (e.g. Glen W. Harrison, Morten I. Lau, and Melonie B. Williams 2002; Tanaka, Camerer, and Nguyen 2010; Steffen Andersen et al. 2008). Respondents were asked to choose between receiving a smaller amount earlier in time or larger amounts with three months delay. We start with: “Do you prefer Rs. 250 tomorrow or Rs. 265 three months later?” We posed five such questions to each individual, with each question increasing the future amount while keeping the earlier amount constant. We thus made the choice to delay increasingly more attractive in each subsequent binary choice (Rs. 265, 280, 300, 330, and 375). The point at which an individual

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<sup>8</sup> The NGO has been active in the area for ten years. Its mission is to support local education through a child- sponsorship program. It is thus not affiliated with local microfinance organizations and gave no cause for villagers to strategize in their responses about their saving and borrowing.

<sup>9</sup> The villages were randomly selected based on the 2001 Indian Census database; however, in three villages in each taluk the BPKS lacked good access to the village head, jeopardizing the ability to carry-out the experiments. These six villages were replaced with other villages that were similar in size, distance to town and educational facilities to the ones originally selected.

switches from choosing the earlier reward to the future reward gives an interval of her discount rate.<sup>10</sup> In the analysis we use the arithmetic means of these intervals to approximate individual discount rates (for specific values see Appendix A).

The same set of binary choices was also offered at a future time frame (as in Ashraf, Karlan and Yin 2006). Here, we started with: “Do you prefer to receive Rs. 250 in one year’s time or Rs. 265 in one year and three months?” And again we increased the values incrementally from Rs. 265 to Rs. 375.

Two design features in the elicitation methodology allow us to identify time preference reversals (differences between current and future discount rates) with greater confidence. First, we shifted the time frame by exactly one year to reduce the effects of seasonality of agricultural incomes and season-specific expenditures (e.g., annual celebrations). Second, we introduced a short delay in the current income option in the earlier time frame; specifically, we asked respondents about receiving the Rs. 250 tomorrow rather than today. This “front end delay” method should control for potential confounds due to lower credibility and higher transaction costs associated with future payments (Harrison, Lau, and Williams 2002). If participants lack confidence that they will receive a reward in the future, they may prefer a current reward irrespective of their actual discount rate. Therefore no payments were made on the day of the experimental session. Instead, participants were making choices between Rs. 250 delivered the next day and a higher amount delivered after three months.<sup>11</sup> The approach also reduces transaction costs differentials between the options; since all payments are in the future, participants should assign the same subjective transaction

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<sup>10</sup> Five percent of respondents switched more than once, and nothing could be inferred about their discount rate. Such choices are uncorrelated with observable characteristics and the respondents were excluded from the analysis, reducing our sample to 544.

<sup>11</sup> In order to test directly whether lack of trust motivated those who show greater impatience in the current time frame than in the future time frame, we included three questions from the General Social Survey (GSS) on “trust”, “fairness” and “helping” into our survey. Responses to these questions are not correlated with our measures of time inconsistency. Similarly, individuals with no previous interaction with the cooperating NGO—and hence those presumably less inclined to trust it—do not, on average, appear more impatient in the current time frame than in the future time frame (results not reported).

costs to both options.<sup>12</sup>

Individual attitudes to risk were elicited in order to control for the curvature of utility function (Andersen et al. 2008). For this, we used a near replication of the protocol designed by Binswanger (1980) in his study of villagers in South India. Each participant was asked to select one out of six different gambles. Every gamble yielded either a high or a low payoff with a probability 0.5. In each subsequent gamble the expected value increased jointly with the variance (Appendix A).

The procedure was designed to motivate participants to make choices according to their true preferences in each choice and to ensure a correct understanding, given the high proportion of illiterate respondents. The experimenter explained the types of choices the participants would make, simulated how payment would work and answered all questions before asking the participants to make actual choices. Ten trained research assistants were at hand to help illiterate participants with recording experimental choices and completing questionnaires. The participants knew that at the end of the meeting it would be randomly determined -- by tossing nametags and numbered ping-pong balls -- whether they would be paid (with probability equal to 20 percent) and according to which choice they would be paid.

Payments relating to risk aversion questions were disbursed immediately. For time discounting questions, winning participants received a cash certificate signed by the chief of the NGO, a local leader and a social worker familiar in the community. The prizes were deposited by the NGO and the social worker was responsible to deliver the amount specified in the cash certificate at the given date. Everyone was also given a participation fee of Rs. 60 to compensate for their opportunity costs (daily income).

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<sup>12</sup> The methodological trade-off is that the approach to measuring present-bias does not strictly mimic the interpretation of “hyperbolic” preferences that centers on the temptation to consume *today* rather than later. If self-discipline problems are restricted only to temptations to consume today (rather than to consume tomorrow or at some other moment that is very soon relative to other options), the results here will under-count the incidence of present-biased (“hyperbolic”) preferences. In this sense, we opt for a conservative procedure.

### *C. Survey data*

Appendix A describes definitions of variables used in the analysis. Data on saving and borrowing were collected as well as information on individual characteristics such as age, education, family background (marital status, household head, and woman's position in the household), and economic conditions. We constructed an index approximating wealth using principal components analysis based on information about items at home, characteristics of the house, and land possession. A second index was formed using principal components based on a set of questions on decision-making power and attitudes about wife beating (taken from the Demographic and Health Surveys), used to approximate women's positions within households.

## **III. Present-bias and borrowing**

### *A. Determinants of time discounting*

We focus on five characteristics resulting from the experiments: "current patience" (based on the choice whether to be rewarded tomorrow or in three months); "future patience" (based on the choice whether to be rewarded in 12 months or in 15 month); time consistency (defined by the equality of the "current" and "future" discount rates); present-biased time inconsistency; and future-biased time inconsistency (patient now, but impatient in the future).

Table 2 shows that almost one third of individuals have present-biased time preferences. We interpret the choices as present-biased (in line with hyperbolic discounting) if the inferred current discount rate is larger than the future discount rate. An individual with present-biased preferences is more impatient with respect to choices affecting consumption very soon (literally tomorrow) than with respect to choices that will play out in the future (literally in one year).

We further distinguish between individuals with “weakly present-biased” preferences and “strongly present-biased” preferences. Weakly present-biased preferences are defined as those that are only one binary choice earlier in the future time frame versus the earlier time frame (i.e., one cell below the diagonal in Table 2). If the difference is larger, a person is regarded as having strongly present-biased preferences. These people are in the lower left cells of Table 2.

Disaggregating the one third of individuals with present-biased time preferences yields that 19.9 percent of the sample are strongly present-biased and 13.2 percent are weakly present-biased. In contrast, fewer than 10 percent of individuals are more patient now than in the future. (As noted in the introduction, these proportions are similar to those found by Ashraf, Karlan and Yin 2006 in the Philippines and by Meier and Sprenger 2010 in the United States.) Table 3 shows that neither education, wealth, nor seasonality of income predict present-biased time inconsistency.<sup>13</sup> The lack of correlations of present-bias and observable characteristics of women accords with psychological studies on impulsiveness and Ashraf, Karlan and Yin (2006).

### *B. Regression specification*

In a textbook case of financial decision-making with time-consistent preferences, the choices of individual  $i$  in village  $v$  depend on her discount rate  $\delta_{iv}^t$ , her level of risk aversion  $R_{iv}$ , observed and unobserved conditioning factors,  $X_{iv}$  and  $\varepsilon_{iv}$ , and fixed village characteristics  $v_i$ . Thus the financial outcome  $Y_{iv}$  is a simple function:

$$Y_{iv} = f(\delta_{iv}^t, R_{iv}, X_{iv}, v_i, \varepsilon_{iv}).$$

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<sup>13</sup> We find intuitive links between discount rates and observable characteristics for the sample that includes men (Web Appendix Table WA1). For example, men tend to be more impatient than women, and we find that more educated individuals are more patient (as in Michal Bauer and Julie Chytilová 2010 in Uganda). Only male farmers are more likely to have strongly present-biased preferences, but the coefficient takes the opposite sign and is not statistically significant in the regression on having weakly present-biased preferences.

We capture these relationships in a linear regression specification, adding variables to capture departures from the textbook case:

$$(1) \quad Y_{iv} = \beta_0 + \beta_1 \delta'_{iv} + \beta_2 P^s_{iv} + \beta_3 P^w_{iv} + \beta_4 F_{iv} + \beta_5 R_{iv} + \beta_6 X_{iv} + \sum_{v=1}^{17} \gamma_v D_{iv} + \varepsilon_{iv},$$

where  $P^s_{iv}$  is a dummy indicating a strongly present-biased individual,  $P^w_{iv}$  is a dummy for being weakly present-biased,  $F_{iv}$  is a dummy for future-biased time inconsistency (dummy for time-consistent preferences is omitted). Village-level fixed effects are controlled through a vector of village dummies  $D_{iv}$ , and  $\varepsilon_{iv}$  is an error term for individual  $i$  in village  $v$ .

The central interest is with  $\beta_2$  and  $\beta_3$ , the coefficients on the indicators for having strongly or weakly present-biased preferences (respectively). Their size and sign depend on which measure of the discount rate  $\delta'_{iv}$  is included in the specific regression, and the resulting patterns illuminate households' "sophistication" and ability to exercise self-control.<sup>14</sup> Regressions are thus run separately for the two measures of the discount rate. The first is what we have been calling current patience:  $\delta'_{iv} = \delta^0_{iv}$ . The second measure is future patience:  $\delta'_{iv} = \delta^1_{iv}$ .

Here we discuss expected correlations between present-biased preferences and financial behavior, depending on whether we assume that: (1) present-biased discounters are naïve, (2) present-biased discounters are sophisticated and have a way to commit to a saving plan, and (3) present-biased discounters are sophisticated, don't have a way to commit to a saving plan but use borrowing via microcredit as a mechanism to systematically put aside money today in order to obtain large sums in the future. We start by describing saving behavior and then relate that to borrowing behavior.

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<sup>14</sup>Ashraf, Karlan and Yin (2006) use a related specification in their analysis of a commitment savings product, in which both current and future discount rates are included simultaneously and the dummy for future-biased preferences is omitted. Their coefficients have a slightly different interpretation, but the main results hold independent of the specification (Web Appendix Tables WA14-A16).



When we control for the current discount rate ( $\delta_{iv}^0$ ) in the regression, the coefficients  $\beta_2$  and  $\beta_3$  on the present-biased indicators estimate the difference in saving levels for a present-biased person (for whom  $\delta_{iv}^0 > \delta_{iv}^1$ ) relative to someone similar in terms of the current discount rate but with time consistent preferences ( $\delta_{iv}^0 = \delta_{iv}^1$ ). For a present-biased population that is “naïve”, immediate concerns over-ride preferences they hold with regard to the future (Ted O'Donoghue and Matthew Rabin 1999). We thus expect them to completely give in to their immediate temptations,  $\beta_2 = \beta_3 = 0$ . This form of naïve, present-biased individual will save and borrow *as if* their preferences are time consistent at the level given by their current discount rate.

In contrast, if the present-biased individuals are “sophisticated”, they appreciate the implications of  $\delta_{iv}^0 \neq \delta_{iv}^1$ , and adjust their behavior to the extent they can given the available mechanisms. Commitment saving mechanisms might allow them to save fully according to their future plans, in which case a saving regression that includes the future discount rate ( $\delta_{iv}^1$ ) yields  $\beta_2 = \beta_3 = 0$ . In this case, temptations would be completely held at bay.

Without mechanisms to maintain self-discipline, all present-biased individuals will systematically under-save, relative to their goals (i.e.,  $\beta_2, \beta_3 < 0$  when controlling for their future discount rate  $\delta_{iv}^1$ ). A result of under-saving is that, all else the same, these present-biased individuals are motivated to borrow more than others. Our framework suggests that *conditional on borrowing from any source*, the “sophisticated” group of present-biased individuals are more likely to take advantage of microcredit mechanisms specifically. One explanation is that investment in enterprise yields future income and entails delayed gratification, just as saving does, and the specific advantage of microcredit lies in its steady flow of structured loan installments. In addition, continuity of borrowing one loan immediately after the last has been repaid can make microcredit borrowing a saving

substitute, even when it is used to fund current consumption: the mechanism works by requiring customers to maintain a steady flow of weekly transfers to the bank in return for the promise of a series of large pay-outs at regular intervals in the future. Sophisticated individuals with present-biased preferences thus obtain a mechanism that has similar features to saving through a commitment device featuring regular deposits and a large pay-out at the end of the designated period. As a result, in a regression in which microcredit borrowing is the dependent variable,  $\beta_2 > \beta_3 \geq 0$  when controlling for  $\delta_{iv}^1$  and conditioning on borrowing from any source. In such a case, saving levels could be even lower than for someone who is time-consistent and has a similar level of current patience (i.e.,  $\beta_2, \beta_3 < 0$  when controlling for the current discount rate). This final result arises partly because present-biased individuals have problems using traditional forms of savings and partly because they adjust financial strategies by taking microcredit loans as substitutes for saving.

### *C. Borrowing*

Present-biased preferences mark borrowing decisions in our sample. As noted earlier, the results hold specifically for women and we only present results for the female sample in Tables 3-7. We report results for men in the web Appendix.<sup>15</sup> The main patterns can be seen in simple averages<sup>16</sup>: Table 4 shows that borrowing is greater for individuals with present-biased preferences, and the difference is particularly striking for women's borrowing from SHGs: 60.7 percent of women with strongly present-biased preferences have a loan from a SHG compared to only 35.9 percent when women are time-consistent.<sup>17</sup> In addition, present-

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<sup>15</sup> In the male sample, we also observe a positive correlation between being present-biased and borrowing, but there is little variation in the source of loans (most borrowing by men is from banks). In addition, we don't find lower saving levels for present-biased men as we did for women, which suggests that, unlike women, they have access to other ways to cope with self-discipline problems.

<sup>16</sup> Note that in Table 4 we don't control for a discount rate and, by definition, present-biased individuals are on average more impatient in the current time frame than time consistent individuals.

<sup>17</sup> The link between experimental choices and financial behavior could result from arbitrage behavior in which individuals make choices in the experiments predicated on their ability to borrow against the future expected

biased women are not more likely to borrow from sources other than SHG (a bank or a moneylender), consistent with our hypothesis that specific features of SHG borrowing are important for individuals with self-control difficulties.

Table 5 shows these and additional correlations in a multivariate context, after controlling for observable characteristics and for a level of patience. In columns 1-2 we analyze determinants of participation in an SHG. We find that present-biased women are more likely to be SHG members than their current discount rate  $\delta_i^0$  suggests (Table 5, column 1):  $\beta_2 > 0$ . When controlling for their future discount rate  $\delta_i^1$ , the coefficient is virtually zero: women's decision to participate in a SHG follows their future patience level more closely than their current patience level.

SHG members are eligible for borrowing after saving for an initial period of several months when members accumulate savings. We find a very close association with SHG borrowing. In columns 3-4 the dependent variable is equal to one if an individual has a loan from an SHG. Strongly present-biased women are 40 percentage points more likely to borrow from SHGs than the level predicted just by their current discount rate (column 3). As noted, patient women borrow more, a result in keeping with the working assumption that the SHG loans are mainly taken for business investments and other forward-looking investments.<sup>18</sup>

Next, we turn to choices between different sources of borrowing. Sophisticated present-biased individuals should be concerned about their ability to repay and hence about the type of loan they would demand. In columns 5-6 of Table 5 we test whether present-

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income from the pay-outs. If arbitrated perfectly, the discount rate inferred from the experimental choices should be equal to the market interest rate independently of the individual's level of patience. Arbitrage is unlikely to drive our results. First, although the amounts in our experiments were relatively large, they are still well below the minimum loan size from SHGs or the formal sector. Second, arbitrage should eliminate time inconsistent choices for people with better opportunities to borrow, but a substantial proportion of individuals made time inconsistent choices in our experiments and these individuals are *more* likely to have a loan.

<sup>18</sup> Introductory economics tells us that patient individuals save more, and the impatient borrow more. That intuition fails, though, when we turn to the billions of people around the world, especially the poor, whose income derives largely from farming or small-scale business. As self-employed entrepreneurs, these households borrow often to support their farms and businesses.

biased women have greater demand for loans other than those from SHGs – arguably with less clear self-disciplining features than those featured in SHGs. Banks typically provide larger loans, require collateral, but the repayments are not organized frequently in small amounts and in groups. The dependent variable is equal to one if an individual has a loan from a bank or a moneylender. We find no correlation with present-biased preferences. To push further, in columns 1-2 of Table 6 we restrict the sample to individuals who have a loan from any provider, thus conditioning on the generic demand for a loan. Conditional on borrowing, strongly present-biased women are more inclined to borrow from SHGs, which is consistent with the hypothesis that features specific to SHG contracts and practices are desirable for individuals with present-biased preferences. (SHG loans may have other advantages with broad appeal, such as lower interest rates, but our focus here is on explaining the particular appeal to present-biased individuals.) When the future discount rate ( $\delta_i^1$ ) is included in the specification, strongly present-biased women borrow at a rate even higher than this discount rate suggests. The result is consistent with the combination of the disciplining effect of SHG loans and the desire to compensate for lower savings levels (shown in the following section).

In columns 3-4 of Table 6 the dependent variable indicates if the respondent has been delayed in repaying at least one loan installment. If the present-biased individuals were “naïve” in the sense that they lack awareness of self-motivation problems, we would expect them to plan to repay but ultimately end up over-consuming and having worse repayment discipline. However, present-biased preferences do not matter in our estimates.

#### **IV. Supporting evidence and alternative hypotheses**

##### *A. Present-bias and saving*

We measure total savings by summing self-reported financial savings held in a bank, post office, SHG and at home. We emphasize two caveats. First, by focusing on financial savings we omit other assets such as land, livestock or jewelry which are hard to value but could be, potentially, an important (typically less liquid) form of saving. Second, self-reported measures of savings, in particular the savings held at home, are vulnerable to measurement error. Despite the noise, the saving data generally support the interpretation presented thus far.

Present-biased preferences matter for overall saving levels of women: the average level of total savings of women with time-consistent preferences is Rs. 2,305, but women with strongly present-biased preferences save only Rs. 1,636 (Table 4). After controlling for other variables, present-biased women save substantially less than their future discount rate would predict (Table 7, column 2), suggesting that they have difficulties in saving according to long-term plans. The coefficient for being strongly present-biased remains negative but is a third the size and not statistically significant when controlling for the current discount rate (column 1): the current self wins out.

This result does not allow us to distinguish whether present-biased women are naïve or sophisticated, unlike the result on SHG borrowing. Considering saving in isolation from borrowing behavior, the results suggest that women are naïve about their time inconsistency or that they are sophisticated but lack mechanisms to address inconsistency.<sup>19</sup> If these women are able to adjust the composition of their savings by saving less at home, as we describe below, we would expect saving levels to be higher than the level predicted by the current discount rate. However, sophisticated present-biased individuals are apt to search for alternative saving devices. We have shown that they are more likely to borrow from SHGs and part of the SHG borrowing could, we argue, serve the same purpose as saving more and partially crowd out the liquid forms of saving that we measure.

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<sup>19</sup> As shown in O'Donoghue and Rabin (1999), sophisticated present-biased individuals could save even less than time consistent individuals with the same current patience if awareness of future saving problems, and thus lower likelihood of achieving a saving target (usefully large lump sum), reduces incentives to save in the first place.

In columns 3-4 of Table 7 we examine home savings as a share of total savings. We hypothesize that people with self-discipline problems are more likely to keep their money outside of the home.<sup>20</sup> More impatient individuals save a higher proportion of their savings at home and less outside of their household (such as in a bank, a post office, or SHG), in part because more impatient people save less overall (and saving less is associated with holding more at home). But the finding is also consistent with a higher priority placed on spending which diminishes the value of opening and using saving accounts. All else the same, present-biased women keep a lower proportion of their financial savings at home than the level predicted by their current discount rate (column 3):  $\beta_2 < 0$ . The future discount rate is a better predictor of their saving practices (column 4): the coefficient for having present-biased preferences is virtually zero after we control for future discount rate. The finding is consistent either with women keeping less cash at hand deliberately or with the notion that they have already given in to the temptation to consume savings held at home.

The overall pattern of results for saving of women is consistent with behavior of “sophisticated” individuals who lack a suitable savings device and use alternative devices to accumulate, as well with predicted behavior of “naïve” present-biased individuals. For men, the coefficients on strongly present-biased preferences suggest the ability to rein in self-control problems (web Appendix, Table WA5).

### *B. Demand for commitment and spousal control issues*

We focus on struggles with self-discipline, but as Siwan Anderson and Jean-Marie Baland (2002) find, the central discipline problem for women may instead involve protecting savings from spouses, with whom the saver has conflicting preferences. In this case individuals do

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<sup>20</sup> There are 82 individuals who report not having any savings and in Table 7 they are excluded from the sample. In order to see the bounds of how important this exclusion is, we repeated the same analysis with non-savers treated as if (1) they saved 100% at home and (2) they saved nothing at home. In both cases the results are qualitatively similar to those observed in Table 7. See web Appendix Table WA11.

not seek to discipline their own preferences, but try instead to “discipline” the interventions of other household members (often spouses). Anderson and Baland (2002) show that the need to protect savings from their husbands triggers women’s participation in ROSCAs in a Kenyan slum. They find an “inverted-U” shaped pattern in their data: women who have little autonomy from their husbands are unlikely to join ROSCAs, as are women with great autonomy (since they do not need the commitments that ROSCAs afford). Women in a middle range, though, are particularly likely to be ROSCA participants.

In all the regressions we control for a measure of women’s decision-making power within a household and its square. We find evidence supporting the spousal control motive for borrowing behavior, but not for savings behavior (web Appendix, Tables WA3-5). Women in the upper mid-range of our measure of women’s position are the most likely to have a loan from SHGs. The result suggests that husbands or other family members respect women’s autonomy over resources from SHG loans but less so for savings or other types of loans. The results for present-biased preferences are robust to the inclusion of these variables.

### *C. Shocks*

Recent income or expenditure shocks can potentially affect time-discounting choices as well financial behavior. If individuals are sufficiently liquidity constrained, a negative shock could make individuals seem more impatient now than in the future, reduce savings, and increase borrowing. The correlations we observed could thus be caused by temporary shocks, rather than by a direct link between fundamental self-control problems and financial behavior. Although we cannot completely rule out this possibility, we designed a series of robustness checks to address the concern.

First, we deliberately shifted the time frame by exactly one year, to attenuate the effect of seasonality of income and expenditures on our measure of present-biased preferences.

After controlling for village fixed effects (as we do in all estimates), the concern reduces to the role of idiosyncratic income or expenditure fluctuations across years, such as those resulting from extremely adverse weather conditions. If farmers experienced or expected a relatively bad harvest this year compared to their usual harvest, they could become more impatient now than in the future. According to official standards and data from the Directorate of Economics and Statistics, Government of Karnataka, the cumulated rainfall since the monsoon until the end of the survey was “normal” in both Honavar and Haliyal Taluks, and when asked directly, most of local leaders indicated that the present rainfall did not substantially differ from previous years.

Second, we test whether those whom we code as present-biased are in a worse position to cope with a negative shock or more likely to have experienced one. Few observable characteristics explain present-biased time inconsistency (Columns 3-4 of Table 3), in line with Ashraf, Karlan and Yin (2006). Neither education nor wealth predicts present-biased time inconsistency at conventional levels of statistical significance. We asked participants to identify their high and low income months within a year. Being at low-income month at the time of our experiments (either on average or in relative terms compared to three months later) does not increase likelihood of being time inconsistent.<sup>21</sup> We further asked the participants what was the major negative factor that hit their household during the last five years (bad harvest, illness or death of family member, robbery, inflation, other) and their responses do not predict time inconsistencies. Farmers tend to be more vulnerable to income shocks than others, and, consistent with the alternative hypothesis, we find that male farmers are more likely to have strongly present-biased preferences. But the coefficient takes the opposite sign (and is not statistically significant) in the regression on having weakly present-

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<sup>21</sup> The experiments were conducted in June and the delayed payments were made in September. The first harvest time in the area is in March and the second harvest time is in October-November. Thus rewards were paid within the same agricultural season and none during a harvest time.



biased preferences; more importantly, our correlations between present biased preferences and financial behavior (Table 5-7) hold for sub-samples of farmers as well as non-farmers.

Third, a negative shock should lead to an increase in loans from all sources, assuming they are equally liquid. In the previous section, however, we show that present-biased women are more likely to have SHG loans and that they are not more likely to have loans from banks or moneylenders. Still, SHG borrowing could be the most liquid source of borrowing in a situation when a household experiences a negative shock. In most cases, however, the rules of SHG lending make SHGs a less liquid form of borrowing relative to alternatives like moneylenders. The process of forming a new SHG normally takes five to six months (NABARD). Members of already existing groups can borrow from internal funds (members' pooled savings) and external funds (loans from commercial banks). In the period of several months, newly formed groups focus on accumulating savings which can be later used for internal borrowing and are important to become eligible for external borrowing. During this period, groups are not eligible for an external loan and internal borrowing is also limited. Similarly, new members joining an existing group are usually required to make a deposit equivalent to the accumulated savings of the existing members before they can borrow (EDA and APSAM 2006). Thus, forming a new SHG or joining an existing SHG is not a fast way to get access to credit. The existing groups eligible for borrowing can take a new external loan only after an outstanding loan is fully repaid, and they are expected to commit to use the funds to invest in productive enterprise. The repayment period depends on the amount of a loan but usually varies from several months to several years. Thus, even for members of existing SHGs, the amount of external funds available for borrowing cannot quickly respond to the immediate needs generated by unexpected shocks. The only source of rapidly-available loans to respond to emergencies would have to come from members of existing SHGs with sufficient accumulated savings. They could in principle use "internal" loans to redistribute

available funds to members with immediate needs. As a result, despite the robustness checks, we do not completely rule out that shocks can explain the results on borrowing and the appearance of present-bias.

## **V. Conclusions**

The textbook model of optimal consumption choice abstracts from self-discipline problems that households may face, limiting their ability to save. Behavioral economics has taken self-discipline as a focus, centering on ways that various contracting mechanisms and types of social support can generate greater savings levels by promoting discipline. We draw a link between these kinds of disciplining mechanisms and the propensity to borrow from microcredit institutions.

The study is based on a series of “lab experiments in the field” designed to elicit measures of time discounting and risk aversion and survey data on financial behavior for a random sample of over 500 individuals in rural India. We show that the likelihood of borrowing from local microcredit institutions is greater for women with present-biased preferences. The finding that present-biased women favor borrowing from microcredit institutions can be partly explained by their general difficulty saving: the present-biased group is more likely to need to borrow than otherwise similar people undertaking comparable investments. But we find that when members of the present-biased group borrow, they are more likely than other (otherwise similar) borrowers to do so through microcredit institutions specifically. The finding is consistent with the notion that the structure of microcredit loans and the harnessing of social pressure provides a way to convert income flows into large sums through a device that—for the present-biased group—is more effective than the alternative of saving up on one’s own. While the evidence opens the possibility of a behavioral

interpretation of microcredit contracts, additional work is needed to establish specific causal links, and we cannot fully rule out the possibility that consumption shocks explain the results.

It might seem that the preference for microcredit borrowing by the present-biased group reflects a concession to the desire for current consumption (rather than being driven by the desire to accumulate). But most borrowing in our sample is for investment, and our result holds even after controlling for the baseline degree of time discounting and for the propensity to borrow in general; the time preference variable should capture aspects of loan demand associated with the desire for current consumption.

The interpretation rests on the way that microcredit loans provide discipline and peer pressure absent in the textbook lending contract. Microcredit contracts have been celebrated by economic theorists for providing novel solutions to problems of moral hazard and adverse selection. The evidence here suggests that a key to their popularity may rest as well with their role in helping borrowers discipline their financial lives. The interpretation helps to explain the existence of the regular repayment schedules used in nearly all microfinance loan contracts globally (Armendáriz and Morduch 2005). The interpretation also helps to explain why microcredit institutions that drop the joint liability element of group lending from their contracts nonetheless have maintained regular repayment schedules and group meetings (Xavier Giné and Dean Karlan 2009). Further research is required to quantify the roles of specific mechanisms that may aid self-discipline.

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TABLE 1 -- SAMPLE CHARACTERISTICS, COMPARISON WITH KARNATAKA AVERAGES (MEANS AND STANDARD DEVIATIONS)

|                     | Total  |          | Male   |          | Female |          | Karnataka <sup>a</sup> |
|---------------------|--------|----------|--------|----------|--------|----------|------------------------|
| Age (years)         | 36.822 | (11.756) | 38.128 | (12.091) | 35.496 | (11.274) | 36.300                 |
| Education (classes) | 4.256  | (4.442)  | 5.004  | (4.684)  | 3.496  | (4.051)  | 4.200                  |
| Illiterate          | 0.395  | (0.489)  | 0.339  | (0.474)  | 0.452  | (0.499)  | 0.425                  |
| Married             | 0.786  | (0.410)  | 0.796  | (0.404)  | 0.777  | (0.417)  | 0.670                  |
| Farmer              | 0.702  | (0.458)  | 0.739  | (0.440)  | 0.664  | (0.473)  | 0.750 <sup>b</sup>     |
| Sample size         | 544    |          | 274    |          | 270    |          |                        |

*Notes:* Standard deviations in parentheses. <sup>a</sup> Source: Indian Census 2001: data for the Karnataka population above 15. <sup>b</sup> Only rural population in Karnataka

TABLE 2 -- DISTRIBUTION OF RESPONSES TO TIME PREFERENCE QUESTIONS

|                              |                 | <b>Future discount rate</b> |                         |                         |                        |                        |                          |                           |
|------------------------------|-----------------|-----------------------------|-------------------------|-------------------------|------------------------|------------------------|--------------------------|---------------------------|
|                              |                 | Patient                     |                         |                         | Impatient              |                        |                          | Total                     |
|                              |                 | DR=0.03                     | DR=0.09                 | DR=0.16                 | DR=0.26                | DR=0.41                | DR=0.60                  |                           |
| <b>Current discount rate</b> | Patient DR=0.03 | 126<br>23%                  | 8<br>1%                 | 6<br>1%                 | 2<br>0%                | 2<br>0%                | 9<br>2%                  | <b>153</b><br><b>28%</b>  |
|                              | DR=0.09         | 37<br>7%                    | 41<br>8%                | 3<br>1%                 | 1<br>0%                | 4<br>1%                | 0<br>0%                  | <b>86</b><br><b>16%</b>   |
|                              | DR=0.16         | 27<br>5%                    | 18<br>3%                | 41<br>8%                | 4<br>1%                | 5<br>1%                | 0<br>0%                  | <b>95</b><br><b>17%</b>   |
|                              | DR=0.26         | 14<br>3%                    | 7<br>1%                 | 12<br>2%                | 11<br>2%               | 3<br>1%                | 3<br>1%                  | <b>50</b><br><b>9%</b>    |
|                              | DR=0.41         | 1<br>0%                     | 6<br>1%                 | 2<br>0%                 | 4<br>1%                | 4<br>1%                | 2<br>0%                  | <b>19</b><br><b>3%</b>    |
| Impatient DR=0.60            | 34<br>6%        | 1<br>0%                     | 11<br>2%                | 5<br>1%                 | 1<br>0%                | 89<br>16%              | <b>141</b><br><b>26%</b> |                           |
| <b>Total</b>                 |                 | <b>239</b><br><b>44%</b>    | <b>81</b><br><b>15%</b> | <b>75</b><br><b>14%</b> | <b>27</b><br><b>5%</b> | <b>19</b><br><b>3%</b> | <b>103</b><br><b>19%</b> | <b>544</b><br><b>100%</b> |

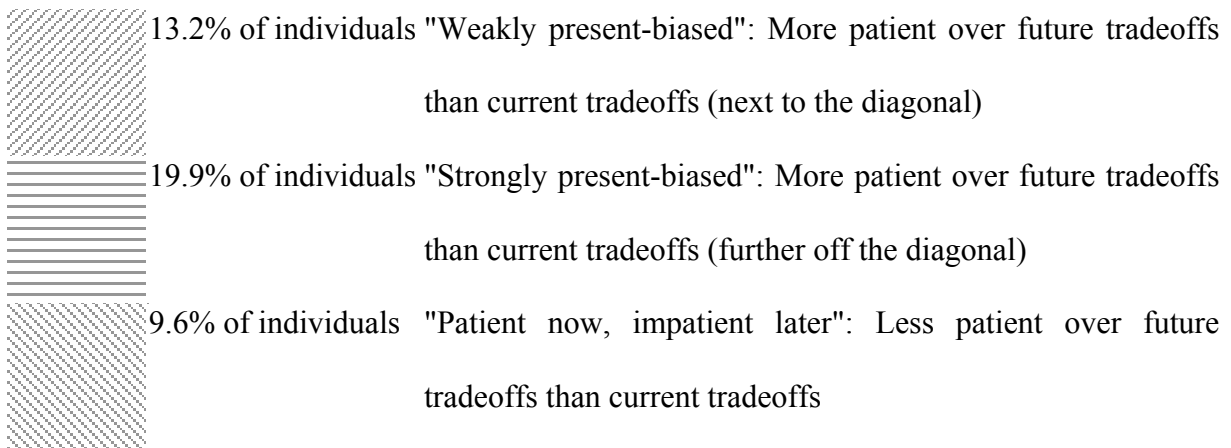


TABLE 3 -- EXPERIMENTAL QUESTIONS AND INDIVIDUAL CHARACTERISTICS

| Dependent variable:         | Level of discounting         |                             | Time preference reversals      |                              |   |
|-----------------------------|------------------------------|-----------------------------|--------------------------------|------------------------------|---|
|                             | Current discount rate<br>(1) | Future discount rate<br>(2) | Strongly present-biased<br>(3) | Weakly present-biased<br>(4) | Patient now, impatient in the future<br>(5) |
| Gamble 2                    | -0.035<br>(0.058)            | -0.019<br>(0.057)           | 0.034<br>(0.121)               | -0.038<br>(0.041)            | -0.030<br>(0.090)                           |
| Gamble 3                    | -0.054<br>(0.050)            | -0.017<br>(0.049)           | -0.078<br>(0.085)              | -0.090<br>(0.036)**          | 0.032<br>(0.111)                            |
| Gamble 4                    | -0.159<br>(0.054)***         | -0.085<br>(0.052)           | -0.082<br>(0.083)              | -0.046<br>(0.039)            | 0.135<br>(0.151)                            |
| Gamble 5                    | -0.084<br>(0.054)            | -0.047<br>(0.053)           | -0.079<br>(0.084)              | -0.067<br>(0.032)            | 0.025<br>(0.115)                            |
| Gamble 6                    | -0.097<br>(0.056)*           | -0.060<br>(0.054)           | -0.126<br>(0.072)              | 0.006<br>(0.066)             | -0.109<br>(0.060)                           |
| Education                   | -0.003<br>(0.004)            | -0.005<br>(0.004)           | -0.005<br>(0.009)              | 0.000<br>(0.005)             | -0.009<br>(0.010)                           |
| Age                         | 0.003<br>(0.008)             | 0.002<br>(0.008)            | -0.017<br>(0.016)              | 0.003<br>(0.011)             | -0.011<br>(0.019)                           |
| (Age) <sup>2</sup>          | -0.000<br>(0.000)            | -0.000<br>(0.000)           | 0.000<br>(0.000)               | -0.000<br>(0.000)            | 0.000<br>(0.000)                            |
| Married                     | 0.026<br>(0.044)             | 0.013<br>(0.043)            | 0.099<br>(0.072)               | -0.043<br>(0.073)            |   |
| Household head              | -0.015<br>(0.056)            | -0.036<br>(0.055)           | 0.229<br>(0.167)               | -0.002<br>(0.072)            |   |
| Wealth                      | 0.011<br>(0.008)             | 0.008<br>(0.008)            | -0.006<br>(0.017)              | -0.005<br>(0.011)            | -0.036<br>(0.023)                           |
| Relative income             | 0.009<br>(0.027)             | -0.009<br>(0.026)           | 0.015<br>(0.054)               | 0.035<br>(0.038)             | -0.025<br>(0.054)                           |
| Farmer                      | 0.028<br>(0.031)             | -0.010<br>(0.030)           | 0.097<br>(0.056)               | -0.082<br>(0.055)            | -0.176<br>(0.098)*                          |
| Negative shock from harvest | -0.036<br>(0.029)            | 0.010<br>(0.029)            | -0.090<br>(0.056)              | 0.046<br>(0.047)             | -0.022<br>(0.061)                           |
| Observations                | 266                          | 266                         | 266                            | 211                          | 151   |
| (Pseudo) R-squared          | 0.29                         | 0.20                        | 0.16                           | 0.22                         | 0.19  |

*Notes:* All specifications include village fixed effects. OLS in columns 1-2. Probit, marginal effects reported in columns 3-5. In Column 5 the variables "Married" and "Household head" dropped due to lack of variation. \* significant at 10%. \*\* significant at 5%. \*\*\* significant at 1%



TABLE 4 -- TIME DISCOUNTING AND FINANCIAL BEHAVIOR OF WOMEN (MEANS AND STANDARD DEVIATIONS)

|                          |         | All women | Future rate | discount | Time consistency        |                       |                 |                      |                |
|--------------------------|---------|-----------|-------------|----------|-------------------------|-----------------------|-----------------|----------------------|----------------|
|                          |         |           | Low         | High     | Strongly present-biased | Weakly present-biased | Time consistent | Patient impatient    | now, in future |
| SHG                      | loan    |           |             |          |                         |                       |                 |                      |                |
| (dummy)                  |         | 0.426     | 0.457       | 0.371    | 0.607                   | 0.447                 | 0.359           | 0.391                |                |
|                          |         | (0.495)   | (0.500)     | (0.486)  | (0.493) <sup>d</sup>    | (0.504)               | (0.481)         | (0.499)              |                |
| Non-SHG                  | loan    |           |             |          |                         |                       |                 |                      |                |
| (dummy)                  |         | 0.281     | 0.318       | 0.217    | 0.321                   | 0.263                 | 0.294           | 0.130                |                |
|                          |         | (0.451)   | (0.467)     | (0.414)  | (0.471)                 | (0.466)               | (0.457)         | (0.344)              |                |
| SHG                      | loan    |           |             |          |                         |                       |                 |                      |                |
| (dummy) <sup>a</sup>     |         | 0.665     | 0.664       | 0.667    | 0.791                   | 0.708                 | 0.579           | 0.818                |                |
|                          |         | (0.473)   | (0.474)     | (0.476)  | (0.412) <sup>d</sup>    | (0.464)               | (0.496)         | (0.405)              |                |
| Any                      | savings |           |             |          |                         |                       |                 |                      |                |
| (dummy)                  |         | 0.863     | 0.884       | 0.825    | 0.857                   | 0.842                 | 0.876           | 0.826                |                |
|                          |         | (0.345)   | (0.321)     | (0.382)  | (0.353)                 | (0.370)               | (0.331)         | (0.388)              |                |
| Total                    | savings |           |             |          |                         |                       |                 |                      |                |
| (Rs. th.)                |         | 2.016     | 2.198       | 1.691    | 1.636                   | 2.069                 | 2.305           | 0.936                |                |
|                          |         | (2.736)   | (2.646)     | (2.875)  | (1.788)                 | (3.808)               | (2.849)         | (0.952) <sup>d</sup> |                |
| Share of home            |         |           |             |          |                         |                       |                 |                      |                |
| savings (%) <sup>b</sup> |         | 0.191     | 0.182       | 0.208    | 0.164                   | 0.148                 | 0.194           | 0.306                |                |
|                          |         | (0.303)   | (0.291)     | (0.326)  | (0.278)                 | (0.260)               | (0.307)         | (0.388)              |                |

Notes: <sup>a</sup> The sample is restricted to only those who have an outstanding loan from SHG, a bank or a moneylender.

<sup>b</sup> The sample is restricted to only those who report having financial savings ("Any savings"=1).

<sup>c</sup> Difference significant at 5% level (t-test), comparison of groups below and above median future patience

<sup>d</sup> Difference significant at 5% level (t-test), comparison with time consistent group

TABLE 5 -- TIME INCONSISTENT PREFERENCES AND SHG BORROWING BY WOMEN

| Estimator<br>Dependent<br>variable: | Probit                          |                      | Probit                |                      |                       | Probit                                |  |
|-------------------------------------|---------------------------------|----------------------|-----------------------|----------------------|-----------------------|---------------------------------------|--|
|                                     | SHG participation               |                      | SHG borrowing         |                      |                       | Non-SHG bor. (bank<br>or moneylender) |  |
| Conditioned by:                     | Current<br>disc. rate           | Future<br>disc. rate | Current<br>disc. rate | Future<br>disc. rate | Current<br>disc. rate | Future<br>disc. rate                  |  |
|                                     | (1)                             | (2)                  | (3)                   | (4)                  | (5)                   | (6)                                   |  |
| Strongly<br>present-biased          | 0.277<br>(0.073)***             | -0.009<br>(0.109)    | 0.401<br>(0.098)***   | 0.216<br>(0.107)**   | 0.0522<br>(0.0846)    | 0.000855<br>(0.0783)                  |  |
| Weakly present-<br>biased           | -0.046<br>(0.125)               | -0.136<br>(0.133)    | 0.050<br>(0.130)      | -0.009<br>(0.128)    | -0.0790<br>(0.0859)   | -0.0916<br>(0.0821)                   |  |
| Current discount<br>rate            | -0.911<br>(0.239)***            |                      | -0.514<br>(0.252)**   |                      | -0.191<br>(0.169)     |                                       |  |
| Future discount<br>rate             |                                 | -1.110<br>(0.253)*** |                       | -0.738<br>(0.272)*** |                       | -0.101<br>(0.175)                     |  |
| Patient<br>impatient<br>future      | now,<br>in<br>-0.075<br>(0.140) | 0.132<br>(0.109)     | 0.051<br>(0.152)      | 0.180<br>(0.155)     | -0.172***<br>(0.0566) | -0.160***<br>(0.0620)                 |  |
| Pseudo<br>squared<br>Observations   | R-<br>0.35<br>239               | 0.38<br>239          | 0.28<br>232           | 0.29<br>232          | 0.21<br>249           | 0.21<br>249                           |  |

*Notes:* We control for risk aversion (six dummies corresponding to chosen gamble), observable characteristics (education, age, marital status, household head, wealth, relative income, farmer, negative shock from harvest; woman's position within household) and village fixed effects. \* significant at 10%. \*\* significant at 5%. \*\*\* significant at 1%

TABLE 6 -- TIME INCONSISTENT PREFERENCES AND BORROWING BY WOMEN

| Estimator                        | Probit              |                    | Probit             |                   |
|----------------------------------|---------------------|--------------------|--------------------|-------------------|
|                                  | SHG borrowing       |                    | Delayed            | repayment of      |
| Dependent variable:              |                     |                    | outstanding loan   |                   |
| Conditioned by:                  | Current disc. rate  | Future disc. rate  | Current disc. rate | Future disc. rate |
|                                  | (1)                 | (2)                | (3)                | (4)               |
| Strongly present-biased          | 0.318<br>(0.080)*** | 0.253<br>(0.093)** | 0.060<br>(0.140)   | -0.064<br>(0.150) |
| Weakly present-biased            | 0.014<br>(0.161)    | -0.021<br>(0.167)  | -0.048<br>(0.190)  | -0.099<br>(0.191) |
| Current discount rate            | -0.303<br>(0.328)   |                    | -0.424<br>(0.338)  |                   |
| Future discount rate             |                     | -0.375<br>(0.366)  |                    | -0.380<br>(0.401) |
| Patient now, impatient in future | 0.225<br>(0.092)    | 0.238<br>(0.081)   | 0.257<br>(0.130)   | 0.275<br>(0.119)  |
| Conditional borrowing?           | on<br>yes           | yes                | yes                | yes               |
| Pseudo R-squared                 | 0.32                | 0.32               | 0.33               | 0.33              |
| Number of observations           | 139                 | 139                | 130                | 130               |

*Notes:* The sample is restricted to only those who have any outstanding loans from a SHG, a bank or a moneylender. In all specifications we control for the same set of variables as in Table 5. \* significant at 10%. \*\* significant at 5%. \*\*\* significant at 1%

TABLE 7 -- TIME INCONSISTENT PREFERENCES AND SAVING BY WOMEN

| Estimator                        | OLS                     |       |                     |       | Tobit                              |       |                     |       |
|----------------------------------|-------------------------|-------|---------------------|-------|------------------------------------|-------|---------------------|-------|
|                                  | Total savings (Rs. th.) |       |                     |       | Share of home savings <sup>a</sup> |       |                     |       |
| Dependent variable:              | Current                 | disc. | Future              | disc. | Current                            | disc. | Future              | disc. |
| Conditioned by:                  | rate                    |       | rate                |       | rate                               |       | rate                |       |
|                                  | (1)                     |       | (2)                 |       | (3)                                |       | (4)                 |       |
| Strongly present-biased          | -0.277<br>(0.450)       |       | -0.839<br>(0.442)*  |       | -0.179<br>(0.089)**                |       | 0.015<br>(0.083)    |       |
| Weakly present-biased            | -0.202<br>(0.535)       |       | -0.363<br>(0.535)   |       | 0.037<br>(0.101)                   |       | 0.095<br>(0.101)    |       |
| Current discount rate            | -1.438<br>(0.920)       |       |                     |       | 0.603<br>(0.167)***                |       |                     |       |
| Future discount rate             |                         |       | -2.032<br>(0.952)** |       |                                    |       | 0.500<br>(0.176)*** |       |
| Patient now, impatient in future | -1.279<br>(0.605)**     |       | -0.892<br>(0.611)   |       | 0.230<br>(0.107)**                 |       | 0.109<br>(0.111)    |       |
| (Pseudo) R-squared               | 0.26                    |       | 0.26                |       | 0.35                               |       | 0.34                |       |
| Number of observations           | 249                     |       | 249                 |       | 213                                |       | 213                 |       |

Notes: In all specifications we control for the same set of variables as in Table 5. \* significant at 10%. \*\* significant at 5%. \*\*\* significant at 1%

## Appendix A

TABLE A1 -- DEFINITION OF VARIABLES (MEANS AND STANDARD DEVIATIONS FOR WOMEN)

| Variables                          | Definition   | Mean (S.D.)   |
|------------------------------------|--|---------------|
| <b>Experimental choices</b>        |  |               |
| Current discount rate              | discount6 values approximating 3-months discount rate in earlier time frame: 0.03 = if discount rate < 6%; 0.09 = if 6% < discount rate < 12%; 0.16 if 12% < discount rate < 20%; 0.26 = if 20% < discount rate < 32%, 0.41 if 32% < discount rate < 50%; 0.6 = if 50% < discount rate | 0.218 (0.212) |
| Future rate                        | discount6 values approximating 3-months discount rate in delayed time frame.   | 0.159 (0.193) |
| Strongly biased                    | present-dummy; 1= current discount rate >> future discount rate the future income option is chosen at least two rows later in the current time frame than in the future time frame   | 0.207 (0.406) |
| Weakly biased                      | present-dummy; 1= current discount rate > future discount rate, the future income option is chosen one row later in the current time frame than in the future time frame   | 0.141 (0.348) |
| Patient impatient in the future    | now,dummy, 1= current discount rate < future discount rate   | 0.085 (0.280) |
| Attitude to risk                   | set of dummies, one for each of the following gambles: (250,250); (225,475); (200,600); (150,750); (50,950); (0,1000). In this table the mean is for first gamble=1, second gamble=2, ..., sixth gamble=6.   | 3.781 (1.504) |
| <b>Financial behavior</b>          |  |               |
| SHG participation                  | Dummy; 1 = being a member of a self-help group (SHG)   | 0.652 (0.477) |
| SHG borrowing                      | Dummy; 1 = has an outstanding loan from SHG  | 0.426 (0.495) |
| Non-SHG borrowing                  | Dummy; 1 = has an outstanding loan from a bank or a moneylender  | 0.281 (0.451) |
| Delayed repayment outstanding loan | Dummy; 1 = being delayed on repayment of the outstanding loan for at least one installment   | 0.677 (0.469) |
| Total savings                      | Rs. th. (savings in bank + savings in post office + SHG monthly contribution*average length of participation + home savings)   | 2.016 (2.736) |

|                        |  |               |
|------------------------|--|---------------|
| Savings in bank        | Rs. th.  | 0.711 (1.549) |
| Savings in post office | Rs. th.  | 0.372 (1.596) |
| Home savings           | Rs. th.  | 0.307 (0.853) |
| SHG savings            | Rs. th. (SHG monthly contribution*average length of participation) | 0.626 (0.591) |
| Share of home saving   | Home savings /Total savings (% , only those who save)              | 0.191 (0.303) |

***Socioeconomic characteristics***

|                             |  |                 |
|-----------------------------|--|-----------------|
| Age                         | Age in years   | 35.496 (11.274) |
| Education                   | Years of schooling completed   | 3.496 (4.051)   |
| Married                     | Dummy; 1 = married; 0 = single or widow  | 0.777 (0.417)   |
| Household head              | Dummy; 1 = household head  | 0.107 (0.310)   |
| Wealth index                | An index calculated by principal component analyses from questions on type of house, electricity connection, land ownership and dummies for possession of 14 types of household equipment                                | -0.080 (1.821)  |
| Relative income             | Dummy; 1 = if income in June < income in September   | 0.504 (0.501)   |
| Farmer                      | Dummy; 1 = farmer  | 0.664 (0.473)   |
| Negative shock from harvest | Dummy; 1 = bad harvest reported as the major negative shock in the past five years   | 0.370 (0.484)   |
| Position in family          | Index calculated by principal component analyses from seven questions on decision-making and five questions on wife's beating. Minimum of the index is set to zero. The higher the index value, the better the position. | 3.617 (1.887)   |

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