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

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Abstract:
This paper draws a link between self-control problems and the contractual mechanisms of microcredit. We use a series of "lab experiments in the field" which were designed to elicit measures of time discounting on a sample of 573 individuals in rural Karnataka, India. Evidence from the experiments were integrated with individual survey data on the economic and financial lives of villagers. One third of participants made choices consistent with hyperbolic preferences (more impatient now than in the future), and would be made better off if they could discipline their time inconsistent preferences. While hyperbolic preferences have been often associated with saving behavior, we describe links to borrowing as well. We find that "hyperbolic" women save a lower share of their savings at home and save less in total levels. Women with hyperbolic preferences are also more likely to borrow--and to do so through microcredit institutions specifically. The finding highlights the role of the fixed and frequent installment schedule ubiquitous in microcredit contracts. While microcredit contracts are celebrated for mitigating informational asymmetries, the evidence suggests that they also offer helpful structure for people with self-discipline problems who seek to accumulate capital but who lack suitable contractual saving devices.

Keywords: time preference, hyperbolic discounting, loan contracts, microfinance

JEL: C93, D91, O12

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Introduction

The Nobel Peace Prize in 2006 celebrated the potential of microcredit to transform the lives of small-scale entrepreneurs by providing access to small loans. Microcredit advocates argue that such access to credit will unleash the productive potential of poor households (Yunus 2002). Microcredit providers are drawn together by shared commitments to offer small-scale transactions, serve the under-served, and use innovative contracts to compensate for the fact that most customers lack collateralizable assets that can be used to secure loans (Armendáriz and Morduch, 2005).

The success 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 helps to answer that question by focusing on psychological conflicts that undermine efforts to save. The focus has been on self-discipline problems that persist in the absence of savings devices that foster regular deposits and that limit withdrawals. One of the hidden challenges faced by the poor is posed by the lack of access to such mechanisms.

These behavioral insights suggest a new view of microcredit, and they point to an often-overlooked feature of contracts that, in principle, provides a mechanism that substitutes for

missing savings devices. This is the near-universal requirement that loans be repaid in regular, frequent, fixed installments over time (Rutherford 2000, Armendáriz and Morduch 2000). An unusual feature of microcredit contracts is that borrowers must typically repay loans in weekly or monthly installments beginning at the very start of the loan, well before investments can be expected to bear fruit. Money to pay installments must, of necessity, come at least in part from other income earned by households, such as from wage work. The repayment process thus looks and feels much like the process of saving in regular increments from earned income. To draw the link, Rutherford (2000) describes traditional saving behavior as "saving up" and borrowing in this form as "saving down." In a textbook loan contract, by contrast, the principal and interest are paid in a single, large payment after profits are reaped.[1]

In drawing the link between microcredit borrowing and saving, we focus on specific problems that emerge when, intellectually, people value future consumption but they nonetheless give in to the temptation to consume today. The internal tension is often depicted as a conflict between a patient "future self" and an impatient "present self" (Schelling 1984, Strotz 1955, Ainslie 1992), a tension captured parametrically by "hyperbolic" discount rates rather than standard linear discounting (Laibson 1997). Our findings relate hyperbolic preferences to microcredit borrowing.

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" model promoted by the Government of India and inspired by Grameen Bank of Bangladesh, the co-winner of the 2006 Nobel Peace Prize. We conducted a series of "lab experiments in the field" 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. (These are "artefactual field experiments" in the classification scheme of Harrison and List, 2004.)

[1] See Armendáriz and Morduch (2005) on the logic of microcredit repayment schedules, and Field and Pande (2007) for a field experiment from urban India.

The questions were not hypothetical: the experiments concerned choices over relatively large stakes, as large as a week's wage (as in Tanaka, et al 2006, and Binswanger 1980), and the structure of the questions allow us to infer intervals for discount rates and evidence of time inconsistency. We construct measures of hyperbolic discounting and relate the measures of time discounting and risk aversion to survey data on the economic and financial lives of the households, including participation in microcredit organizations.

The experiments identify roughly one third of the population as exhibiting choices consistent with hyperbolic discounting. Those in this group discount the future more heavily when asked a series of questions about the preference to consume now versus in three months, relative to the degree of discounting implicit in how they answer similar questions about consumption in twelve months versus fifteen months.

In our sample, women in the "hyperbolic" group tend to hold a smaller share of their overall savings at home, a finding consistent with a desire to avoid the everyday temptation of depleting cash on hand. Women in the hyperbolic group are also more likely than other women to join local microcredit organizations, and more likely to borrow from them (after controlling for their baseline degree of time discounting). While we find that women are generally interested in opportunities to borrow, women with hyperbolic preferences are especially likely to do so via microcredit. The results are robust to including a range of observable individual characteristics, evidence on seasonal income patterns, and measures of intra-family decision-making power.

The evidence is consistent with the notion that microcredit borrowing offers helpful structure for people with self-discipline problems who seek to accumulate capital but who lack convenient contractual saving devices. In a different world—one in which villagers weren't vulnerable to time-inconsistent behavior and/or had attractive contractual saving devices—the households might only save (or at least would borrow less). But in an imperfect world, the nature of microcredit contracts makes borrowing an alternative way to steadily transfer money

to a bank and end up with a "usefully large sum" (Rutherford 2000). In this sense, borrowing and saving are drawn together as substitute mechanisms used toward similar ends.

The next section describes self-help groups. Section 3 describes the economics of self-control. Section 4 describes the sample selection, experimental design for eliciting subjective discount rates, and the survey data. Section 5 presents the empirical results on determinants of patience and time inconsistencies. Section 6 discusses how the experimental choices correlate with observed financial behavior and describes alternative hypotheses. Section 7 concludes.

2. Self-Help Groups and microcredit

Self-help groups (SHGs) are the main source of microcredit in India. SHGs are the major providers of financial services in our sample, although moneylenders, banks, and postal savings schemes also operate in the communities. SHGs are based on groups formed endogenously in communities, sometimes 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 (Seibel 2005). 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. The SHGs are permitted as informal entities to obtain bank loans and the whole group is responsible for the loan repayment. By March 2007, 2.92 million SHGs were providing services to 41 million members (NABARD 2007).

SHGs predominantly attract women, although no bias is built into the program design. In our sample, 76 percent of group members are women. The participation rate within our sample is 46 percent and this number is very similar in both regions we study. No village has fewer than 20 percent of individuals participating in an SHG.

All SHG members must deposit regularly into compulsory savings accounts (deposits average Rs. 40 per month[2]). 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.

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. A recent survey of SHGs shows that 83 percent of loans were used for production or other purposes—notably agricultural production, animal husbandry, and microenterprise--rather than consumption (Consultative Group to Assist the Poor 2007).

3. Self-Control and Financial Behavior

The degree of time discounting is essential in making saving and investment decisions. The behavioral economics literature has pushed further, based on experimental evidence that discount rates often vary with the time frame (Frederick et al. 2002). In particular, people are often more impatient for current trade-offs than for future tradeoffs (Strotz 1955, Ainslie 1992). This is captured parametrically by hyperbolic (or "quasi-hyperbolic") time discount functions (Laibson 1997). Hyperbolic preferences create a tension between future plans and current actions. If individuals are "sophisticated" enough to realize it, they may demand a commitment to "tie their hands" now. If they are "naïve" and do not address their inconsistencies, individuals may later regret their decisions (O'Donoghue and Rabin 1999). For sophisticated people with hyperbolic preferences, for example, savings rates should rise when given the choice to opt into savings devices that incorporate commitments to save regularly and that limit withdrawals. The cardinal feature of the devices is to keep present

[2] At the time of our study the exchange rate was 40.6 Indian rupees per US dollar.

temptations at bay by contracting to deposit money in fixed increments at pre-specified times. These kinds of devices take many forms. In richer countries, the most common is direct-deposited pension accounts; in poorer communities, a range of informal devices share this feature, including community-run savings clubs and rotating savings and credit associations (Rutherford 2000).

Hyperbolic preferences have been invoked to explain a growing range of economic puzzles in poor countries. Duflo, Kremer and Robinson (2005) observe patterns consistent with sophisticated hyperbolic preferences in their field experiments on fertilizer adoption, Mullainathan (2005) argues that time inconsistent preferences help explain erratic school attendance. Gugerty (2007) similarly interprets the widespread use of informal rotating savings and credit associations (ROSCAs) as a commitment device to overcome time inconsistencies faced by savers. She observes that participants value public pressure to make regular saving deposits; as some ROSCA participants put it, "you can't save alone." In keeping with this, Armendáriz and Morduch (2005) highlight difficulties saving at home, and they invoke savings difficulties as a rationale for why popular informal savings and borrowing institutions such as ROSCAs do not fall apart. By keeping money at a distance or by imposing rigidity to its access, spending may be much less tempting in the presence of immediate pressures (Mullainathan 2005). Basu (2007) uses hyperbolic preferences as the basis of a theoretical treatment that explains why individuals simultaneously save and borrow, a pattern commonly observed by microcredit practitioners. He argues that the existence of sanctions in the case of loan default provides incentives for discipline that make paying back a loan easier for individuals with hyperbolic preferences than regularly building up savings accounts. Self-control problems, although present around the world, may matter more in poor countries where immediate pressures are greater and mechanisms to help with self-control problems are more limited.

Ashraf et al. (2006) illustrate the link between time preference inconsistency and savings rigidity. They offered savers of a rural bank in the Philippines the opportunity to save using a new product that differed from the existing ones only by restricting access of savers to their deposits until either given maturity or given amount was achieved. They find that 28 percent of those being offered the commitment product accepted it. Women who demanded the "commitment" product were more likely to have hyperbolic time preferences—and access to such accounts notably increased their short-term saving.

We turn here to the link between hyperbolic preferences and borrowing decisions. As noted, savings with commitment and paying credit in installments are very similar in terms of the pressure to follow an intended course of action by taking regular steps. For example, Strotz (1955) and more recently Laibson (1997) highlight this similarity. Borrowing, though, is a roundabout way to save, and it is costly. While most people expect to earn interest on saving deposits, evidence shows that people are willing to pay to save when options are limited. The saving device tested in the Philippines, for example, was valued by the women although costly to them in that the accounts offer no extra compensation for the associated illiquidity. Similarly, in Ghana, local deposit collectors are a common part of the informal financial sector, charging customers a substantial fee for a simple, secure, disciplined ways to save. One calculation shows that in South India, a similar form of deposit collector who takes savings from their customers each day, returning the accumulation after 220 days, charges depositors a fee equivalent to 30 percent of deposits on an annualized basis.[3] In parallel with such devices, microcredit borrowing can be an effective next-best accumulation device.

An alternative reason why the poor may demand commitments like these stem from household conflicts. In this case individuals do not seek to discipline their own preferences, but try instead to "discipline" the preferences of other household members (often spouses). Anderson and Baland (2002) show that the need to protect savings from their husbands

[3] See Rutherford (2000) and the discussion in Armendáriz and Morduch (2005).

triggers women's participation in ROSCAs in a Kenyan slum. They find a notable "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 protections that ROSCAs afford). Women in a middle range, though, are particularly likely to be ROSCA participants. In the work below, we find that the effect of hyperbolic preferences is robust to including measures of individual autonomy and power within households.

4. Experimental and survey design

Although much has been written about time discounting, experimental evidence is largely limited to laboratory environments in developed countries. A significant contribution is Harrison et al. (2002) and Andersen et al. (2008) who estimate the subjective discount rate among a representative sample of the Danish population. Several innovative studies, typically in low-income countries, employ experimental tasks to predict behavior outside of labs to study motivations behind behavioral choices.[4] In our study we are primarily interested in whether people with time inconsistent preferences behave differently from those having consistent preferences.

Sample selection

The survey design generated a varied sample of the rural population of Karnataka. Data were collected in June 2007 in cooperation with BPKS, an Indian NGO in Honavar and Haliyal taluks (a taluk is an administrative unit akin to a county, part of a larger district within a state). Honavar is a coastal region and, of the two, is more developed in terms of infrastructure, market access and access to education and financial facilities. Figure 1

[4] For example, Binswanger (1980) and Liu (2008) elicit individual attitudes to risk and observe correlations with agricultural behavior. Karlan (2005) uses the results of trust games to predict default among clients of FINCA. Tanaka et al (2007) take an approach similar to ours. Thomas and Hamoudi (2006) measure discounting, risk aversion, and altruism to study motivations behind inter-generational exchanges.

provides a map and Table 1 compares the two taluks on a range of variables. Nine villages were selected from each taluk, and 35 people were selected in each village using a random walk method.[5] 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. We used village meeting halls, typically schools, as field labs. The very high response rate stemmed in part from the support of village heads. Self-selection concerns are limited by the high take-up rates.

Table 2 compares the sample characteristics with Karnataka averages from 2001, restricted to the population older than 15 years. The average age and education levels are not statistically different, but we have a slightly lower proportion of illiterate respondents in our sample (40 percent compared with 43 percent in the entire state). This may reflect increases in enrollment ratios in 1980s and 1990s. Age of marriage is typically higher in urban areas that are included in the Karnataka average, while our respondents are villagers and therefore more likely to be married. Although the selection strategy was not intended to generate a representative sample of rural population of Karnataka, the sample captures its variety.

Measuring discount rates and risk aversion

We used a simple protocol to elicit discount rates, drawing on practices common in developed and developing countries (e.g. Harrison et al. 2002; Tanaka et al. 2006).[6] Respondents were asked to choose between receiving 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?"

[5] The villages were randomly selected based on the 2001 Indian Census database; however, in three villages in each taluk the BPKS did not have a good access and knowledge of a village head. These were replaced with other villages that were similar in size, distance to town and educational facilities to the ones originally selected.
[6] In their surveying article Cardenas and Carpenter (2005) classify this methodology as the "choice task method." For a discussion on relative advantages of using "choices task method" vs. alternative "matching-task method" see Frederick et al. (2002). Our decision was largely made on the basis of simplicity given the low education levels in the area.

We posed five such questions to each individual, with each question increasing the future amount up to Rs. 375 while keeping the earlier amount constant. We thus made the choice to delay increasingly more attractive in each subsequent binary choice (Table 3, Panel A gives the choices). The point at which an individual switches from choosing the earlier reward to the future reward gives an interval of her discount rate. In the analysis we use the arithmetic means of these intervals to approximate individual discount rates (for specific values see Table 5). 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.

The same set of binary choices was also offered at a future time frame (as in Ashraf, et al. 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?" (See Table 3, Panel B.) We denote the discount rate calculated from the current tradeoffs as the "current discount rate," and that calculated from the future tradeoffs as the "future discount rate." Inconsistencies provide evidence of hyperbolic preferences, as discussed in the next section.

Several 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. This "front end delay" method should control for potential confounds due to lower credibility and higher transaction costs associated with future payments (it is used, for example, by Harrison et al. 2002; Pender 1996). 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. The approach also reduces transaction costs differentials between the options; since all payments are in the future, participants should assign the same subjective transaction costs to both options.

Third, the set of binary choices in the future time period (with a one year delay) were asked immediately after the set of choices offered in the earlier time frame. This sequencing should lead to a conservative estimate of the likelihood of time preference reversals since it biases toward consistency.

Individual attitudes to risk were also elicited in order to control for the curvature of utility function. We have used a near replication of the simple protocol designed by Binswanger (1980) in his study of villagers in South India and later used by Barr (2003) in Zimbabwe. 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. The sizes of the prize were set at the level of time discounting choices. The expected value of the least risky gamble was set at Rs. 250, and the higher payoff in the most risky gamble was Rs. 1000. The prizes for all the gambles are in Table 4.[7]

Much care has been devoted to ensuring a correct understanding of experimental choices given the high proportion of illiterate respondents. Ten trained research assistants were on hand to help illiterate respondents. Before the experimental choices were made, the experimenter informed the participants that at the end of the session each of them would have

[7] We used two sets of prizes to elicit risk aversion. The relative proportions in the gambles were exactly the same, but amounts for the second set of gambles were lower, with the expected value of Rs. 30 for the least risky gamble and with the maximum payoff of Rs. 120 for the most risky gamble. In the analysis we control for risk aversion inferred from gambles with higher amounts, which were set on a level comparable to time discounting choices.

a 20 percent chance of being paid according to one of their choices.[8] He then explained the principle of future payments and simulated the randomization procedure - tossing numbered ping-pong balls from a bag – which would determine whether and according to which choice a participant would be paid.[9]

At the end of a session, randomly selected respondents were rewarded. 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.[10]

Survey data

Table 5 describes definitions of variables used in the analysis. A wide range of information on individual characteristics was collected such as age, education, family background (marital status, household head, and woman's position in the household), economic conditions and financial behavior. 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 set of questions on decision-making power and on attitudes about wife beating was used to approximate women's position within households (Jensen and Oster 2007). Again we used principle components to construct an index. Data on individual savings in a bank, a post office, at home and participation in SHGs together with information on borrowing indicate individual financial behavior.

[8] A similar incentive technique was used, for example, by Botelho et al. (2006) in a lab experiment conducted among students in Timor-Leste.
[9] In 12 villages, the experimenter was the director of the cooperating NGO, in six remaining villages the main instructor was the associate director who was also present at previous meetings as a research assistant. The results reported below do not change substantively after controlling for experimenter effect (not reported).
[10] In addition, everyone was given a participation fee amounting Rs. 60 to compensate for opportunity costs (daily income). One session lasted on average four hours and these payments were made upon completion of the entire session.

5. Determinants of time discounting

We focus on four characteristics resulting from the experiments: current patience (based on Table 3, Panel A), future patience (based on Table 3, Panel B), present-biased time inconsistency (hyperbolic discounting) and future-biased time inconsistency ("patient now, impatient in the future"). In this section we examine how observable characteristics (gender, age, education, wealth, income fluctuations, family status) predict these traits. In Table 6 we compare means for different subgroups. In the regression analysis we use OLS for discount rates and probits for time preference reversals. Observations are clustered at the village level.[11]

Determinants of discount rates

We observe two clear relationships with respect to levels of patience as approximated by the level of discount rates. First, women make more patient choices than men.[12] Table 6 shows that the current three-months discount rate is 27.0 percent for men but only 21.8 percent for women. For the future discount rate the averages are 22.6 percent and 15.9 percent respectively. For both discount rates the differences are significant at the 1 percent level. The results accord with evidence on behavior from developing countries showing that income in the hands of women is more likely to be used for future-oriented activities like education and health expenditures (Thomas 1990; Quisumbing and Maluccio 2003) rather than current consumption. Similarly, the positive experience of microfinance institutions with women is often attributed to women's greater patience (Yunus, 2002). Thomas and Hamoudi (2006)

[11] Using an ordered probit instead of OLS yields comparable results. The results also do not change substantively after controlling for village fixed effects (not reported).

[12] During the experimental meetings the participants were given a lunch. We noticed that most women did not eat the meal, but waited until the end of the session and brought it home to share with their children. Men ate the lunch immediately.

also find greater patience in women relative to men in a recent experimental study in rural Mexico.

Second, as in Kirby et al. (2002) and Bauer and Chytilová (2007), we find that more educated individuals are more patient, an effect that is particularly strong for men (Table 6). The mean of the current discount rate for men with above median education is 19.7 percent, while for below median education it is 33.8 percent. For women, the effect is only marginally significant, possibly due to the substantially lower variance in education of women (45 percent of women are illiterate in the sample).

In the first three columns of Table 7, the dependent variable is the current discount rate, and it is the future discount rate in the next three columns. The regression specifications yield similar conclusions as the table of means. Each additional year of schooling is associated with a decrease in the current discount rate of 1.3 percentage points and a decrease in the future rate of 1.5 percentage points. These are only associations, of course, since the relationship is in part endogenous: education can reduce income constraints or enhance planning skills and, all else the same, patient individuals are more likely to invest in education.

Determinants of time-inconsistent preferences

We interpret the choices as "hyperbolic" if the inferred current discount rate is higher than the future discount rate: an individual with hyperbolic preferences is more impatient now than in the future. We further distinguish between individuals with weakly hyperbolic preferences and strongly hyperbolic preferences. Weakly hyperbolic preferences reflect a difference between current and future discount rates that is relatively small, resulting from choosing the future reward only one binary choice earlier in future time frame (Table 3, Panel B) compared to earlier time frame (Panel A). If the difference is larger, a person is regarded as having strongly hyperbolic preferences.

Table 8 illustrates definitions of the time inconsistencies and describes their distribution. The current discount rate is on the vertical axis and the future rate is on the horizontal axis. Cells on the diagonal (where the current discount rate equals the future discount rate) represent individuals with time consistent preferences. Below the diagonal, the current discount rate is higher than the future discount rate. An individual is considered as "weakly hyperbolic" if she made a combination of choices that are next to the diagonal and as "strongly hyperbolic" if combinations lie further below the diagonal.[13] Above the diagonal are individuals with future-biased time inconsistency, in which individuals are more patient now than in the future.

Almost one third of individuals have hyperbolic time preferences (19.9 percent are strongly hyperbolic and 13.2 percent are weakly hyperbolic), whereas fewer than 10 percent of individuals are more patient now than in the future.

The first 6 columns of Table 9 show the determinants of hyperbolic preferences. Few observable characteristics explain hyperbolic time inconsistency. Women who are married or are household heads are more likely to have strongly hyperbolic preferences. The coefficients have an opposite sign and are not statistically significant for women having weakly hyperbolic preferences. None of the variables would predict time inconsistency of men with statistical significance. These (non-) results are similar to estimates of Ashraf et al (2006) and other psychological studies on impulsiveness that similarly find little association with observable characteristics.

[13] Note that the inferred discount rates are not linearly increasing (to limit censoring for a given number of binary choices). Hence, the definition of being "weakly hyperbolic" includes individuals with changes in discount rates between the two time frames that vary by different absolute amounts. As a robustness check, we redefined the dividing line between strongly and weakly hyperbolic preferences. In the first variant, we define "strongly hyperbolic" individuals as those whose preferences change by more than 0.09 from the range of discount rates associated with time consistent choices. This variant makes very little difference both in terms of the number of observations defined as strongly hyperbolic and, not surprisingly, in the results. In the second variant, we define "strongly hyperbolic" individuals as having a current discount rate higher than the future discount rate by more than 0.16 units. Doing so decreases the size of the group by 26 observations and reduces the differences in behavior between strongly and weakly hyperbolic described in Section 6, but the basic results hold.

There are two major concerns to consider before interpreting the observed reversals as indications of hyperbolic preferences. First, the preference reversals may mirror cash flow fluctuations between the earlier and the delayed time frame. Agricultural income is likely to fluctuate between seasons within a particular year. Similarly, local celebrations are organized on an annual basis with fixed dates. To address this concern, we deliberately shifted the time frame by exactly one year. The remaining concern then reduces to the role of income or expenditure fluctuations across years, such as those resulting from extremely adverse weather conditions. If farmers experienced or expected 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. Moreover, being a farmer does not predict a higher likelihood of having hyperbolic preferences. As a further check, participants were asked to select the major unexpected shock during the last five years; 42 percent selected low harvest due to bad weather, but this characteristic also fails to predict preference reversals.

Second, the reversals may reflect expected transaction costs and lower credibility of future rewards resulting in a higher discount rate now and lower discounting in the future. As noted earlier, we mitigate this concern by designing the binary choices so that there are no immediate payments and by putting the responsibility for future payments into the hands of respected individuals familiar to the participants. In order to test if the reversal is driven by lack of trust we also included three questions from the General Social Survey (GSS) on "trust", "fairness" and "helping" into our survey. An index from these questions is uncorrelated with both weakly and strongly hyperbolic preferences (p-value=0.39 and 0.34, respectively) as are the elements taken separately. Similarly, individuals with no previous

interaction with the cooperating NGO -- and hence those presumably less inclined to trust it -- are not more likely to have hyperbolic preferences. Moreover, if the credibility issue was the driver of time preference reversal, the hyperbolic preferences should not be correlated with financial behavior, which contradicts our observations shown in the next section.

Columns 7, 8, and 9 of Table 9 show how individual characteristics predict being patient now and impatient in the future. Although men are more likely to have future-biased preferences than women (10.6 percent compared to 8.5 percent), no independent variable explains the reversal in their case. Women with less wealth are more likely to be more patient now than in the future. We show in the next section that people with this type of preferences are also substantially less financially active in terms of both borrowing and saving. The most plausible explanation is differential uncertainty about cash flow now and after one year. If a person near the subsistence level knows her cash flow is now above subsistence but feels uncertain about cash flow next year, she may become less impatient about her choices now than in the future. Unfortunately this is impossible to test without data on relative riskiness of individual income streams.

6. Discounting and Financial Decisions

The heart of the paper links the non-laboratory borrowing and savings decisions to the experimental choices observed in the field labs. We test several hypotheses. The first hypothesis is that more patient individuals save more and are more likely to favor long-term savings goals. Second, individuals with hyperbolic preferences have saving difficulties. They recognize the tension between their current and future levels of patience and adjust their financial strategies. Specifically, they reduce the share of savings held at home (where temptation is greatest) and they seek commitment devices like SHG loans. If contractual

savings devices had been available in this sample, we would expect to demand for them as well.

Table 10 presents the summary statistics on saving and borrowing for individuals with varying degrees of patience and time consistency. We follow-up the analyses of means with regression analyses. The upper panel in Table 10 shows the results for women, the lower panel focuses on men. On average, the level of self-reported financial savings (in a bank, post office, SHG and at home) is Rs. 2,016 for women and 3,113 for men. Individual savings rise with patience as reflected by the discount rate in the later time frame (i.e., Table 3, panel B). The total savings of women with time-consistent preferences are Rs. 2,305, whereas women with strongly hyperbolic preferences save only Rs. 1,636, which suggests the existence of saving difficulties for women with hyperbolic preferences. For men, we observe no real difference, which suggests that men may have better mechanisms for addressing time inconsistencies. For both men and women, a lower proportion of savings is held at home if individuals have hyperbolic preferences, which accords with the hypothesis that "sophisticated" individuals will avoid keeping savings at home.

Levels of patience also help to predict the purpose of savings. We define the purpose of savings as being future-oriented if it is (self-reported) primarily motivated by desires to pay for agricultural investment, business, education, or medical procedures; it equals zero if savings are mainly for basic consumption (celebrations, personal items, household equipment). More patient individuals are, as expected, more likely to report a future-oriented savings goal. Women with a discount rate below the median future discount rate, for example, are 24.7 percentage points more likely to have future-oriented savings goal.

We observe sharp differences also for borrowing. For both men and women, the likelihood of borrowing rises with hyperbolic preferences and, in general, the level of future patience. The difference is particularly striking for women's borrowing from SHGs: 60.7 percent of women

with strongly hyperbolic preferences have a loan from a SHG compared to only 35.9 percent when women are time consistent.[14]

Preference reversal in the opposite direction (more patient now than in the future) predicts low saving levels and low borrowing activity, which complies with our earlier observation that these individuals are very poor.

Savings and borrowing: Regression results

In the textbook case of financial decision-making with time consistent preferences, the choices of individual *i* depend on her discount rate D_i^t, her level of risk aversion R_i, and both observed and unobserved conditioning factors, X_i and e_i. Thus the outcome Y_i is a simple function:

$$Y_i = f(D_i^t, R_i, X_i, e_i).$$

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

$$(1) \qquad Y_i = b_0 + b_1 D_i^t + b_2 H_i^s + b_3 H_i^w + b_4 F_i + b_5 R_i + b_6 X_i + e_i,$$

where Y_i is the financial behavior, D_i^t is a discount rate, H_i^s is a dummy indicating a strongly hyperbolic individual, H_i^w is a dummy for being weakly hyperbolic, F_i is a dummy for future-biased time inconsistency (dummy for time consistent preferences is omitted), R_i is a dummy for being risk averse, X_i is a vector of observable characteristics and e_i is an error

[14] It could be argued that the link between experimental choices and financial behavior results from arbitrage behavior in which individuals make choices in the experiments predicated on their ability to borrow against the future expected income from the pay-outs. In other words, they engage in arbitrage between the lab and their outside opportunities to borrow. For example, an impatient person could choose to wait in the experiment and receive a higher expected pay-out, but then borrow outside and repay the loan after receiving the pay-out. If arbitraged 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. While theoretically possible, 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 (and hence presumably have better access to borrowing), a result inconsistent with the arbitrage argument.

term for individual *i*. Standard errors are clustered at the village level. (Only minor changes in the results occur when we control for village fixed effects; Appendix, Table A1).

In general, more patient individuals are more likely to save. The behavioral economics literature complicates this notion by introducing multiple selves. We start by considering someone with hyperbolic preferences interested in saving. To capture the role of time inconsistencies, we run the specifications with two variations. In one, we use the current discount rate (based on questions in Table 3, Panel A) as a reference point, so $D_i^t = D_i^0$. In the second variant, we include the future discount rate (Table 3, Panel B), so $D_i^t = D_i^1$. When we control for the current discount rate, D_i^0, the coefficients b_2 and b_3 will estimate the difference in financial behavior for a hyperbolic person relative to the level predicted for a person with time consistent preferences and a similar level of patience in the current period. A large and significant coefficient on the hyperbolic indicators (b_2 and b_3) suggests that the current self does not prevail. Similarly, controlling for the future discount rate D_i^1 gives a comparison to a future self.

Ashraf et al. (2006) use a related specification in their analysis of a commitment savings product—with a slightly different interpretation. To see the difference, consider the case when there are only two values of each discount rate – high and low. There are then four types of individuals: patient and time consistent, impatient and time consistent, hyperbolic (current discount rate high, future discount rate low), and time inconsistent with a future bias (current discount rate low, future discount rate high).

Ashraf et al. (2006) apply the following specification:

$$(2) \qquad Y_i = a_0 + a_1 D_i^0 + a_2 D_i^1 + a_3 H_i + a_6 X_i + e_i .$$

The coefficient a_3 estimates the effect of being hyperbolic relative to time consistent or future biased individuals (here, it is not possible to also identify the coefficient on the dummy for being future-biased). A comparable version of our specification (1) can be written as

$Y_i = b_0^{'} + b_1^{'} D_i^t + b_3^{'} H_i + b_4^{'} F_i + b_6^{'} X_i + e_i$, where t=0,1. The difference is that we include only one of the discount rates and add the dummy for future biased individuals. When we control for current patience, the coefficient $b_3^{'}$ indicates a difference in behavior between the hyperbolic group and the time consistent impatient group, and it can be shown that $b_3^{'} = a_3 - a_2$. In the second version, where we control for future patience, the behavior of hyperbolic group is contrasted to the time consistent patient group and $b_3^{'} = a_3 + a_1$. Our specification generalizes this simple set-up.

In the analysis we compare how the behavior of the hyperbolic individuals departs from that of time consistent individuals, conditional on their level of patience. Two natural benchmarks arise: the level of patience associated with current patience (current self) and the level associated with future patience (future self). In equation (1) our two coefficients for hyperbolic preferences directly capture these departures, whereas the coefficient in Ashraf et al (2006) compares hyperbolic individuals to the average behavior of the group of time consistent and future-biased individuals.[15]

If individuals completely give in to their immediate temptations—that is, they are "naïve" hyperbolics—saving behavior should follow their current discount rate (i.e., D_i^0). The indicator variable for being hyperbolic should not enter strongly in the regression (i.e., $b_2 = b_3 = 0$), since saving behavior will be captured by the discount rate. But households are unlikely to be completely naïve. If they are "sophisticated," they appreciate the implications of $D_i^0 \neq D_i^1$, and adjust their behavior to the extent they can given the available mechanisms. In this case, commitment mechanisms might lead them to a situation in which a regression that has the future discount rate in it (i.e., D_i^1), also yields that $b_2 = b_3 = 0$. In this case, temptations would be completely held at bay. The parallel regression with the current

[15] See Appendix Table A2 for results from a specification in the spirit of Ashraf et al. (2006), in which both current and future discount rates are included instead of the dummy for future-biased preferences.

discount rate (D_i^0) would yield that $b_2 > b_3 > 0$. "Sophisticated" hyperbolics might also over-compensate by applying commitment devices that lead to even higher levels of saving than their future discount rates would suggest (a class of "sophisticated" behavior highlighted by O'Donoghue and Rabin 1999); here, $b_2 > b_3 > 0$ in the regression anchored by the future discount rate D_i^1.

An alternative situation, in which "sophisticated" individuals have no way to commit to saving, could result in their giving up and saving even less than the level predicted by current patience (i.e., $b_2, b_3 < 0$ when controlling for current patience). Here, individuals recognize that in the future they will have to permanently fight not to over-spend so they choose not to save so much in the first place (O'Donoghue and Rabin 1999).

The same patterns should hold for microcredit production loans, given the premise that they are investments and, due to the structure of microcredit contracts, entail delayed gratification. As with saving, people with hyperbolic preferences who do not recognize the tension with their future selves (or who are powerless to act), will simply follow their current discount rate D_i^0. Sophisticated individuals, when armed with effective commitment devices, will diverge from the pattern suggested by D_i^0. In the villages we study, the structure of microcredit loans can make them useful commitment devices for individuals seeking better ways to accumulate. Using a similar argument as in the case of saving with commitment, sophisticated hyperbolics would then be even more likely to borrow than predicted by the preferences of their future selves (i.e., $b_2 > b_3 > 0$ when controlling for D_i^1). The same pattern could reflect, directly, the need by hyperbolic borrowers to compensate for their saving difficulties. If this latter motivation drives behavior, then hyperbolic preferences should increase the demand for all loans, rather than microcredit loans specifically, a result we do not find for women.

Saving

Men and women who are more patient as predicted by the experiments save more. While for men hyperbolic preferences make little difference to overall saving levels (columns 2 and 4 of Table 11), they do for women. The evidence is consistent with men having better tools to cope with time inconsistencies. Specifically, hyperbolic women save substantially less than their future patience, as captured by D_i^1, suggests (Table 11, columns 3), a result that holds after controlling for observables. We see that via $b_2 < 0$. When controlling for current patience D_i^0, the coefficient for being hyperbolic is smaller and not statistically significant (column 1). This suggests that women's saving behavior follows their current patience level more closely than their future patience level. The results are qualitatively similar for weakly hyperbolic women, though measured with greater uncertainty. As expected, wealthier individuals report higher saving levels and more educated men also report significantly higher savings.

Preferences should also affect the purposes of saving. Table 12 turns to determinants of the self-reported purpose of savings. Similarly to Table 7, more patient men and women have more "future-oriented" savings goals, i.e. $b_1 < 0$. Having hyperbolic preferences matters relatively less. For hyperbolic women, future patience is a better predictor of the purpose of savings as indicated by positive significant coefficients on the hyperbolic indicators when controlling for current patience (column 1) and negative and not significant coefficients when controlling for future patience (columns 3). For hyperbolic men, current patience is a more accurate predictor of savings goals (columns 2 and 4). In general household heads and women are more likely to have future-oriented savings goals, as are married individuals and people with more education.

Hyperbolic preferences should, though, affect how people save. In Table 13 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.[16] 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.

Controlling for all of that, hyperbolic women adjust their savings practices to keep at home a lower proportion of their financial savings than the level predicted by their current selves (column 1). That is $b_2 < 0$. The future discount rate is a better predictor of their saving practices (column 3).

In sum, the experimentally-derived discount rates yield plausible predictions about saving behavior: patient people save more and have more "future-oriented" saving goals. Hyperbolic women save less than their future level of patience suggests they should. They do, though seem aware of the tension (and thus are not fully "naïve"). The clearest evidence thus far is seen in their systematically saving less at home.

Borrowing

The role of hyperbolic preferences continues to mark financial decisions when we turn to borrowing behavior. Hyperbolic people borrow more, a result consistent with both the greater need for borrowing to compensate for low saving levels and for workable commitment devices. As we show below, hyperbolic individuals have a particular demand for microcredit

[16] There are 82 individuals who report not having any savings (see Table 10 for more details on their characteristics) and it is not clear how to treat the share of home saving among non-savers. In Table 13 they were 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 13. In particular, strongly hyperbolic women save significantly less at home than predicted by their measured patience in the current period.

loans through SHGs, a finding that suggests the importance of commitment devices. As noted in the introduction, SHG loans have the advantages (in terms of disciplining mechanisms) of weekly loan installment schedules and public repayments within the villages.

In Table 14 we analyze the determinants of having a loan from any source: from a bank, a SHG or a moneylender. Patient women borrow more, a result in keeping with the working assumption that the loans are mainly taken for business investments and other forward-looking investments.[17] For women, being married, middle-aged, less educated, and having recently experienced a shock at the harvest increases the likelihood of borrowing.

Strongly hyperbolic women are 20 percentage points more likely to have a loan compared to the level predicted by the patience of their current self (column 1) and the coefficient on being hyperbolic is positive though not statistically significant when controlling for the preferences of the future self (column 3).

Although for men we also observe a positive correlation between being hyperbolic and having a loan, we can push the analysis further on the sample of women. First, borrowing by men is mainly restricted to banks, while there is substantial SHG borrowing activity among women in our sample (42.6 percent have an SHG loan versus only 13.9 percent of men). In addition, we didn't find lower savings for time-inconsistent men as we did for women, which suggests that they have other ways to cope with self-discipline problems not available to women.

We begin by studying how being hyperbolic affects the choice between different types of loans. In Table 15 the dependent variable is equal to one if an individual has a loan from an SHG. We can see that the results for women's discounting and borrowing in Table14 were largely driven by SHG loans. Strongly hyperbolic women are 36.4 percentage points more likely to borrow from SHGs than predicted by their current level of patience (column 1).

[17] 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.

In columns 5-8, we restrict the sample only to individuals who have a loan (independently of its provider) and do the same analysis. This restriction thus conditions on the generic demand for a loan and places the focus on loan type. Importantly, we still observe similar results for hyperbolic discounting. Conditional on borrowing, strongly hyperbolic 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 hyperbolic preferences. (SHG loans may have other advantages relative to alternative loans types, such as lower interest rates, but our focus here is on features that are particularly appealing to hyperbolics.) When future patience levels, D_i^1, are included in the specification, strongly hyperbolic women borrow at a rate even higher than those discount rates suggest. The result is explained by the combination of the disciplining effect of SHG loans and the desire to compensate for lower savings levels.

The interpretation above centers on self-control issues, and the results are robust to extending the specifications to include a measure of women's position within a household (to capture "spousal control" issues). Spousal control can be another motivating factor for why women seek commitment mechanisms; i.e., to keep money from husbands whose spending preferences vary from those of their wives (Anderson and Baland 2002). Theory predicts that women who have little autonomy from their husbands are unlikely to use a commitment device, as are women with substantial autonomy (since they do not need the protection of commitment).

As found by Anderson and Baland (2002), the action here comes from women with a mid-level of autonomy. We find evidence supporting the spousal control motive for borrowing behavior, but not for savings behavior. Women in the third quartile of our measure of women's position are the most likely to have a loan from SHGs (Table 15). 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 on hyperbolics are little changed by this extension.

7. 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 this as a focus, centering on ways that various contracting mechanisms 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 results from 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 women's choice to borrow in general, and the propensity to do so through local microcredit institutions specifically, is greater for women with hyperbolic preferences.

After controlling for the general preference for consuming today versus in the future, we find that women with time preferences exhibiting "strong" hyperbolic discounting save lower proportion of their savings at home (in keeping with self-discipline difficulties) and save less in total levels.

Borrowing through microcredit institutions can provide a partial solution to these problems. They provide a way to accumulate that is structured and regulated both by SHG loan officers and by fellow villagers.

The finding that hyperbolic women favor borrowing from SHGs can be partly explained by their difficulty saving, so they are less likely to be able to rely on their own resources for capital. Hence, the hyperbolic group is more likely to need to borrow than otherwise similar people undertaking comparable investments. Another explanation that has been a particular

focus above, is that the structure of microcredit loans provides a way to convert income flows into large sums through a device that—for the hyperbolic group—is more effective than the alternative of saving up. A third explanation is that the hyperbolic group is giving in to their desire for current consumption, driving up loan demand. Our result, though, holds even after controlling for the baseline degree of time discounting; the time preference variable should capture aspects of loan demand associated with the desire for current consumption.

The analysis 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 success may rest as well with their role in helping borrowers discipline their financial lives. The evidence helps to explain the puzzling existence of the regular repayment schedules used in nearly all microfinance loan contracts globally (Armendáriz and Morduch 2005). The evidence also helps to explain why microfinance institutions that drop the joint liability element of group lending from their contracts nonetheless have maintained regular repayment schedules and group meetings (Gine and Karlan 2008).

References

Ainslie, George W. 1992. *Picoeconomics.* Cambridge, UK: Cambridge University Press.

Andersen, Steffen, Glenn W. Harrison, Morten I. Lau, and E. E. Rutström. 2008."Eliciting Risk and Time Preferences." *Econometrica,* 76(3): 583.

Anderson, C. L., Maya Dietz, Andrew Gordon, and Marieka Klawitter. 2004."Discount Rates in Vietnam." *Economic Development and Cultural Change,* 52(4): 873-887.

Anderson, Siwan and Jean-Marie Baland. 2002."The Economics of Roscas and Intrahousehold Resource Allocation." *Quarterly Journal of Economics,* 117(3): 963-995.

Armendáriz De Aghion, Beatriz and Jonathan Morduch. 2005. *The economics of microfinance.* Cambridge, MA: MIT Press.

Ashraf, Nava, Dean Karlan, and Wesley Yin. 2006."Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines." *Quarterly Journal of Economics,* 121(2): 635-672.

Barr, Abigail. 2003. "Risk Pooling, Commitment, and Information: An Experimental Test of Two Fundamental Assumptions." Oxford University Centre for the Study of African Economies Working Paper CSAE.

Basu, Karna. 2007. "A Behavioral Model of Simultaneous Borrowing and Saving." http://www.cid.harvard.edu/neudc07/docs/neudc07_s3_p07_basu.pdf.

Bauer, Michal and Julie Chytilová. 2007. "The Impact of Education on Subjective Discount Rate in Ugandan Villages." http://ies.fsv.cuni.cz/storage/publication/3293_uganda.pdf.

Binswanger, Hans B. 1980."Attitudes Toward Risk: Experimental Measurement in Rural India." *American Journal of Agricultural Economics*, 62(3): 395-407.

Botelho, Anabela, Glenn W. Harrison, Pinto, Ligia M. Costa, E. E. Rutström and Paula Veiga. 2006. "Discounting in Developing Countries: Experimental Evidence from Timor-Leste."
http://www.econ.canterbury.ac.nz/downloads/discounting_in_developing_countries.pdf.

Cardenas, Juan C. and Jeffrey P. Carpenter. 2005. "Experiments and Economic Development: Lessons from Field Labs in the Developing World." Middlebury College Economics Discussion Paper No. 05-05.

Consultative Group to Assist the Poor [CGAP]. 2007. "Sustainability of Self-Help Groups in India: Two Analyses." CGAP Occasional paper No. 12.

Daley-Harris, Sam. 2007. "State of the Microcredit Summit Campaign Report 2007."
http://www.microcreditsummit.org/pubs/reports/socr/EngSOCR2007.pdf.

Duflo, Esther, Michael Kremer and Jonathan Robinson. 2006. "Why Don't Farmers use Fertilizer: Evidence from Field Experiments in Western Kenya."
http://www.iies.su.se/seminars/papers/070308.pdf.

Field, Erica and Rohini Pande. 2007. "Repayment Frequency and Default in Micro-Finance: Evidence from India." Forthcoming in Journal of European Economics Association Papers and Proceedings.

Frederick, Shane, George Loewenstein, and Ted O'Donoghue. 2002."Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature*, 40(2): 351-401.

Gine, Xavier and Dean Karlan. 2008. "Peer Monitoring and Enforcement: Long Term Evidence from Microcredit Lending Groups with and without Group Liability." http://research.yale.edu/karlan/downloads/bulak.pdf.

Gugerty, Mary K. 2007."You Can't Save Alone: Commitment in Rotating Savings and Credit Associations in Kenya." *Economic Development and Cultural Change,* 55: 251-282.

Harrison, Glenn W., Morten I. Lau, and Melonie B. Williams. 2002."Estimating Individual Discount Rates in Denmark: A Field Experiment." *American Economic Review,* 92(5): 1606-1617.

Harrison, Glenn W. and John A. List. 2004."Field Experiments." *Journal of Economic Literature,* 42(4): 1009-1055.

Jensen, Robert and Emily Oster. 2007. "The Power of TV: Cable Television and Women's Status in India." http://home.uchicago.edu/~eoster/tvwomen.pdf.

Karlan, Dean. 2005."Using Experimental Economics to Measure Social Capital and Predict Financial Decisions." *American Economic Review,* 95(5): 1688-1699.

Kirby, Kris N., Ricardo Godoy, Victoria Reyes-García, Elizabeth Byron, Lilian Apaza, William Leonard, Eddy Pérez, Vincent Vadez, and David Wilkie. 2002."Correlates of Delay-Discount Rates: Evidence from Tsimane' Amerindians of the Bolivian Rain Forest." *Journal of Economic Psychology,* 23(3): 291-316.

Knack, Stephen and Philip Keefer. 1997."Does Social Capital have an Economic Payoff? A Cross-Country Investigation." *Quarterly Journal of Economics,* 112(4): 1251-1288.

Laibson, David. 1997."Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics,* 112(2): 443-477.

Lederman, Daniel, Norman V. Loayza, and Ana M. Menendez. 2002." Violent Crime: Does Social Capital Matter?" *Economic Development and Cultural Change,* 50(3): 509-539.

Liu, Elaine. 2008. "Time to Change what to Sow: Risk Preferences and Technology Adoption Decisions of Cotton Farmers in China." PhD diss. Princeton University.

Mullainathan, Sendhil. 2005. "Development economics through the lens of psychology." In *Annual wold bank conference in development economics 2005: Lessons from experience,* ed. Francois Bourguignon and Boris Pleskovic, Oxford, UK: Oxford University Press.

National Bank for Agriculture and Rural Development [NABARD]. 2007. "Snapshot of SHG-Bank Linkage in India-March 2007." NABARD report.

O'Donoghue, Ted and Matthew Rabin. 1999."Doing it Now Or Doing it Later." *American Economic Review,* 89(1): 103-124.

Pender, John L. 1996."Discount Rates and Credit Markets: Theory and Evidence from Rural India." *Journal of Development Economics,* 50(2): 257-296.

Quisumbing, Agnes R. and John A. Maluccio. 2003."Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa." *Oxford Bulletin of Economics and Statistics,* 65(3): 283-328.

Rutherford, Stuart. 2000. *The poor and their money.* USA: Oxford University Press.

Schelling, Thomas C. 1984. *Choice and consequence.* Cambridge, MA: Harvard University Press.

Seibel, Hans D. and Stefan Karduck. 2005. "Transaction costs of self-help groups: A study of NABARD's SHG banking programme in india." In *Financial growth in india and china.* ed. Alagiri Dhandapani, Hyderabad: IFCAI Univ. Press.

Singh,Inderjit, Lyn Squire, and John Strauss. 1986. *Agricultural household models: Extensions, applications, and policy.* Baltimore, MD: Johns Hopkins University Press.

Strotz, Robert H. 1955."Myopia and Inconsistency in Dynamic Utility Maximization." *The Review of Economic Studies,* 23(3): 165-180.

Tanaka, Tomomi, Colin F. Camerer and Quang Nguyen. 2006. "Preferences, Poverty, and Politics: Field Experiments and Survey Data from Vietnam." http://www.hss.caltech.edu/~camerer/Vietnam.pdf.

Thomas, Duncan. 1990."Intra-Household Resource Allocation: An Inferential Approach." *Journal of Human Resources,* 26(1): 635-664.

Thomas, Duncan and Amar Hamoudi. 2006. "Do You Care? Altruism and Inter-Generational Exchanges in Mexico." California Center for Population Research Online Working Paper No. 008-06.

Yunus, Muhammad. 2002. "Toward eliminating poverty from the world: Grameen bank experience." In *Making progress: Essays in progress and public policy,* ed. C. Leigh Anderson and Janet W. Looney, Lanham: MD: Lexington Books.

Figure 1: Map of Karnataka and geographical location of Honavar and Haliyal Talukas

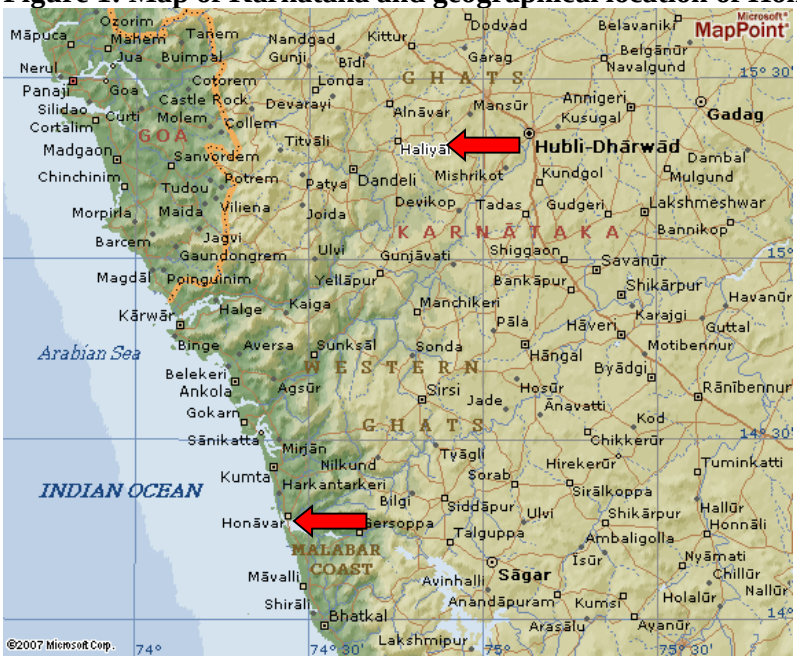

Table 1: Honavar and Haliyal Talukas - Descriptive Statistics

	Honavar	Haliyal
Total population	160,331	105,851
Number of villages	92	111
Rural literacy rate (%)	74	60
Total population/primary schools	629	868
Total population/secondary schools	5,529	15,122
Total population/bank facilities	4,581	26,463
Villages having post office (%)	63	28
Villages with paved road connection (%)	72	60

Note: Source: Indian Census 2001

Table 2: Sample characteristics, comparison with Karnataka averages (means, standard deviations)

	Total	Male	Female	Honavar	Haliyal	Karnataka*
Age (years)	36.822	38.128	35.496	36.759	36.885	36.300
	(11.756)	(12.091)	(11.274)	(11.060)	(12.443)	
Education (classes)	4.256	5.004	3.496	5.967	2.519	4.200
	(4.442)	(4.684)	(4.051)	(4.487)	(3.658)	
Illiterate	0.395	0.339	0.452	0.204	0.589	0.425
	(0.489)	(0.474)	(0.499)	(0.404)	(0.493)	
Married	0.786	0.796	0.777	0.729	0.844	0.670
	(0.410)	(0.404)	(0.417)	(0.445)	(0.363)	
Farmer	0.702	0.739	0.664	0.632	0.772	0.750**
	(0.458)	(0.440)	(0.473)	(0.483)	(0.420)	
Sample size	544	274	270	274	270	

Note: *Source: Indian Census 2001: data for the Karnataka population above 15. ** only rural population.

Table 3: Eliciting discount rates (payoffs)

	Panel A (current discount rate)	
	Tomorrow **Earlier reward**	After three months **Delayed reward**
choice 1	250	265
choice 2	250	280
choice 3	250	300
choice 4	250	330
choice 5	250	375
	Panel B (future discount rate)	
	After one year **Earlier reward**	After one year and three months **Delayed reward**
choice 1	250	265
choice 2	250	280
choice 3	250	300
choice 4	250	330
choice 5	250	375

Table 4: Eliciting attitude to risk (payoffs)

Prospect	Bad luck payoff (50%)	Good luck payoff (50%)
1	250	250
2	225	475
3	200	600
4	150	750
5	50	950
6	0	1000

Table 5: Definition of variables

Variables	Definition	Mean	Std dev
Experimental choices			
Current discount rate	6 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%, 0.14 if 32% < discount rate < 50%; 0.6= if 50% < discount rate	0.244	0.228
Future discount rate	6 values approximating 3-months discount rate in delayed 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%, 0.14 if 32% < discount rate < 50%; 0.6= if 50% < discount rate	0.193	0.221
Strongly hyperbolic	dummy; 1= current discount rate >> future discount rate, as defined in Table 9	0.199	0.399
Weakly hyperbolic	dummy; 1= current discount rate > future discount rate, as defined in Table 9	0.132	0.339
Patient now, impatient in the future	dummy, 1= current discount rate < future discount rate	0.096	0.294
Risk aversion	dummy, 1= if risk aversion above median (i.e. selects gamble (250,250) or (225,475) or (200,600)), 0= if risk aversion below median (i.e. if selects (150,750) or (50,950) or (0,1000))	0.452	0.498
Financial behavior			
Loan	Dummy; 1 = has an outstanding loan; 0 = doesn't have an outstanding loan	0.597	0.491
SHG loan	Dummy; 1 = has an outstanding loan from SHG; 0 = doesn't have an outstanding loan from SHG	0.281	0.450
Total savings	Rs. th. (savings in bank + savings in post office + SHG monthly contribution*average length of participation + home savings)	2.569	5.454
Share of home savings	Home savings /Total savings (%, only those who save)	0.333	0.386
Future oriented purpose of savings	Dummy; 1 = if the major purpose of savings is future-oriented (agricultural investment, business, education, doctor); 0 = if it focuses on current consumption (celebration, personal items, household equipment)	0.546	0.498
Socioeconomic characteristics			
Female	Dummy; 1 = female; 0 = male	0.496	0.500
Age	Age in years	36.822	11.756
Education	Years of schooling completed	4.256	4.442
Married	Dummy; 1 = married, divorced or widow; 0 = single	0.851	0.357
Household head	Dummy; 1 = household head; 0 = non household head	0.397	0.490
Position in the family	Position of a woman in a 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
Wealth index	Wealth index calculated by principal component analyses from questions on type of house, electricity connection, land ownership and dummies for possesion of 14 types of household equipment	0.000	1.893
Income in June < income in Sept.	Dummy; 1 = if income in June < income in September; 0 = if income in June >= income in September	0.496	0.500

Table 6: Experimental questions and individual characteristics (means, standard deviations)

	All	Female							Male						
	Total	Total	Education		Age		Wealth		Total	Education		Age		Wealth	
			Low	High	Young	Old	Low	High		Low	High	Young	Old	Low	High
Patience															
Current discount rate	0.244	0.218	0.241	0.191	0.205	0.234	0.236	0.197	0.270	0.338	0.197	0.259	0.281	0.307	0.232
	(0.228)	(0.212)	(0.223)	(0.195)	(0.207)	(0.218)	(0.219)	(0.202)	(0.239)	(0.254)	(0.199)	(0.242)	(0.237)	(0.248)	(0.225)
Future discount rate	0.193	0.159	0.180	0.135	0.164	0.154	0.186	0.133	0.226	0.294	0.152	0.230	0.221	0.267	0.184
	(0.221)	(0.193)	(0.209)	(0.170)	(0.202)	(0.183)	(0.209)	(0.173)	(0.240)	(0.267)	(0.182)	(0.247)	(0.234)	(0.259)	(0.213)
Time consistency															
Strongly hyperbolic preferences	0.199	0.207	0.223	0.189	0.192	0.226	0.222	0.187	0.190	0.204	0.174	0.164	0.216	0.188	0.191
	(0.399)	(0.406)	(0.418)	(0.393)	(0.395)	(0.420)	(0.417)	(0.391)	(0.393)	(0.405)	(0.381)	(0.372)	(0.413)	(0.392)	(0.395)
Weakly hyperbolic preferences	0.132	0.141	0.128	0.156	0.123	0.161	0.148	0.134	0.124	0.085	0.167	0.121	0.127	0.101	0.147
	(0.339)	(0.348)	(0.336)	(0.364)	(0.330)	(0.369)	(0.357)	(0.342)	(0.330)	(0.279)	(0.374)	(0.328)	(0.334)	(0.303)	(0.355)
Patient now, impatient in future	0.096	0.085	0.095	0.074	0.103	0.065	0.111	0.060	0.106	0.099	0.114	0.129	0.082	0.101	0.110
	(0.294)	(0.280)	(0.294)	(0.262)	(0.305)	(0.247)	(0.315)	(0.238)	(0.308)	(0.299)	(0.319)	(0.336)	(0.276)	(0.303)	(0.314)
Attitude to risk															
Risk averse	0.452	0.470	0.446	0.500	0.493	0.444	0.511	0.425	0.434	0.479	0.386	0.421	0.448	0.449	0.419
	(0.498)	(0.500)	(0.499)	(0.502)	(0.502)	(0.499)	(0.502)	(0.496)	(0.497)	(0.501)	(0.489)	(0.496)	(0.499)	(0.499)	(0.495)

Table 7: Determinants of discount rates

Dependent variable	Current discount rate			Future discount rate		
	All	Male	Female	All	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.070			-0.095		
	(0.033)**			(0.031)***		
Age	-0.013	-0.019	-0.007	-0.009	-0.017	-0.001
	(0.007)*	(0.013)	(0.010)	(0.006)	(0.007)**	(0.008)
$(Age)^2$	1.5e-04	2.2e-04	7.7e-05	8.4e-05	1.7e-04	-3.6e-06
	(8.0e-05)*	(1.4e-04)	(1.2e-04)	(6.0e-05)	(7.6e-05)**	9.4e-05
Education	-0.013	-0.018	-0.007	-0.015	-0.022	-0.007
	(0.003)***	(0.004)***	(0.005)	(0.003)***	(0.003)***	(0.005)
Wealth	8.5e-04	2.2e-05	0.004	0.002	0.006	5.5e-04
	(0.006)	(0.009)	(0.007)	(0.005)	(0.007)	(0.008)
Income in June < income in Sept	-0.011	-0.041	0.018	-0.020	-0.051	0.012
	(0.024)	(0.031)	(0.028)	(0.023)	(0.028)*	(0.029)
Farmer	-0.008	-0.035	0.017	-0.021	-0.029	-0.012
	(0.019)	(0.028)	(0.032)	(0.017)	(0.027)	(0.024)
Negative shock from harvest	0.032	0.036	0.032	0.045	0.035	0.056
	(0.027)	(0.028)	(0.041)	(0.028)	(0.036)	(0.036)
Married	0.032	0.048	0.042	0.031	0.076	0.005
	(0.035)	(0.073)	(0.065)	(0.041)	(0.062)	(0.061)
Household head	-7.4e-05	-0.020	0.034	-0.014	-0.036	-0.022
	(0.032)	(0.042)	(0.070)	(0.037)	(0.056)	(0.063)
Constant	0.547	0.717	0.306	0.483	0.693	0.201
	(0.117)***	(0.217)***	(0.150)*	(0.079)***	(0.111)***	(0.102)*
Observations	538	272	266	538	272	266
R-squared	0.09	0.15	0.03	0.11	0.17	0.04

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. OLS, standard errors corrected for clustering at the village level. For columns 1, 2, 3 the dependent variable is the "current discount rate" calculated from the binary choices between amount next day and after three months. It has 6 values calculated as arithmetic means of inferred ranges of discount rate. For columns 4, 5, 6 the dependent variable is the "future discount rate" calculated from the binary choices between amount after one year or amount after one year and three months.

Table 8: Distribution of responses to time preference questions (number of observations, %)

		Future discount rate						
		Patient					Impatient	Total
		DR=0.03	DR=0.06	DR=0.16	DR=0.26	DR=0.41	DR=0.60	
Patient	DR=0.03	126 23%	8 1%	6 1%	2 0%	2 0%	9 2%	**153** **28%**
	DR=0.09	37 7%	41 8%	3 1%	1 0%	4 1%	 0%	**86** **16%**
Current discount rate	DR=0.16	27 5%	18 3%	41 8%	4 1%	5 1%	 0%	**95** **17%**
	DR=0.26	14 3%	7 1%	12 2%	11 2%	3 1%	3 1%	**50** **9%**
	DR=0.41	1 0%	6 1%	2 0%	4 1%	4 1%	2 0%	**19** **3%**
Impatient	DR=0.60	34 6%	1 0%	11 2%	5 1%	1 0%	89 16%	**141** **26%**
Total		**239** **44%**	**81** **15%**	**75** **14%**	**27** **5%**	**19** **3%**	**103** **19%**	**544** **100%**

13.2% of individuals	"Weakly hyperbolic": More patient over future tradeoffs than current tradeoffs (next to the diagonal)
19.9% of individuals	"Strongly hyperbolic": More patient over future tradeoffs than current tradeoffs (further off the diagonal)
9.6% of individuals	"Patient now, impatient later": Less patient over future tradeoffs than current tradeoffs

Table 9: Determinants of time preference reversals

Dependent variable	Strongly hyperbolic preferences			Weakly hyperbolic preferences			Patient now, impatient in the future		
	All	Male	Female	All	Male	Female	All	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.005			0.052			-0.058		
	(0.050)			(0.064)			(0.034)*		
Age	0.014	0.008	0.020	-0.010	-0.004	-0.019	0.007	0.011	0.001
	(0.010)	(0.013)	(0.017)	(0.007)	(0.013)	(0.013)	(0.006)	(0.010)	(0.013)
$(Age)^2$	-1.3e-04	-6.7e-05	-2.1e-04	1.3e-04	7.1e-05	2.1e-04	-1.2e-04	-1.8e-04	-3.1e-05
	(1.1e-04)	(1.4e-04)	(2.1e-04)	(8.1e-05)	(1.3e-04)	(1.4e-04)	(7.6e-05)	(1.3e-04)	(1.7e-04)
Education	0.003	0.005	0.001	-1.2e-04	0.003	-0.003	-0.001	-0.003	0.002
	(0.004)	(0.005)	(0.006)	(0.006)	(0.008)	(0.010)	(0.004)	(0.005)	(0.008)
Wealth	0.002	0.005	-0.002	-0.006	-0.011	0.001	-0.010	-6.2e-04	-0.030
	(0.008)	(0.011)	(0.012)	(0.013)	(0.019)	(0.016)	(0.005)*	(0.010)	(0.009)***
Income in June < income in Sept.	0.026	0.037	0.015	-0.003	-0.043	0.036	-0.020	-0.049	-0.005
	(0.034)	(0.051)	(0.049)	(0.033)	(0.051)	(0.038)	(0.024)	(0.039)	(0.044)
Farmer	-0.060	-0.047	-0.077	0.061	0.046	0.079	-0.006	0.005	-0.032
	(0.030)**	(0.045)	(0.037)**	(0.046)	(0.056)	(0.064)	(0.030)	(0.049)	(0.046)
Negative shock from harvest	0.030	0.033	0.027	-0.052	-0.052	-0.055	-0.008	-0.002	-0.023
	(0.038)	(0.044)	(0.053)	(0.044)	(0.065)	(0.064)	(0.024)	(0.042)	(0.034)
Married	-0.077	-0.029	-0.141	0.027	-0.018	0.133	0.033	-0.109	
	(0.070)	(0.076)	(0.112)	(0.030)	(0.119)	(0.054)**	(0.033)	(0.096)	
Household head	-0.037	-0.027	-0.074	0.071	0.036	0.294	-0.047	0.040	
	(0.046)	(0.090)	(0.052)	(0.059)	(0.081)	(0.160)*	(0.036)	(0.044)	
Observations	538	272	266	538	272	266	538	272	203

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Probit, marginal effects reported, standard errors corrected for clustering at the village level. In column 1,2,3 the dependent variable "strongly hyperbolic preferences" equals to one if the current discount rate is higher than the future discount rate and the difference is "large" (see Table 8). Hence, these individuals exhibit hyperbolic time preferences. In column 4,5,6 the dependent variable "weakly hyperbolic preferences" equals to one if the current discount rate is higher than the future discount rate and the difference is "small" (see Table 8). In column 7, 8, 9 the dependent variable equals to one if the future discount rate is higher than the current discount rate. Hence, these individuals exhibit time inconsistency, but not in the direction associated with hyperbolicity.

Table 10: Time discounting and financial behavior (means, standard deviations)

	Total	Future discount rate		Time consistency			
		Low	High	Strongly hyperbol.	Weakly hyperbol.	Consist.	Pat. now, impat. in future
WOMEN							
Borrowing							
Loan	0.641	0.688	0.557	0.768	0.632	0.621	0.478
	(0.481)	(0.465)	(0.499)	(0.426)	(0.489)	(0.487)	(0.511)
SHG loan	0.426	0.457	0.371	0.607	0.447	0.359	0.391
	(0.495)	(0.500)	(0.486)	(0.493)	(0.504)	(0.481)	(0.499)
SHG loan (conditional on borrowin	0.665	0.664	0.667	0.791	0.708	0.579	0.818
	(0.473)	(0.474)	(0.476)	(0.412)	(0.464)	(0.496)	(0.405)
Saving							
Having any savings	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)
Share of home savings	0.191	0.182	0.208	0.164	0.148	0.194	0.306
only those having any savings	(0.303)	(0.291)	(0.326)	(0.278)	(0.260)	(0.307)	(0.388)
Future-oriented purpose of saving	0.591	0.680	0.433	0.589	0.632	0.579	0.609
	(0.493)	(0.468)	(0.498)	(0.496)	(0.489)	(0.495)	(0.499)
Number of observations	270	173	97	56	38	153	23
MEN							
Borrowing							
Loan	0.555	0.585	0.520	0.654	0.559	0.541	0.448
	(0.498)	(0.494)	(0.502)	(0.480)	(0.504)	(0.500)	(0.506)
SHG loan	0.139	0.163	0.110	0.173	0.059	0.157	0.069
	(0.346)	(0.371)	(0.314)	(0.382)	(0.239)	(0.365)	(0.258)
Saving							
Having any savings	0.836	0.884	0.780	0.827	0.794	0.855	0.793
	(0.371)	(0.321)	(0.416)	(0.382)	(0.410)	(0.353)	(0.412)
Total savings (Rs. th.)	3.113	3.350	2.839	3.221	3.206	3.267	1.967
	(7.154)	(6.375)	(7.979)	(5.148)	(5.093)	(8.539)	(2.682)
Share of home savings	0.479	0.442	0.527	0.440	0.375	0.500	0.546
only those having any savings	(0.407)	(0.399)	(0.415)	(0.432)	(0.353)	(0.414)	(0.376)
Future-oriented purpose of saving	0.502	0.517	0.484	0.346	0.559	0.516	0.643
	(0.501)	(0.501)	(0.502)	(0.480)	(0.504)	(0.501)	(0.488)
Number of observations	274	147	127	52	34	159	29

Table 11: Total savings (Rs. th.)

Dependent variable	Total savings (Rs. th.)			
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
Strongly hyperbolic	-0.422	0.333	-0.933	0.058
	(0.413)	(0.731)	(0.447)*	(0.791)
Weakly hyperbolic	-0.679	-0.618	-0.843	-0.983
	(0.628)	(1.008)	(0.650)	(1.153)
Current discount rate	-1.309	0.479		
	(0.740)*	(1.520)		
Future discount rate			-2.036	-1.622
			(0.882)**	(1.978)
Patient now, impatient in future	-1.165	-0.860	-0.768	-0.727
	(0.438)**	(0.719)	(0.390)*	(0.664)
Risk averse	-0.088	0.718	-0.071	0.706
	(0.281)	(0.765)	(0.287)	(0.761)
Age	0.265	0.351	0.262	0.316
	(0.090)***	(0.185)*	(0.091)**	(0.194)
$(Age)^2$	-0.003	-0.004	-0.003	-0.003
	(0.001)**	(0.002)*	(0.001)**	(0.002)*
Education	-0.020	0.226	-0.025	0.185
	(0.057)	(0.087)**	(0.057)	(0.077)**
Wealth	0.406	1.131	0.409	1.141
	(0.164)**	(0.385)***	(0.161)**	(0.395)**
Income in June < income in Sept.	0.279	-0.480	0.298	-0.574
	(0.264)	(0.735)	(0.268)	(0.777)
Farmer	0.153	0.109	0.144	0.038
	(0.392)	(1.116)	(0.379)	(1.101)
Negative shock from harvest	-0.097	-0.170	-0.038	-0.097
	(0.412)	(0.874)	(0.418)	(0.865)
Married	0.280	4.218	0.277	4.358
	(0.481)	(2.344)*	(0.495)	(2.385)*
Household head	0.721	-5.230	0.732	-5.302
	(0.704)	(1.881)**	(0.670)	(1.878)**
Position in the family	0.069		0.069	
	0.240		0.240	
$(Position\ in\ the\ family)^2$	-0.008		-0.007	
	(0.025)		(0.025)	
Constant	-2.881	-5.203	-2.670	-3.702
	(1.238)**	(3.754)	(1.271)**	(3.926)
Observations	249	272	249	272
R-squared	0.17	0.24	0.18	0.24

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. OLS, standard errors corrected for clustering at village level. Total savings are calculated as a sum of savings on a bank account, in a post office, contributions to SHGs and financial savings held at home.

Table 12: Future-oriented purpose of savings

Dependent variable	Future oriented purpose of savings			
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
Strongly hyperbolic	0.130	-0.106	-0.068	-0.252
	(0.078)*	(0.080)	(0.081)	(0.101)**
Weakly hyperbolic	0.014	-0.011	-0.037	-0.027
	(0.077)	(0.107)	(0.075)	(0.111)
Current discount rate	-0.615	-0.479		
	(0.142)***	(0.160)***		
Future discount rate			-0.591	-0.389
			(0.176)***	(0.189)**
Patient now, impatient in future	-0.048	0.059	0.087	0.194
	(0.134)	(0.119)	(0.128)	(0.114)*
Risk averse	-0.073	-0.075	-0.085	-0.077
	(0.098)	(0.083)	(0.101)	(0.085)
Age	0.044	-0.029	0.044	-0.027
	(0.021)**	(0.022)	(0.021)**	(0.022)
$(Age)^2$	-6.5e-04	3.4e-04	-6.5e-04	3.2e-04
	(2.8e-04)**	(2.4e-04)	(2.8e-04)**	(2.4e-04)
Education	0.024	0.005	0.024	0.006
	(0.013)*	(0.011)	(0.013)*	(0.011)
Wealth	0.029	0.009	0.028	0.010
	(0.025)	(0.028)	(0.025)	(0.028)
Income in June < income in Sept.	0.121	0.034	0.121	0.034
	(0.055)**	(0.075)	(0.061)**	(0.076)
Farmer	0.077	0.101	0.073	0.110
	(0.074)	(0.122)	(0.072)	(0.121)
Negative shock from harvest	0.039	0.197	0.050	0.184
	(0.096)	(0.084)**	(0.096)	(0.083)**
Married	0.236	0.008	0.225	0.022
	(0.133)*	(0.114)	(0.134)*	(0.116)
Household head	0.369	0.180	0.373	0.174
	(0.087)***	(0.093)*	(0.084)***	(0.092)*
Position in the family	0.246		0.250	
	(0.098)**		(0.100)**	
$(Position\ in\ the\ family)^2$	-0.030		-0.030	
	(0.014)**		(0.015)**	
Observations	248	271	248	271

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Probit, marginal effects reported, standard errors corrected for clustering at village level. Future-oriented purpose of savings is a dummy variable equal to 1, if the major purpose of savings is future-oriented (agricultural investment, business, education, doctor), and equal to 0, if it focuses on current consumption (celebration, personal items, household equipment).

Table 13: Share of home savings

Dependent variable	Share of home savings			
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
Strongly hyperbolic	-0.313	-0.147	-0.089	-0.045
	(0.146)**	(0.124)	(0.079)	(0.108)
Weakly hyperbolic	-0.056	-0.010	-0.003	0.029
	(0.090)	(0.097)	(0.085)	(0.096)
Current discount rate	0.655	0.187		
	(0.235)***	(0.342)		
Future discount rate			0.605	0.358
			(0.265)**	(0.369)
Patient now, impatient in future	0.273	0.061	0.129	-0.022
	(0.123)**	(0.134)	(0.113)	(0.143)
Risk averse	-0.169	-0.046	-0.155	-0.042
	(0.088)*	(0.086)	(0.091)*	(0.086)
Age	-0.058	-0.001	-0.060	0.002
	(0.022)***	(0.030)	(0.023)***	(0.030)
$(Age)^2$	6.2e-04	2.3e-06	6.5e-04	-2.9e-05
	(2.6e-04)**	(3.5e-04)	(2.7e-04)**	(3.5e-04)
Education	-0.006	-0.041	-0.006	-0.038
	(0.010)	(0.013)***	(0.010)	(0.013)***
Wealth	0.017	-0.086	0.018	-0.087
	(0.021)	(0.022)***	(0.020)	(0.022)***
Income in June < income in Sept.	0.116	-0.069	0.119	-0.060
	(0.059)*	(0.113)	(0.059)**	(0.116)
Farmer	0.094	0.284	0.098	0.286
	(0.101)	(0.130)**	(0.100)	(0.128)**
Negative shock from harvest	-0.158	0.032	-0.164	0.032
	(0.114)	(0.117)	(0.116)	(0.115)
Married	0.278	-0.424	0.283	-0.441
	(0.138)**	(0.151)***	(0.136)**	(0.150)***
Household head	0.336	0.085	0.327	0.094
	(0.187)*	(0.152)	(0.182)*	(0.149)
Position in the family	0.006		-0.003	
	(0.081)		(0.084)	
$(Position\ in\ the\ family)^2$	0.003		0.003	
	(0.010)		(0.011)	
Constant	0.896	0.895	0.937	0.769
	(0.558)	(0.622)	(0.582)	(0.638)
Observations	213	227	213	227

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Tobit (lower limit = 0; upper limit =1), standard errors corrected for clustering at village level. Share of home savings is equal to home savings divided by total savings. Only respondents with positive total savings are included.

Table 14: Having loan

Dependent variable	Loan			
	Female (1)	Male (2)	Female (3)	Male (4)
Strongly hyperbolic	0.203	0.142	0.085	0.168
	(0.075)***	(0.074)*	(0.086)	(0.078)**
Weakly hyperbolic	-0.007	0.071	-0.050	0.100
	(0.082)	(0.060)	(0.085)	(0.060)*
Current discount rate	-0.340	-0.021		
	(0.133)**	(0.147)		
Future discount rate			-0.514	0.149
			(0.188)***	(0.164)
Patient now, impatient in future	-0.246	-0.070	-0.143	-0.087
	(0.120)**	(0.123)	(0.107)	(0.130)
Risk averse	0.052	0.212	0.061	0.213
	(0.068)	(0.061)***	(0.067)	(0.063)***
Age	0.068	0.017	0.067	0.020
	(0.019)***	(0.018)	(0.020)***	(0.018)
$(Age)^2$	-8.7e-04	-2.1e-04	-8.7e-04	-2.4e-04
	(2.4e-04)***	(2.0e-04)	(2.6e-04)***	(2.0e-04)
Education	-0.021	0.003	-0.023	0.006
	(0.010)**	(0.013)	(0.010)**	(0.014)
Wealth	0.013	0.026	0.014	0.025
	(0.033)	(0.017)	(0.034)	(0.017)
Income in June < income in Sept.	-0.049	0.005	-0.043	0.013
	(0.063)	(0.063)	(0.062)	(0.066)
Farmer	0.081	0.180	0.079	0.186
	(0.071)	(0.051)***	(0.071)	(0.053)***
Negative shock from harvest	0.102	0.124	0.121	0.119
	(0.056)*	(0.096)	(0.056)**	(0.097)
Married	0.379	0.173	0.385	0.162
	(0.141)***	(0.133)	(0.140)***	(0.137)
Household head	0.119	-0.123	0.121	-0.117
	(0.157)	(0.115)	(0.150)	(0.113)
Position in the family	0.138		0.143	
	(0.065)**		(0.064)**	
$(Position\ in\ the\ family)^2$	-0.012		-0.012	
	(0.008)		(0.008)	
Observations	249	272	249	272

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Probit, marginal effects reported, standard errors corrected for clustering at village level. The dependent variable equals to one, if an individual has an outstanding loan from a bank, SHG or moneylender.

Table 15: Having SHG loan

Dependent variable	SHG loan							
	Whole sample				Conditional on having a loan			
	Female (1)	Male (2)	Female (3)	Male (4)	Female (5)	Male (6)	Female (7)	Male (8)
Strongly hyperbolic	0.364	0.048	0.225	0.014	0.285	0.029	0.212	-0.018
	(0.082)***	(0.037)	(0.088)**	(0.043)	(0.081)***	(0.062)	(0.085)**	(0.071)
Weakly hyperbolic	0.064	-0.099	0.019	-0.100	0.070	-0.205	0.041	-0.211
	(0.087)	(0.041)**	(0.085)	(0.042)**	(0.104)	(0.074)***	(0.108)	(0.075)***
Current discount rate	-0.365	-0.104			-0.270	-0.129		
	(0.145)**	(0.106)			(0.147)*	(0.174)		
Future discount rate			-0.596	-0.069			-0.397	-0.149
			(0.201)***	(0.095)			(0.205)*	(0.169)
Patient now, impatient in future	-0.046	-0.090	0.073	-0.073	0.236	-0.137	0.255	-0.104
	(0.113)	(0.035)**	(0.112)	(0.045)	(0.073)***	(0.087)	(0.068)***	(0.106)
Risk averse	0.056	0.042	0.061	0.041	0.016	-0.005	0.012	-0.007
	(0.073)	(0.047)	(0.073)	(0.048)	(0.083)	(0.087)	(0.085)	(0.086)
Age	0.072	-0.009	0.072	-0.008	0.041	-0.024	0.044	-0.024
	(0.026)***	(0.015)	(0.026)***	(0.015)	(0.036)	(0.024)	(0.036)	(0.024)
$(Age)^2$	-9.1e-04	7.2e-05	-9.1e-04	6.2e-05	-5.1e-04	2.5e-04	-5.5e-04	2.5e-04
	(3.1e-04)***	(1.7e-04)	(3.2e-04)***	(1.7e-04)	(4.4e-04)	(2.6e-04)	(4.5e-04)	(2.7e-04)
Education	-0.021	0.002	-0.022	0.003	-0.008	0.004	-0.009	0.004
	(0.011)*	(0.006)	(0.011)**	(0.006)	(0.012)	(0.008)	(0.012)	(0.008)
Wealth	-0.003	0.012	-0.001	0.012	-0.015	0.014	-0.014	0.014
	(0.026)	(0.010)	(0.027)	(0.009)	(0.023)	(0.020)	(0.023)	(0.020)
Income in June < income in Sept	-0.060	0.048	-0.054	0.048	-0.080	0.087	-0.077	0.084
	(0.080)	(0.049)	(0.081)	(0.050)	(0.097)	(0.081)	(0.099)	(0.084)
Farmer	-0.027	-0.060	-0.035	-0.058	-0.078	-0.222	-0.081	-0.223
	(0.067)	(0.045)	(0.066)	(0.044)	(0.096)	(0.110)**	(0.096)	(0.110)**
Negative shock from harvest	0.170	0.066	0.194	0.062	0.133	0.079	0.140	0.075
	(0.086)**	(0.054)	(0.089)**	(0.054)	(0.093)	(0.089)	(0.095)	(0.089)
Married	0.271	0.087	0.273	0.086	0.269	0.109	0.289	0.113
	(0.102)***	(0.070)	(0.108)**	(0.072)	(0.270)	(0.124)	(0.270)	(0.125)
Household head	0.141	-0.008	0.152	-0.009	0.175	-0.004	0.188	-0.008
	(0.191)	(0.077)	(0.187)	(0.077)	(0.162)	(0.142)	(0.157)	(0.142)
Position in the family	0.220		0.229		0.228		0.232	
	(0.064)***		(0.065)***		(0.085)***		(0.088)***	
$(Position\ in\ the\ family)^2$	-0.022		-0.023		-0.024		-0.025	
	(0.009)**		(0.009)**		(0.012)**		(0.012)**	
Observations	249	272	249	272	159	152	159	152

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Probit, marginal effects reported, standard errors corrected for clustering at village level. The dependent variable equals to one, if an individual has an outstanding loan from SHG. In columns 1-4 the whole sample is included, in columns 5-8 only those with some loan are included.

Appendix

Table A1: Hyperbolic preferences and financial behavior with village fixed effects

	Relative to current patience		Relative to future patience	
	Female	Male	Female	Male
	(1)	(2)	(3)	(4)
Dependent variable	**Total savings (Rs. th.)**			
Strongly hyperbolic	-0.418	0.745	-0.944	0.116
	(0.449)	(1.122)	(0.440)**	(1.187)
Weakly hyperbolic	-0.342	-0.704	-0.490	-1.119
	(0.529)	(1.322)	(0.529)	(1.351)
Dependent variable	**Future oriented purpose of savings**			
Strongly hyperbolic	0.126	-0.040	-0.038	-0.210
	(0.096)	(0.100)	(0.103)	(0.098)**
Weakly hyperbolic	0.012	0.089	-0.026	0.069
	(0.123)	(0.115)	(0.127)	(0.119)
Dependent variable	**Share of home savings**			
Strongly hyperbolic	-0.184	-0.136	0.009	-0.036
	(0.087)**	(0.126)	(0.082)	(0.127)
Weakly hyperbolic	0.014	-0.044	0.067	-0.008
	(0.099)	(0.144)	(0.100)	(0.146)
Dependent variable	**Loan**			
Strongly hyperbolic	0.225	0.171	0.094	0.222
	(0.087)**	(0.090)*	(0.101)	(0.090)**
Weakly hyperbolic	-0.027	0.126	-0.063	0.162
	(0.121)	(0.104)	(0.124)	(0.103)
Dependent variable	**SHG loan**			
Strongly hyperbolic	0.386	0.055	0.209	0.026
	(0.098)***	(0.051)	(0.105)**	(0.045)
Weakly hyperbolic	0.045	-0.063	-0.005	-0.064
	(0.125)	(0.022)***	(0.124)	(0.022)***
Dependent variable	**SHG loan (conditional on having a loan)**			
Strongly hyperbolic	0.314	0.038	0.238	-0.021
	(0.078)***	(0.092)	(0.095)**	(0.087)
Weakly hyperbolic	-0.007	-0.183	-0.049	-0.187
	(0.162)	(0.050)***	(0.169)	(0.050)***
Current discount rate	yes	yes	no	no
Future discount rate	no	no	yes	yes
Patient now, impatient in future	yes	yes	yes	yes
Observable characteristics	yes	yes	yes	yes
Village fixed effects	yes	yes	yes	yes

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Probit for dependent variables Future oriented purpose of savings, Loan, SHG loan and SHG loan (conditional on having a loan); marginal effects reported. OLS for Total savings. Tobit (lower limit = 0; upper limit =1) for Share of home savings. In columns 1 and 2 the current discount rate is controlled for. In columns 3 and 4 the future discount rate is controlled for. In all columns we also control for dummy for having future-biased preferences, risk aversion, all other observable characteristics used in Tables 11-15 and village fixed effects.

Table A2: Hyperbolic preferences and financial behavior: alternative specification

	Saving					
Dependent variable	Total savings (Rs. th.)		Future-oriented purpose of savings		Share of home savings	
	Female	Male	Female	Male	Female	Male
Strongly hyperbolic	-1.777	-1.763	0.080	-0.036	-0.185	0.154
	(0.640)**	(1.451)	(0.201)	(0.143)	(0.188)	(0.203)
Weakly hyperbolic	-1.247	-2.314	-0.033	-0.012	-0.004	0.273
	(0.890)	(1.752)	(0.130)	(0.116)	(0.136)	(0.182)
	Borrowing					
Dependent variable	Loan		SHG loan		SHG loan	
	Female	Male	Female	Male	Female	Male
Strongly hyperbolic	0.030	0.241	0.289	-0.043	0.365	-0.117
	(0.124)	(0.138)*	(0.132)**	(0.058)	(0.113)***	(0.119)
Weakly hyperbolic	-0.079	0.148	0.023	-0.075	0.134	-0.172
	(0.138)	(0.078)*	(0.129)	(0.044)*	(0.102)	(0.071)**

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors corrected for clustering at village level. Probit for dependent variables Future oriented purpose of savings, Loan, SHG loan and SHG loan (conditional on having a loan); marginal effects reported. OLS for Total savings. Tobit (lower limit = 0; upper limit =1) for Share of home savings. Table reports the coefficients after controlling for dummies for each level of current discount rate, dummies for each level of future discount rate (as in Ashraf et al. 2006), risk aversion and all other observable characteristics used in Tables 11-15.

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