The economics and psychology of long term savings and pensions: a randomised experiment among low-income entrepreneurs in Maharashtra, India

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Note to readers

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Contents

List of Tables and Figures

1. Introduction

This research project fills a specific niche in our understanding of savings behavior. In particular, we examine determinants of long-term savings among low-income households. As we argue below, long-term savings is fundamentally different from short-term savings (which has been more widely researched), and is a subject of particular importance for developing economies.

Over the past few years, much has been made of the potential demographic dividends from India's population. Without corresponding growth in formal employment, this is more likely to be a demographic burden. Approximately 85% of India's workforce is engaged in the informal sector without access to social security benefits accorded to those employed in the organized sector. Social changes such as the decline of joint families and migration to urban areas have increased the vulnerability of low-income households and some segments of the population, such as the elderly.

It is widely accepted that access to banking can provide both growth and security to vulnerable households. It is also well understood that poor households, especially in developing countries, tend to be underserved by credit markets. In recent decades, the question of credit has emerged as a major focus in development economics.

Much existing research has studied credit through the lens of moral hazard and adverse selection (Debraj Ray, Development Economics, 1998). As a result of problems of asymmetric information, the poor might be denied access to loans. This in turn could restrict their ability to invest in income-generating activities, buy durable goods, or deal with income shocks. Several recent papers have shown how microfinance and other forms of informal banking can provide creative solutions to the problem of asymmetric information, once again opening up (limited) credit for the poor (Beatriz Armendariz & Jonathan Morduch, The Economics of Microfinance, 2007). Despite the obvious advantages afforded by microfinance, however, the evidence of its impact on welfare is mixed (Abhijit Banerjee, Esther Duflo, Rachel Glennerster, & Cynthia Kinnan, "The Miracle of Microfinance? Evidence from a Randomized Evaluation", 2009).

As a consequence, there has been a growing interest in the potential of pure savings to also help households achieve better financial outcomes. This has been partly motivated by research in behavioral economics which demonstrates that individuals might have self-control problems, or time-inconsistent preferences (Nava Ashraf, Dean Karlan, & Wesley Yin, " Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines", QJE, 2006). This suggests that access to basic secure savings instruments is insufficient; in addition, individuals need commitment savings—savings accounts with penalties for early withdrawal (Karna Basu, "Commitment Savings in Informal Banking Markets", JDE, 2014). Furthermore, papers in behavioral economics demonstrate that a number of other features that might have been considered extraneous to financial decision-making do, in fact, matter (Marianne Bertrand, Dean Karlan, Eldar Shafir, Sendhil Mullainathan, & Jonathan Zinman, "What's Advertising Content Worth? Evidence from a Consumer Credit Marketing Field Experiment" , QJE, 2010).

Given that individuals in developing countries have less access to complex savings instruments that offer commitment, there appears to be a large untapped potential for economic empowerment through the provision of such services. A number of recent field experiments (see Ashraf, Karlan, & Yin, 2006, above) convincingly demonstrate this. They also show that the design and marketing of such products can play an important role.

Our concern with long-term savings is specifically regarding the determinants of demand – such as household characteristics, financial awareness and institutional features. The motivations for long-term savings are fundamentally different from short-term savings. Here, the objective is not investment or the purchase of durable goods; rather, savings can improve one's ability to cope with both anticipated day-to-day expenses and unanticipated medical expenses at a time when income flows are low to nonexistent. This is a particularly urgent concern for low-income households in developing countries for two reasons. First, as traditional models of long-term security get diluted through the dissolution of the joint family, those who do not have access to their own savings instruments remain the most vulnerable. Second, long-term financial decision-making is inherently difficult, even for those who are financially highly literate. In most formal occupations, for example, the employer makes these decisions on the behalf of the individual (Richard Thaler & Shlomo Benartzi, "Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving", JPE, 2004).

Given the background above, our research program can be seen as having a twofold motivation:

(a) How can behavioral economics inform long-term savings behavior, and how does this differ from short-term savings behavior?

(b) How do socioeconomic and institutional characteristics affect the take-up of long-term savings?

While addressing these questions, we hope to also understand the extent of under-saving for old-age consumption and thereby inform policy and the development of new financial products for the poor.

In this research, we use a novel combination of survey data, field experiment data, and real-world banking behavior to understand the long-term savings decisions of the poor. Our primary intervention consists of a two-part randomized trial designed to encourage takeup of a long-term savings instrument. The target population consists of low-income households in Maharashtra. In the first part of our study, we exposed a fraction of our target population to three framing treatments that delivered information in different ways. While the interventions revealed a clear interest in takeup, they also revealed large institutional hurdles for households. In the second part of the study, we methodically lift these hurdles and analyze their impacts on takeup.

This report describes the initial results from our empirical analysis of a randomized controlled trial of innovative approaches to encourage adoption of a long-term savings product in Maharashtra, India. As we explain below, the results are extremely encouraging. Our second round of interventions appears to have substantial impacts on adoption—adoption rates under treatments are 37%-20% higher than under control.

These results should be of interest to policymakers and practitioners in spheres related to banking for low-income households.

Our final research output is expected to comprise three papers, described below.

First, we will produce and circulate a version of the primary paper, which investigates determinants of takeup of pension savings and, to a lesser extent, patterns of savings and welfare implications. Our primary outcome of interest will be pension plan adoption, and our secondary outcomes of interest will be patterns of deposits, changes in overall financial behavior, and self-reported measures of welfare. Our primary explanatory variables will be the treatment assignments, while socioeconomic characteristics, time preferences, and financial literacy will serve as controls or interaction variables. This will allow us to address the role of framing and transaction costs in pension adoption. The role of our explanatory variables has not been studied in the existing literature, and we are confident this paper will contribute to important questions in both development economics and behavioral economics.

We will subsequently also write two papers of academic interest. One will focus on the relationship between hypothetically elicited time preferences and actual financial behavior. Several papers in economics elicit time preferences using hypothetical questions, and we would like to understand to what extent these preferences are reflected in actual decisions. Using data on lockbox deposits, pension savings, and short term commitment savings (Mann Deshi Bank's Pigmy accounts), we will be able to generate valuable correlations between financial decisions and elicited preferences.

Finally, we will use our data on financial literacy to develop a more refined model of the types of financial mistakes consumers might make. This should help build improved targeted financial education programs.

All components of this study have been solely funded by International Initiative for Impact Evaluation.

The structure of this report is as follows: the next section outlines the research questions and hypotheses addressed by the study; section 3 describes the context in which the study has been conducted and the concerns of representativeness and external validity; section 4 contains a timeline of all the stages of the study; the details of the intervention and its implementation are in section 5; section 6 deals with the sampling strategy for the study; the empirical results are presented in section 7; section 8 provides a discussion and section 9 concludes and address some policy implications of the study.

2. Theory of Change and Hypotheses

Research in behavioural economics has indicated that people do not always make the best long-term decisions. This can be due to inconsistencies in their preferences, behavioural biases or self control problems. Previous studies suggest that in even societies with a high level of financial literacy, individuals are better off with a "nudge" to help them make better choices (Sunstein, Cass and Richard Thaler, 2012,Nudge: Improving Decisions about Health, Wealth, and Happiness, Penguin Books).

A committment savings device, which is the focus of this study, enables people to restrict access to their accumulated savings thereby correcting for their self-control problems or inconsistencies. Through some as yet untested marketing interventions and incentives, our study aims to address the gap in the literature on adoption of long-term committment savings in the context of a developing country like India.

This randomised control trial is conducted among low-income households in rural and semi-urban Maharashtra. The sample, selected from the clients of Mann Deshi Mahila Sahakari Bank, has access to formal banking and posseses varying levels of financial literacy. They are well poised to be introduced to slightly more sophisticated instruments such as long-term savings or pension products (e.g. UTI Retirement Benefit Fund). Prior to our experiment, the UTI Retirement Benefit Fund was an existing option for the clients of Mann Deshi Bank. However, due to certain reasons (dicussed in later sections) adoption was considerably low. The design of our project seeks to inform policy on how takeup rates respond to how the product is framed, what incentives or initial assistance are given, socioeconomic and behavioural profiles of households.

The marketing treatments that we implement in the first part of our study highlight different aspects of the savings product, e.g. emphasis on the “hard-commitment” or the penalty feature. By offering some clients a seemingly less flexible product we can observe whether there is a revealed preference for commitment in order to avoid self control problems or inconsistencies in their choices. The second part of our study aims to lift the administrative hurdles in the takeup process, e.g. filling up forms. This intervention will reveal how assistance with the signing up process affects takeup and future deposits. Considering the evolution of the pensions market in India (see section 8), this experiment will help policymakers identify and consequently, ease the bottlenecks on the demand side.

The two experiments therefore test two distinct sets of hypotheses. In the first, we ask whether framing and marketing, while leaving all contractual terms including costs and benefits the same, can induce takeup. In the second, we ask whether a small nudge, comprising reduced administrative costs or a token reward, can induce takeup. In the context of this study, the answer to the first set of questions appears to be no, while the answer to the second set is an unambiguous yes.

To summarize, our research questions are the following:

- Is there an untapped demand for long-term savings?
- Do long-term savings decisions depend on the way the savings product is framed?
- Do long-term savings decisions depend on the salience of future needs?
- Do long-term savings decisions depend on initial administrative costs?
- Does adoption of long-term savings alter consumption and savings behavior along other dimensions?
- Are socioeconomic determinants of long-term savings similar to the socioeconomic determinants of short-term savings?

The null hypothesis, if markets functioned smoothly and individual decision-making followed standard economic axioms, is that the answer to the first four questions is “no”. However, as described above, there is reason to believe that markets are incomplete and that individuals suffer from biases in decision-making. Our study is designed to disentangle several of these mechanisms.

Our data analysis is based on surveys and administrative data. The analysis will have several components. The first and most important category of outcomes relates to long-term savings accounts: attempts to take-up, actual take-up, and deposit behavior. Due to randomization, we can identify the impact of treatments (in both the original and extended interventions) through a test of simple differences. These results are reported in the current report.

While the paragraph above lays out the basic program evaluation, our intention is to acquire a deeper and more structural understanding of savings behavior. To this end, some of the continuing data analysis will involve examining the relationship between adoption and time preferences, and impacts of adoption on other financial behavior.

Our policy question, embedded in the research agenda, is the following: how can long-term savings products be framed and designed so as to serve as a viable instrument for long-term financial security? Next, we list some preliminary results from baseline and takeup data.

As explained in detail in Section 5, we implemented two experiments. In the first experiment, the sample of participants was randomly allotted to one of four groups: T1 (offered the savings product with emphasis on penalty for early withdrawal), T2 (offered the savings product with emphasis on flexibility related to early withdrawal), T3 (offered the savings product as in T1 but with the option of more frequent deposits), and a control.

The second experiment was run on a smaller sample (a sub-sample of the above). Participants were randomly allotted to one of five groups: A (offer of assistance filling out the enrollment form and first deposit free), B (offer of assistance filling out the enrollment form and third deposit free), C (offer of assistance filling out the enrollment form), D (reminder information about the savings product but no assistance), and a control.

We first conduct some balance checks. These ensure that randomization was carried out properly and also provide some description of the typical participant in our study. We look at some standard variables that will also serve as potential controls in the program evaluation. Age, Number of years of education, Household size, Income (monthly), Total savings balance (across accounts), and Total loan balance (across accounts) are easy to interpret. In addition, we include Time preferences from a series of hypothetical questions (higher values indicate greater impatience) and Financial literacy from a series of hypothetical questions (higher values indicate greater financial sophistication).

Table 1 below provides balance checks for the first experiment. We find that there were no significant differences between treatments and control.

Table 1:Balance checks for 1st intervention

Covariates	Treatment Assignment[1]				P-value
	Control	T1	T2	T3	
Age	36.1 (9.53)	35.9 (9.46)	35.8 (9.37)	35.9 (9.13)	0.962
Number of years of education	6.53 (3.41)	6.50 (3.31)	6.41 (3.34)	6.41 (3.34)	0.845
Household size	5.35 (2.24)	5.63 (2.76)	5.39 (2.50)	5.46 (2.49)	0.116
Income	3,434 (16,511)	3,608 (13,753)	2,845 (9,069)	3,628 (14,699)	0.626
Time Preferences	0.662 (1.89)	0.462 (1.98)	0.433 (1.92)	0.385 (1.81)	
Financial Literacy	3.11 (1.01)	3.15 (0.934)	3.13 (1.02)	3.11 (0.983)	0.833
Total Savings balance	15,106 (37,410)	15,115 (45,392)	13,448 (28,833)	16,849 (83,687)	0.639
Total Loan balance	79,974 (254,689)	76,965 (191,228)	59,037 (144,554)	83,590 (306,926)	0.142
Sample Size	827	826	826	827	

Note: The sample size in each treatment group applies to all covariates, except for time preferences (TP) and financial literacy (FL). The sample sizes for the treatment groups for TP and FL are 788, 738, 749 and 729 respectively. The difference in sample size arises since TP and FL data are only elicited from takeup survey data, and not baseline survey data.

Table 2 provides balance checks for the second experiment. Since that experiment was implemented for a smaller sample, control averages are different from above (but similar).

As we can see below, for the second experiment, only age is significantly different between the control and treatment groups. Yet, this difference seems economically minor.The table reveals that the average respondent is of an ideal age to respond to our treatments, has had some years of formal education, and yet has a low savings balance (especially relative to loans). The financial literacy variables indicates the average number of correct responses in a module consisting of four questions. These averages suggest that we have a population well suited to be introduced to long-term savings.

[1] Treatments for the first experiment are as follows: T1 – basic marketing information about the UTI pension product, T2 – marketing information with the penalty aspect de-emphasized, T3 – marketing information with the option of weekly instead of monthly deposits

Table 2: Summary statistics and balance check for 2nd intervention

Covariates	Treatment Assignment†					F-Stat P-value
	Control	A	B	C	D	
Age	36.93 (9.56)	34.20 (8.86)	34.68 (8.87)	34.12 (8.32)	35.35 (8.87)	0.005***
Number of years of education	6.32 (3.33)	6.73 (3.27)	6.52 (3.42)	6.59 (3.28)	6.60 (3.37)	0.647
Household size	5.45 (2.50)	5.59 (2.39)	5.53 (2.34)	5.50 (2.42)	5.22 (2.74)	0.360
Income	3,539 (15,119)	3,041 (8,466)	4,033 (20,270)	3,080 (7,602)	2,944 (9,107)	0.582
Financial Literacy	3.13 (1.00)	3.12 (0.93)	3.02 (1.03)	3.16 (0.98)	3.13 (0.95)	0.739
Total Savings balance	14,455 (63,081)	13,225 (22,986)	11,503 (20,763)	17,246 (50,793)	13,682 (24,012)	0.705
Total Loan balance	73,537 (213,217)	85,085 (174,034)	76,598 (416,574)	83,587 (204,488)	64,788 (167,329)	0.561
Sample size	1,845	295	303	317	290	

Next, we report regression results for outcome variables that we might be interested in. These regressions were conducted over the entire sample, with standard errors clustered by branch. These are OLS regressions of the following form:

$$Y_{ij} = \alpha + \beta * D_{ij} + \epsilon_{ij}$$

The left-hand side variables refer to an observation of individual *i* in branch *j*. β is a vector of coefficients on the explanatory variables. The goal of this analysis is to go beyond merely learning about averages (as in Tables 1 and 2) to gaining a better sense of correlations so we can see how these variables might be jointly distributed in the population.

In the table below (Table 3), columns list the explanatory variables used. We can see several interesting patterns. There is a small but negative relationship between financial literacy and age. As we would expect, more educated individuals display a higher level of financial literacy. More interestingly, education is positively correlated with both savings and loans. Finally, we find that those with higher savings also have higher loans, suggesting that engagement in banking results in greater participation in both savings and credit.

† Treatments for the second experiment are as follows: A – basic financial training and assisted adoption with an incentive of Rs.100 for the first deposit, B – basic financial training and assisted adoption with an incentive of Rs.100 for the third deposit conditional on 2 independent deposits, C – basic financial training and assisted adoption with no incentive, D – no assistance or incentive, only basic financial training.

Table 3: Regression results for time-preferences and financial literacy and balances

Determinants	Outcome variables			
	Time Preferences	Financial Literacy	Total Savings Balance	Total Loans Balance
Age	0.0077 (0.006)	-0.004** (0.003)	50.1 (132.4)	851.1* (733.8)
Number of years of education	0.0053 (0.013)	0.082*** (0.014)	1,337* (614)	6,534.6** (2,365)
Income	3.36×10^{-7} (1.27×10^{-6})	1.54×10^{-6} (1.71×10^{-6})	0.093 (0.059)	0.902 (0.538)
Time Preferences		0.300 (0.016)	-392.6** (124)	2,403* (994.0)
Financial Literacy	0.122 (0.072)		1,163 (1,073)	3,331 (7,520)
Total Savings Balance	-5.19×10^{-7}* (2.55×10^{-7})	3.79×10^{-7} (3.93×10^{-7})		0.803*** (0.065)
Total Loans Balance	1.69×10^{-7} (1.53×10^{-7})	5.78×10^{-8} (1.19×10^{-7})	0.043 (0.026)	

Finally, Table 4 below provides a summary of time preference data, that will be used to complement the analysis of household behavior. The data are taken from hypothetical questions posed in the baseline and takeup surveys. During each survey, respondents were asked the following types of questions: (a) choose between a fixed sum today and varying sums a month from today; (b) choose between a fixed sum one year from now and varying sums thirteen months from now. From questions (a) we are able to infer short-term impatience and from questions (b) we are able to infer long-term impatience. In the table below, we see that 2,383 individuals have time-consistent preferences—their choices do not vary across immediate tradeoffs and delayed tradeoffs. A significant portion of the sample displays a taste for instant gratification, with 339 being significantly present-biased. We will use this data for controls and interactions in continuing analysis.

While there are indeed some concerns associated with using hypothetical questions rather than ones with real stakes, we were limited by budgetary concerns. Nevertheless, our approach follows much of the literature including Ashraf, Karlan, and Yin (QJE, 2006).

Table 4: Time preferences

TP	Freq.	Percent	Cum.
-5	82	2.73	2.73
-4	7	0.23	2.96
-3	14	0.47	3.43
-2	15	0.50	3.93
-1	17	0.57	4.49
0	2,383	79.33	83.82
1	49	1.63	85.45
2	61	2.03	87.48
3	19	0.63	88.12
4	18	0.60	88.72
5	339	11.28	100.00
Total	3,004	100.00	

In a later section, we describe treatment effects. Despite weak treatment effects of the first intervention, we show that there is a clear and statistically significant interest in adoption. We findin the second intervention that, as administrative hurdles are lowered, actual adoption and intention to adopt rise dramatically.

3. Context and Validity

The target population consists of low-income semi-rural households in the Indian state of Maharashtra. We worked with Mann Deshi Mahila Bank, a local cooperative bank that offers a range of savings and loan services and is considering an expansion of a “pension” savings product. The product is a market-indexed long-term savings account provided by the Unit Trust of India, with penalties for early withdrawal (declining penalties over time, with full maturity when the depositor turns 58 years old).

We randomly selected 3300 clients with active savings accounts. These individuals are, therefore, partially banked, i.e. they have some familiarity with savings (and possibly loan) contracts and are appropriately placed to be introduced to more sophisticated savings instruments.From a policy perspective, this population is ideal for our experiment. Our goal is to learn about banking decisions of those who are low-income but in a position to engage with more sophisticated banking contracts.

Mann Deshi Mahila Bank operates out of 6 different branches in the district of Satara, located in Western Maharashtra. This area is primarily rural or semi-urban and agriculture is the main occupation practiced here. The cooperative movement in the region has been very successful, especially among sugarcane farmers, and financial penetration is relatively high compared to other parts of the country. This part of Maharashtra falls within the “rain shadow” area of the country and generally receives very little rainfall, particularly the taluks of Mann and Khatav. The year 2012 was declared a drought year due to which incomes and

assets of many households were adversely hit. The Mann Deshi Foundation and many other government and privately-sponsored organisations had to set up cattle camps to provide fodder and water to livestock in affected areas. The monsoons in 2013 were considerably better. Our study, spanning over almost 3 years, captures the experiences of respondents during both periods. These conditions of weather fluctuations and uncertain income flows provide a rich context for this experiment.

4. Timeline of Program and Evaluation

a. Baseline Survey – 25th June to 15th October, 2011
b. Intervention – 10th December, 2011 to 15th April, 2012
c. Take Up Survey – 27th May to 15th August, 2012
d. Midline Survey – 15th October to 15th December, 2012
e. Midline Follow Up Survey – 25th December, 2012 to 12th March, 2013
f. Extended Intervention – 4th July to 29th August, 2013
g. Endline Survey – 28th December,2013 to 25th March, 2014

5. Program design and implementation

Founded in 1997, Mann Deshi Mahila Bank was India's first rural financial institution to receive a cooperative license from the Reserve Bank of India. The bank has grown from start-up share capital worth US$15000 to assets worth US$ 470,459.32 in 2012-2013. Mann Deshi currently has over 185,000 clients, out of whom roughly one-half are low-income rural women who earn their living as street vendors, vegetable vendors, milk vendors, weavers, wage laborers etc. More than 85% of its clients come from the "priority or weak sector", as designated by the Reserve Bank of India and 70% of its clients come from backward castes and scheduled tribes. While India is host to some of the largest microfinance institutions (MFIs) in the world, regulatory restrictions prevent these institutions from offering long-term pensions and savings products. Mann Deshi, being a cooperative bank, is one of the few institutions allowed to mobilize public deposits and, one of the few institutions (to our knowledge) offering pension products to low-income women.Choosing Mann Deshi as the implementing organisation provided us with access to clients who were already engaged, to some extent, in the formal banking network but were not exposed to more sophisticated savings devices such as micro-pensions. All these factors were taken into consideration while selecting Mann Deshi Mahila Bank as the implementing organisation.

According to the initial proposal, 6 treatments were planned but this was later reduced to 3 due to feasibility concerns post discussion with MD officials. The main concerns were that there was limited room to vary the terms of savings contracts, and most interactions happened through agents. These restrictions turned out to be a useful disciplining device—as our second intervention shows, even with minimal alteration to the terms of the savings contract, large effects can be generated.

First Intervention

For the first experiment, which was implemented in 2012, the individuals were stratified by bank branch and randomly assigned to one of four groups—three treatments and a control. This experiment focused on framing, which has been shown to matter for financial product

design. In each treatment, individuals received a brief session in which they were exposed to the principles of compound interest and encouraged to think about long-term savings goals. The variation across treatments was limited to the description of the savings product. In treatment 1, the product was described in the “benchmark” manner—individuals were provided with administrative information about the account, shown tables with maturity yields for standard deposit patterns and a range of plausible interest rates, and were explicitly informed of the early withdrawal penalty terms and amounts. In treatment 2, the same product terms were described without the salience on penalty. Instead, individuals were explicitly shown that they could withdraw at any time, but that they earned —rewards for keeping their deposits longer. In treatment 3, the product was described as in treatment 1, and individuals were also offered the option of weekly (rather than the default monthly) deposits. The goal of these interventions was to understand the roles of commitment and flexibility in the take-up of a commitment savings product. We hypothesize that those who have self-control problems and are conscious of them will be encouraged by treatments 1 and 3, while those who value flexibility will be encouraged most by treatment 2. The control group serves as a useful comparison to observe take-up amongst those who were informed about the savings product through Mann Deshi’s usual channels.

Second Intervention

After the first intervention, a new dimension—that of agent incentives—came into focus. It was clear that there is significant interest in long-term savings but low take-up due to agent reluctance to assist with the administrative follow-through. This was somewhat unexpected given our initial meetings with the bank and the agents, but the primary cause appeared to be the low commission on long-term savings relative to short-term savings (this is determined by the Unit Trust of India and beyond our control).
Though unanticipated, this added to the richness of the study as it helps clarify how institutional structures might interact with randomized evaluations. Had the same experiment been conducted in a more controlled environment, the problem of agent incentives, which matters for both internal and external validity, could have gone unnoticed.
The second intervention aimed to overcome certain procedural hurdles that come in the way of adopting the UTI Retirement Benefit Fund. These include inability to fill up initial forms, hesitance on the part of Mann Deshi Bank agents and lack of clarity regarding adoption protocol. The intervention comprised of a brief explanation of how simple and compound interest works and some assistance with procedures to open the account. The treatment groups are the following:

A. The first treatment group got assistance in completing the documentation required to adopt the product (this involves providing ID and address proof, passport photos and naming a nominee). Further, we also provided the first month’s deposit (Rs.100) and they could either continue or withdraw it as per their preferences. While conducting the intervention, we gave a brief training on how basic calculations of simple and compound interest work

B. The second treatment group also got assistance in completing the documentation. However, it is then upon them to make the first 2 months’ deposit (Rs.100) while we give them the incentive of providing the 3rd month’s deposit if they successfully make the first 2 payments. They also received the financial training.

C. The third treatment group got assistance in terms of financial training and with adoption procedures but they did not get any monetary aid for opening the pension account.
D. The fourth treatment group neither got any assistance in completing the documentation nor any incentive to adopt the product. They did however, get the financial training.
E. The control group was not visited at all. They were not given the training or any incentives.

For some purposes in our analysis below, group D can be treated as a control since members of group E were not approached during the intervention and we therefore lack some data on them. For others, group E can be treated as a control.

The fieldstaff responsible for administering the treatments maintained fidelity to the program design and this was monitored by a combination of measures. Firstly, quality checks in the form of accompaniments and back-checks by superviors were conducted for more than 30% of the sample. Secondly, 100% of the intervention data and field reports were scrutinised to ensure that the pre-assigned treatments were adhered to.

While our research program has been slightly modified relative to the initial proposal, it retains the spirit of the original question: how are households incentivized to adopt long-term savings? As explained below, our changes were driven by realities on the ground, including the organizational structure of Mann Deshi, our learning about household characteristics, and the relationship between the bank, the independent agents, and clients. The modifications and additions made to the program design are summarized below:

1. In the early stages of the project, the door-to-door Mann Deshi Bank agents were not inclined to market the UTI pension product and recruit clients for it. This was due to the fact that there was no incentive provided for them. The solution proposed before the intervention was to offer a 1% commission to the agents for half the sample (phase 1) and not provide them for the other half (phase 2). However, the agents still lacked enthusiasm for the product and adoption was found to be very low. We decided to pay the agents the predetermined 1% commission uniformly, for all clients they recruit to overcome this, thereby removing any distinction between the two phases.

2. Following the first intervention (elaborated above) consisting of marketing treatments, the data from the Take Up Survey revealed very low take-up of the pension product despite high levels of interest among the respondents. The reasons cited for not adopting the product were related to unfamiliarity with the product and its adoption procedures and reluctance on the part of the Mann Deshi agents and staff. Many respondents claimed that they would adopt the product if their agents approached them with it. The reluctance on the part of the agents despite the incentives was unforeseen as was the respondents' difficulty with the paper work. These ground realities motivated the second intervention that was conducted prior to the Endline Survey. The second intervention (elaborated above) aimed to build on the interest generated by the first and facilitate the adoption of the pension product. This involved regular follow-ups and coordination with the Mann Deshi agents and staff.

3. In long-term studies such as this, it is customary to use respondent gifts to combat the onset of respondent fatigue. During the Midline survey we chose to gift the respondents lock-boxes so that they have the option to use it for short-term savings at home. This feature

added a research question about the relationship between self-control regarding short-term savings and overall savings behaviour to our study. It was necessary to conduct a short survey after the Midline to monitor how much respondents were able to save during two months and compare it to their expected savings and targets stated earlier. This round of surveys was unplanned in the initial proposal but will add more depth to the behavioural aspects of this study.

6. Methodology and Evaluation Design and Implementation

The sample was selected from a list of Mann Deshi Mahila Bank's clients. They were stratified according to the six branches of the bank and the account type that the clients held. This was done in the ratio of their ocurrence in Mann Deshi's total clientbase. (See figure below) The final sample size reached during the baseline was 3300.

The assignment of the treatments was randomised. The power calculations provide minimum sample sizes for the second intervention. Since the first intervention had larger samples, the same calculations serve as a justification for the first intervention (See appendix B).

Figure 1: Randomisation for 1st Intervention (T1, T2, T3, C)

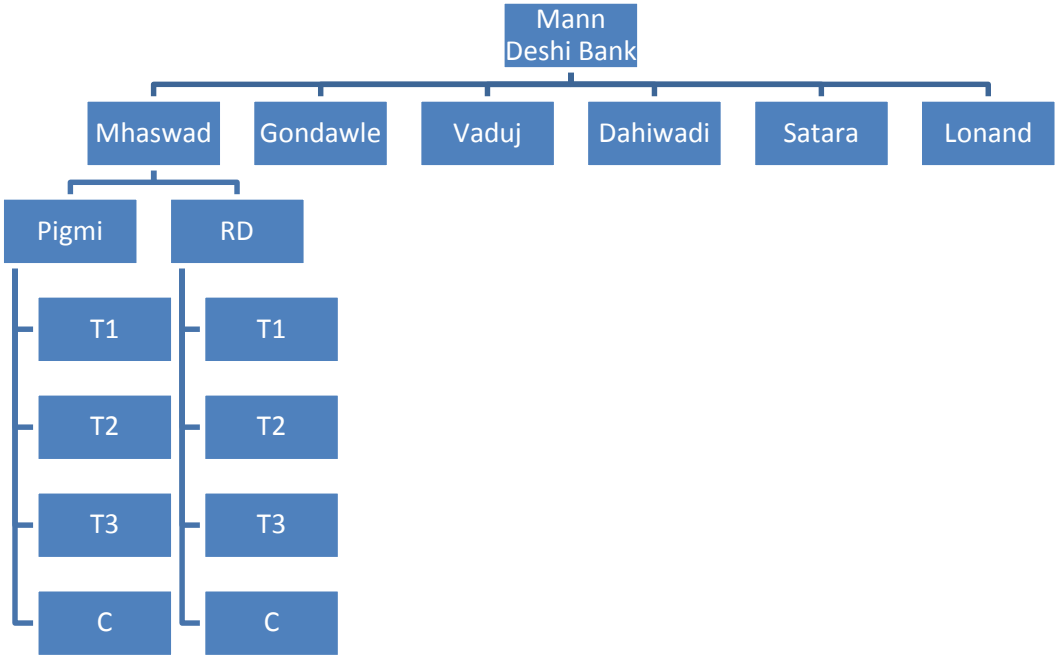
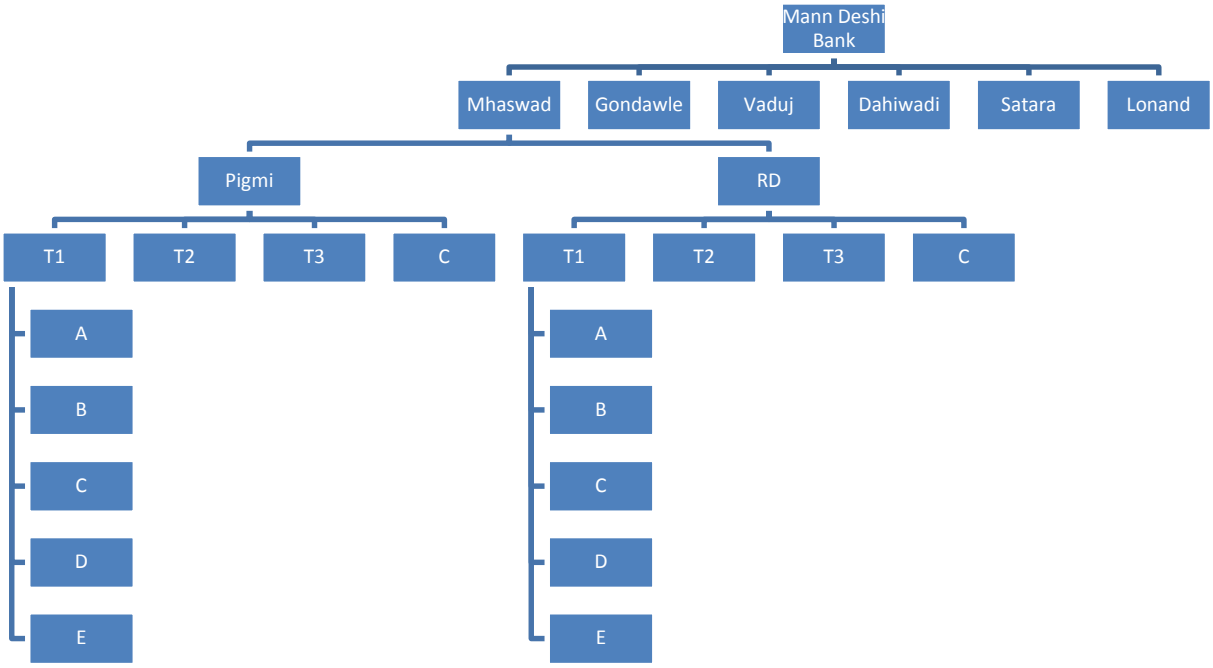


Figure 2: Randomisation for 2nd Intervention(A,B,C,D, E)



7a. Impact analysis and results of the key evaluation questions

Experiment 1

We now describe the main results of the paper. Recall that there were two experiments. In the first, the treatments were designed to re-frame the pension product: the first treatment provided basic information, the second emphasized the commitment aspect of the product, while the third emphasized the flexibility of the product.

For the impact analysis, we start with the first experiment. There are three possible outcomes: takeup, intention to takeup, and intention to takeup if agent arrives with forms. All regressions are OLS, where the main coefficient of interest is on the treatment dummies (T_{ij} is a vector of treatment dummies and D_{ij} is a vector of controls):

$$Y_{ij} = \alpha + \beta * T_{ij} + \gamma * D_{ij} + \epsilon_{ij}$$

Table 5 below lists regression results without any controls.

Table 5: First experiment treatment effects

	UTI Take up	Intention to adopt UTI	Adopt UTI if agent brings forms
T1	0.020*** (0.0046)	0.342*** (0.037)	0.053 (0.064)
T2	0.005 (0.003)	0.320*** (0.047)	0.039 (0.085)
T3	0.008*** (0.002)	0.344*** (0.047)	0.040 (0.083)
Constant	0.0025 (0.001)	0.036** (0.013)	0.340 (0.053)
Number of observations	3004	3000	2272
Notes: All regressions are clustered by branch. *** significant at the 1 percent level ** significant at the 5 percent level * significant at the 10 percent level			

Treatment effects for treatments 1 and 3 were significant, but extremely small in magnitude. This is interesting for a number of reasons.We can see that there was significant interest in joining, but very little adoption. However, even within the low levels of adoption, there were significant treatment effects, suggesting that the treatments were effective in creating interest, but there were other unforeseen hurdles preventing takeup.

A test of differences reveals that the coefficient on T1 is significantly different from the coefficient on T2 (5% sig.) as well as the coefficient on T2 (10% sig.). The difference between the coefficients on T2 and T3 is not statistically significant.

The fact that treatments 1 and 3 had significant effects but 2 did not reveals that consumers are motivated by the perception of *less flexibility* in a product. There was greater takeup when we stressed penalties than when we stressed flexibility. Nevertheless, individuals appear to be relatively less interested in weekly deposits. This provides an indication that self-control problems might play a role in financial decisions. Continuing empirical analysis will examine this in greater detail.

The overall lesson from the first experiment is that, while information provision raises interest, it does not raise takeup. This naturally leads to the second experiment, which attempts to harness this interest into actual adoption through small nudges.

Finally, in Table 6 we present the treatment effects on UTI adoption along with a series of control variables. This reveals other determinants of takeup and sets up a framework that is consistent with the analysis of the second experiment.

Table 6 (and all remaining tables) are appended to the end of this paper. For the reader's reference, the following control variables are used:

- Branch: Mann Deshi bank branch dummies (since there could be infrastructural differences across branch)
- Age
- Years of education
- Income (monthly)
- Time preferences: the level of impatience in hypothetical questions exhibited by the respondent
- Household size
- Financial literacy level: calculated as the number of correct responses to a series of financial literacy questions
- Total savings
- Total loans (outstanding)

As we can see, bank branch matters for takeup. In addition, older respondents are more likely to adopt UTI (but the coefficient is very small).

Experiment 2

In Tables 7-10, we consider the second experiment. Recall that the treatments consisted of different nudges: (A) paperwork assistance with an early adoption reward; (B) paperwork assistance with a delayed and conditional adoption reward; (C) pure paperwork assistance; and (D) information.

Table 7 uses as the outcome variable whether the form was filled out at the time of the interview. Table 8 uses as the outcome variable whether the form was actually submitted to Mann Deshi. In each table, we consider several regression specifications, including different sets of control variables. These two tables list fewer observations since we did not reach the control group during this phase of the study. Therefore, we treat group D (information) as a control. In the remaining tables, which use endline data, we are able to again incorporate the entire sample.

The results are consistent and striking. We list the main observations below.

First, it is clear that the second experiment had dramatic effects.As we would expect, effects on initial form-filling were higher than effects on ultimate form-submission. Yet, effects on both were strong. This reminds us that most individuals did indeed follow through after the initial meeting with surveyors. These results are noteworthy because it was not obvious at the outset that an intervention as minimal as offering to help individuals fill forms would generate such high levels of adoption. This serves as a key policy lesson of the paper.

In general treatment A had the strongest effect, followed by treatment B, followed by treatment C. A test of differences shows that, for both sets of regressions, the effect of treaments A and B are significantly different that the effect of treatment C (1% sig. and 5% sig, respectively). There is no statistically significant difference between the coefficients on Treatments A and B. This tells us that the immediate incentive has only a weakly stronger effect on adoption than the delayed incentive. Nevertheless, it is noteworthy that the treatment without financial incentives had a strong effect too. This suggests that logistical obstacles were an important cause of initial non-adoption.

As before, branch dummies matter for takeup. It is interesting to note that the treatment assignment in the first experiment plays no significant role. This could be due to the staggered timing of the experiments.

In both sets of regressions, we find that education and income were negatively correlated with takeup. Furthermore, in the first set of regressions, total savings is also negatively correlated with takeup. These effects are possibly due to the fact that richer, more educated participants already have other sources of long-term savings instruments. This is consistent with the idea that those with higher savings in other products were also less likely to takeup.

We also conducted a similar analysis using endline data, in which respondents directly reported whether they had adopted the product and, if so, how much they planned to deposit. The results are reported in Tables 9 and 10. There are two outcomes. The first table reports takeup on treatments, with several possible controls. The second table reports the amount to be deposited, conditional on takeup. Here, we are able to use the entire sample since we

Again, we confirm that there are strong treatment effects for both incentivized and non-incentivized treatments. This confirms our previous results. Here, a test of differences shows that each treatment coefficient is significantly different from the others, suggesting that the immediate incentive has the greatest impact on adoption.

Furthermore, the second table reveals interesting details about the patterns of deposits for different treatments. We find that incentivized treatments result in smaller deposits. This is quite striking, as it no longer suggests that financial incentives to adopt the product are unequivocally preferable. While adoption rates are higher when incentives are provided, those who adopt can be expected to save less in the long run. We intend to follow up on this question once continuing administrative data is received from the bank in the coming months.

7b. Compound Interest Mistakes

The endline data yielded additional information on individual decision-making processes that has the potential to improve our understanding of mistakes. The tables shown below relate to a growing body of literature that argues that people tend to under-estimate compound interest. To investigate this further, we asked respondents a series of hypothetical questions about interest rate accumulation in several scenarios (one-time saving vs recurring saving vs one-time borrowing; 2% compound interest annually vs 10% compound interest annually; and one to twenty year time horizons).

Some results are reported in the attached average response tables. Comparing the results to the correct answers, we see that on average, respondents are overestimating almost all the time, both in the short and long horizon, as well as for both interest rates. The only question in which respondents underestimated was for long horizon of 20 years and interest rate of 10%. This is quite different from the results of preceding studies.

Results from different scenarios are described below.

Consider the one time deposit of 100 into a savings account. Interest is compounded annually.

- For an interest rate of 2%, individuals overestimate (marginally) in very short horizons, and the size of their overestimation increases slightly as the duration of time becomes longer.

- For an interest rate of 10%, individuals overestimate (greatly) in very short horizons, but the size of their overestimation marginally decreases as the duration of time becomes longer. With longer time horizons, individuals get negligibly better with their predictions.

Consider the monthly deposit of 100 into a savings account. Interest is compounded annually.

- For an interest rate of 2%, individuals underestimate (marginally) in very short horizons, and the size of their underestimation increases slightly as the duration of time becomes longer.

- For an interest rate of 10%, individuals underestimate (marginally) in very short horizons, and the size of their underestimation increases slightly as the duration of time becomes longer.

Consider a borrowed loan of 1000. Interest is compounded annually.

- For an interest rate of 2%, individuals estimate accurately in very short horizons. As time horizon increases, individuals begin to overestimate the amounts they have to repay.

- For an interest rate of 10%, individuals overestimate (greatly) in very short horizons, but the size of their overestimation marginally decreases as the duration of time becomes longer. With longer time horizons, individuals get negligibly better with their predictions.

Consider the one time deposit of 1000 into a savings account. Interest is compounded annually.

- For an interest rate of 2%, individuals underestimate (marginally) in very short horizons, and the size of their underestimation increases slightly as the duration of time becomes longer. Individuals predict more inaccurately as the time horizon increases.

- For an interest rate of 10%, individuals overestimate (greatly) in very short horizons. But with longer time horizons, individuals get marginally better with their predictions, overestimating by less.

8. Discussion and Policy Recommendations

The results yield some clear lessons. From the first experiment we find that marketing and some forms of framing trigger interest in long-term savings; yet this does not translate into adoption. The second experiment successfully reveals some obstacles to adoption. By lifting these, in particular by providing assistance with form-filling, adoption rises dramatically.

This is a significant result, as our research identifies an obstacle that can be removed at relatively low cost, with large potential benefits. This is also consistent with behavioral economics models that suggest that consumers are particularly sensitive to immediate costs.

The second experiment suggests that small changes to the design and marketing of long-term savings can result in strong rises in adoption. We observe that, in the absence of the treatments, adoption was close to zero. While the first experiment generated significant interest, the magnitudes of the effects were low. Through the second experiment, we identify the main hurdle associated with adoption—paperwork and logistics. It is interesting that even a treatment without financial incentives (treatment C) had such high takeup effects (20%, highly statistically significant). While the financial incentives raised takeup further, continuing research will reveal whether they survive a cost-benefit analysis.

These results suggest some simple policy changes in the Indian personal finance environment. In particular, attention needs to be paid to not just the monetary aspects of products but at non-monetary costs. These non-monetary costs can loom large for the poor whose literacy and especially financial literacy might be limited.

While the entire range of financial products including deposits, payments, transfers, credit, broking etc. are available to a large mass, the uptake of these services has been sporadic and has occurred in fits of policy action/awakening. Some targeted initiatives by the central bank and the government has yielded some encouraging results but the overall financial access is still poor.

One of the major regulatory concerns has been a multitude of regulators and ingenuity of the service providers in exploiting the grey areas in regulations. A case in point has been the unregulated growth of Ponzi schemes of various natures. They have ranged from time share at tourist destination to PAN card scheme (which is a play on Indian Financial Identification). At present India has four financial sector regulators corresponding to markets (Securities and Exchange Board of India -SEBI), insurance (Insurance Regulatory and Development Authority-IRDA), commodities (FMC) and pensions(Pension Fund Regulatory and Development Authority -PFRDA) with Reserve bank of India (RBI)acting as a supervising banking regulator for monetary policy. Indian microfinance sector is predominantly credit driven though there have been remittances and savings products on offer. Traditionally savings as product was not on offer as collection of Public savings was governed by RBI and Saving Collectives were always considered in grey zone. The current development of Bandhan getting a banking License is indicative of maturing of Indian Microfinance institutions and also of greater trust of regulator on the stable and efficient players.

Indian Pensions Reforms have focussed on design and governance of employer funded and/or employee contribution driven initiatives such as introduction of National Pension Scheme for government employees in 2004 and subsequently for all citizens. This was partly driven by state's desire of diminished role in funding pensions for its own employees and converting the system to defined contribution from defined benefits. One of the highlight of NPS has been the provision of non-withdrawable Tier I coupled with a voluntary withdrawable Tier II account. This gives flexibility towards creating long term savings as well savings for some of the short term objectives. Enrolment in NPS or NPS Lite has been meagre except for government sector where it is mandatory enrolment. Various factors including stringent Know Your Customer (KYC) norms, reluctance of channel intermediaries to discuss the product and lack of suitable financial incentives for the channel partners have created a lack lustre growth of NPS and related products for ordinary citizen subscribers outside government.

NPS Lite which was specifically aimed at the disadvantaged section of the society especially in the rural with small savings has been a complete disaster. The competition in the long term small savings space is dominated by aggressively marketed, fixed return and relaxed enrolment norms products. Unfortunately, most of these are chain schemes bordering on Ponzi scheme albeit with a local or contemporary flavour of underlying assets like teak wood, computer education, timeshare resorts etc. NPS Lite on the other hand has a vanilla product, cannot Guarantee Returns which are market determined, follows the KYC norms including national identification documentation and suffers from almost negligible intermediation commissions.

Financial services intermediaries have pointed to the need of understanding consumer behaviour for financial products and possible improvements in product design to create demand for such long term financial products. Major issues of seemingly lucrative products and viral marketing blitz by the fly-by-night operators has to be tackled by players like UTI and MD by understanding product design and consumer decision making for financial products. The problem is acute in rural areas which is the focus of the study due to lack of scale and limited use of technology thus reducing the push by service providers.

It appears that our research has revealed some key issues associated with the adoption of long-terms savings among the poor, and has identified simple approaches to raise adoption. While there are natural benefits to the continued expansion of more complex products and financial schemes, our research serves as a reminder that the greatest returns might lie in simpler solutions, including modified administrative hurdles.

This suggests several areas for continuing research. We would like to understand how individual time preferences and other household characteristics matter for adoption. More importantly, it is necessary to understand to what extent the effects persist—do individuals continue to make deposits, do they adjust on consumption margins, do their other banking decisions change, and how are any of the above affected differentially by the treatments. We expect to soon have the necessary data to answer these questions so we can make a reasoned policy proposal that addresses relevant questions of both internal and external validity.

Appendix: Tables

Table 6

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)	Adopted UTI (1st exp)
T1	0.020***	0.020***	0.021***	0.021***	0.021***	0.021***	0.021***	0.021***	0.021***	0.021***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
T2	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
T3	0.008***	0.008***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
branch2		-0.004***	-0.005***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***
		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Branch3		-0.001***	-0.001***	-0.002	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002
		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Branch4		-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.005***	-0.005***	-0.005***
		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Branch5		-0.000***	-0.001**	-0.001	-0.001*	-0.001	-0.001	-0.001	-0.001	-0.001
		(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Branch6		0.001***	0.001***	0.001***	0.000**	0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
age			0.000**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
years of education				0.001	0.001	0.001	0.001	0.000	0.000	0.000
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
income					-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
					(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
time preferences (impatience)						0.001	0.001	0.001	0.001	0.001
						(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
household size							0.000	0.000	0.000	0.000
							(0.001)	(0.001)	(0.001)	(0.001)
financial literacy level								0.002	0.002	0.002
								(0.002)	(0.002)	(0.002)
total savings									-0.000	-0.000
									(0.000)	(0.000)
total loans										0.000
										(0.000)
Constant	0.003	0.004**	-0.014	-0.019	-0.019	-0.020	-0.022*	-0.026*	-0.026*	-0.026*
	(0.001)	(0.001)	(0.007)	(0.012)	(0.012)	(0.012)	(0.009)	(0.013)	(0.013)	(0.013)
Observations	3,004	3,004	3,004	3,004	3,004	3,004	3,004	3,004	3,004	3,004
R-squared	0.005	0.006	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)	UTI form filled (experiment 2)
TreatmentA	0.417***	0.416***	0.417***	0.419***	0.419***	0.419***	0.425***	0.427***	0.427***	0.426***	0.427***
	(0.036)	(0.036)	(0.036)	(0.039)	(0.038)	(0.038)	(0.040)	(0.042)	(0.042)	(0.042)	(0.042)
TreatmentB	0.376***	0.376***	0.376***	0.377***	0.375***	0.376***	0.380***	0.381***	0.382***	0.381***	0.381***
	(0.065)	(0.065)	(0.065)	(0.067)	(0.067)	(0.067)	(0.070)	(0.071)	(0.071)	(0.071)	(0.071)
TreatmentC	0.259***	0.259***	0.260***	0.262***	0.260***	0.260***	0.264***	0.265***	0.264***	0.268***	0.268***
	(0.027)	(0.028)	(0.028)	(0.031)	(0.033)	(0.034)	(0.030)	(0.030)	(0.031)	(0.032)	(0.033)
Branch2		0.030***	0.030***	0.033***	0.019**	0.020**	0.020**	0.020**	0.018*	0.018**	0.014*
		(0.001)	(0.001)	(0.003)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Branch3		-0.059***	-0.059***	-0.055***	-0.041***	-0.040***	-0.039***	-0.040***	-0.041***	-0.035***	-0.038***
		(0.001)	(0.001)	(0.003)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)	(0.009)	(0.008)
Branch4		0.059***	0.058***	0.062***	0.077***	0.077***	0.090***	0.088***	0.086***	0.088***	0.086***
		(0.001)	(0.001)	(0.004)	(0.005)	(0.005)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Branch5		0.134***	0.133***	0.131***	0.141***	0.140***	0.148***	0.144***	0.139***	0.143***	0.139***
		(0.000)	(0.001)	(0.002)	(0.004)	(0.004)	(0.004)	(0.009)	(0.010)	(0.010)	(0.012)
Branch6		0.122***	0.122***	0.123***	0.120***	0.119***	0.121***	0.119***	0.119***	0.119***	0.115***
		(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
T1			-0.020	-0.019	-0.020	-0.020	-0.025	-0.024	-0.024	-0.026	-0.025
			(0.034)	(0.032)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
T2			-0.053	-0.052	-0.055	-0.054	-0.060	-0.060	-0.058	-0.059	-0.060
			(0.035)	(0.035)	(0.036)	(0.035)	(0.036)	(0.036)	(0.036)	(0.037)	(0.037)
T3			-0.021	-0.021	-0.024	-0.023	-0.025	-0.025	-0.023	-0.026	-0.024
			(0.029)	(0.028)	(0.030)	(0.029)	(0.031)	(0.030)	(0.030)	(0.031)	(0.033)
age				0.002	0.000	0.000	0.001	0.001	0.001	0.001	0.001
				(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
years of education					-0.017**	-0.016**	-0.016**	-0.016*	-0.017**	-0.015**	-0.015*
					(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
income						-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
time preferences (impatience)							-0.001	-0.001	-0.001	-0.001	-0.001
							(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
household size								-0.004	-0.005	-0.004	-0.004
								(0.006)	(0.006)	(0.006)	(0.006)
financial literacy level									0.011	0.012	0.013
									(0.010)	(0.010)	(0.010)
total savings										-0.000**	-0.000**
										(0.000)	(0.000)
total loans											-0.000
											(0.000)
Constant	0.000	-0.042	-0.019	-0.099	0.084	0.076	0.065	0.086	0.060	0.047	0.049
	(.)	(0.030)	(0.022)	(0.104)	(0.125)	(0.122)	(0.125)	(0.113)	(0.125)	(0.126)	(0.125)
Observations	1,205	1,205	1,205	1,205	1,205	1,205	1,159	1,159	1,159	1,159	1,159
R-squared	0.132	0.155	0.157	0.159	0.173	0.174	0.179	0.179	0.180	0.183	0.184

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)	UTI form submitted (experiment 2)
TreatmentA	0.380***	0.381***	0.381***	0.384***	0.383***	0.384***	0.388***	0.390***	0.390***	0.390***	0.390***
	(0.041)	(0.041)	(0.042)	(0.044)	(0.043)	(0.042)	(0.045)	(0.043)	(0.043)	(0.043)	(0.043)
TreatmentB	0.343***	0.343***	0.343***	0.345***	0.343***	0.345***	0.348***	0.350***	0.349***	0.347***	0.348***
	(0.056)	(0.056)	(0.056)	(0.057)	(0.057)	(0.056)	(0.058)	(0.058)	(0.058)	(0.058)	(0.059)
TreatmentC	0.240***	0.243***	0.243***	0.246***	0.244***	0.245***	0.243***	0.245***	0.245***	0.249***	0.250***
	(0.030)	(0.031)	(0.032)	(0.033)	(0.033)	(0.033)	(0.031)	(0.030)	(0.030)	(0.032)	(0.032)
Branch2		-0.076***	-0.076***	-0.072***	-0.082***	-0.080***	-0.075***	-0.074***	-0.072***	-0.072***	-0.076***
		(0.001)	(0.001)	(0.002)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
Branch3		-0.100***	-0.099***	-0.095***	-0.085***	-0.085***	-0.087***	-0.089***	-0.088***	-0.081***	-0.083***
		(0.001)	(0.001)	(0.003)	(0.004)	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Branch4		-0.061***	-0.060***	-0.056***	-0.046***	-0.045***	-0.037***	-0.039***	-0.037***	-0.035**	-0.036***
		(0.001)	(0.002)	(0.003)	(0.004)	(0.004)	(0.007)	(0.009)	(0.009)	(0.009)	(0.009)
Branch5		0.084***	0.084***	0.082***	0.089***	0.088***	0.097***	0.091***	0.094***	0.098***	0.095***
		(0.000)	(0.001)	(0.002)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)	(0.007)	(0.009)
Branch6		0.043***	0.043***	0.044***	0.042***	0.041***	0.042***	0.040***	0.040***	0.040***	0.037***
		(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)
T1			0.011	0.011	0.011	0.011	0.012	0.013	0.013	0.011	0.011
			(0.037)	(0.036)	(0.034)	(0.035)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
T2			-0.014	-0.012	-0.014	-0.013	-0.019	-0.019	-0.020	-0.021	-0.021
			(0.049)	(0.049)	(0.048)	(0.048)	(0.046)	(0.047)	(0.047)	(0.048)	(0.048)
T3			-0.018	-0.018	-0.020	-0.019	-0.024	-0.023	-0.024	-0.028	-0.026
			(0.033)	(0.031)	(0.031)	(0.030)	(0.037)	(0.037)	(0.037)	(0.038)	(0.039)
age				0.003	0.001	0.001	0.002	0.002	0.002	0.002	0.002
				(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
years of education					-0.011	-0.011	-0.010	-0.010	-0.009	-0.007	-0.007
					(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
income						-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
time preferences (impatience)							0.003	0.003	0.003	0.003	0.003
							(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
household size								-0.007	-0.007	-0.006	-0.006
								(0.006)	(0.006)	(0.005)	(0.005)
financial literacy level									-0.008	-0.007	-0.007
									(0.007)	(0.007)	(0.007)
total savings										-0.000***	-0.000***
										(0.000)	(0.000)
total loans											-0.000
											(0.000)
Constant	0.000	0.020	0.024	-0.067	0.056	0.049	0.033	0.065	0.085	0.068	0.070
	(0.000)	(0.030)	(0.025)	(0.089)	(0.140)	(0.138)	(0.134)	(0.130)	(0.133)	(0.135)	(0.134)
Observations	1,205	1,205	1,205	1,205	1,205	1,205	1,159	1,159	1,159	1,159	1,159
R-squared	0.116	0.140	0.141	0.144	0.150	0.152	0.155	0.157	0.157	0.163	0.163

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 9

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)	active UTI account (endline)
TreatmentA	0.362***	0.363***	0.363***	0.366***	0.366***	0.366***	0.373***	0.373***	0.374***	0.373***	0.373***
	(0.059)	(0.061)	(0.060)	(0.061)	(0.061)	(0.061)	(0.064)	(0.063)	(0.063)	(0.063)	(0.063)
TreatmentB	0.286***	0.287***	0.287***	0.290***	0.290***	0.290***	0.295***	0.295***	0.295***	0.295***	0.295***
	(0.058)	(0.060)	(0.060)	(0.060)	(0.060)	(0.059)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
TreatmentC	0.191***	0.192***	0.192***	0.195***	0.196***	0.195***	0.195***	0.195***	0.195***	0.195***	0.195***
	(0.039)	(0.040)	(0.040)	(0.041)	(0.041)	(0.041)	(0.040)	(0.039)	(0.039)	(0.039)	(0.039)
TreatmentD	-0.036**	-0.035**	-0.035**	-0.033*	-0.033*	-0.033*	-0.032*	-0.033*	-0.033*	-0.033*	-0.033*
	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)
Branch2		-0.007	-0.007	-0.009	-0.010	-0.010	-0.008	-0.009	-0.010	-0.010	-0.009
		(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Branch3		-0.035***	-0.035***	-0.036***	-0.034***	-0.034***	-0.037***	-0.039***	-0.040***	-0.039***	-0.039***
		(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Branch4		0.017***	0.018***	0.018***	0.020***	0.020***	0.020***	0.019***	0.018***	0.018***	0.019***
		(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Branch5		0.036***	0.036***	0.035***	0.036***	0.035***	0.035***	0.032***	0.031***	0.031***	0.032***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Branch6		0.030***	0.030***	0.029***	0.029***	0.028***	0.028***	0.025***	0.025***	0.025***	0.026***
		(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
T1			0.015	0.015	0.015	0.015	0.017	0.018	0.018	0.018	0.018
			(0.020)	(0.020)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
T2			-0.009	-0.008	-0.008	-0.008	-0.010	-0.010	-0.010	-0.010	-0.010
			(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)	(0.019)	(0.018)
T3			-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
			(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
age				0.001*	0.001*	0.001*	0.001**	0.001*	0.001**	0.001**	0.001*
				(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
years of education					-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
					(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
income						-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
time preferences (impatience)							-0.000	-0.000	-0.000	-0.000	-0.000
							(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
household size								-0.004*	-0.004*	-0.004	-0.004
								(0.002)	(0.002)	(0.002)	(0.002)
financial literacy level									0.004	0.004	0.004
									(0.004)	(0.004)	(0.004)
total savings										-0.000	-0.000
										(0.000)	(0.000)
total loans											0.000
											(0.000)
Constant	0.043***	0.037*	0.036*	-0.008	0.010	0.009	0.000	0.025	0.016	0.015	0.015
	(0.010)	(0.016)	(0.018)	(0.036)	(0.036)	(0.036)	(0.033)	(0.041)	(0.043)	(0.043)	(0.043)
Observations	2,878	2,878	2,878	2,878	2,878	2,878	2,835	2,835	2,835	2,835	2,835
R-squared	0.171	0.177	0.178	0.179	0.179	0.179	0.184	0.185	0.185	0.185	0.185

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 10

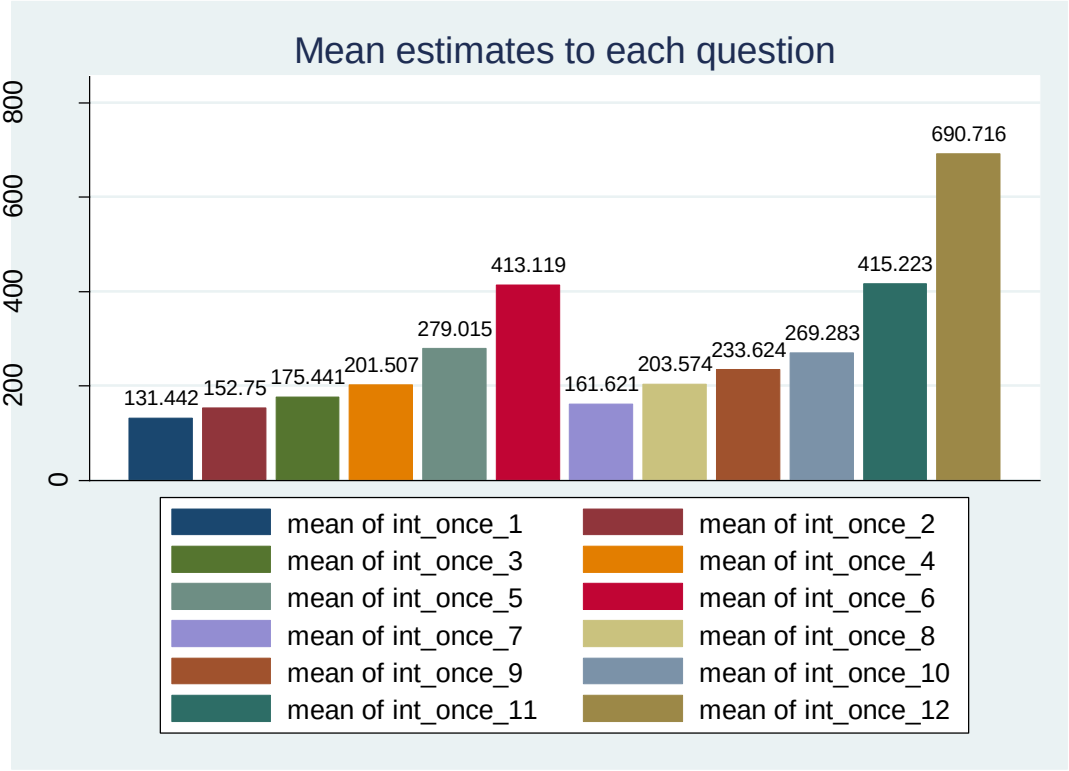
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)	planned deposit amount (endline)
TreatmentA	-89.125*	-90.709*	-89.591*	-95.895	-86.144	-86.522	-88.930	-83.406	-83.824*	-83.150	-78.908
	(40.140)	(42.135)	(43.627)	(52.543)	(45.595)	(45.747)	(47.359)	(42.095)	(40.210)	(41.536)	(41.986)
TreatmentB	-80.444	-82.863	-79.380*	-79.914*	-68.136*	-67.982*	-68.994*	-64.757**	-59.665**	-50.518*	-33.943
	(41.666)	(42.278)	(37.481)	(37.748)	(27.641)	(26.995)	(27.494)	(25.114)	(21.226)	(20.990)	(24.820)
TreatmentC	38.175	41.198	37.825	33.820	40.782	40.905	31.273	35.133	35.851	37.820	28.072
	(87.103)	(88.613)	(88.338)	(83.992)	(90.168)	(89.787)	(91.227)	(92.159)	(92.357)	(84.297)	(79.523)
TreatmentD	-100.714**	-70.402***	-91.647**	-86.941**	-124.864**	-130.945**	-150.520**	-123.411**	-133.702**	-118.227**	-98.028*
	(37.570)	(17.421)	(30.576)	(22.276)	(39.226)	(43.086)	(52.243)	(32.163)	(41.599)	(37.455)	(48.318)
Branch2		5.056	11.828	7.321	13.608	16.106	17.225	17.263	10.499	16.460*	41.350
		(7.586)	(12.974)	(6.806)	(10.261)	(11.157)	(12.290)	(12.328)	(5.338)	(7.750)	(29.890)
Branch3		-9.169	-6.280	-9.118	-12.568	-11.715	-4.206	5.929	7.691	11.047	16.944
		(6.449)	(3.177)	(7.758)	(9.758)	(9.101)	(6.457)	(5.369)	(7.678)	(7.091)	(10.838)
Branch4		21.461**	26.903*	21.728**	11.677	15.742**	-5.532	0.873	-5.549*	-3.816	5.717
		(7.726)	(11.904)	(5.734)	(6.373)	(4.021)	(3.962)	(7.550)	(2.362)	(2.986)	(8.947)
Branch5		13.794**	17.492	14.301**	13.504**	11.903*	20.674*	27.851	21.668**	30.725**	53.580
		(4.263)	(9.449)	(5.453)	(4.984)	(5.076)	(8.161)	(14.289)	(7.539)	(11.436)	(30.265)
Branch6		188.887***	188.611***	184.429***	175.579***	173.046***	171.621***	175.856***	173.337***	171.615***	189.180***
		(5.640)	(6.114)	(3.308)	(7.268)	(9.363)	(11.471)	(8.300)	(9.686)	(12.080)	(12.305)
T1			18.418	20.145	24.264	24.679	35.708	32.725	34.591	27.943	27.492
			(23.745)	(26.836)	(30.517)	(31.413)	(31.184)	(29.658)	(32.593)	(24.835)	(33.033)
T2			7.857	8.056	15.269	17.153	29.904	34.818	34.607	36.239	43.702
			(25.373)	(25.351)	(31.212)	(32.741)	(29.316)	(32.548)	(32.110)	(34.015)	(41.318)
T3			79.689	82.545	86.706	89.599	109.470	112.514	114.703	112.720	111.871
			(66.481)	(71.335)	(73.589)	(75.288)	(77.885)	(78.637)	(82.138)	(80.739)	(81.226)
age				-1.377	-0.083	0.077	-0.039	0.137	0.134	-0.473	-1.065
				(2.343)	(1.707)	(1.644)	(1.884)	(1.773)	(1.736)	(2.277)	(2.280)
years of education					10.370	11.119	10.877	10.116	8.643	8.494	7.497
					(6.683)	(7.022)	(6.890)	(6.373)	(4.914)	(5.601)	(6.326)
income						-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
						(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
time preferences (impatience)							3.289	2.396	1.571	2.294	1.676
							(4.168)	(3.310)	(3.302)	(4.046)	(2.697)
household size								11.921	12.171	11.271	8.291
								(10.362)	(10.964)	(9.264)	(6.489)
financial literacy									18.786	11.252	2.141
									(22.257)	(16.831)	(11.508)
total savings										0.001	0.001
										(0.001)	(0.001)
total loans											0.000
											(0.000)
Constant	200.714***	168.090***	136.987***	190.846**	68.675	60.838	55.668	-19.650	-68.278	-40.247	-17.525
	(37.570)	(15.226)	(28.334)	(68.130)	(47.610)	(45.983)	(46.287)	(96.728)	(159.530)	(133.839)	(121.500)
Observations	295	295	295	295	295	295	289	289	289	289	289
R-squared	0.027	0.067	0.077	0.078	0.087	0.089	0.092	0.099	0.102	0.117	0.155

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix A: Exponential Growth Bias

*B1. Suppose you made a **one-time** deposit of Rs.100 in a savings account earning interest compounded annually**,** how much would it be worth after:*

Results



Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	int_once_1	int_once_2	int_once_3	int_once_4	int_once_5	int_once_6
10%	int_once_7	int_once_8	int_once_9	int_once_10	int_once_11	int_once_12

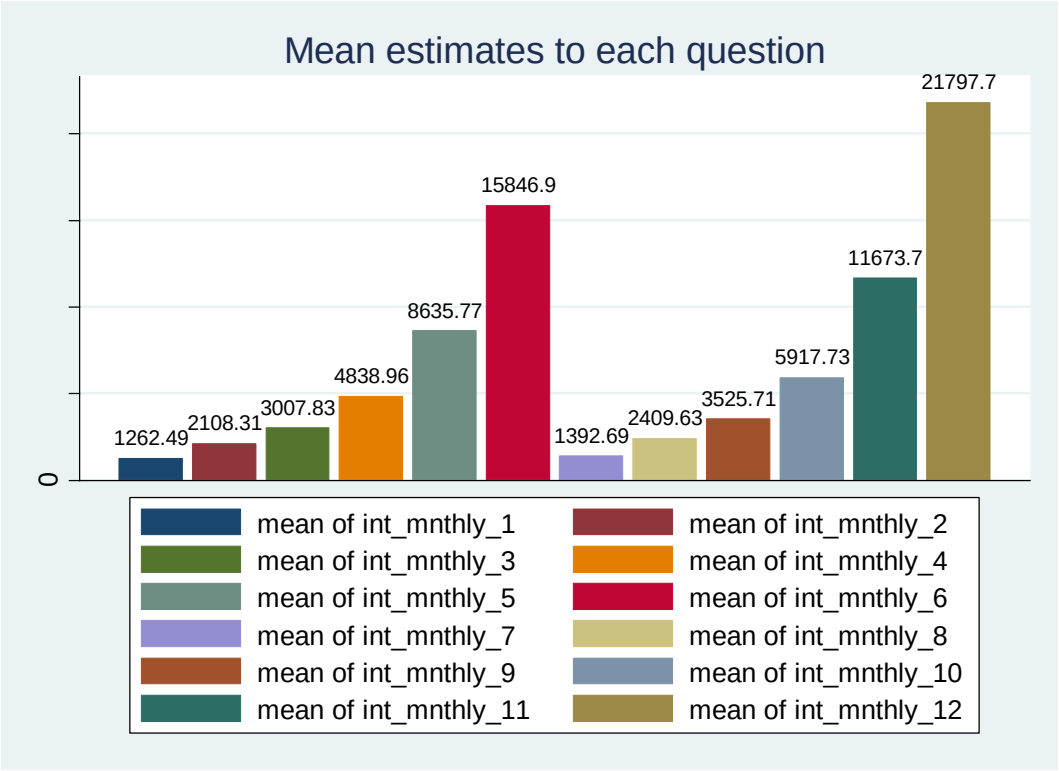
Correct Answers

Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	102	104.04	106.12	110.41	121.90	148.59
10%	110	121	133.10	161.05	259.37	672.75

Comparing the results to the correct answers, we see that on average, respondents are overestimating all the time, both in the short and long horizon, as well as for both interest rates.

B20. Suppose you deposited Rs.100 every month in a savings account earning interest compounded annually, how much would it be worth after:

Results



Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	int_mnthly_1	int_ mnthly _2	int_ mnthly _3	int_ mnthly _4	int_ mnthly _5	int_ mnthly _6
10%	int_ mnthly _7	int_ mnthly _8	int_ mnthly _9	int_ mnthly _10	int_ mnthly _11	int_ mnthly _12

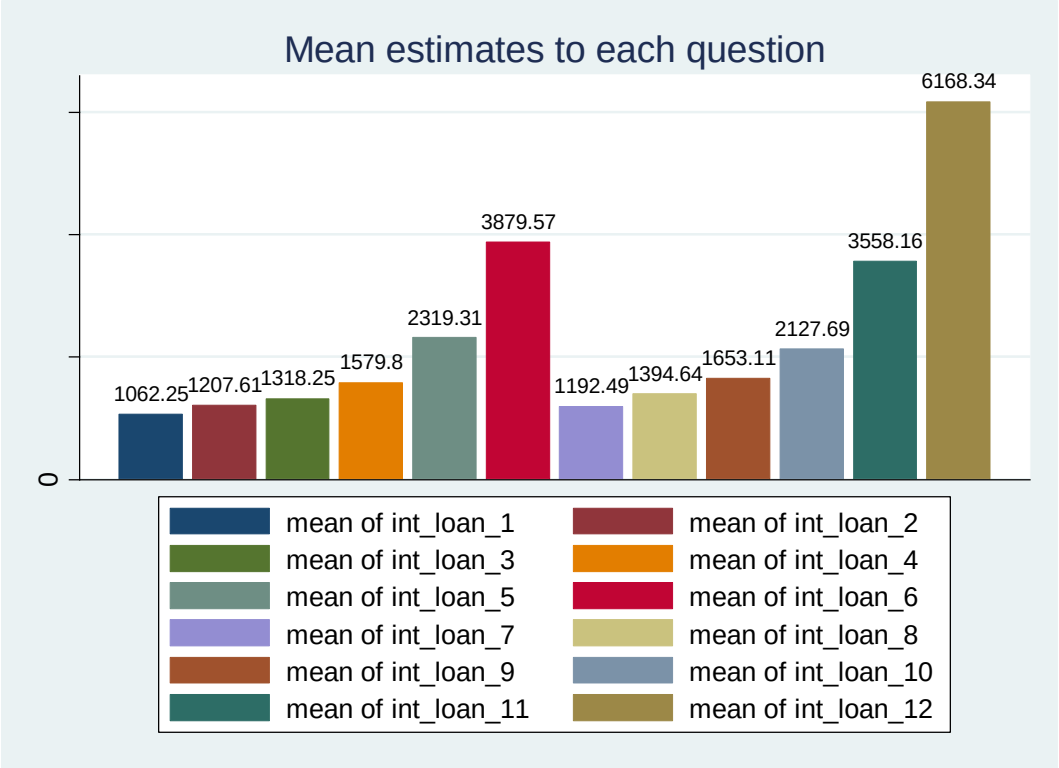
Correct Answers

Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	1,224	2,472.48	3,745.93	6,369.75	13,402.46	29,739.98
10%	1,320	2,772	4,369.20	8,058.73	21,037.40	75,603.00

Comparing the results to the correct answers, we see that on average, respondents are overestimating in short horizons of 1 to 2 years, and underestimating in horizons greater or equal to 3 years. This is consistent with both interest rates of 2% and 10%.

C26 *Suppose you **borrowed** Rs.1000 and had to repay with interest compounded annually. How much would you have to repay if you returned the money after:*

Results



Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	int_loan_1	int_ loan _2	int_ loan _3	int_ loan _4	int_ loan _5	int_ loan _6
10%	int_ loan _7	int_ loan _8	int_ loan _9	int_ loan _10	int_ loan _11	int_ loan _12

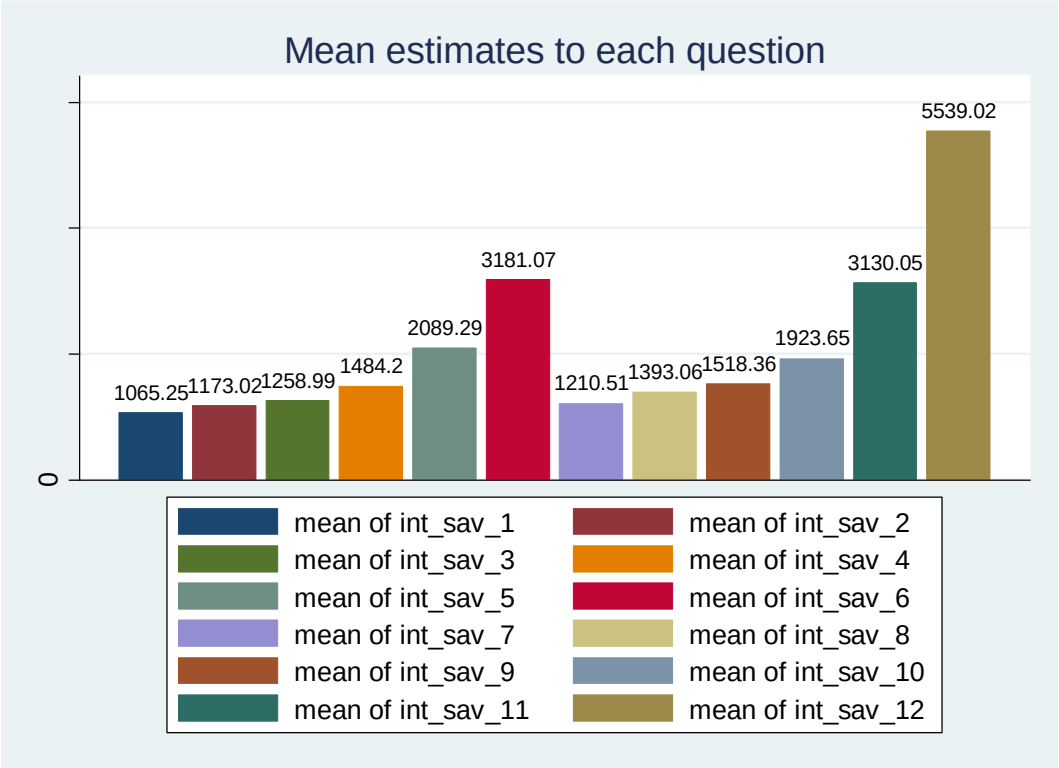
Correct Answers

Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	1,020	1,040.40	1,061.21	1,104.08	1,218.99	1,485.95
10%	1,100	1,210	1,331	1,610.51	2,593.74	6,727.50

Comparing the results to the correct answers, we see that on average, respondents are overestimating almost all the time, both in the short and long horizon, as well as for both interest rates. The only question in which respondents underestimated was for long horizon of 20 years and interest rate of 10%.

*D9 Suppose you made a **one-time** deposit of Rs.1000 in a savings account earning interest compounded annually**,** how much would it be worth after:*

Results



Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	int_sav_1	int_ sav _2	int_ sav _3	int_ sav _4	int_ sav _5	int_ sav _6
10%	int_ sav _7	int_ sav _8	int_ sav _9	int_ sav _10	int_ sav _11	int_ sav_12

Correct Answers

Rate	After 1 yr	After 2 yrs	After 3 yrs	After 5 yrs	After 10 yrs	After 20 yrs
2%	1,020	1,040.40	1,061.21	1,104.08	1,218.99	1,485.95
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Comparing the results to the correct answers, we see that on average, respondents are overestimating almost all the time, both in the short and long horizon, as well as for both interest rates. The only question in which respondents underestimated was for long horizon of 20 years and interest rate of 10%.

Define Size of mistake as $\frac{\text{correct answer - respondent's answer}}{\text{correct answer}}$, thus

(1) If the value is negative, this implies that the respondent is overestimating.

(2) If the value is positive, the respondent is underestimating.

We ran regressions of the size of mistake on the time horizon, taking interest rate as given, and controlling for individual's fixed effects.

- A positive constant term will imply that in very short time horizons (close to zero), the respondent will underestimate.

- A negative constant term will imply that in very short time horizons (close to zero), the respondent will overestimate.

- Given a positive constant term, a positive regression coefficient on time horizon implies that as the time horizon increases (ie the duration of time lengthens), the size of the mistake gets larger. The respondent consistently underestimates and the size of his underestimation increases as the duration of time becomes longer.

- Given a positive constant term, a negative regression coefficient on time horizon implies that as the time horizon increases (ie the duration of time lengthens), the size of the mistake gets smaller. The respondent is getting more accurate with his predictions by underestimating by less as the duration of time gets longer.

- Given a negative constant term, a positive regression coefficient on time horizon implies that as the time horizon increases (ie the duration of time lengthens), the size of the mistake gets larger. The respondent is getting more accurate with his predictions by overestimating by less as the duration of time gets longer.

- Given a negative constant term, a negative regression coefficient on time horizon implies that as the time horizon increases (ie the duration of time lengthens), the size of the mistake gets larger. The respondent consistently overestimates and the size of his overestimation increases as the duration of time becomes longer.

Appendix B: Sample Size Calculations

First intervention

Our main outcome of interest is the rate at which individuals adopt the pension plan across different treatments. This is a binary variable (Yes/No), so we are essentially comparing proportions of takeup across groups. Let us consider the comparison between the control group and any treatment group. The standard error of the difference in takeup is given by:

$$\sqrt{p_t\ (1-p_t)\ /\ n_t + p_c(1-\ p_c)\ /n_c}$$

Here, p_t and p_c refer to expected proportions of takeup in treatment and control groups, respectively, and n_t and n_c refer to the sample sizes of treatment and control groups, respectively. We will be selecting sample of equal size, so $n_t = n_c = n$, which yields the following standard error:

$$\sqrt{\frac{p_t(1-p_t) + \ p_c\ (1-p_c)}{n}}$$

We will adopt the following common, conservative standard: we would like an 80% chance of detecting a statistically significant difference, which is estimated at at least 8% (in other words, we make the conservative assumption that takeup will vary by more than 8% between treatment and control groups). In order to achieve this, the sample size should be large enough that the estimated difference is at least 2.8 standard errors away from 0. In other words:

$$0.08 \quad > \quad 2.8\sqrt{\frac{p_t(1-\ p_t) + \ p_c(1-p_c)}{n}}$$

$$\Rightarrow n > \left(\frac{2.8}{0.08}\right)^2 [p_t\ (1-p_t) + \ p_c\ (1-p_c)]$$

An upper bound on $[p_t\ (1-p_t) + \ p_c\ (1-p_c)]$ is $p_t\ (1-p_t) + \ p_c\ (1-p_c)$. So, our sample size requirement is:

$$n > \left(\frac{2.8}{0.08}\right)^2 \left(\frac{1}{2}\right) = 612.5$$

Our sample size of 750 is a safe and reasonable number given these requirements.

Second intervention

Our main outcome of interest is the rate at which individuals adopt the pension plan across different treatments. This is a binary variable (Yes/No), so we are essentially comparing proportions of takeup across groups. Let us consider the comparison between the control group and any treatment group. The standard error of the difference in takeup is given by:

$$\sqrt{p_t\,(1-p_t)/n_t + p_c(1-p_c\,)/n_c}$$

Here, p_t and p_c refer to expected proportions of takeup in treatment and control groups, respectively, and n_t and n_c refer to the sample sizes of treatment and control groups, respectively. We will be selecting sample of equal size, so $n_t = n_c = n$, which yields the following standard error:

$$\sqrt{\frac{p_t(1-p_t) + p_c\,(1-p_c)}{n}}$$

We will adopt the following common, conservative standard: we would like an 80% chance of detecting a statistically significant difference, which is estimated at at least 15% (in other words, we make the conservative assumption that take up will vary by more than 15% between treatment and control groups). In order to achieve this, the sample size should be large enough that the estimated difference is at least 2.8 standard errors away from 0. In other words:

$$0.15 > 2.8\sqrt{\frac{p_t(1-p_t) + p_c\,(1-p_c)}{n}}$$

$$\Rightarrow n > \left(\frac{2.8}{0.15}\right)^2 [p_t(1-p_t) + p_c(1-p_c)]$$

An upper bound on $[p_t(1-p_t) + p_c(1-p_c)]$ is $\frac{1}{2}$. So, our sample size requirement is:

$$n > \left(\frac{2.8}{0.15}\right)^2 \left(\frac{1}{2}\right) = 174$$

Our sample size of 325 is a safe and reasonable number given these requirements.

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