The Role of Regret in Prize-Linked Savings: Experimental Evidence from Kenya

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Savings as a Policy Objective

- Access to savings is an important avenue toward economic development.

- Poor households face savings constraints.
  - Only 22 percent of the world's poorest have an account at a financial institution (Demirguc-Kunt et al. 2018). Even less use them regularly.
  - The prevalence of alternative strategies (livestock, cash under the mattress, informal groups, gambling, etc.) suggest a latent demand for saving.

- Product design (default savings, commitment devices, reminders) targeted to problems of self-control/attentiveness have proven very cost-effective (Ashraf, Karlan, and Yin 2006; Dupas and Robinson 2013; Somville and Vandewalle 2018).

Prize-Linked Savings

Prize-linked savings (PLS) provide stochastic returns to savings deposits (a lottery ticket for saving).

- Typically returns full principal (no negative returns).

- Involves both in-kind and monetary rewards.

- Has existed since the 17th century and can be found in both the developed and developing world.

- There is policy interest in using this product as a way to encourage saving (Kearney et al. 2010).

Research Questions

1. Can prize-linked savings induce account usage in low-income settings?

2. How much of this effect can we attribute to a specific mechanism (regret aversion)?

Overview

- Provided a mobile savings account to 311 periurban residents of Nairobi, Kenya.

- Experimentally vary the incentive structure (fixed versus stochastic) and information structure.

- Observe account activity over a 60-day period.
  1. Estimate the effect of stochastic incentives on program savings and usage.
  2. Estimate the effect on savings by other means, consumption, and gambling.
  3. Quantify the role of regret aversion.

Study Setting

- Sample of 311 adults from Kibera and other settlements around Nairobi.
- Less than half of the sample consider themselves employed.
- Many are salespersons and casual laborers: only 5% receive regular income with an average of USD PPP 77 monthly.
- A little over half save regularly and most use ROSCAs.
- Average savings amount to USD 23.
- 24% report having gambling problems.

Mobile Savings

- Subjects provided an airtime account linked to their mobile phones for 60 days.

- Transactions made by sending airtime free of charge.

- Subjects received daily SMS reporting balance.

- Lockbox savings; withdrawal allowed only on the 30th and final day.

- Principal and returns transferred to subjects after 60 days via M-Pesa.

Experiment

Control ($N = 105$)

- Certain 5% return applied to daily deposits
- Daily balance and returns reported via SMS

PLS ($N = 103$)

- Subjects are given a lottery ticket daily
- Returns are proportional to your deposit that day
- Lottery is drawn the following morning
- Always given feedback on whether lottery ticket wins

PLS conditional feedback ($N = 103$)

- Incentives identical to PLS
- Received a lottery ticket only if made a deposit that day
- No feedback on lottery results if no deposit

Data

1. Subject demographics, preference elicitation, and psychological indices from a lab session before the experiment.

2. Detailed daily transaction data (deposits, withdrawals, balances).

3. Savings by other means, self-reported gambling behavior, and program feedback from an endline questionnaire.

I. What are the effects of prize-linked incentives on savings?

Effect on Savings

$$Y_i = \beta_0 + \beta_1 NF_i + \beta_2 PLS_i + \varepsilon_i \tag{1}$$

Y_i : outcome for individual i

NF_i : assignment to No Feedback group

PLS_i : assignment to PLS (with feedback) group

ε_i : idiosyncratic error

Effect on Savings

Table 1: Treatment effects – Mobile savings

	Effect estimates			Sample	
	(1)	(2)	(3)	(4)	(5)
	No Feedback	PLS	PLS-No Feedback	Control Mean (SD)	Obs.
Total no. of deposits		5.71**		13.66	311
		(2.45)		(15.08)	
No. of days saved		4.94**		11.78	311
		(2.08)		(12.93)	
Total deposit amount		-1.60		14.87	311
		(2.91)		(24.48)	
Total withdrawal amount		1.63**		1.07	311
		(0.74)		(4.53)	

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses. Columns 4–5 report the mean and SD of the control group and the number observations, respectively. Observations are at the individual level. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Effect on Savings

- The "extensive margin": effects on account usage but not total savings.
  - Consistent with other studies of lottery incentives (Brune 2015; Gertler et al. 2017).
  - Null effect on savings amount likely due to liquidity constraints.

II. How much of the effect can be explained by regret aversion?

A Theory of Regret

- Preferences depend on comparisons between outcomes of chosen and foregone prospects (Bell 1983; Loomes and Sugden 1982).
- Individuals experience regret after the resolution of prospects. Suppose state i is realized, $f, g \in B$, and f is chosen.

$$Q(f_i; g_i) = u(f_i) + R(u(f_i) - u(g_i))$$

- R is non-decreasing and satisfies $R(0) = 0$.

$$f \succsim g \leftrightarrow \sum_i p_i \cdot [Q(f_i; g_i) - Q(g_i; f_i)] \geq 0$$

- Q linear corresponds to EU theory while Q convex corresponds to regret aversion.

Identifying Regret Aversion

- Regret is not experienced (not anticipated) if unchosen prospects are not resolved.

- Manipulation of feedback have predictable consequences for behavior of regret averse individuals.

- This is the central test of regret aversion (Filiz-Ozbay and Ozbay 2007; Zeelenberg and Pieters 2004; Zeelenberg et al. 1996).

- **Hypothesis**: More deposits in PLS with feedback than without.

The Role of Regret Aversion

Table 2: Treatment effects – Mobile savings

	Effect estimates			Sample	
	(1)	(2)	(3)	(4)	(5)
	No Feedback	PLS	PLS-No Feedback	Control Mean (SD)	Obs.
Total no. of deposits	4.59*	5.71**	1.13	13.66	311
	(2.52)	(2.45)	(2.84)	(15.08)	
No. of days saved	3.93*	4.94**	1.01	11.78	311
	(2.05)	(2.08)	(2.32)	(12.93)	
Total deposit amount	-0.79	-1.60	-0.81	14.87	311
	(3.34)	(2.91)	(2.88)	(24.48)	
Total withdrawal amount	0.53	1.63**	1.10	1.07	311
	(0.94)	(0.74)	(1.02)	(4.53)	

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses. Columns 4–5 report the mean and SD of the control group and the number observations, respectively. Observations are at the individual level. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Results – Regret Aversion

Figure 1: Timing of deposits
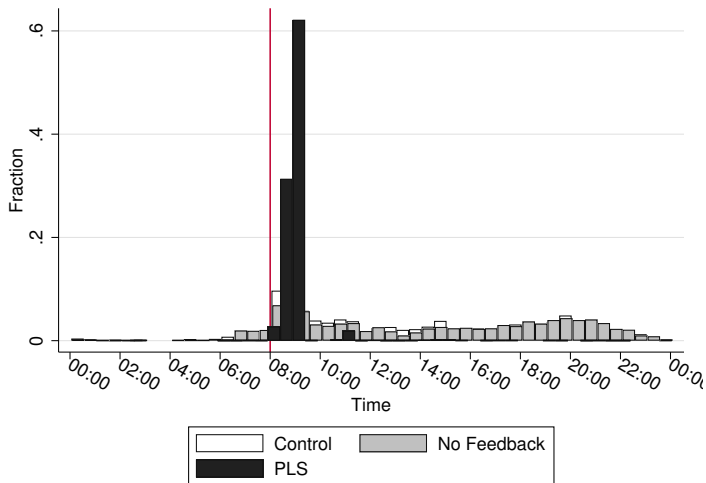
III. What are the effects of PLS on expenditures and savings by other means?

Results – Other Savings

Table 3: Treatment effects – Savings outside the project

	Effect estimates			Sample	
	(1)	(2)	(3)	(4)	(5)
	No Feedback	PLS	PLS-No Feedback	Control Mean (SD)	Obs.
Total savings last month	18.45	-17.87	-36.32	80.31	284
	(25.16)	(14.64)	(24.06)	(112.74)	
M-Pesa savings last month	-5.42	-6.71	-1.29	20.42	284
	(6.34)	(5.49)	(5.30)	(44.67)	
ROSCA savings last month	1.48	7.37	5.89	22.24	283
	(6.76)	(6.79)	(7.33)	(42.18)	
Saves with a ROSCA	-0.02	0.14**	0.16**	0.54	284
	(0.07)	(0.07)	(0.07)	(0.50)	

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses. Columns 4–5 report the mean and SD of the control group and the number observations, respectively. Observations are at the individual level. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Results – Expenditure

Table 4: Treatment effects – Expenditure

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS-No Feedback	(4) Control Mean (SD)	(5) Obs.
Airtime	-0.33**	-0.13	0.20*	0.35	284
	(0.15)	(0.19)	(0.12)	(1.47)	
Business-related	0.08*	0.10**	0.02	0.06	284
	(0.04)	(0.05)	(0.05)	(0.25)	
Durable goods	-0.06	-0.01	0.05	0.13	284
	(0.04)	(0.05)	(0.04)	(0.34)	
Loan repayment	-0.01	-0.02	-0.01	0.09	284
	(0.04)	(0.04)	(0.04)	(0.28)	
Food	0.04	-0.08	-0.12*	0.28	284
	(0.07)	(0.06)	(0.06)	(0.45)	
Rent and housing payments	-0.03	-0.00	0.03	0.11	284
	(0.04)	(0.04)	(0.04)	(0.31)	
Health-related	-0.02	-0.03*	-0.01	0.03	284
	(0.02)	(0.02)	(0.01)	(0.18)	
Other non-durables	0.01	0.03	0.02	0.01	284
	(0.02)	(0.02)	(0.03)	(0.10)	
Saved balance	0.04	0.06	0.02	0.07	284
	(0.04)	(0.04)	(0.05)	(0.26)	
School-related	0.08	0.02	-0.06	0.12	284
	(0.05)	(0.05)	(0.05)	(0.32)	
Transfers	0.02	-0.00	-0.02	0.02	284
	(0.03)	(0.02)	(0.03)	(0.15)	
Travel	-0.00	-0.00	0.00	0.02	284
	(0.02)	(0.02)	(0.02)	(0.15)	
Did not save	-0.02	-0.01	0.01	0.10	284
	(0.04)	(0.04)	(0.04)	(0.30)	

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses. Columns 4–5 report the mean and SD of the control group and the number observations, respectively. Observations are at the individual level. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

IV. What are the effects of PLS on gambling?

Results

Table 5: Multinomial treatment effects – Gambling behavior

	Relative risk ratio				Sample
	(1)	(2)	(3)	(4)	(5)
	Constant	No Feedback	PLS	PLS-No Feedback	Obs.
Gambled less	0.22***	0.91	1.69	1.86	284
	(0.06)	(0.38)	(0.66)	(0.76)	
Gambled more	0.16***	1.62	3.03***	1.87*	284
	(0.05)	(0.69)	(1.23)	(0.69)	

Notes: This table reports estimates from a multinomial logit regression of the categorial response on treatment assigment. Each row corresponds to a response category with the baseline value as . Column 1 reports the constant term corresponding to the mean of the control group. Columns 2–3 reports the treatment effect in relative risk ratios compared to the control group. Column 4 reports the difference between the two PLS treatments. Standard errors are in parentheses. Column 5 reports the number of observations in the analytic sample. Observations are

Conclusion

- The savings experiment finds that:
  1. PLS can increase account usage but not savings per se.
  2. Behavior is consistent with regret aversion.
  3. Little effect on other savings, consumption.
  4. Some evidence that PLS is complementary to gambling.

- Policy implications
  - Welfare consequences are not obvious.
  - Revenue neutral (in expectation) compared to standard subsidies.
  - Useful from a policy perspective if it encourages habit formation (Schaner 2018).

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The Decision to Save with PLS

- A one-shot decision problem to save under PLS. Denote f_i the payoff for depositing in state i of the lottery draw and $u(f_i)$ the associated VNM utility.
- Saving without feedback satisfies

$$\sum_{i=1}^{4} p_i \cdot [u(f_i) + \gamma R(u(f_i) - u(0))] \geq u(0) \tag{2}$$

$$\sum_{i=1}^{4} p_i \cdot [u(f_i) + \gamma R(u(f_i) - u(0))] \geq u(0) + \sum_{i=1}^{4} p_i \cdot \gamma R(u(0) - u(f_i)) \tag{3}$$

- Under standard assumptions, saving without feedback condition is stricter than always with feedback so marginal individuals will be induced to save when they expect feedback.
- Captures the idea that people who don't save may or may not be exposed to regret and that they take this into account ex ante.
- Without regret ($\gamma = 0$), there is no effect of lottery feedback.

Financial Inclusion

More account ownership does not necessarily translate into more formal saving
Adults with an account (%)
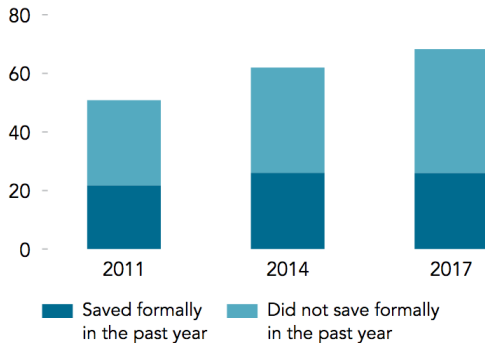
Source: Global Findex database.

Lottery Draws

Table 6: Observed and expected lottery results

	Freq.	Pct. observed	Pct. expected
No match	7065	81.49	62.43
One match	1518	17.51	22.22
Two matches	86	0.99	1.23
Complete match	1	0.01	0.00

Notes: The first column tabulates the frequency of observed lottery ticket matches. The second and third columns report the observed and expected probabilities, respectively, of each type of lottery match. A lottery ticket was a random sequence of four numbers between 1 and 9, inclusive. Prizes were awarded according to how well a participant's lottery numbers matched the winning numbers. If the first or second numbers matched, a 10% match of savings was awarded. If *both* the first and second numbers matched, a 100% match of savings was awarded. If all numbers matched, a prize of 200 times the daily savings was awarded.

Results – Regret Aversion

We estimate the following equation conditional on assignment to the PLS with feedback group and not having saved one period prior.

$$Y_{i,t} = \pi \text{Win}_{i,t-1} + \omega_t + u_{i,t} \tag{4}$$

$Y_{i,t}$: i made a deposit at time t

$\text{Win}_{i,t-1}$: won yesterday's lottery

ω_t : period fixed effect

u_i : idiosyncratic error

Results – Regret Aversion

Table 7: Regression of deposits on treatment and lottery results

	Made a deposit
Winning ticket	0.02**
	(0.01)
Adjusted R^2	0.081
Control mean	0.20
Observations	4473

Notes: This table reports estimates of a regression of having saved at period t on winning the lottery at t conditional on being in the PLS group and not having saved at $t-1$. The unit of observation is individual-by-period. Standard errors are in parentheses and clustered at the individual level. * denotes significance at 10