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.
  - Estimate the effect of stochastic incentives on account usage
  - Estimate the effect on savings by other means, consumption, and gambling
  - Quantify the role of regret aversion

Related Literature

1. **The effect of PLS on savings**: We are one of the first field experiments studying lottery incentives and the first to test for mechanisms.
   - In the lab, lotteries effectively increase the savings rate (Atalay et al. 2014; Filiz-Ozbay et al. 2015).
   - In the field, works over many domains (Brune 2015; Dizon and Lybbert 2016; Gajic, Cameron, and Hurley 2011; Gertler et al. 2017; Loibl et al. 2016).
2. **Regret aversion in economic choice**: first to study regret aversion in the domain of household finance and provide some evidence on dynamic effects.
   - Lottery feedback influences play in Dutch postcode lotteries (Zeelenberg and Pieters 2004).
   - Loser's regret drives overbidding in first price auctions (Filiz-Ozbay and Ozbay 2007).
   - Repeated experiences of regret dissuades risky choices and feedback provides learning opportunities (Imas, Lamé, and Wilson 2016).

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 ($N = 103$)

- Enter into a lottery drawn daily
- Equal in expectation to 5% return and guarantees no losses
- Always given feedback on whether lottery ticket wins
- Only redeemable if deposited that day

PLS without feedback ($N = 103$)

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

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.

Results

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

Results – Mobile Savings

Table 1: Treatment effects – Mobile savings

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS-No Feedback	(4) Control Mean (SD)	(5) 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.

Discussion – Mobile Savings

- Effects occur on the "extensive margin".
  - Consistent with other studies of lottery incentives (Brune 2015; Gertler et al. 2017).
  - Can be rationalized as the subdivision of lotteries (Samuelson 1963).
- Null effect on savings amount likely due to liquidity constraints (Loibl et al. 2016).
- What does this tell us about potential mechanisms?

Results

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

A Theory of Regret

Regret (Zeelenberg and Pieters 2004)

"...a negative, cognitively based emotion that we experience when realizing or imagining that our present situation would have been better, had we decided differently"

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 obtains, $f, g \in B$, and f is chosen.

$$\Psi(f_i; g_i) = u(f_i) + \gamma R(u(f_i) - u(g_i))$$

- R is strictly increasing, decreasingly concave, and satisfies $R(0) = 0$.
- If individuals can anticipate regret/rejoicing then it affects ex ante behavior.

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

Identifying Regret Aversion

- Regret is not experienced (anticipated) if unchosen prospects are not resolved.
- This is the central test of regret aversion in the lab (Filiz-Ozbay and Ozbay 2007; Zeelenberg and Pieters 2004; Zeelenberg et al. 1996).
- In our study, individuals in PLS treatments can experience regret only if they chose *not* to save and learned about a winning ticket at the resolution of the daily lottery.
- **Hypothesis**: More deposits with feedback than without.

Results – Regret Aversion

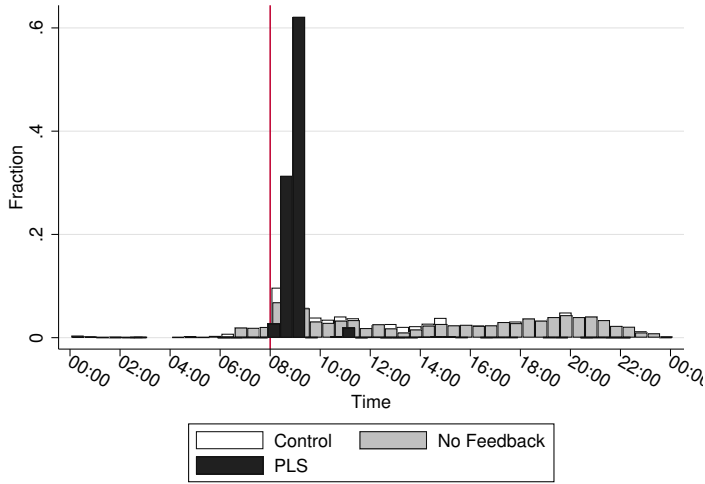
Table 2: Treatment effects – Mobile savings

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS-No Feedback	(4) Control Mean (SD)	(5) 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

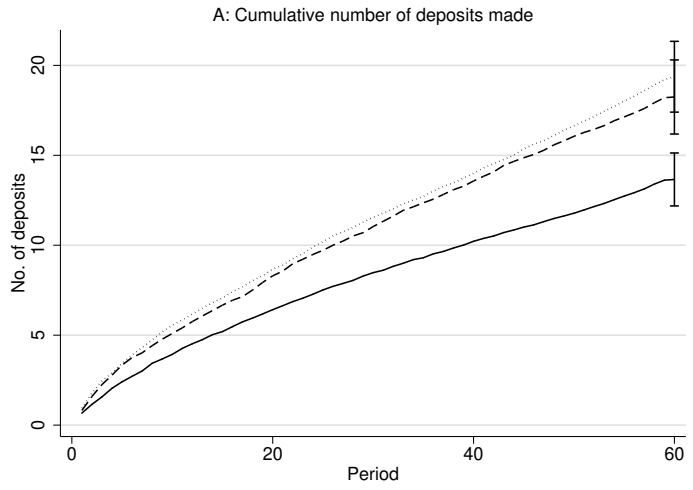
Figure 1: Timing of deposits



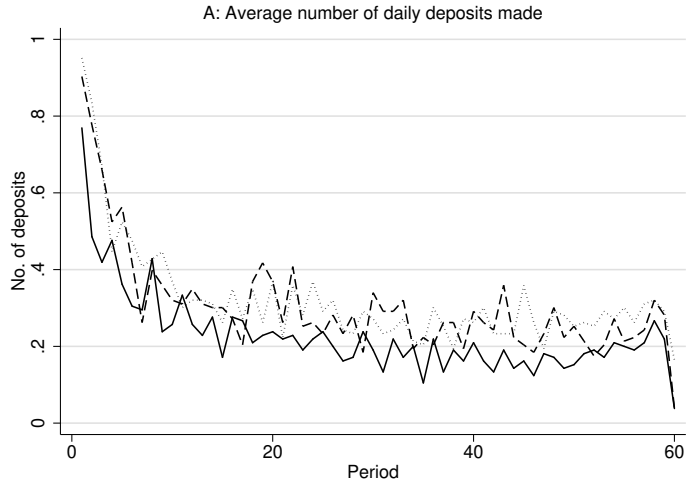
Results

How does the effect evolve over time?

Results – Effects Over Time



Results – Effects Over Time



Conclusion

- The savings experiment finds that:
  - PLS can increase account usage but not savings per se.
  - Behavior is consistent with regret aversion.
  - Recently experienced regret reinforces subsequent effect.
  - Little effect on other savings, consumption, gambling.

- Further research
  - Observe entire portfolio of assets, consumption.
  - Investigate long-term effects.
  - A structural approach to help quantify role of alternative explanations.
  - Examine cost-effectiveness relative to other products.
  - Understand learning and salience of regret.
  - Understanding portfolio selection when all types of savings are available.

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Regret Aversion with PLS

- Suppose $u(0) = 0$ and denote f_i the payoff for depositing in state i.
- Saving without feedback:

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

- Saving with feedback:

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

- $R(0) = 0$ and strictly increasing implies that $R(u(f_i)) > 0$ and $R(-u(f_i)) < 0$.

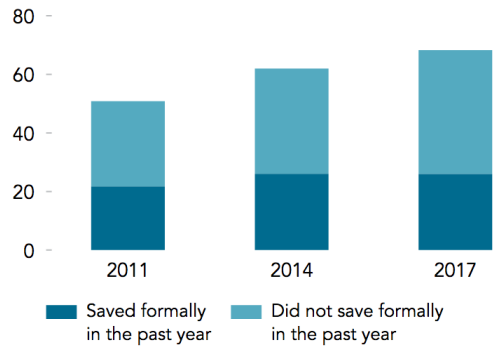
Demonstration

	States of the world		
Choice	Blue (33.3%)	Yellow (33.3%)	Red (33.3%)
A	$50	$100	$0
B	$0	$50	$100

Financial Inclusion

More account ownership does not necessarily translate into more formal saving

Adults with an account (%)



Source: Global Findex database.

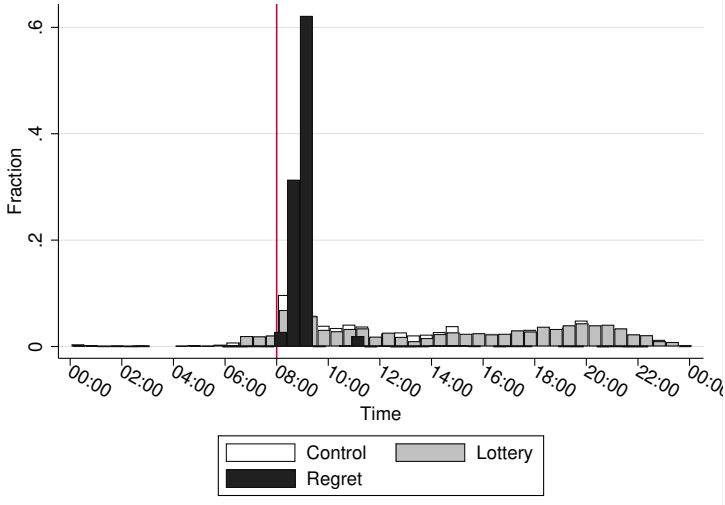
Lottery Draws

Table 3: 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.

Timing


Fraction
0
.2
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00:00
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08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time
Control
Lottery
Regret

Results

Table 4: Treatment effects – Savings outside the project

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS-No Feedback	(4) Control Mean (SD)	(5) 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

Table 5: 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.

Results

Table 6: Treatment effects – Gambling

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS-No Feedback	(4) Control Mean (SD)	(5) Obs.
Gamble more	0.06	0.15***	0.08	0.12	284
	(0.05)	(0.06)	(0.06)	(0.32)	
Gamble less	-0.02	0.04	0.06	0.16	284
	(0.05)	(0.06)	(0.05)	(0.37)	
More tempted to gamble	0.09	0.05	-0.04	0.47	284
	(0.07)	(0.07)	(0.07)	(0.50)	
Less tempted to gamble	-0.01	0.03	0.04	0.06	284
	(0.03)	(0.04)	(0.04)	(0.25)	

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.