

Using Lotteries to Encourage Savings: Experimental Evidence from Kenya

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Savings as a Policy Objective

- Access to savings is an important avenue toward economic development.
 - Can be used to invest in productive assets when unable to borrow.
 - Allows for some degree of consumption smoothing when insurance is incomplete.
- 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) suggest a latent demand for saving.

Savings as a Policy Objective

- ① Mobile technologies, bank expansions, lowering account requirements, etc. (Burgess and Pande 2005; Dupas and Robinson 2009; Dupas et al. 2014; Jack and Suri 2011).
- ② Subsidy experiments estimate very low interest rate elasticities (Karlan and Zinman 2018; Schaner 2018).
- ③ Financial literacy is low in developing countries and education interventions have mixed results (Miller et al. 2015).
- ④ 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).

- There is policy interest in using this product as way to encourage saving (Kearney et al. 2010).
- Has existed since the 17th century in England and common in many parts of the world (ibid.).
- NS&I Premium Bonds in the U.K. since 1956 and A-Million-A-Month in South Africa (defunct).
- Legal in the US since 2014.

Prize-Linked Savings

How might lotteries induce savings over regular interest-bearing accounts?

- Thrill of playing (Conlisk 1993).
- Large sums for purchasing durable goods when credit constrained/adjustment costs (Herskowitz 2016).
- Non-linear probability weighting (Kahneman and Tversky 1992).
- **Aversion to anticipated regret** can induce apparently risk-seeking behavior (Bell 1983; Loomes and Sugden 1982; Zeelenberg et al. 1996).

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.
 - Test the effect of stochastic incentives
 - Quantify the role of regret aversion
 - Limited evidence on total savings, consumption, gambling
 - Heterogeneous effects

Related Literature

- Do lottery-like incentives work?
 - In the lab, lotteries effectively increase the savings rate (Atalay et al. 2014; Filiz-Ozbay et al. 2015). Evidence for non-linear probability weighting.
 - 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).
- Contributions
 - Account usage as an outcome has been given little attention.
 - A field experiment that quantifies the role of a specific channel.
 - One of the few tests of regret aversion outside the lab.

Study Setting



Study Setting

Sample of 311 adults from Kibera and other settlements around Nairobi.

- Less than half of the sample consider themselves employed.
- Only 5% receive regular income with an average of USD PPP 77 monthly.
- A little over half save regularly and most use ROSCAs.
- Average monthly savings amount to USD 23.
- 24% report having gambling problems.

Mobile Savings

- Respondents provided a mobile phone linked to a Sambaza account for 60 days.
- Make deposits by sending airtime free of charge.
- Respondents received daily SMS reporting balance.
- Lockbox savings; withdrawal allowed only on the 30th day.
- Principal returned after 60 days via M-Pesa.

Experiment

Control ($N = 105$)

- Certain 5% match on daily deposits
- Daily balance and returns reported via SMS

PLS ($N = 103$)

- Daily lottery equal in expectation to 5% return
- Guarantees no losses
- Always gets a lottery ticket but redeemable if deposited

PLS without feedback ($N = 103$)

- Incentives identical to PLS
- Received a lottery ticket only if made a deposit that day

Data

- ① Subject demographics and preference elicitation 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** (2.45)		13.66 (15.08)	311
No. of days saved		4.94** (2.08)		11.78 (12.93)	311
Total deposit amount		-1.60 (2.91)		14.87 (24.48)	311
Total withdrawal amount		1.63** (0.74)		1.07 (4.53)	311

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.

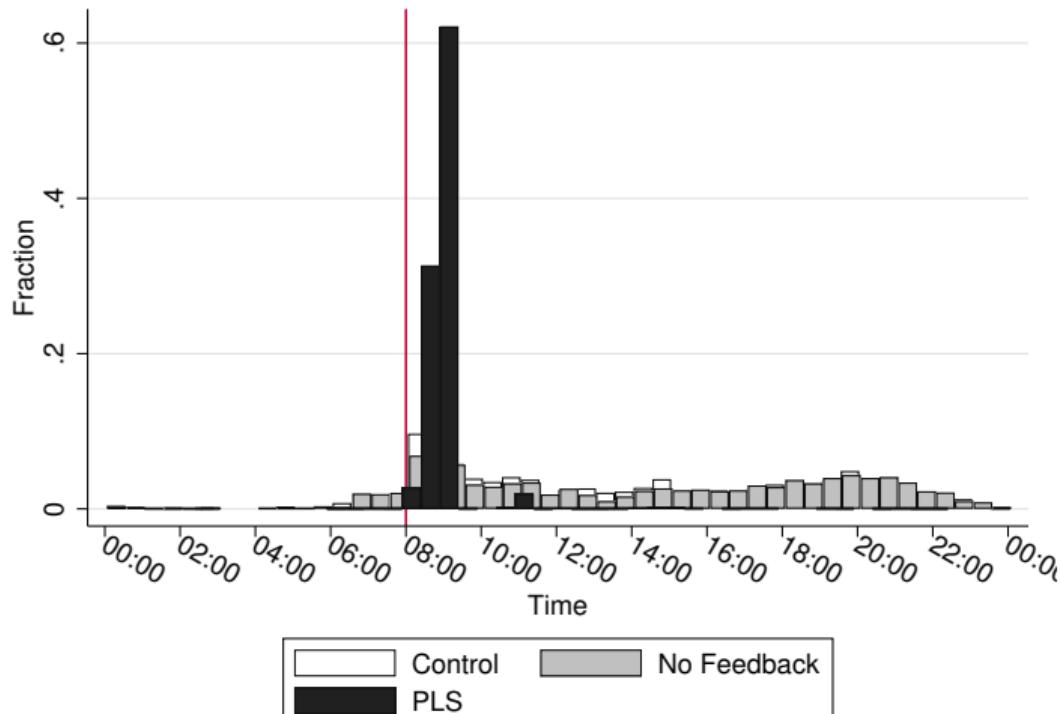
Results – Regret Aversion

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* (2.52)	5.71** (2.45)	1.13 (2.84)	13.66 (15.08)	311
No. of days saved	3.93* (2.05)	4.94** (2.08)	1.01 (2.32)	11.78 (12.93)	311
Total deposit amount	-0.79 (3.34)	-1.60 (2.91)	-0.81 (2.88)	14.87 (24.48)	311
Total withdrawal amount	0.53 (0.94)	1.63** (0.74)	1.10 (1.02)	1.07 (4.53)	311

Results – Regret aversion

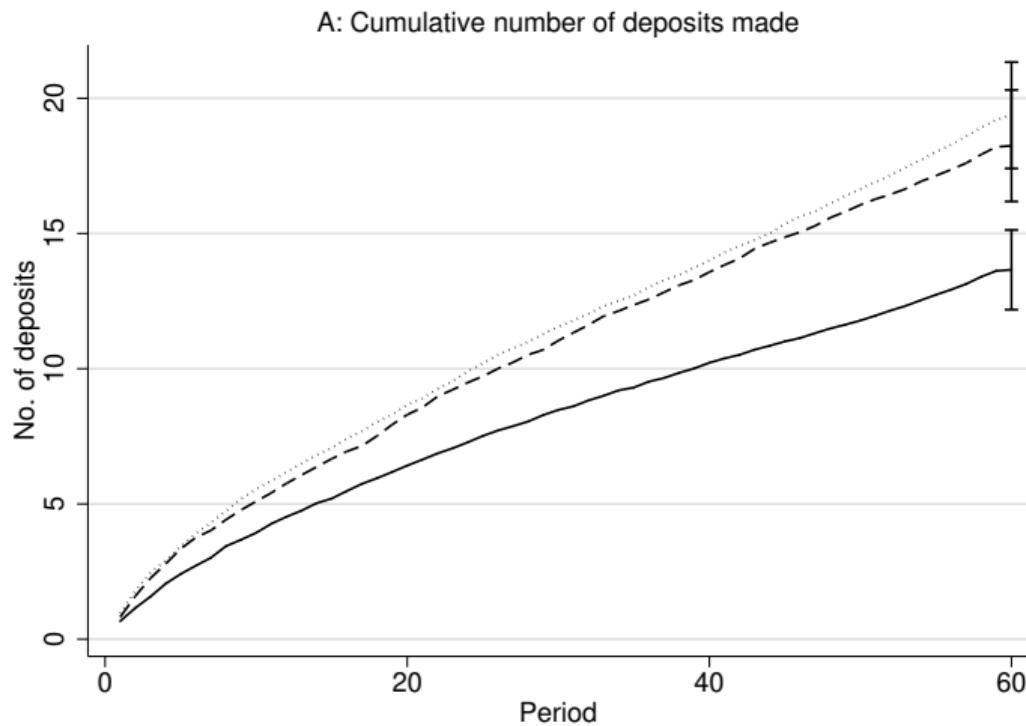
Figure 1: Timing of deposits



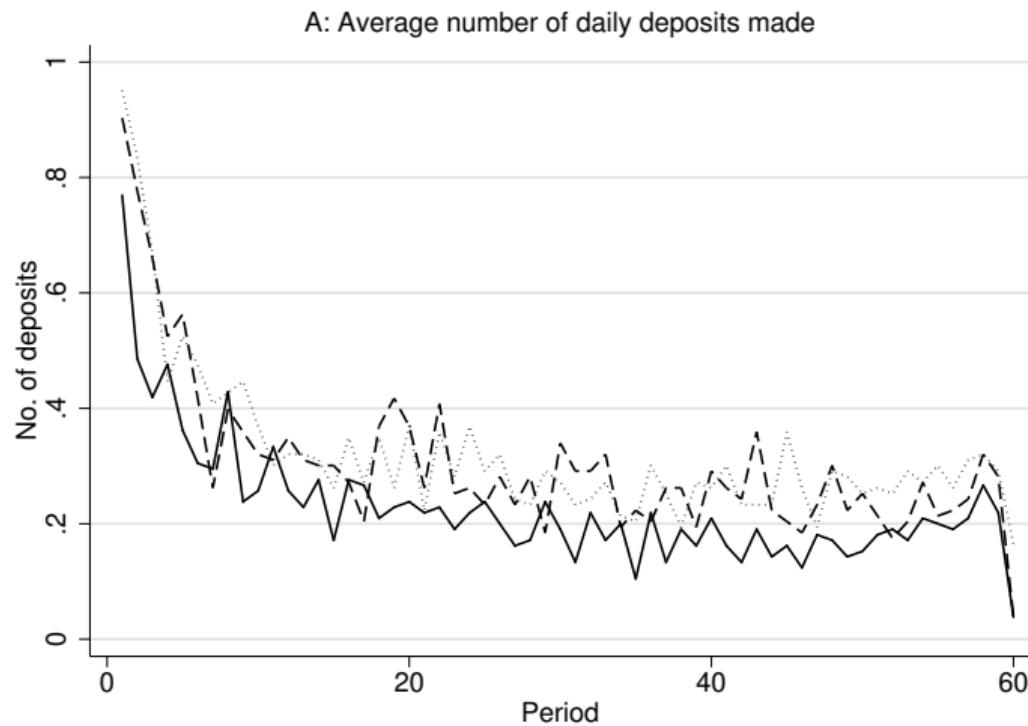
Results

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.

References |

- Ashraf, Nava, Dean Karlan, and Wesley Yin. "Tying Odysseus to the Mast: Evidence From a Commitment Savings Product in the Philippines". In: *The Quarterly Journal of Economics* 121.2 (May 2006), pp. 635–672. ISSN: 0033-5533, 1531-4650. DOI: 10.1162/qjec.2006.121.2.635.
- Atalay, Kadir et al. "Savings and prize-linked savings accounts". In: *Journal of Economic Behavior & Organization* 107, Part A (Nov. 2014), pp. 86–106. ISSN: 0167-2681. DOI: 10.1016/j.jebo.2014.07.015.
- Bell, David E. "Risk premiums for decision regret". In: *Management Science* 29.10 (1983), pp. 1156–1166.
- Brune, Lasse. "The Effect of Lottery-Incentives on Labor Supply: A Firm Experiment in Malawi". In: (2015).
- Burgess, Robin and Rohini Pande. "Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment". In: *The American Economic Review* 95.3 (2005). Publisher: American Economic Association, pp. 780–795. ISSN: 0002-8282.

References II

- Conlisk, John. "The utility of gambling". In: *Journal of Risk and Uncertainty* 6.3 (1993), pp. 255–275.
- Demirguc-Kunt, Asli et al. *The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution*. The World Bank, 2018.
- Dizon, Felipe and Travis J. Lybbert. "Leveraging the Lottery for Financial Inclusion: Lotto-Linked Savings Accounts in Haiti". In: (2016).
- Dupas, Pascaline and Jonathan Robinson. *Savings constraints and microenterprise development: Evidence from a field experiment in Kenya*. Tech. rep. National Bureau of Economic Research, 2009.
- . "Why don't the poor save more? Evidence from health savings experiments". In: *The American Economic Review* 103.4 (2013), pp. 1138–71.
- Dupas, Pascaline et al. "Challenges in banking the rural poor: Evidence from Kenya's western province". In: *African Successes: Modernization and Development*. University of Chicago Press, 2014.

References III

- Filiz-Ozbay, Emel and Erkut Y. Ozbay. "Auctions with anticipated regret: Theory and experiment". In: *The American Economic Review* 97.4 (2007), pp. 1407–1418.
- Filiz-Ozbay, Emel et al. "Do lottery payments induce savings behavior? Evidence from the lab". In: *Journal of Public Economics* 126 (June 2015), pp. 1–24. ISSN: 0047-2727. DOI: 10.1016/j.jpubeco.2015.02.007.
- Gajic, Aleksandra, David Cameron, and Jeremiah Hurley. "The cost-effectiveness of cash versus lottery incentives for a web-based, stated-preference community survey". en. In: *The European Journal of Health Economics* 13.6 (June 2011), pp. 789–799. ISSN: 1618-7598, 1618-7601. DOI: 10.1007/s10198-011-0332-0.
- Gertler, Paul et al. "The Long-Term Effects of Temporary Incentives to Save: Evidence from a Field Experiment in Mexico". In: (2017).
- Herskowitz, Sylvan. "Gambling, Saving, and Lumpy Expenditures: Sports Betting in Uganda". In: (2016).

References IV

- Jack, William and Tavneet Suri. *Mobile money: the economics of M-PESA*. Tech. rep. National Bureau of Economic Research, 2011.
- Kahneman, Daniel and Amos Tversky. "Advances in prospect theory: Cumulative representation of uncertainty". In: *Journal of Risk and uncertainty* 5.4 (1992), pp. 297–323.
- Karlan, Dean and Jonathan Zinman. "Price and control elasticities of demand for savings". In: *Journal of Development Economics* 130 (Jan. 2018), pp. 145–159. ISSN: 0304-3878. DOI: 10.1016/j.jdeveco.2017.10.004.
- Kearney, Melissa Schettini et al. *Making Savers Winners: An Overview of Prize-Linked Savings Products*. NBER Working Paper 16433. National Bureau of Economic Research, Inc, 2010.
- Loibl, Cäzilia et al. *Testing Strategies to Increase Saving and Retention in Individual Development Account Programs*. SSRN Scholarly Paper ID 2735625. Rochester, NY: Social Science Research Network, Feb. 2016.

References V

- Loomes, Graham and Robert Sugden. "Regret theory: An alternative theory of rational choice under uncertainty". In: *The economic journal* 92.368 (1982), pp. 805–824.
- Miller, Margaret et al. "Can You Help Someone Become Financially Capable? A Meta-Analysis of the Literature". en. In: *The World Bank Research Observer* 30.2 (Aug. 2015). Publisher: Oxford Academic, pp. 220–246. ISSN: 0257-3032. DOI: 10.1093/wbro/lkv009.
- Samuelson, Paul A. "Risk and uncertainty: A fallacy of large numbers". In: (1963).
- Schaner, Simone. "The Persistent Power of Behavioral Change: Long-Run Impacts of Temporary Savings Subsidies for the Poor". en. In: *American Economic Journal: Applied Economics* 10.3 (July 2018), pp. 67–100. ISSN: 1945-7782, 1945-7790. DOI: 10.1257/app.20170453.
- Somville, Vincent and Lore Vandewalle. "Saving by Default: Evidence from a Field Experiment in Rural India". en. In: *American Economic Journal: Applied Economics* 10.3 (July 2018), pp. 39–66. ISSN: 1945-7782, 1945-7790. DOI: 10.1257/app.20160547.

References VI

Zeelenberg, Marcel and Rik Pieters. "Consequences of regret aversion in real life: The case of the Dutch postcode lottery". In: *Organizational Behavior and Human Decision Processes* 93.2 (2004), pp. 155–168.

Zeelenberg, Marcel et al. "Consequences of Regret Aversion: Effects of Expected Feedback on Risky Decision Making". In: *Organizational Behavior and Human Decision Processes* 65.2 (Feb. 1996), pp. 148–158. ISSN: 0749-5978. DOI: 10.1006/obhd.1996.0013.

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 $R(-u(f_i)) < 0$.

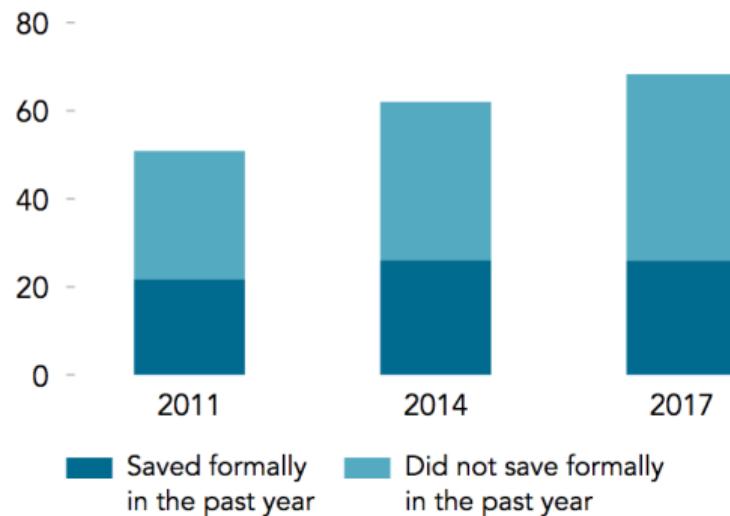
Demonstration

Choice	States of the world		
	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.

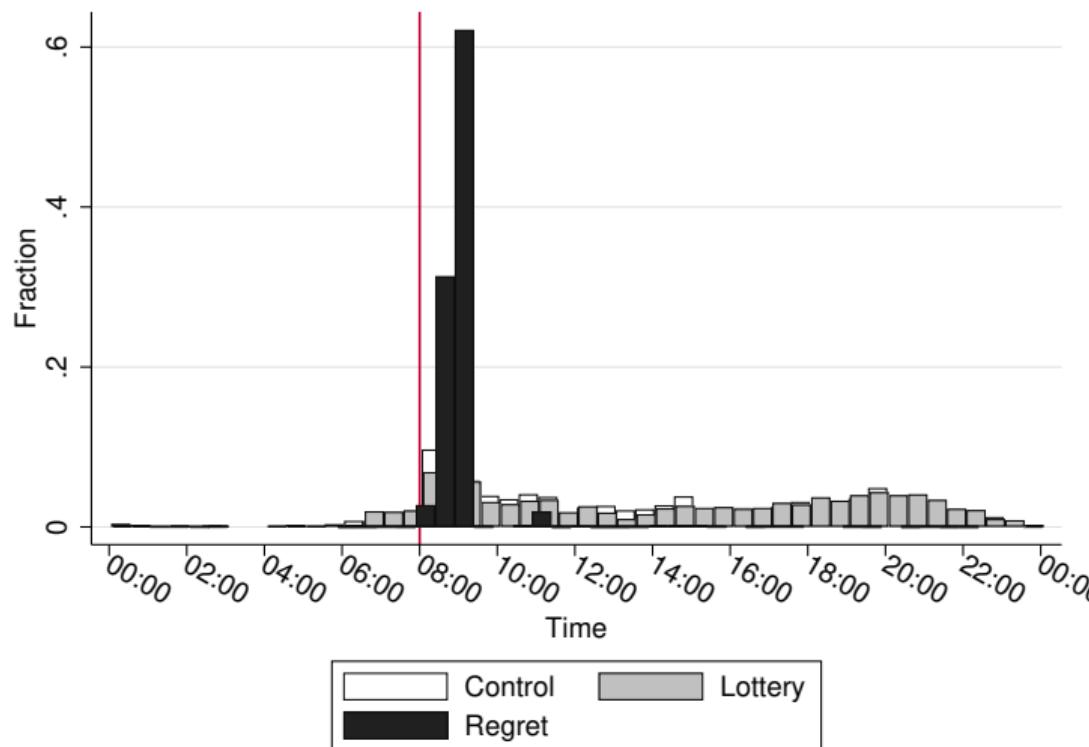
Lottery Draws

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



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 (25.16)	-17.87 (14.64)	-36.32 (24.06)	80.31 (112.74)	284
M-Pesa savings last month	-5.42 (6.34)	-6.71 (5.49)	-1.29 (5.30)	20.42 (44.67)	284
ROSCA savings last month	1.48 (6.76)	7.37 (6.79)	5.89 (7.33)	22.24 (42.18)	283
Saves with a ROSCA	-0.02 (0.07)	0.14** (0.07)	0.16** (0.07)	0.54 (0.50)	284

Note: Columns 1-3 report OLS estimates of the treatment effects. Standard errors are clustered by month. Column 4 shows the mean and standard deviation of the control group. Column 5 shows the number of observations.

Results

Table 5: Treatment effects – Expenditure

	Effect estimates			Sample	
	(1) No Feedback	(2) PLS	(3) PLS- Feedback	(4) Control Mean (SD)	(5) Obs.
Spent balance on food	0.04 (0.07)	-0.08 (0.06)	-0.12* (0.06)	0.28 (0.45)	284
Spent balance on school	0.29 (0.24)	0.17 (0.27)	-0.13 (0.32)	0.24 (1.11)	284
Spent balance on business	0.13 (0.08)	0.08* (0.04)	-0.04 (0.09)	0.06 (0.25)	284
Spent balance on durable goods	-0.00 (0.03)	-0.03 (0.03)	-0.03 (0.03)	0.05 (0.23)	284
Spent balance on repaying loans	0.04 (0.05)	-0.00 (0.04)	-0.04 (0.05)	0.11 (0.31)	284
Saved balance	0.04	0.05	0.01	0.07	284

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 (0.05)	0.15*** (0.06)	0.08 (0.06)	0.12 (0.32)	284
Gamble less	-0.02 (0.05)	0.04 (0.06)	0.06 (0.05)	0.16 (0.37)	284
More tempted to gamble	0.09 (0.07)	0.05 (0.07)	-0.04 (0.07)	0.47 (0.50)	284
Less tempted to gamble	-0.01 (0.03)	0.03 (0.04)	0.04 (0.04)	0.06 (0.25)	284