

# Using Lotteries to Encourage Savings: Experimental Evidence from Kenya

Justin Abraham<sup>1</sup>   Merve Akbas<sup>2</sup>   Dan Ariely<sup>2</sup>   Chaning Jang<sup>3</sup>

<sup>1</sup>University of California, San Diego

<sup>2</sup>Duke University

<sup>3</sup>Busara Center for Behavioral Economics

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# Savings as a Policy Objective

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- Access to savings is an important avenue toward economic development.
  - Annual returns to capital can be as high as 300% in Sub-Saharan Africa (Udry and Anagol 2006).
  - Allows for some degree of consumption smoothing when insurance is incomplete.
- Initial and transaction costs can be prohibitive for the poor (Karlan, Ratan, and Zinman 2014).
- In Kenya, 80% of adults have a banking account or mobile money but only 30% actually use it to save (Demirguc-Kunt et al. 2018).

## Savings as a Policy Objective

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- ① Mobile technologies, etc. aimed at lowering transaction costs (Jack and Suri 2011; Karlan and Zinman 2018).
- 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

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- 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

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How might lotteries induce savings over regular interest-bearing accounts? I.e. why do people play lotteries?

- Thrill of playing (Conlisk 1993).
- Preferences for skewness (Garrett and Sobel 1999).
- Large sums for purchasing durable goods when credit constrained/adjustment costs (Herskowitz 2016).
- 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

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- ① Can prize-linked savings induce account usage in low income settings?
- ② How much of this effect can we attribute to regret aversion?

## Overview

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- 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

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- 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; Loibl et al. 2016).
  - Regret aversion is an unaddressed confound from other explanations.
- Empirical tests of regret aversion using feedback manipulation (Filiz-Ozbay and Ozbay 2007; Zeelenberg and Pieters 2004; Zeelenberg et al. 1996).
- Little understanding of regret aversion in repeated settings.

# Study Setting

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## Study Setting

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Sample of 311 adults from informal settlements in 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

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- 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

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## 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

## Results

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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

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- 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

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

# A Theory of Regret

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## 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

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- 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

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- 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

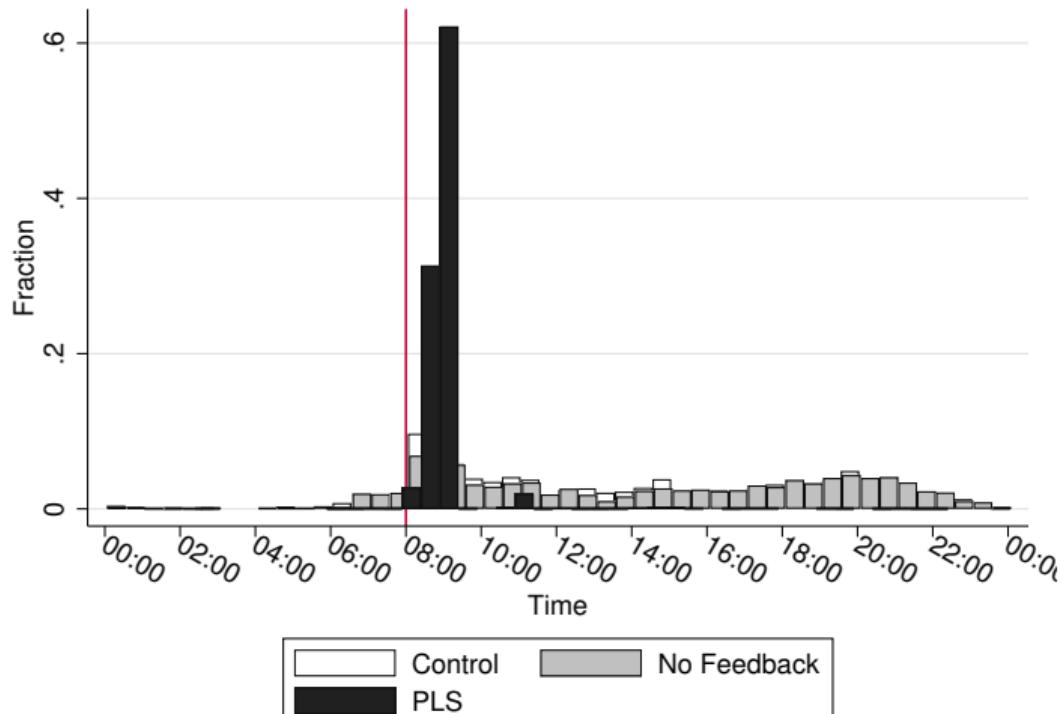
Table 2: Treatment effects – Mobile savings

	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

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Figure 1: Timing of deposits



## Results – Regret Aversion

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Table 3: 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
Period 1 effect	0.12
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 Regret 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

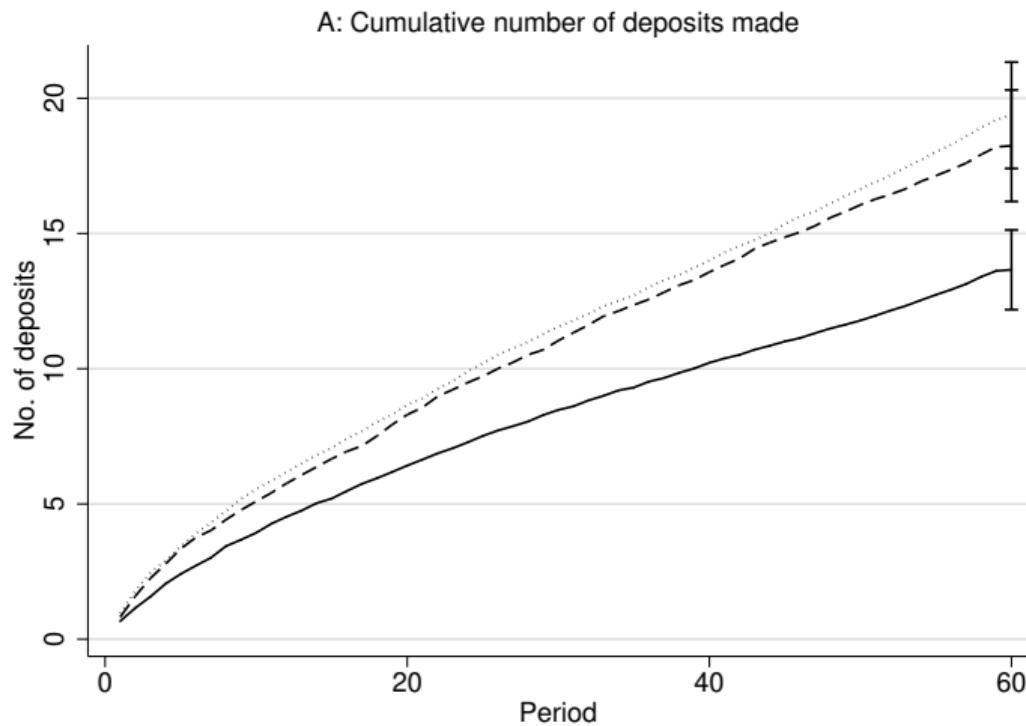
## Results

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How does the effect evolve over time?

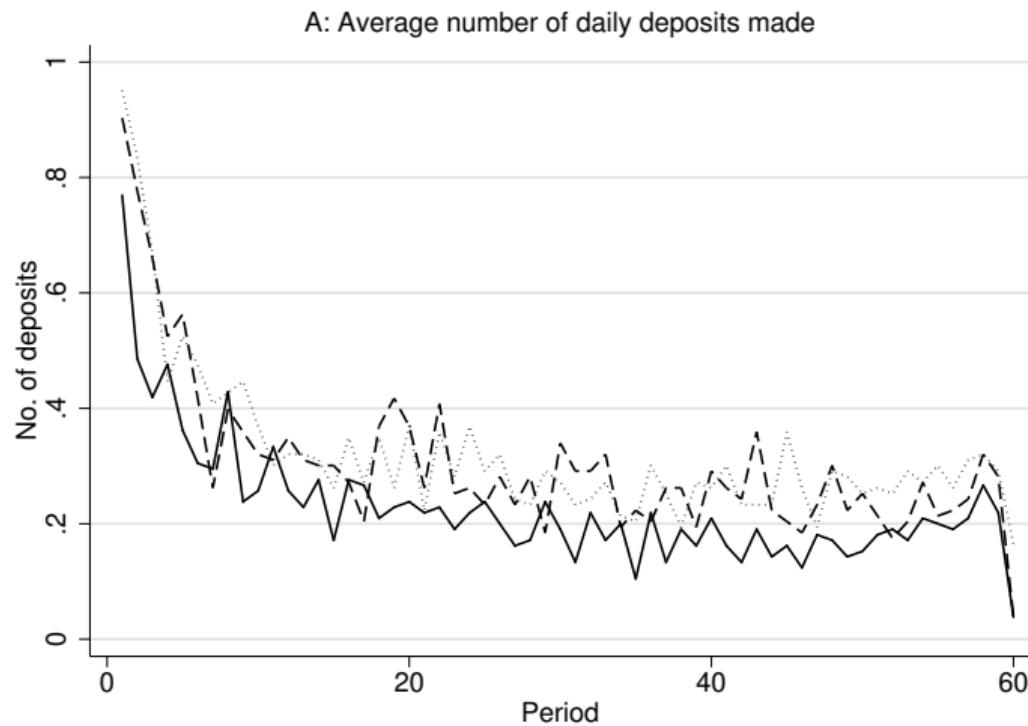
## Results – Effects Over Time

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## Results – Effects Over Time

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# Conclusion

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- 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

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- 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

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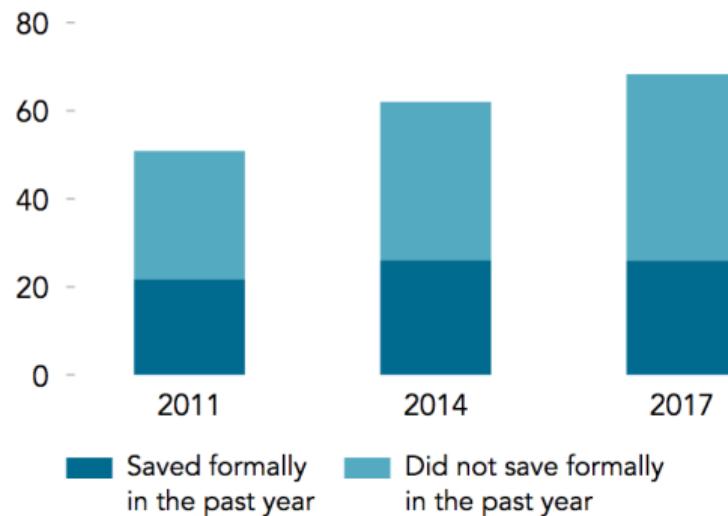
Choice	States of the world		
	Blue (33.3%)	Yellow (33.3%)	Red (33.3%)
A	\$50	\$100	\$0
B	\$0	\$50	\$100

# Financial Inclusion

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**More account ownership does not necessarily translate into more formal saving**

Adults with an account (%)



Source: Global Findex database.

## Lottery Draws

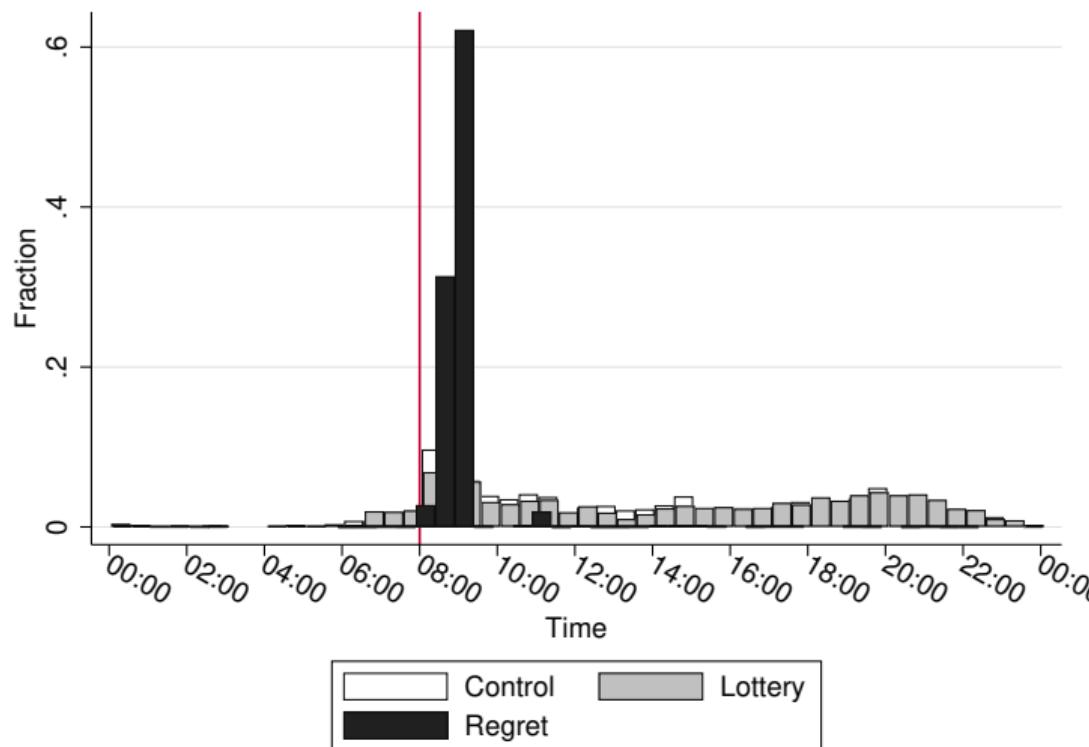
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Table 4: Observed and expected lottery results

	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 5: 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

# Results

Table 6: 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 7: 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