

# Using Lotteries to Encourage Savings: Experimental Evidence from Kenya

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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** (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

Table 1: Treatment effects – Mobile savings

|                         | Effect estimates |               |                           | Sample                         |             |
|-------------------------|------------------|---------------|---------------------------|--------------------------------|-------------|
|                         | (1)<br>Lottery   | (2)<br>Regret | (3)<br>Regret-<br>Lottery | (4)<br>Control<br>Mean<br>(SD) | (5)<br>Obs. |
| Total no. of deposits   | 4.59*            |               |                           | 13.66<br>(15.08)               | 311         |
| No. of days saved       | 3.93*            |               |                           | 11.78<br>(12.93)               | 311         |
| Total deposit amount    | -0.79<br>(3.34)  |               |                           | 14.87<br>(24.48)               | 311         |
| Total withdrawal amount | 0.53<br>(0.94)   |               |                           | 1.07<br>(4.53)                 | 311         |

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in

## Discussion

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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.
- 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 a common test of regret aversion in the lab (Filiz-Ozbay and Ozbay 2007; Zeelenberg and Pieters 2004).
- *Hypothesis:* More deposits with feedback than without.

## Results

Table 2: Treatment effects – Mobile savings

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

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in

# Results

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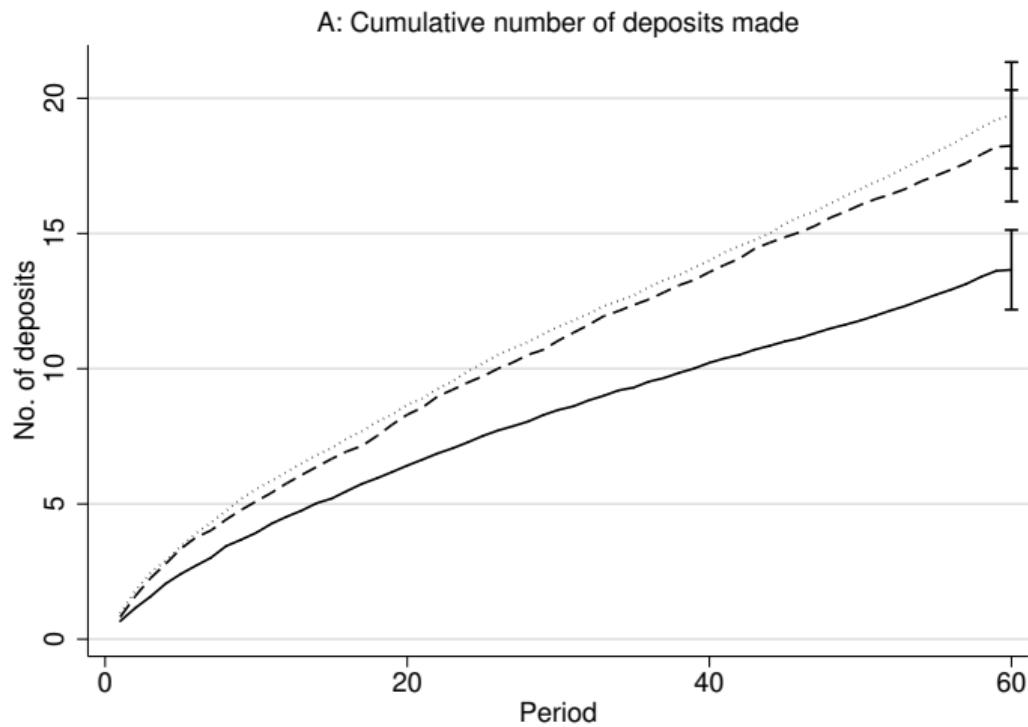
## Results

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How does the effect evolve over time?

# Results

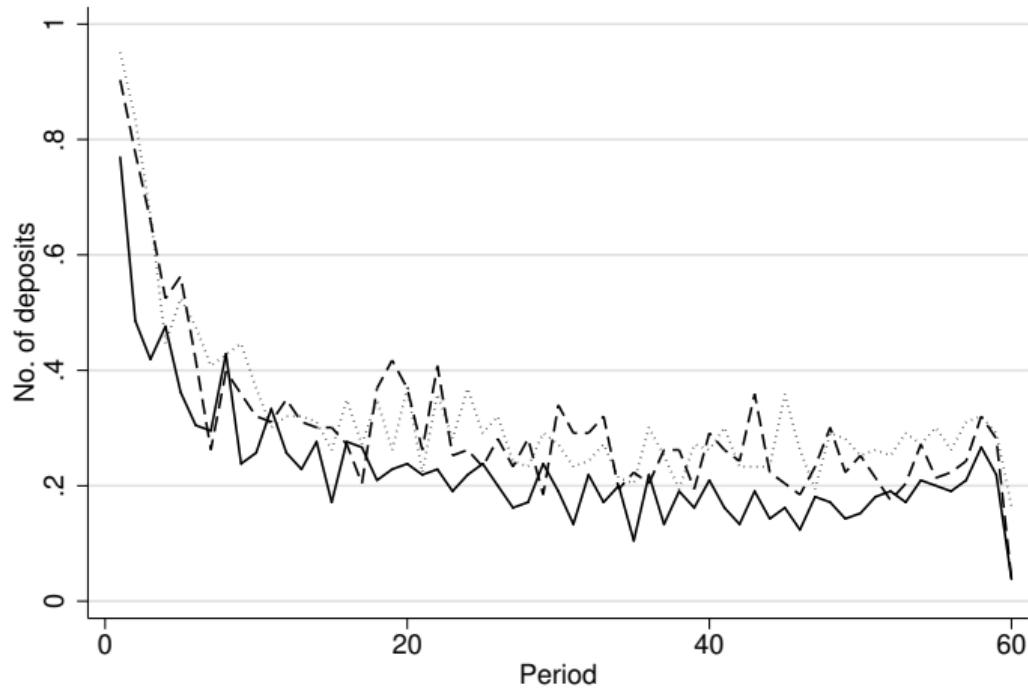
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# Results

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A: Average number of daily deposits made



## Results

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Does experienced regret mediate anticipated regret?

## Results

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Table 3: Regression of deposits on treatment and lottery results

| Made a deposit  |                  |
|-----------------|------------------|
| Winning ticket  | 0.02**<br>(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

# 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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## Demonstration

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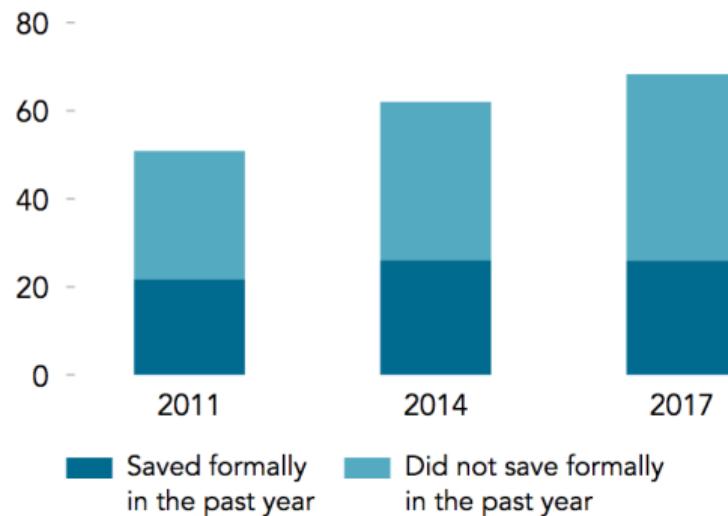
| Choice | States of the world |                |             |
|--------|---------------------|----------------|-------------|
|        | Blue (33.3%)        | Yellow (33.3%) | Red (33.3%) |
| A      | \$50                | \$100          | \$0         |
| B      | \$0                 | \$50       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

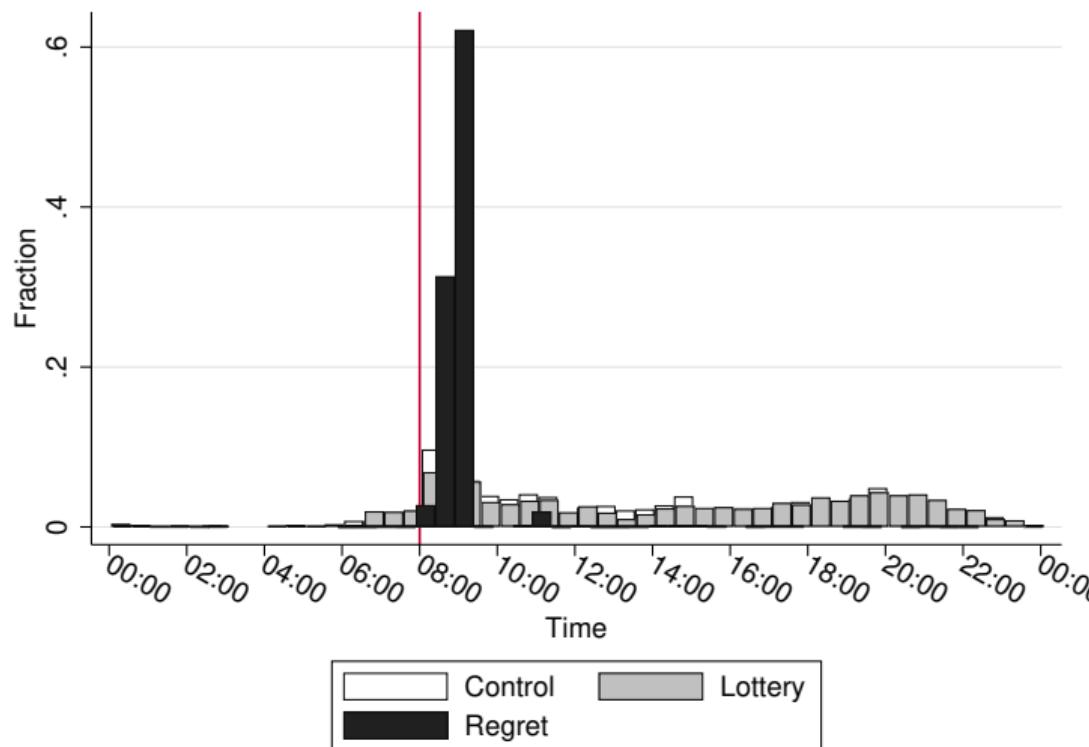
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Table 4: Observed and expected lottery results

|                | 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)<br>Lottery   | (2)<br>Regret     | (3)<br>Regret-<br>Lottery | (4)<br>Control<br>Mean<br>(SD) | (5)<br>Obs. |
| Total savings last month  | 18.45<br>(25.16) | -17.87<br>(14.64) | -36.32<br>(24.06)         | 80.31<br>(112.74)              | 284         |
| M-Pesa savings last month | -5.42<br>(6.34)  | -6.71<br>(5.49)   | -1.29<br>(5.30)           | 20.42<br>(44.67)               | 284         |
| ROSCA savings last month  | 1.48<br>(6.76)   | 7.37<br>(6.79)    | 5.89<br>(7.33)            | 22.24<br>(42.18)               | 283         |
| Saves with a ROSCA        | -0.02<br>(0.07)  | 0.14**<br>(0.07)  | 0.16**<br>(0.07)          | 0.54<br>(0.50)                 | 284         |

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses.

# Results

Table 6: Treatment effects – Expenditure

|                                 | Effect estimates |                 |                           | Sample                         |             |
|---------------------------------|------------------|-----------------|---------------------------|--------------------------------|-------------|
|                                 | (1)<br>Lottery   | (2)<br>Regret   | (3)<br>Regret-<br>Lottery | (4)<br>Control<br>Mean<br>(SD) | (5)<br>Obs. |
| Spent balance on food           | 0.04<br>(0.07)   | -0.08<br>(0.06) | -0.12*<br>(0.06)          | 0.28<br>(0.45)                 | 284         |
| Spent balance on school         | 0.29<br>(0.24)   | 0.17<br>(0.27)  | -0.13<br>(0.32)           | 0.24<br>(1.11)                 | 284         |
| Spent balance on business       | 0.13<br>(0.08)   | 0.08*<br>(0.04) | -0.04<br>(0.09)           | 0.06<br>(0.25)                 | 284         |
| Spent balance on durable goods  | -0.00<br>(0.03)  | -0.03<br>(0.03) | -0.03<br>(0.03)           | 0.05<br>(0.23)                 | 284         |
| Spent balance on repaying loans | 0.04<br>(0.05)   | -0.00<br>(0.04) | -0.04<br>(0.05)           | 0.11<br>(0.31)                 | 284         |
| Saved balance                   | 0.04<br>(-0.04)  | 0.05<br>(-0.04) | 0.01<br>(-0.05)           | 0.07<br>(-0.06)                | 284         |

## Results

Table 7: Treatment effects – Gambling

|                        | Effect estimates |                   |                           | Sample                         |             |
|------------------------|------------------|-------------------|---------------------------|--------------------------------|-------------|
|                        | (1)<br>Lottery   | (2)<br>Regret     | (3)<br>Regret-<br>Lottery | (4)<br>Control<br>Mean<br>(SD) | (5)<br>Obs. |
| Gamble more            | 0.06<br>(0.05)   | 0.15***<br>(0.06) | 0.08<br>(0.06)            | 0.12<br>(0.32)                 | 284         |
| Gamble less            | -0.02<br>(0.05)  | 0.04<br>(0.06)    | 0.06<br>(0.05)            | 0.16<br>(0.37)                 | 284         |
| More tempted to gamble | 0.09<br>(0.07)   | 0.05<br>(0.07)    | -0.04<br>(0.07)           | 0.47<br>(0.50)                 | 284         |
| Less tempted to gamble | -0.01<br>(0.03)  | 0.03<br>(0.04)    | 0.04<br>(0.04)            | 0.06<br>(0.25)                 | 284         |

Notes: Columns 1–3 report OLS estimates of the treatment effect. Standard errors are in parentheses.