Saving for a Rainy Day: Experimental Evidence on Prize Linked Saving and Financial Shocks

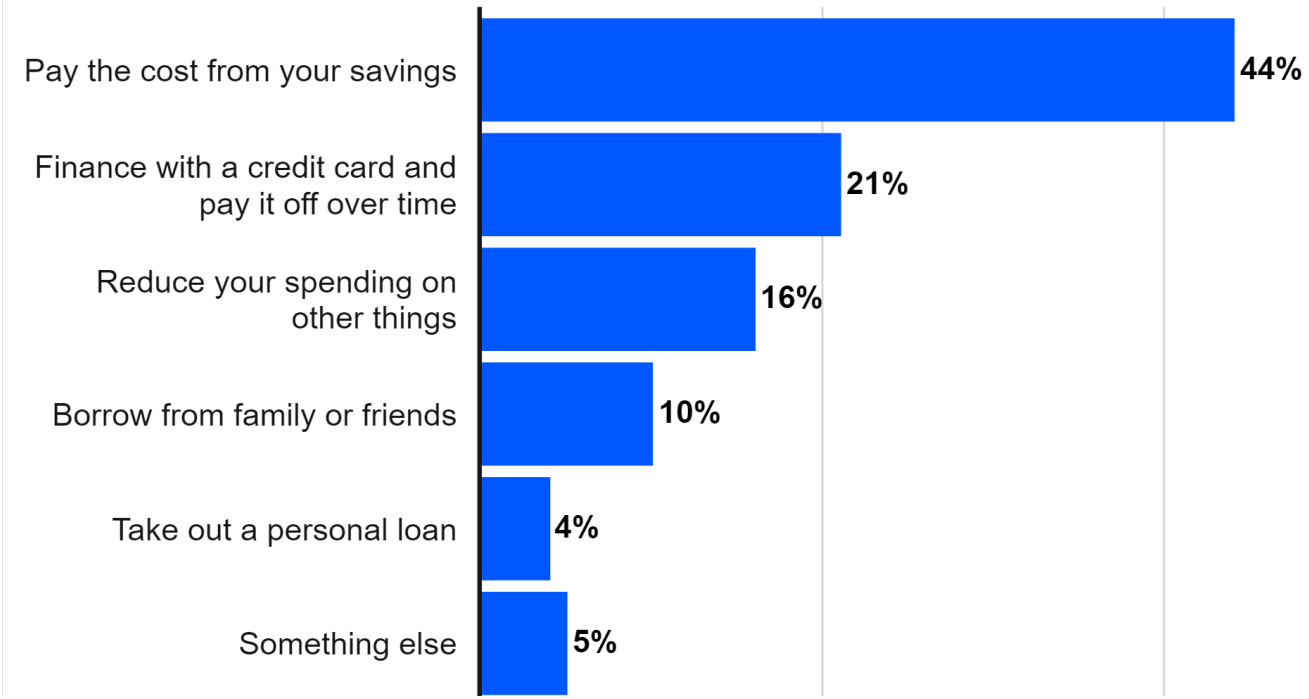
Kaden Grace

April 19, 2024

THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

Motivation

We asked: Which of the following best describes how you would deal with a major unexpected expense, such as $1,000 for an emergency room visit or car repair?



Bankrate survey, December 2023

Background: Prize Linked Savings (PLS)

- Dollars saved in PLS become entries in a drawing
  - Probability(Win) is (almost) a linear function of your deposit
- PLS is a "no-lose lottery;" principal is never at risk

Background: Prize Linked Savings (PLS)

- Dollars saved in PLS become entries in a drawing
  - Probability(Win) is (almost) a linear function of your deposit
- PLS is a "no-lose lottery;" principal is never at risk
- Popular in the UK
  - Premium Bonds, £25 "tickets" for a £1m prize

Background: Prize Linked Savings (PLS)

- Dollars saved in PLS become entries in a drawing
  - Probability(Win) is (almost) a linear function of your deposit
- PLS is a "no-lose lottery;" principal is never at risk
- Popular in the UK
  - Premium Bonds, £25 "tickets" for a £1m prize
- Still illegal in most US states
  - Fear of state lottery revenue cannibalization

What do we already know?

- People prefer PLS to standard saving even if the return is lower
- Effect is strongest among poor households
- Access to PLS increases total savings
    - Atalay et al. (2014), Filiz-Ozbay et al. (2015), Dizon & Lybbert (2021), Jindapon et al. (2022), Gertler et al. (2023)

What do we already know?

- People prefer PLS to standard saving even if the return is lower
- Effect is strongest among poor households
- Access to PLS increases total savings
  - Atalay et al. (2014), Filiz-Ozbay et al. (2015), Dizon & Lybbert (2021), Jindapon et al. (2022), Gertler et al. (2023)
- Saving increases stability, but decreases consumption
- PLS can increase savings, but does this increase welfare?

Research Question

Can access to a Prize-Linked Savings Account (PLSA) increase welfare for low-income households that face negative financial shocks?

Policy Implications

- PLS could move consumers closer to optimal consumption paths
- Vulnerable households better prepared for unexpected expenses
- Relatively cheap method of incentivizing saving

Why an Experiment?

- Jappelli and Pistaferri (2010) on observational data: "The lesson of the literature is that identifying episodes of genuine exogenous and unanticipated income changes is difficult."
- Observational data uses weather, layoffs, disabling injuries, etc. to measure financial shocks

Why an Experiment?

- Jappelli and Pistaferri (2010) on observational data: "The lesson of the literature is that identifying episodes of genuine exogenous and unanticipated income changes is difficult."
- Observational data uses weather, layoffs, disabling injuries, etc. to measure financial shocks
- However, complete portfolio allocation is difficult to observe

Contribution

- I use a controlled laboratory setting to measure the *welfare effects* of access to a PLSA.

1. Experimental Design

2. Empirical Analysis

Experimental Design

Build on Hey and Dardanomi (1988)'s design:

- Agent receives 20 tokens of income, and can choose to:
  - **consume** by converting tokens to cash at a decreasing rate (asymptotic at $3), or
  - **save** tokens at 16% until the next period, or
  - **save** tokens in a PLS with a prize of 60 tokens
- Saving 20 tokens in PLS gives a 5.3% chance of winning.
- 10% chance of incurring a 60-token expense
- 10 periods, played twice with different parameters

Round

1

Remaining time: 29

Instructions: Your task is to allocate your tokens.
You can place your tokens in the **Lottery Account** and **convert tokens to dollars**.

Any tokens you do not use will be saved in your **Bank Account** until the next round and earn 16% interest.

Remember, the only way to earn real money in this experiment is by converting your tokens into dollars.

Starting Balance		Bank Account		Lottery Account		Convert to dollars			
20	=	0	+		+		-- > $	0.00	
		V		V					
		0	+	0	+	60 tokens Lottery Chance: %	-	60 tokens Expense Chance: 10%	=
		Bank Account with 16% Interest		Lottery Account		0.00			Ending Balance

Calculate | Submit

Round	1	2	3	4	5	6	7	8	9	10	**Total**
Earnings	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**

Round

1

Remaining time: 29

Instructions: Your task is to allocate your tokens.
You can place your tokens in the **Lottery Account** and **convert tokens to dollars**.

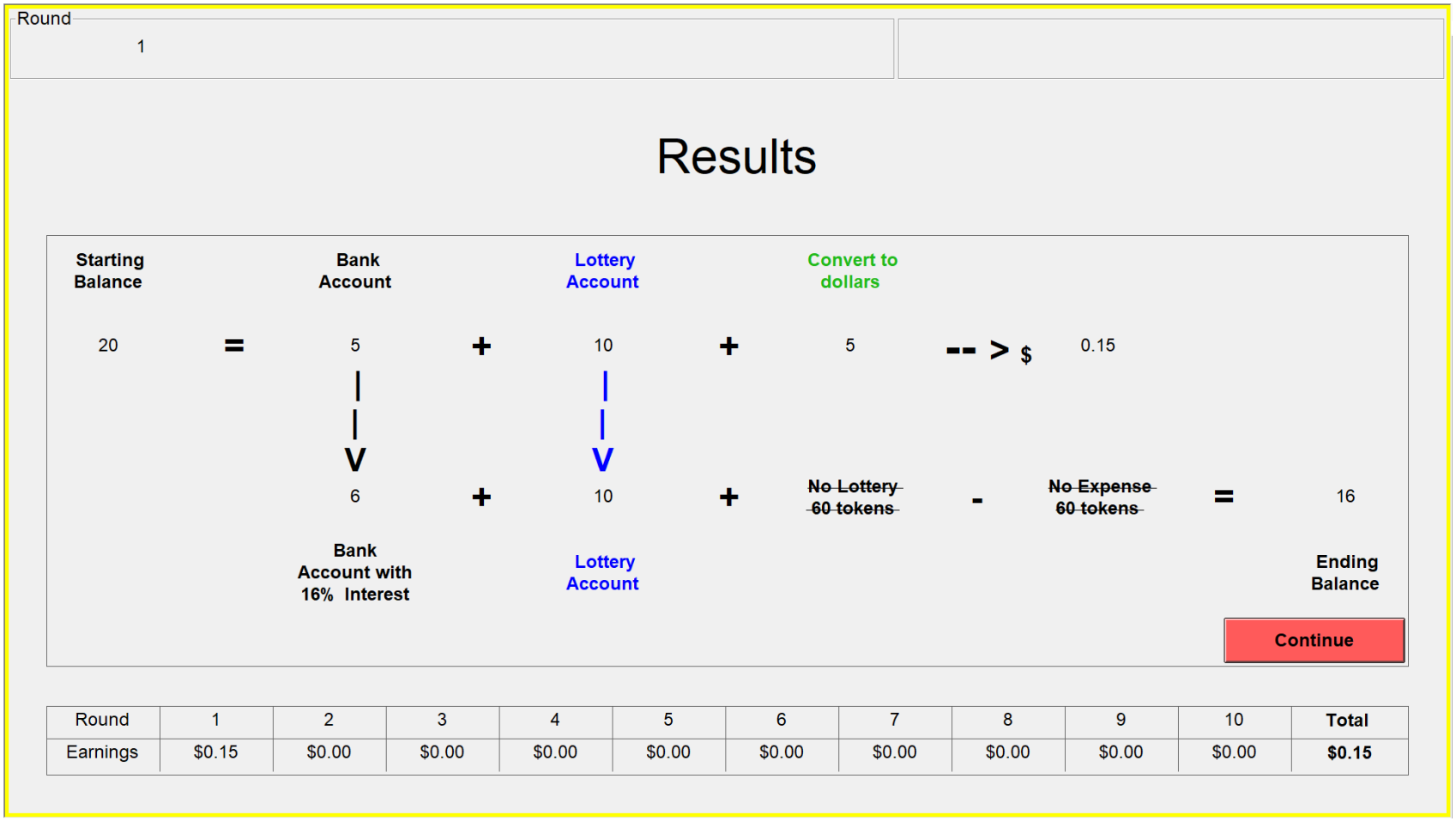
Any tokens you do not use will be saved in your **Bank Account** until the next round and earn 16% interest.

Remember, the only way to earn real money in this experiment is by converting your tokens into dollars.

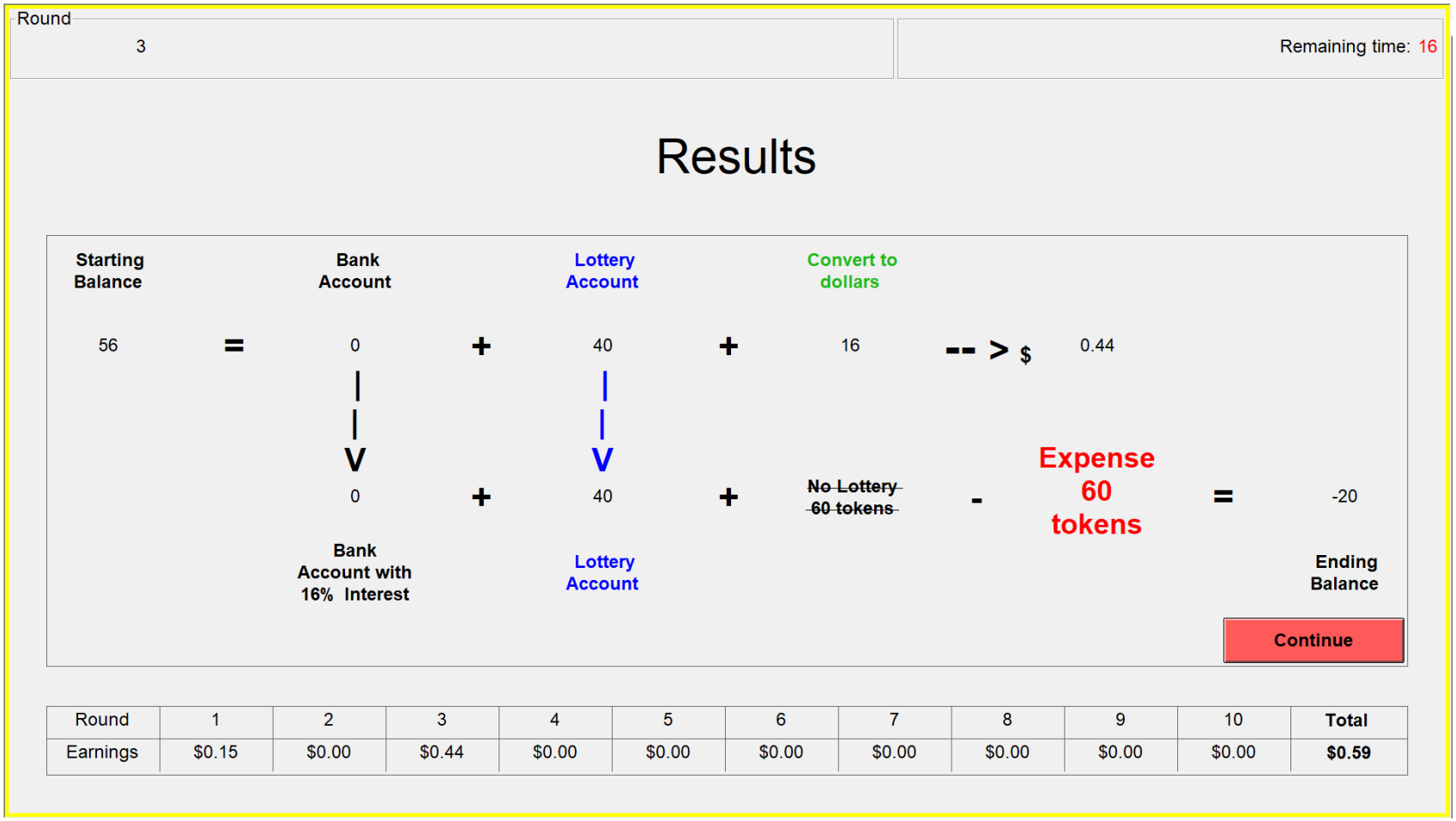
Starting Balance		Bank Account		Lottery Account		Convert to dollars			
20	=	5	+	10	+	5	-- > $	0.15	
		V		V					
		6	+	10	+	60 tokens Lottery Chance: %	-	60 tokens Expense Chance: 10%	=
		Bank Account with 16% Interest		Lottery Account		2.67			Ending Balance

Calculate | Submit

Round	1	2	3	4	5	6	7	8	9	10	Total
Earnings	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.00**



Round	1	2	3	4	5	6	7	8	9	10	**Total**
Earnings	$0.15	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.15**



Round	1	2	3	4	5	6	7	8	9	10	**Total**
Earnings	$0.15	$0.00	$0.44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$0.59**

Decreasing Returns to Consumption

Tokens	Dollars
10	$0.29
20	$0.54
30	$0.78
40	$0.99
50	$1.18
60	$1.35
70	$1.51
80	$1.65
90	$1.78
100	$1.90

Tokens	Dollars
110	$2.00
120	$2.10
130	$2.18
140	$2.26
150	$2.33
160	$2.39
170	$2.45
180	$2.50
190	$2.55
200	$2.59

Tokens	Dollars
210	$2.63
220	$2.67
230	$2.70
240	$2.73
250	$2.75
260	$2.78
270	$2.80
280	$2.82
290	$2.83
300	$2.85

External Validity

- Subject's incentive is the sum of payoffs in the experiment
- Household's incentive is the sum of lifetime consumption

External Validity

- Subject's incentive is the sum of payoffs in the experiment
- Household's incentive is the sum of lifetime consumption
- Incentives aligned $\Longrightarrow$

  subject's lab decisions $\approx$ household's real-life decisions

Treatments

Treatment	PLSA Prize	Shock Size
1	No PLSA Offered	2x(Income)
2	1x(Income)	2x(Income)
3	3x(Income)	2x(Income)
4	No PLSA Offered	3x(Income)
5	1x(Income)	3x(Income)
6	3x(Income)	3x(Income)

Table: Parameters in each treatment

Hypotheses

1. Subjects over-consume (under-save) in early periods.
2. Introducing a PLSA leads subjects to save more and consume less in early periods.
3. The PLSA will still be effective even if its prize is relatively small.

What does it mean to over-consume?

- Solve the model with backward induction for $c^*(a_{it})$, the optimal consumption choice given the subject i's assets in period t

What does it mean to over-consume?

- Solve the model with backward induction for $c^*(a_{it})$, the optimal consumption choice given the subject i's assets in period t
- Calculate the gap between **optimal** and **observed** consumption:

$$\text{Error}_{it} = c_{it}^{observed} - c^*(a_{it})$$

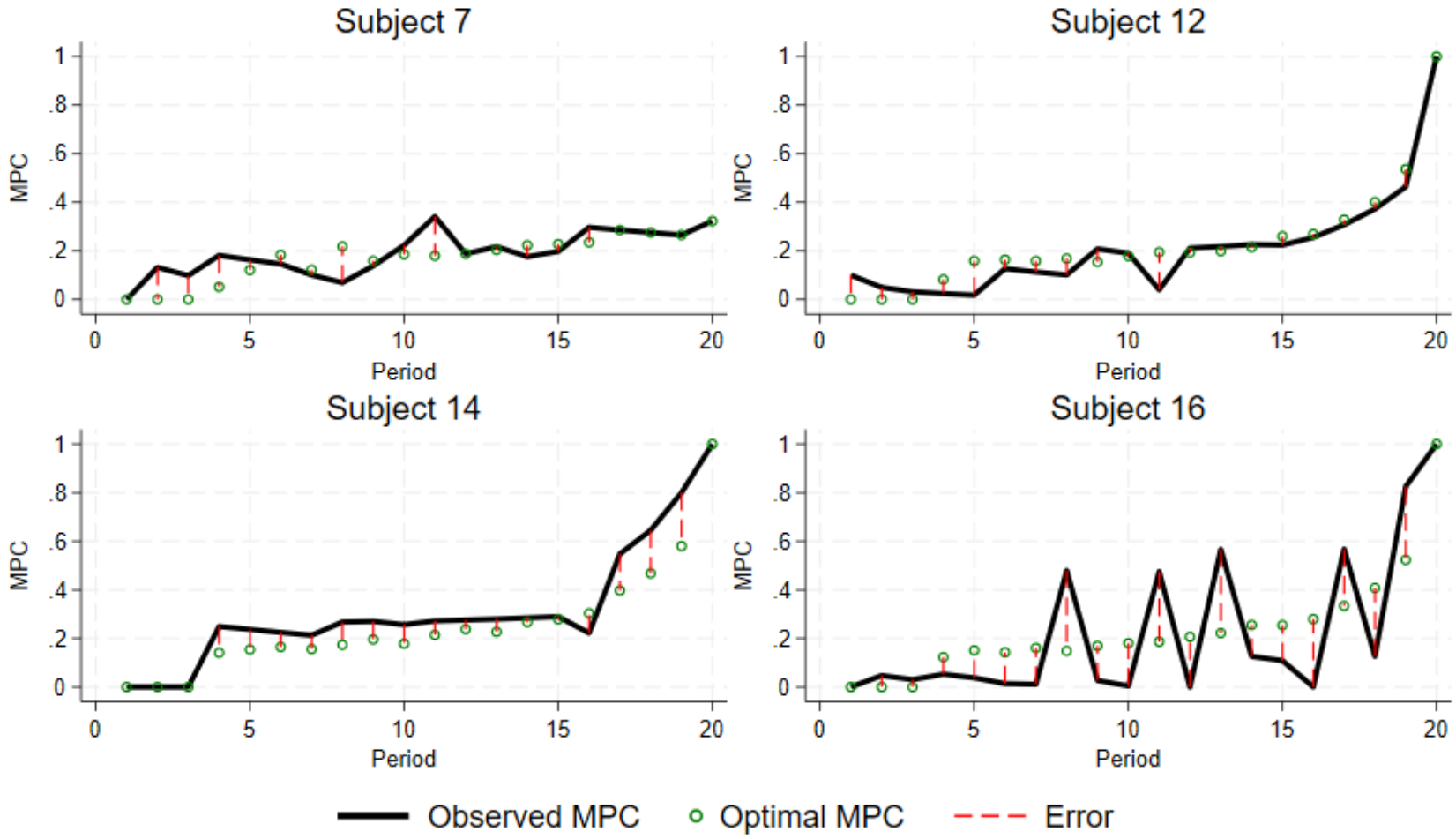
What does it mean to over-consume?

- Normalize into Marginal Propensity to Consume (MPC)

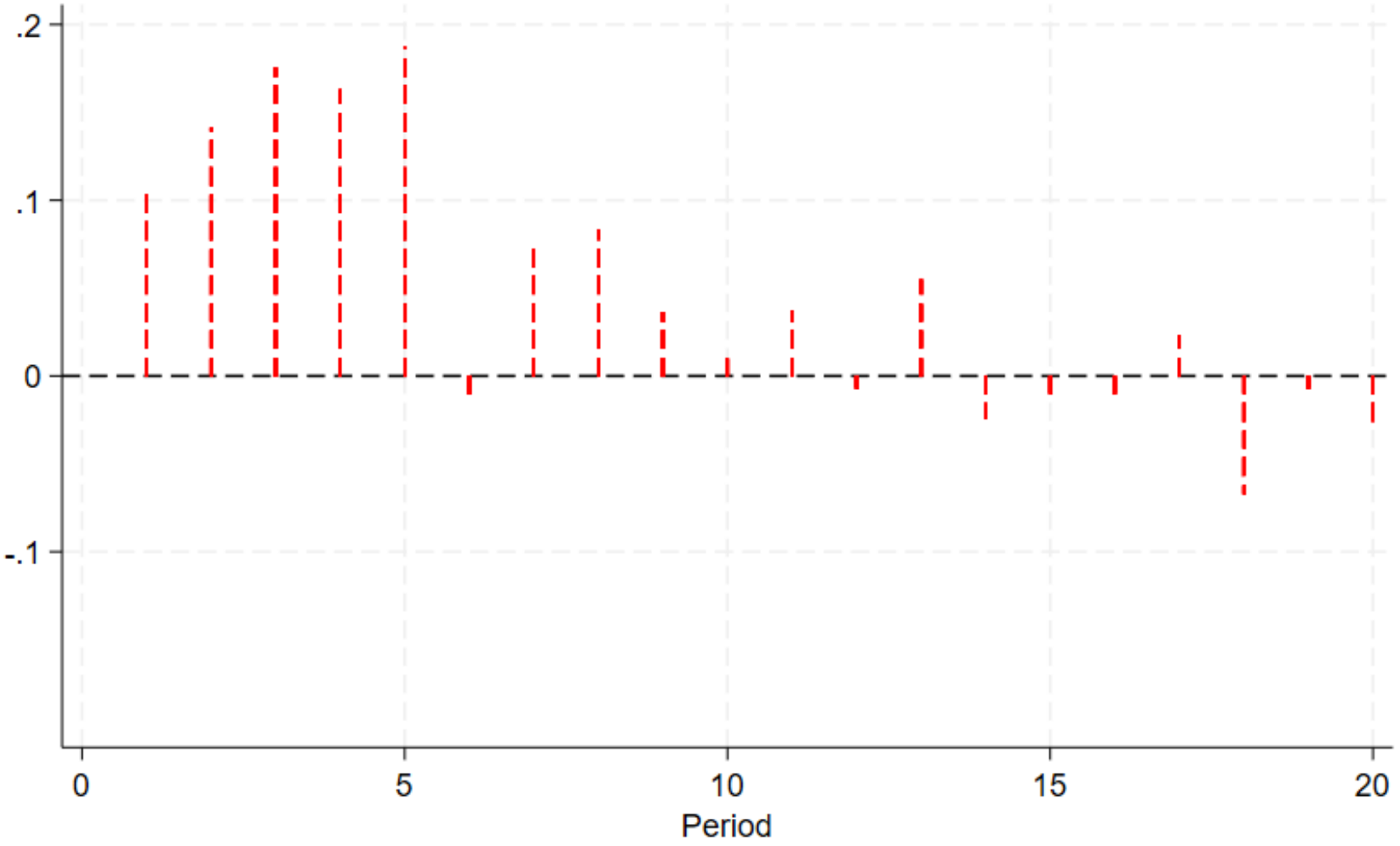
$$\frac{\text{Error}_{it}}{a_{it}} = \frac{c_{it}^{\text{observed}} - c^*(a_{it})}{a_{it}} = \text{MPC}_{it}^{observed} - \text{MPC}_{it}^{*} = \text{MPC}_{\text{it}}^{\text{error}}$$

- $\text{MPC}_{it}^{error} \in [-1, 1]$ is the fraction of assets the subject either over (+) or under (-) consumed in period t

MPC_{it}^{error} of Selected Subjects, December Pilot



Average MPC^{error}, December Pilot



1 Experimental Design

2 Empirical Analysis

Empirical Analysis

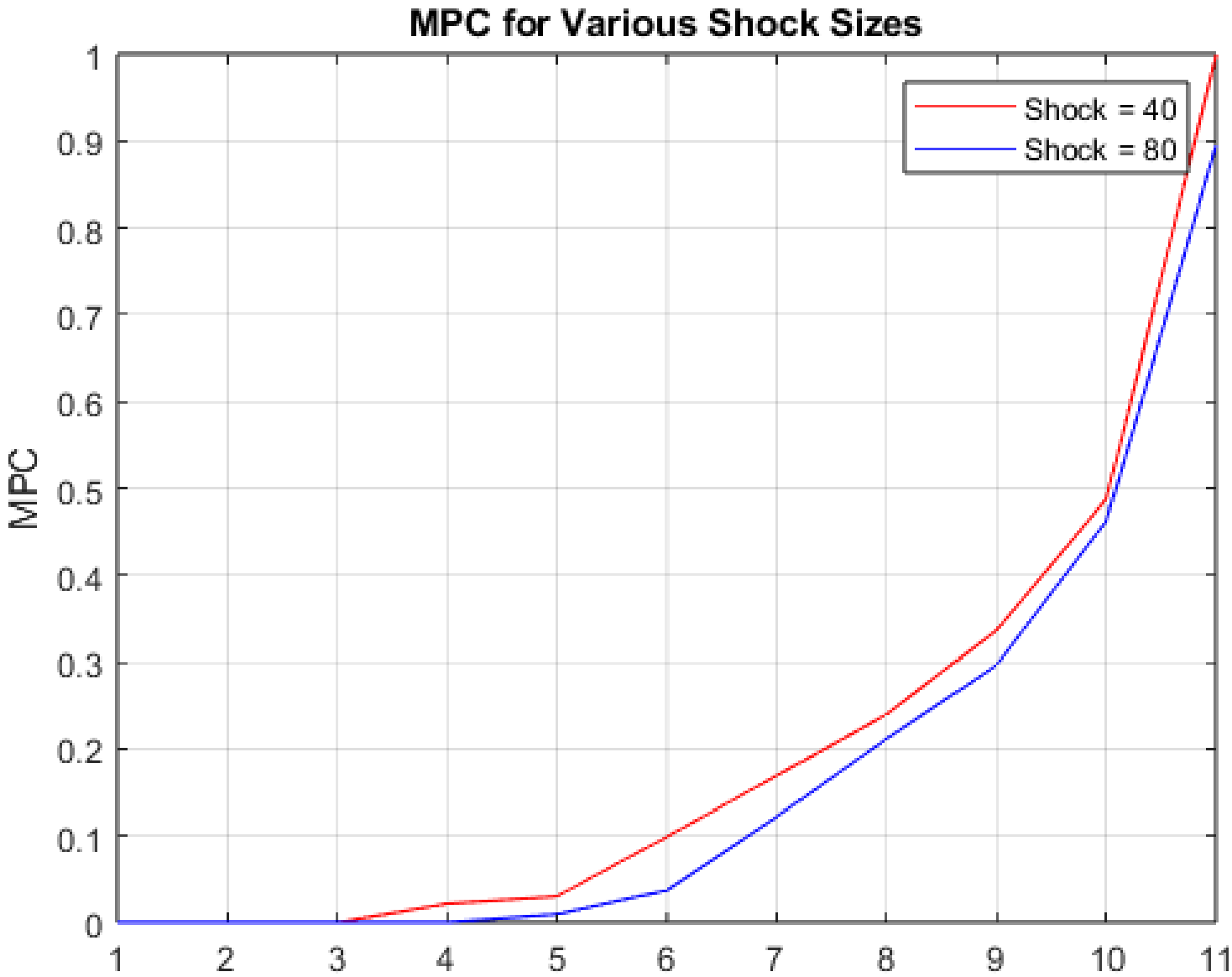
$$\underbrace{|\text{MPC}_{ist}^{error}|}_{\substack{\text{abs. value}\\ \text{deviation}\\ \text{from}\\ \text{optimality}}} = \alpha + \beta * \underbrace{\text{Treat}_{it}}_{\substack{=1\\ \text{if PLS}\\ \text{offered}}} + \delta * \underbrace{\text{Second}_{s}}_{\substack{=1\\ \text{if played}\\ \text{second}\\ \text{in session}}} + \underbrace{\gamma_i}_{\substack{\text{subject}\\ \text{FE}}} + \underbrace{\tau_t}_{\substack{\text{period}\\ \text{FE}}} + \underbrace{u_{it}}_{\substack{\text{error}\\ \text{corr. w/in}\\ \text{sessions}}}$$

- Identification is across the two treatments, within the subject
- β is coefficient of interest
  - $\beta < 0 \implies$ PLS is welfare-improving

Next Steps

- Simulated sessions with variation in parameters
- Sessions starting next week

Appendix: Simulated MPC Paths



Appendix: Simulated Earnings Distributions