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

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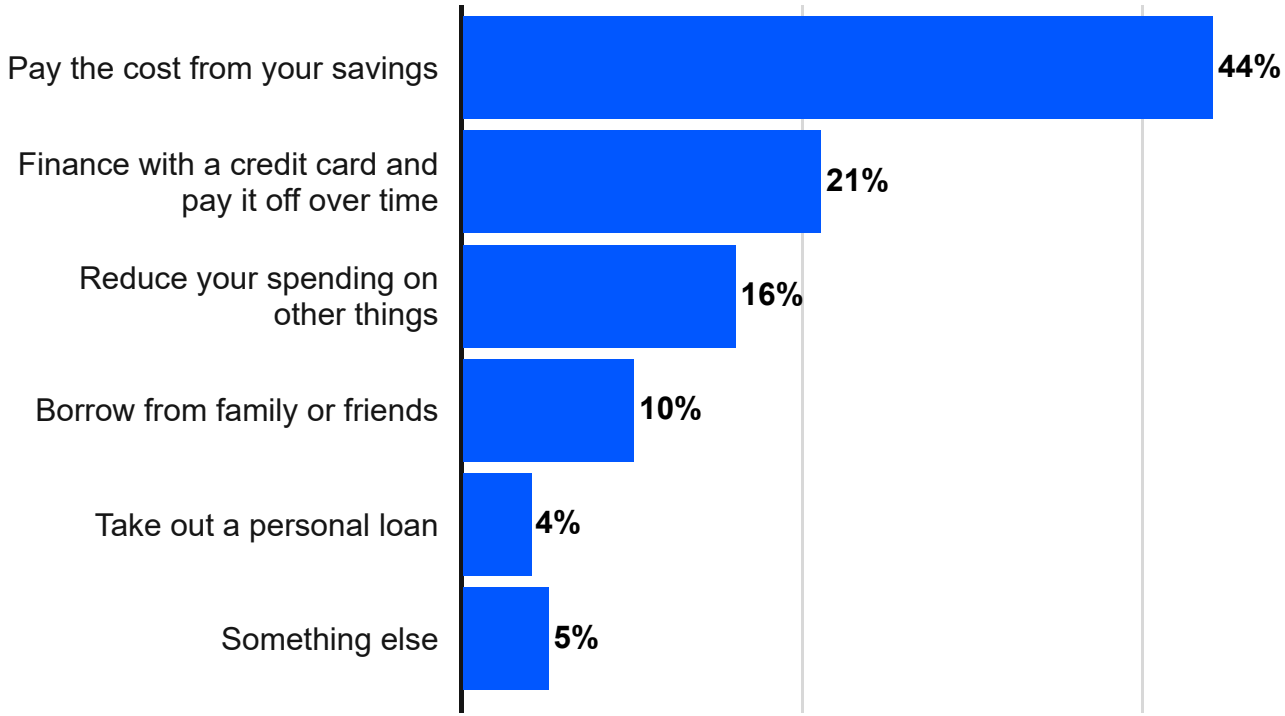
Motivation

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?



Source: Bankrate survey, December 15-17, 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
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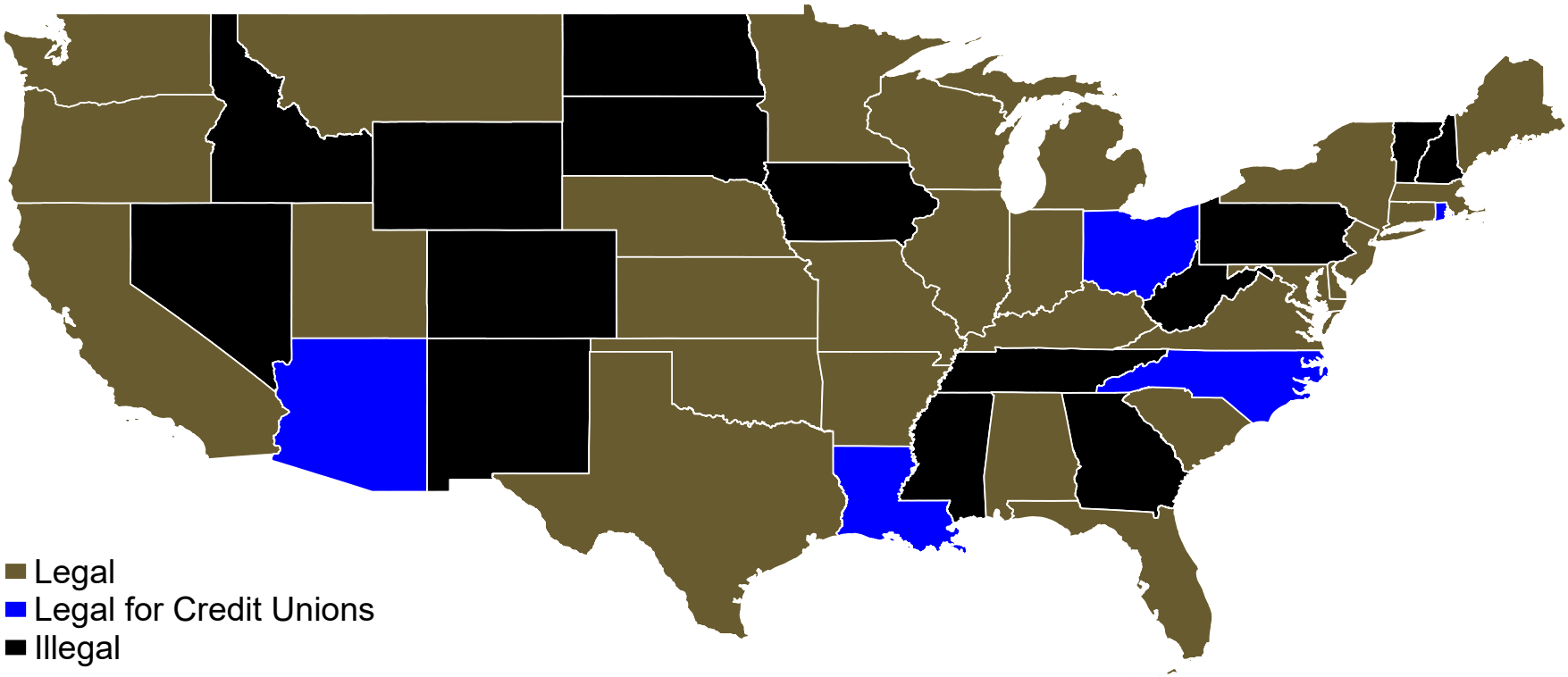
- Popular in the UK
  - Premium Bonds, £25 "tickets" for a £1m prize
- Still illegal in some US states
  - Fear of state lottery revenue cannibalization

PLS Legality



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If PLS is "dominated," why is it popular?

- Agents have short planning horizons
- Agents over-estimate the probability of winning
- Agents directly gain utility from the gamble

What do we already know about PLS?

- 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)

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- Saving increases stability but decreases consumption
- PLS can increase savings, but does this increase welfare?
- ... under what conditions?

Research Question

What is the dynamic welfare impact of PLSAs on consumers who face unexpected financial shocks?

Preview of Results

- Subjects have sufficiently short horizons such that PLSAs increase welfare by preventing under-saving
- PLS access causes 17.9% improvement in optimal behavior

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."
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Why an Experiment?

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- Observational data uses weather, layoffs, disabling injuries, etc. to measure financial shocks
- Complete portfolio allocation is difficult to observe
- Experiment allows for precise choice of parameters

Contribution

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

1. Experimental Design
2. Empirical Analysis
3. Results
4. Conclusion

1 Experimental Design

2 Empirical Analysis

3 Results

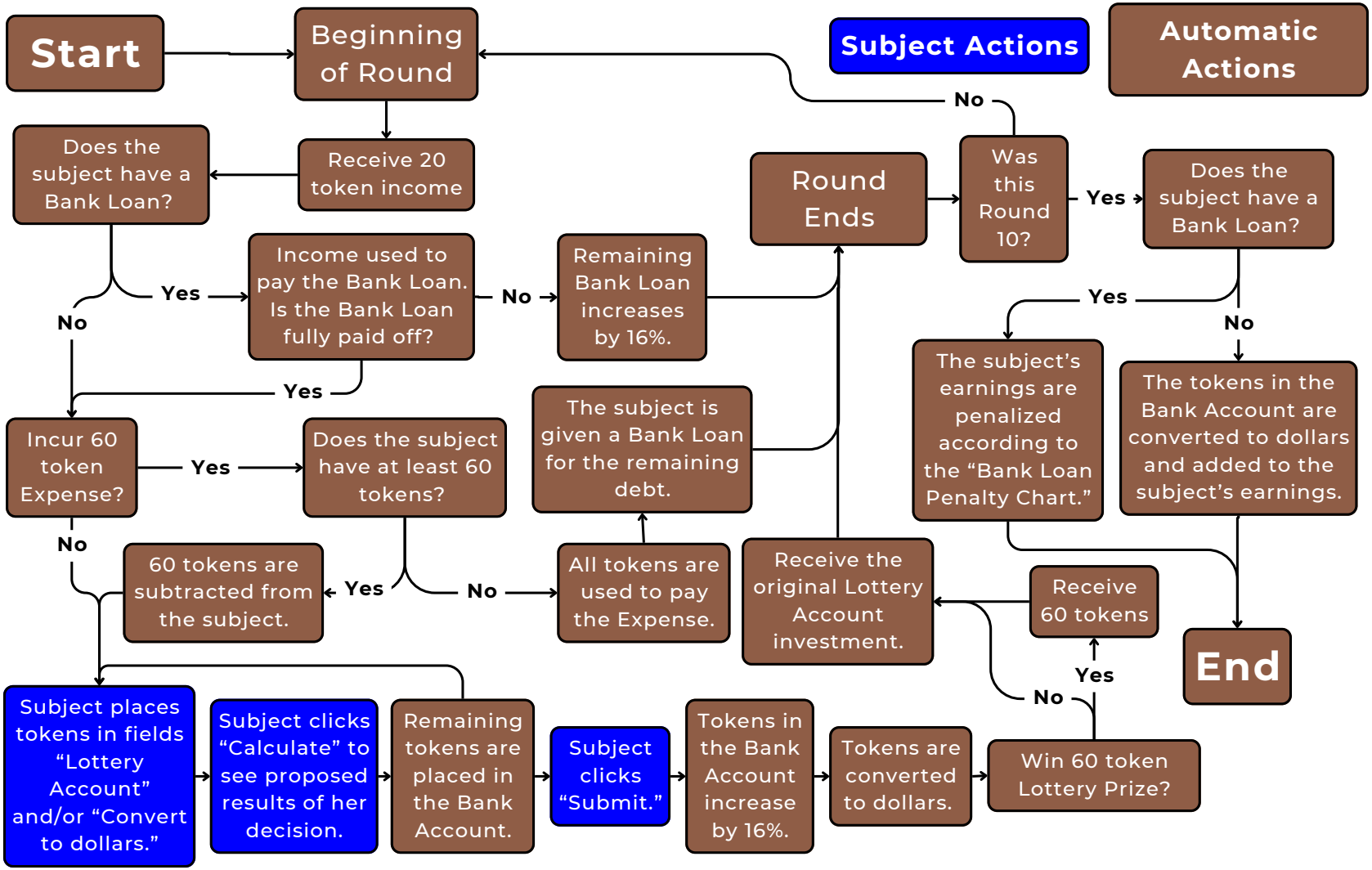
4 Conclusion

Experimental 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
- Saving 20 tokens in PLS gives a 5.3% chance of winning.
- 10% chance of incurring a 60-token expense
- 10 periods, played twice

Decreasing Returns to Consumption

Tokens	Dollars	Tokens	Dollars	Tokens	Dollars
10	$ 0.29	110	$ 2.00	210	$ 2.63
20	$ 0.54	120	$ 2.10	220	$ 2.67
30	$ 0.78	130	$ 2.18	230	$ 2.70
40	$ 0.99	140	$ 2.26	240	$ 2.73
50	$ 1.18	150	$ 2.33	250	$ 2.75
60	$ 1.35	160	$ 2.39	260	$ 2.78
70	$ 1.51	170	$ 2.45	270	$ 2.80
80	$ 1.65	180	$ 2.50	280	$ 2.82
90	$ 1.78	190	$ 2.55	290	$ 2.83
100	$ 1.90	200	$ 2.59	300	$ 2.85



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**

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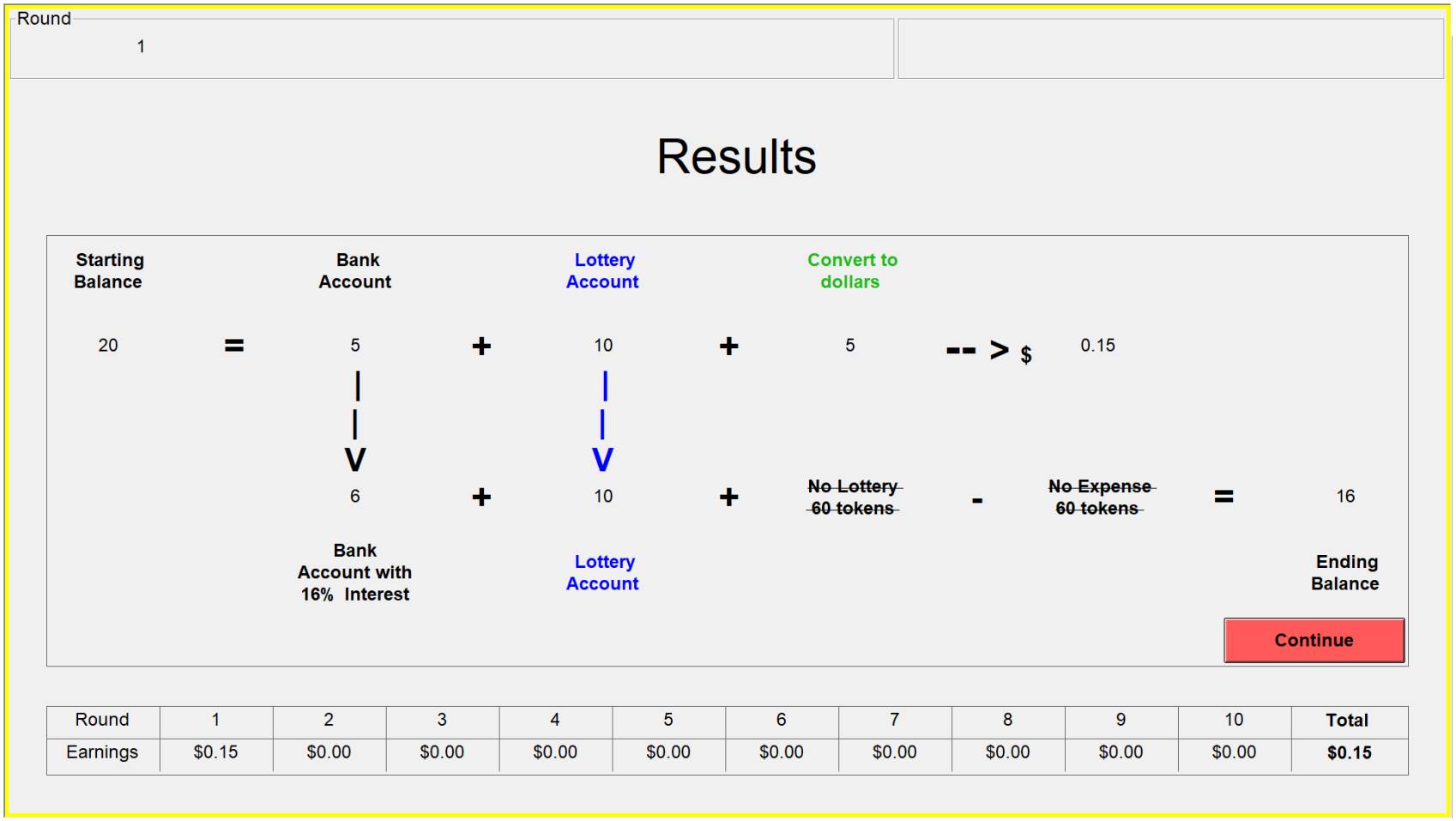
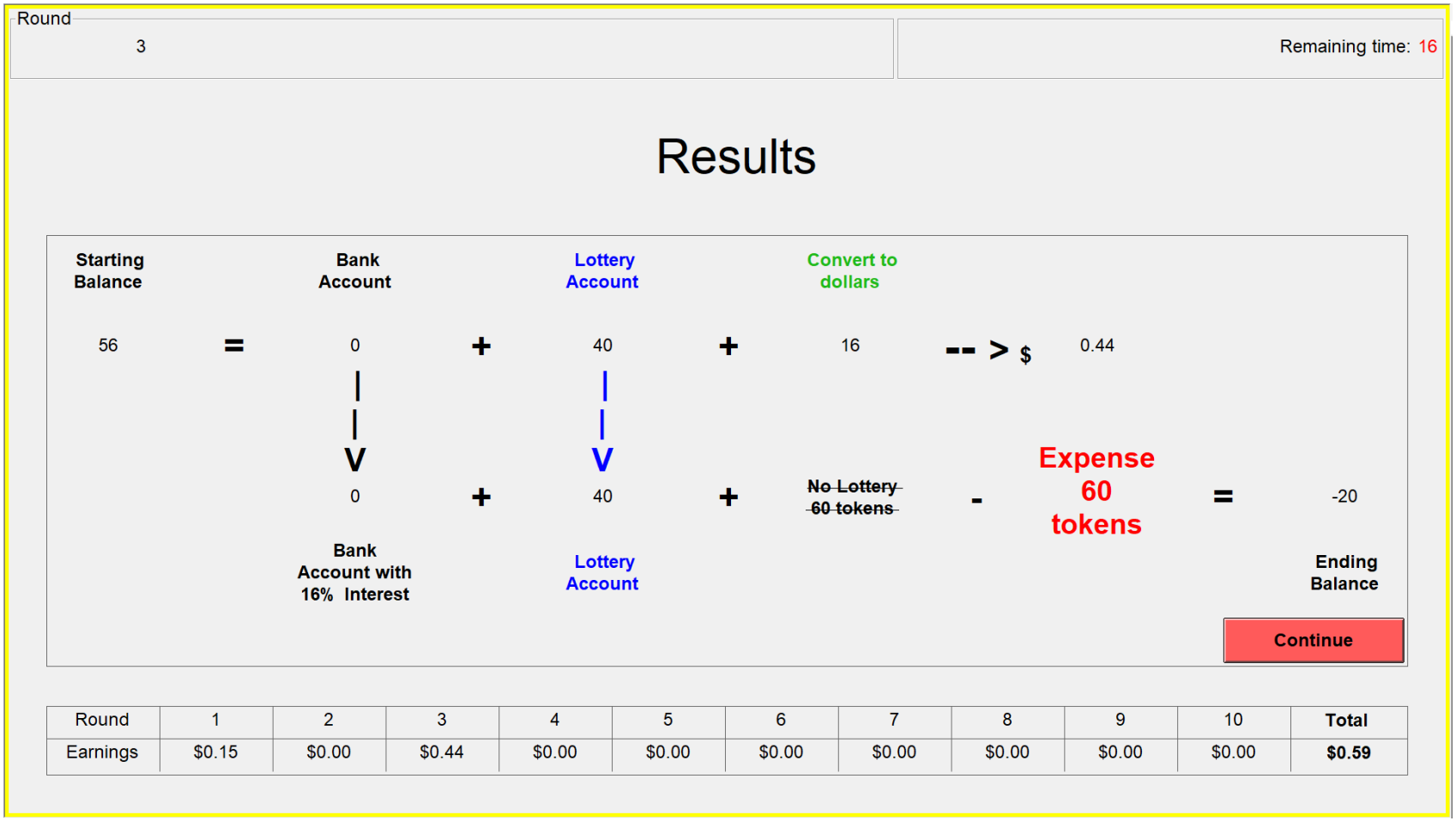
Starting Balance		Bank Account		Lottery Account		Convert to dollars			
20	=	5	+	10	+	5	-- > $	0.15	
		V		V					
		6	+	10	+	60 tokens Lottery Chance: %	-	60 tokens Expense Chance: 10%	=
		Bank Account with 16% Interest		Lottery Account		2.67			Ending Balance

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**



Treatments

Treatment	PLSA Prize
1	No PLSA Offered, "No Prize"
2	6x(Income), "High Prize"
3	3x(Income), "Low Prize"

Session Type	Treatments	# Participants
No Prize/High Prize	1 & 2	56
No Prize/Low Prize	1 & 3	52
High Prize/Low Prize	2 & 3	49
Total		157

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

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- 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?

- Calculate 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

Data

	Mean	St. Dev.	Min.	Max
Assets	88.34	95.59	-294	680
Standard Savings	57.62	85.19	-294	624
PLSA Savings	20.82	58.43	0	680
Tokens Consumed	9.92	26.81	0	455
Dev. from Optimal Cons.	-9.06	42.68	-311	232
Abs. MPC Error	0.21	0.25	0	1
Expense Incurred	0.09	0.29	0	1
Female	0.52	0.50	0	1
N	3140			

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Empirical Analysis

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

- β is coefficient of interest
  - $\beta < 0 \implies$ PLS causes shift towards more optimal behavior

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What is the treatment effect on optimality? (Unit: |MPC|)

PLSA	-0.0443***	-0.0451***		
	(0.0160)	(0.0159)		
Second		-0.0264**		-0.0265**
		(0.0125)		(0.0126)
High			-0.0347*	-0.0354*
			(0.0182)	(0.0180)
Low			-0.0543***	-0.0552***
			(0.0177)	(0.0176)
Constant	0.2383***	0.2520***	0.2383***	0.2521***
	(0.0157)	(0.0167)	(0.0157)	(0.0167)
N	3140	3140	3140	3140

What is the treatment effect on earnings? (Unit: $)

PLSA	-0.5718***	-0.5817***		
	(0.1887)	(0.1870)		
Second		-0.3504*		-0.3529*
		(0.1846)		(0.1840)
High			-0.3889*	-0.3971*
			(0.2168)	(0.2147)
Low			-0.7620***	-0.7738***
			(0.2345)	(0.2333)
Constant	4.1667***	4.3483***	4.1667***	4.3496***
	(0.1518)	(0.1778)	(0.1519)	(0.1777)

What is the treatment effect on assets when shocked?

(Unit: Tokens)

PLSA	-22.9917	
	(14.4109)	
High		-17.0181
		(17.7770)
Low		-28.3136*
		(15.7658)
Constant	52.4773***	52.4773***
	(11.2578)	(11.2770)
N	296	296

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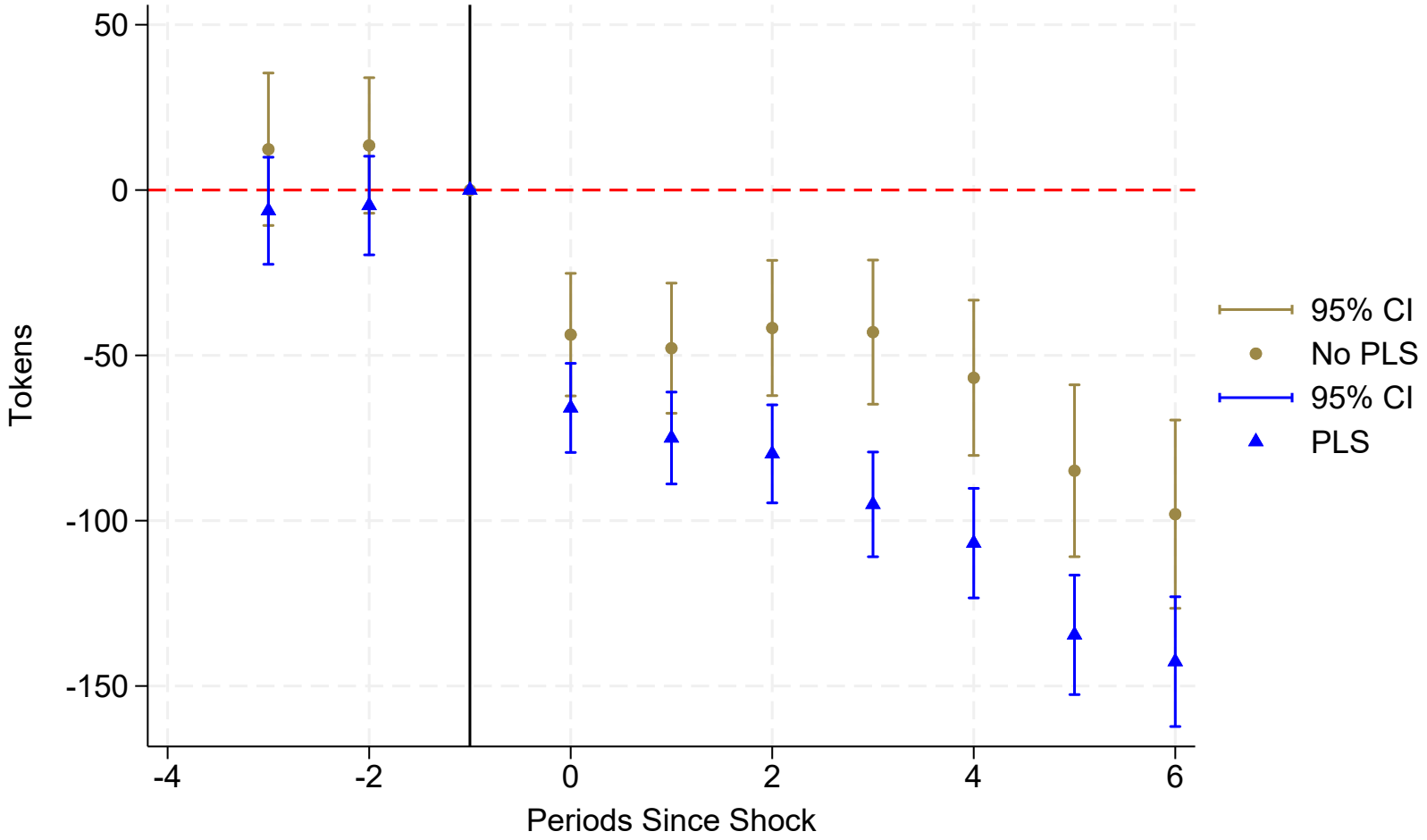

What is the treatment effect on Prob(Borrow) when shocked? (Unit: Prob(Borrow))

PLSA	0.1014	
	(0.0750)	
High		0.0264
		(0.0918)
Low		0.1682**
		(0.0814)
Constant	0.3409***	0.3409***
	(0.0577)	(0.0578)
N	296	296

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Conclusion

PLS causes:

- 17.9% shift towards the optimal consumption path
- 9.1% - 17.8% decrease in earnings depending on prize size
- significant decrease in available assets following a shock
- increase in the probability of borrowing following a shock

Next Steps

- Individual horizon estimation
- Subjective probability weighting
- Welfare comparisons