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# The Last Race Effect

## Risk Preferences or Time Preferences?

*SCC-76 2017 Annual Meeting  
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Pensacola Beach, FL*

*Dr. Thomas Sproul & Clayton Michaud  
University of Rhode Island*



# The Last Race Effect

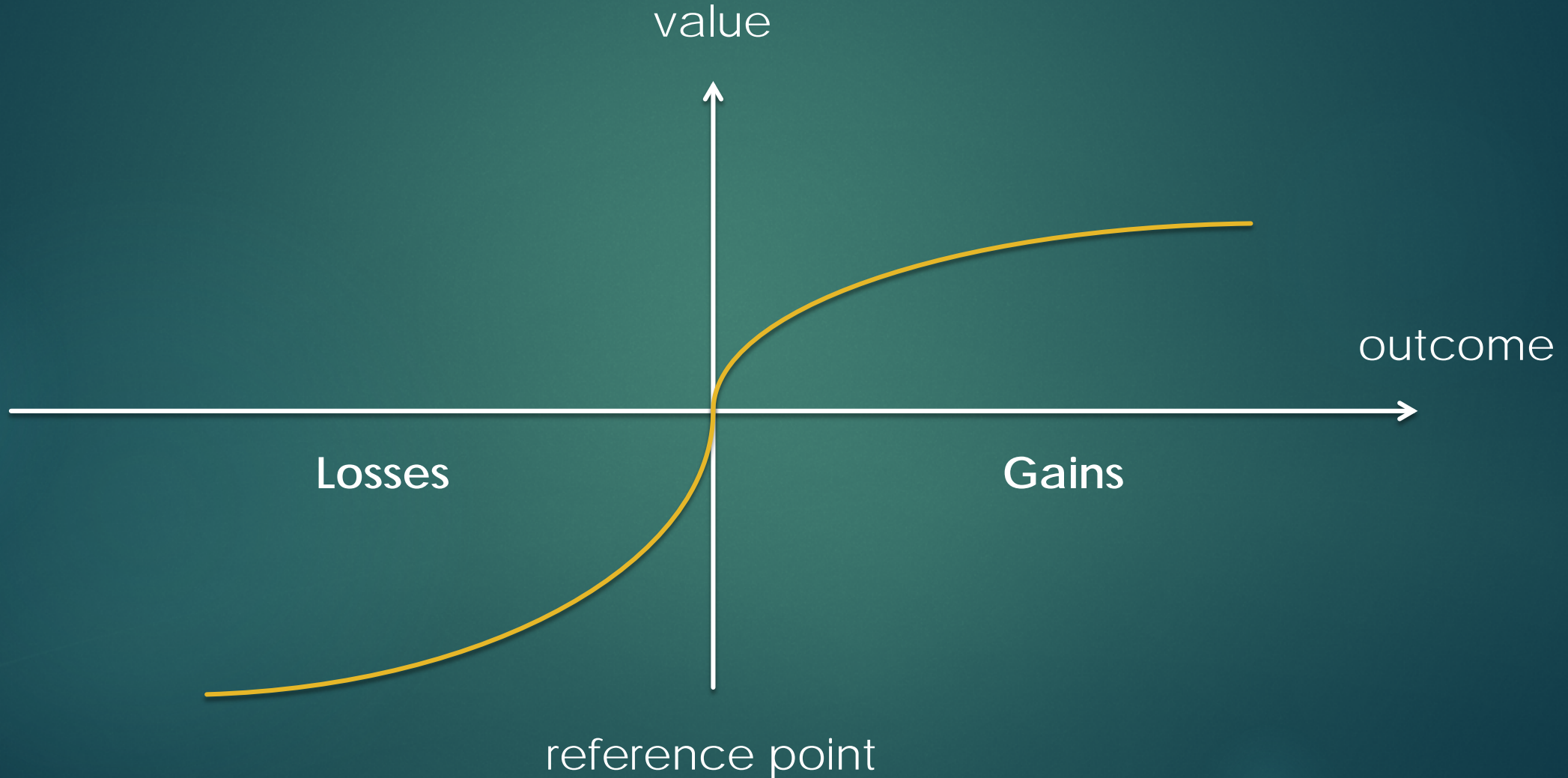
- ▶ **Last Race Effect.** A phenomenon where peri-mutual gamblers are observed to shift their wagers towards more risky bets as the last race of the day approaches.

- McGlothlin (1956), Ali (1977)

- ▶ Consistent with prospect theory... gamblers are down on average at the end of the day, and the value function is **convex** below the reference point of breakeven.

- Kahneman and Tversky (1979)

# The Prospect Theory Value Function





# Key Findings

- ▶ In a 2014 pilot experiment on myopic loss aversion, replicating Gneezy and Potters (1997), **we observed subjects increasing their bets in the last round, despite being in the gains domain.**
- ▶ Conducted an experiment to test whether the last race effect exists only in the loss domain.
  - ▶ **It does not!** (though losses do make it stronger)
- ▶ Other data from the pilot experiment suggests time preferences may play a role.

# Pilot Experiment

- ▶ Replication of Gneezy and Potters (1997), but we did only the “high-frequency” rounds:
  - ▶ Subjects play 9 rounds (we did this twice).
  - ▶ Each round has new budget of \$2.
  - ▶ Any amount invested wins 2.5X with  $\Pr(\text{Win}) = 1/3$ .
  - ▶ Bets were recorded on paper slips, so all subjects were aware when it was the final round (last slip).



*Dependent Variable: Bet Amount*

<b>Coefficient</b>	<b>M1: RE</b>	<b>M2: FE</b>
Intercept	0.9982*** (0.0421)	0.9956*** (0.0219)
Last Round (=1)	0.2542*** (0.0520)	0.2547*** (0.0521)
Loss Domain (=1)	0.1553*** (0.0386)	0.1610*** (0.0388)
Last Round X Loss Domain	0.4488*** (0.0618)	0.4533*** (0.0619)
R-Squared (overall)	0.02	0.02
Joint Test (Wald/F)	73.40	18.77
N obs.	2376	2376
N groups	132	132

*Robust standard errors are in parentheses. \*\*\* denotes statistical significance at the 99.9% level. Fixed effect for "Part 2" not shown, and subject-level fixed effects not shown for Model 2.*



# Our Experiment

- ▶ Computerized interface with colored balls being described as if drawn from an urn *with replacement*.
- ▶ Subjects could see their past wins and losses, but could not see accumulated winnings.
- ▶ Subjects were not told the number of rounds. All played 9 rounds, then random treatment assigned in 10th.
  - ▶ Treatment group saw a banner in the 10<sup>th</sup> round telling them it was the last round of the experiment.
  - ▶ Control group saw nothing different in the 10<sup>th</sup> round, and the experiment ended by surprise.



# Protocol

## Round 1

### Round 1

In this Stage, each round is a betting decision. You can bet up to \$2.00 each round, and you keep any amount you do not bet.

**Your winning color is YELLOW.**



You win 2.5x your bet if the ball drawn matches your winning color. If any other color is drawn you lose your bet.

The balls are drawn from an urn and **the balls are replaced after each draw**. There are equal numbers of blue, red, and yellow balls in the urn:



**Example:** You bet \$1.50 and lose. You earn \$0.50 for the round ( $\$2.00 - \$1.50 = \$0.50$ ).

**Example:** You bet \$0.50 and win. You earn \$3.25 for the round ( $\$2.00 + 2.5 \times \$0.50 = \$3.25$ ).

If this Stage is chosen for payment, your payment will be determined by your total winnings over all rounds. That means \$2.00 per round if you do not bet, or between \$0.00 and \$7.00 per round if you do.

**Please enter your bet below for this round.**

Your bet must be between \$0 and \$2.

Bet Amount \$

# Protocol

## Round 2

### Round 2

In this Stage, each round is a betting decision. You can bet up to \$2.00 each round, and you keep any amount you do not bet.

**Your winning color is YELLOW.**



You win 2.5x your bet if the ball drawn matches your winning color. If any other color is drawn you lose your bet.

The balls are drawn from an urn and **the balls are replaced after each draw**. There are equal numbers of blue, red, and yellow balls in the urn:



**Example:** You bet \$1.50 and lose. You earn \$0.50 for the round ( $\$2.00 - \$1.50 = \$0.50$ ).

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If this Stage is chosen for payment, your payment will be determined by your total winnings over all rounds. That means \$2.00 per round if you do not bet, or between \$0.00 and \$7.00 per round if you do.

**Please enter your bet below for this round.**

Your bet must be between \$0 and \$2.

The earlier draws are shown below. Each ball drawn is replaced into the urn before the next draw.



Bet Amount \$



# Protocol

## Round 10 Control

### Round 10

In this Stage, each round is a betting decision. You can bet up to \$2.00 each round, and you keep any amount you do not bet.

**Your winning color is YELLOW.**



You win 2.5x your bet if the ball drawn matches your winning color. If any other color is drawn you lose your bet.

The balls are drawn from an urn and **the balls are replaced after each draw**. There are equal numbers of blue, red, and yellow balls in the urn:



**Example:** You bet \$1.50 and lose. You earn \$0.50 for the round ( $\$2.00 - \$1.50 = \$0.50$ ).

**Example:** You bet \$0.50 and win. You earn \$3.25 for the round ( $\$2.00 + 2.5 \times \$0.50 = \$3.25$ ).

If this Stage is chosen for payment, your payment will be determined by your total winnings over all rounds. That means \$2.00 per round if you do not bet, or between \$0.00 and \$7.00 per round if you do.

**Please enter your bet below for this round.**

Your bet must be between \$0 and \$2.

The earlier draws are shown below. Each ball drawn is replaced into the urn before the next draw.



Bet Amount \$

# Protocol

## Round 10 Treatment

### Round 10

This is the last round of the experiment. After this choice you will be taken to the summary page.

In this Stage, each round is a betting decision. You can bet up to \$2.00 each round, and you keep any amount you do not bet.

**Your winning color is RED .**



You win 2.5x your bet if the ball drawn matches your winning color. If any other color is drawn you lose your bet.

The balls are drawn from an urn and **the balls are replaced after each draw**. There are equal numbers of blue, red, and yellow balls in the urn:



**Example:** You bet \$1.50 and lose. You earn \$0.50 for the round ( $\$2.00 - \$1.50 = \$0.50$ ).

**Example:** You bet \$0.50 and win. You earn \$3.25 for the round ( $\$2.00 + 2.5 \times \$0.50 = \$3.25$ ).

If this Stage is chosen for payment, your payment will be determined by your total winnings over all rounds. That means \$2.00 per round if you do not bet, or between \$0.00 and \$7.00 per round if you do.

**Please enter your bet below for this round.**

Your bet must be between \$0 and \$2.

The earlier draws are shown below. Each ball drawn is replaced into the urn before the next draw.





# Results

*Dependent Variable: Bet in Round 10*

<b>Coefficient</b>	<b>Model 1</b>	<b>Model 2</b>
Intercept	0.6434*** (0.0686)	0.6093*** (0.0785)
Treatment	0.3701*** (0.1105)	0.3204** (0.1379)
Loss Domain (=1)		0.0742 (0.1420)
Treatment X Loss Domain		0.5357*** (0.1536)
R-Squared	0.07	0.08
F-statistic	11.50	4.92
N obs.	157	157

*Robust standard errors are in parentheses. \*\*\* and \*\* denote statistical significance at the 99.9% and 99% levels, respectively.*

# Results (cont.)

- ▶ **Treatment significant regardless of losses or gains!**
- ▶ Loss domain only causes bet increase when subjects know it is the final round (unlike in pilot).

Not shown:

- ▶ Age and gender not significant predictors of the effect.
- ▶ Dummy for college economics, also not.
- ▶ Dummy for college stats, very marginal ( $p = 0.057$ ), but unexpected sign (beta =  $-0.2396$ ).



# The Role of Time Preferences?

- ▶ The last race effect exists regardless of gain or loss.
- ▶ Maybe it has an element of losing their chance to act?

Evidence from our pilot experiment:

- ▶ Subjects were paid by personal check, so we observed the number of days until it cleared.
- ▶ Time delay is a proxy measure of present-bias
  - ▶ Gives weak identification (no control group) of whether time preferences correlate with the last race effect.

# Present-Bias Model

Subjects choose to act now or in the future, according to:

$$\max_{t \in \{0,1\}} (B - c_0) \cdot (t = 0) + \beta \cdot (B - E[c]) \cdot (t = 1)$$

- ▶ Present-biased (time-inconsistent) have  $\beta < 1$ .
- ▶ If cost of check cashing is a random variable, then

$$\begin{aligned} \Pr(t = 0 | \beta < 1) - \Pr(t = 0 | \beta = 1) \\ = F(\beta E[c] + (1 - \beta)B) - F(E[c]) > 0 \end{aligned}$$

So, present-biased subjects likely to cash checks sooner.



# Testing Present-Bias Model

- ▶ We used regression to generate a maximum likelihood estimate for the last race effect (LRE) for each subject: average residual over round 9 of each trial.
- ▶ Both payment and LRE were significant predictors of earlier clearing, with signs consistent with present-bias model (earlier clearing for larger payment, larger LRE).
- ▶ Results robust to instrumenting for payment amount, to limit endogeneity problems.

# Present-Bias Regressions

*Dependent Variable: Days to payment clearing*

<b>Coefficient</b>	<b>Model 1</b>	<b>Model 2</b>
Intercept	46.04*** (10.34)	81.10*** (24.35)
LRE-Hat	-12.08* (4.71)	-15.00** (4.93)
Payment Amount (instrumented in Model 2)	-1.00* (0.47)	-2.80* (1.16)
R-Squared	0.07	—
Joint Test (F/Wald)	3.91	4.92
N obs.	132	132

*Robust standard errors are in parentheses. \*\*\*, \*\*, and \* represent statistical significance at the 99.9%, 99% and 95% levels, respectively.*



# For Discussion...

## ▶ Key Results:

- ▶ Last race effect not driven only by loss.
- ▶ Risk-taking behavior is influenced by deadlines.
- ▶ May be predictable via present-bias.

## ▶ Questions?

## ▶ Ideas for explicit experimental test?