

Temptation: Immediacy and Certainty

Lucas Reddinger

UCSB

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Does risk significantly diminish present bias?

- ▶ The future is inherently risky
- ▶ A variety of circumstances may inhibit a future reward

- ▶ Immediacy is necessary for certainty
- ▶ Risk may similarly diminish a preference for immediate reward
- ▶ Chakraborty, Halevy, Saito (2020); Epper, Fehr-Duda (2019)

- ▶ Does certainty significantly increase present bias?

Prior evidence that risk moderates present bias

- ▶ Keren and Roelofsma (1995)

	Probability of monetary reward					
	$p = 1.0$		$p = 0.9$		$p = 0.5$	
Imminent future						
<i>A</i> : \$50 now	82%	(49)	54%	(38)	39%	(39)
<i>A'</i> : \$55 in 4 weeks	18%	(11)	46%	(32)	61%	(61)
Remote future						
<i>B</i> : \$50 in 26 weeks	37%	(22)	25%	(20)	33%	(33)
<i>B'</i> : \$55 in 30 weeks	63%	(38)	75%	(59)	67%	(67)
Difference	45%		29%		6%	

- ▶ Present-biased (non-stationary time prefs) near certainty ($p = 1$, $p = 0.9$)
- ▶ Dynamically consistent (stationary) with substantial risk ($p = 0.5$)

Prior evidence that risk moderates present bias

- ▶ Keren and Roelofsma (1995) report these seminal results
 - ▶ Hypothetical stakes
- ▶ Weber and Chapman (2005) replicate these results
 - ▶ Hypothetical stakes
- ▶ Baucells and Heukamp (2010) report consistent findings
 - ▶ Extremely low probability of implementing any given decision
- ▶ Augenblick, Niederle, Sprenger (2015) do not address risk-delay interaction
 - ▶ Study present-bias using monetary and real-effort stakes
 - ▶ Subjects instructed that isolating each decision is optimal
 - ▶ Each subject makes 20 decisions; one is implemented
- ▶ No studies approximate immediate and certain real stakes

Overview of experimental design

- ▶ Focus on dynamic inconsistency
- ▶ Run on Amazon Mechanical Turk
- ▶ Day 0:
 - ▶ Complete 10 real-effort tasks
 - ▶ Allocate 360 tasks between Day 2 and Day 9
 - ▶ Receive \$1.50
- ▶ Day 2:
 - ▶ Complete 10 real-effort tasks
 - ▶ Allocate 360 tasks between Day 2 and Day 9
 - ▶ One of these decisions is selected for implementation
 - ▶ Work the implemented tasks for Day 2
 - ▶ Receive \$1.50
- ▶ Day 9:
 - ▶ Complete 10 real-effort tasks
 - ▶ Work the implemented tasks for Day 9
 - ▶ Receive \$6.50

Real-effort task

PRACTICE MODE

The correct answers are already filled in to save you time.

Complete 10 required rows of counting

Please count the number of zeros ("0") on each line and enter it in the box.

Each row will be marked correct or incorrect. You must correct errors before submission.

Row No.	String	Count ("0")
1	1000110011100011	8
2	1000010100000001	12
3	1110001110000011	8
4	0100110010101111	7
5	0000100010101110	10
6	1101001011001010	8
7	0000111001010001	10
8	1011100110010010	8
9	1110110100011111	5
10	0110001100111001	8

Check responses and save

Treatment: risky price, risky day

- ▶ Allocate real effort between Day 2 and Day 9
 - ▶ $e_i^{\text{Day 2}} + R_i e_i^{\text{Day 9}} = 360$
 - ▶ Choose for each possible trade-off rate (price) $R_i \in \{1.5, 1.25, 1, 0.75, 0.5\}$
- ▶ Decide on Day 0 and then again on Day 2

Day 0	Day 2
Allocate at R_1 (prob 1/10)	Allocate at R_1 (prob 1/10)
Allocate at R_2 (prob 1/10)	Allocate at R_2 (prob 1/10)
Allocate at R_3 (prob 1/10)	Allocate at R_3 (prob 1/10)
Allocate at R_4 (prob 1/10)	Allocate at R_4 (prob 1/10)
Allocate at R_5 (prob 1/10)	Allocate at R_5 (prob 1/10)

- ▶ One of these ten decisions is implemented randomly

Treatment: risky price, certain day

- ▶ Allocate real effort between Day 2 and Day 9
 - ▶ $e_i^{\text{Day } 2} + R_i e_i^{\text{Day } 9} = 360$
 - ▶ Choose for each possible trade-off rate (price) $R_i \in \{1.5, 1.25, 1, 0.75, 0.5\}$
- ▶ Decide on Day 0 and then again on Day 2

Day 0	Day 2
Allocate at R_1 (prob 1/10)	Allocate at R_1 (prob 1/5)
Allocate at R_2 (prob 1/10)	Allocate at R_2 (prob 1/5)
Allocate at R_3 (prob 1/10)	Allocate at R_3 (prob 1/5)
Allocate at R_4 (prob 1/10)	Allocate at R_4 (prob 1/5)
Allocate at R_5 (prob 1/10)	Allocate at R_5 (prob 1/5)

- ▶ Just before Day 2 decisions, informed that a coin flip has selected only Day 2 decisions to matter
- ▶ One of these five decisions is implemented randomly

Treatment: certain price, risky day

- ▶ Allocate real effort between Day 2 and Day 9
 - ▶ $e_i^{\text{Day } 2} + R_i e_i^{\text{Day } 9} = 360$
 - ▶ Choose for each possible trade-off rate (price) $R_i \in \{1.5, 1.25, 1, 0.75, 0.5\}$
- ▶ Decide on Day 0 and then again on Day 2

Day 0	Day 2
Allocate at R_1 (prob 0)	Allocate at R_1 (prob 0)
Allocate at R_2 (prob 1/2)	Allocate at R_2 (prob 1/2)
Allocate at R_3 (prob 0)	Allocate at R_3 (prob 0)
Allocate at R_4 (prob 0)	Allocate at R_4 (prob 0)
Allocate at R_5 (prob 0)	Allocate at R_5 (prob 0)

- ▶ One of these two decisions is implemented randomly

Treatment: certain price, certain day

- ▶ Allocate real effort between Day 2 and Day 9
 - ▶ $e_i^{\text{Day } 2} + R_i e_i^{\text{Day } 9} = 360$
 - ▶ Choose for each possible trade-off rate (price) $R_i \in \{1.5, 1.25, 1, 0.75, 0.5\}$
- ▶ Decide on Day 0 and then again on Day 2

Day 0	Day 2
Allocate at R_1 (prob 0)	Allocate at R_1 (prob 0)
Allocate at R_2 (prob 1/2)	Allocate at R_2 (prob 1)
Allocate at R_3 (prob 0)	Allocate at R_3 (prob 0)
Allocate at R_4 (prob 0)	Allocate at R_4 (prob 0)
Allocate at R_5 (prob 0)	Allocate at R_5 (prob 0)

- ▶ Just before Day 2 decisions, informed that a coin flip has selected only the Day 2 decision to matter
- ▶ This **one** decision is implemented with certainty

Overview of treatments

- ▶ Allocate real effort between Day 2 and Day 9
 - ▶ $e_i^{\text{Day 2}} + R_i e_i^{\text{Day 9}} = 360$
 - ▶ Choose for each possible trade-off rate (price) $R_i \in \{1.5, 1.25, 1, 0.75, 0.5\}$
- ▶ Decide on Day 0 and then again on Day 2

Treatment	Day 0	Day 2
Risky Price, Risky Day	Allocate at R_1 (prob 1/10)	Allocate at R_1 (prob 1/10)
	Allocate at R_2 (prob 1/10)	Allocate at R_2 (prob 1/10)
	Allocate at R_3 (prob 1/10)	Allocate at R_3 (prob 1/10)
	Allocate at R_4 (prob 1/10)	Allocate at R_4 (prob 1/10)
	Allocate at R_5 (prob 1/10)	Allocate at R_5 (prob 1/10)
Risky Price, Certain Day	Allocate at R_1 (prob 1/10)	Allocate at R_1 (prob 1/5)
	Allocate at R_2 (prob 1/10)	Allocate at R_2 (prob 1/5)
	Allocate at R_3 (prob 1/10)	Allocate at R_3 (prob 1/5)
	Allocate at R_4 (prob 1/10)	Allocate at R_4 (prob 1/5)
	Allocate at R_5 (prob 1/10)	Allocate at R_5 (prob 1/5)
Certain Price, Risky Day	Allocate at R_1 (prob 0)	Allocate at R_1 (prob 0)
	Allocate at R_2 (prob 1/2)	Allocate at R_2 (prob 1/2)
	Allocate at R_3 (prob 0)	Allocate at R_3 (prob 0)
	Allocate at R_4 (prob 0)	Allocate at R_4 (prob 0)
	Allocate at R_5 (prob 0)	Allocate at R_5 (prob 0)
Certain Price, Certain Day	Allocate at R_1 (prob 0)	Allocate at R_1 (prob 0)
	Allocate at R_2 (prob 1/2)	Allocate at R_2 (prob 1)
	Allocate at R_3 (prob 0)	Allocate at R_3 (prob 0)
	Allocate at R_4 (prob 0)	Allocate at R_4 (prob 0)
	Allocate at R_5 (prob 0)	Allocate at R_5 (prob 0)

Model with expected utility and β - δ discounting

- ▶ Assume Expected Utility with Quasi-Hyperbolic Discounting (ANS 2015)
- ▶ Simply compare present-bias factor β between treatments
- ▶ CRRA periodic convex effort costs: $c(e) = (e + 10)^\alpha$
- ▶ On decision-day d , minimize discounted effort costs:

$$\min_{e_{i,d}^t} \beta^{1(d=0)} (e_{i,d}^{\text{Day } 2} + 10)^\alpha + \beta\delta^7 (e_{i,d}^{\text{Day } 9} + 10)^\alpha, \text{ s.t. } e_i^{\text{Day } 2} + R_i e_i^{\text{Day } 9} = 360$$

- ▶ Euler equation:

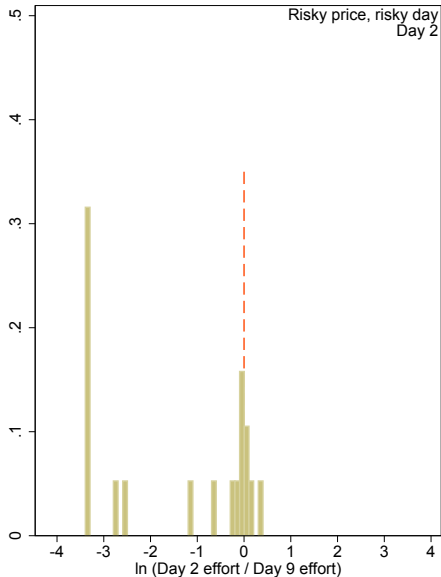
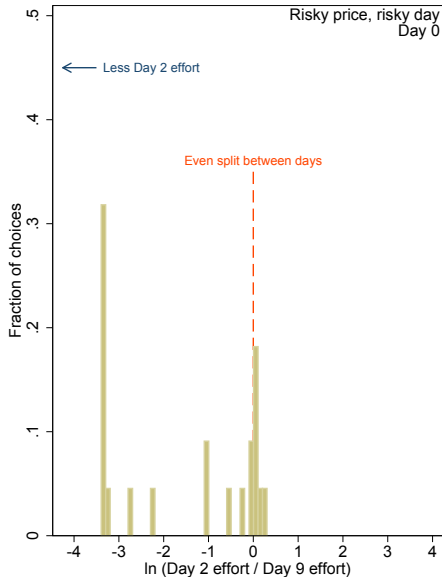
$$\left(\frac{e_{i,d}^{\text{Day } 2} + 10}{e_{i,d}^{\text{Day } 9} + 10} \right)^{\alpha-1} = \frac{\beta^{1(d=2)} \delta^7}{R_i}$$

- ▶ Reduced form:

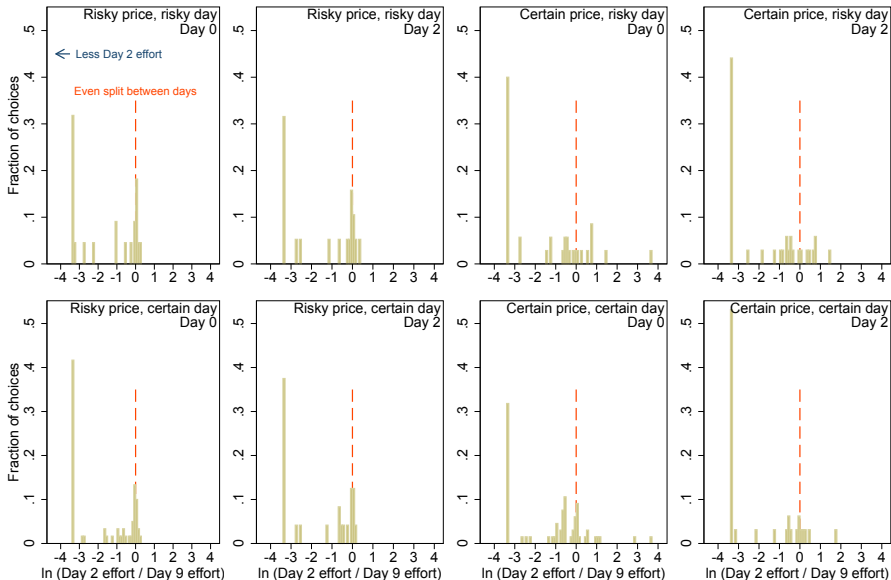
$$\ln \frac{e_{i,d}^{\text{Day } 2} + 10}{e_{i,d}^{\text{Day } 9} + 10} = \underbrace{\frac{\ln \delta}{\alpha - 1}}_{\eta_0} 7 + \underbrace{\frac{-1}{\alpha - 1}}_{\eta_1} \ln R_i + \underbrace{\frac{\ln \beta}{\alpha - 1}}_{\eta_2} \mathbb{1}(d = 2)$$

- ▶ Recovery: $\alpha = 1 - \eta_1^{-1}$, $\beta = \exp(-\eta_2 \eta_1^{-1})$, $\delta = \exp(-\eta_0 \eta_1^{-1})$

Results for the baseline treatment



Results



Results: treatment effects by day

- ▶ On Day 0, subjects with certain day choose 15 fewer tasks for Day 2
- ▶ On Day 2, subjects with certain day choose 26 fewer tasks for Day 2
- ▶ On Day 2, subjects with certain price choose 64 fewer tasks for Day 2

	$E_{i,d}$ (log-effort-ratio) Choices			
	On Day 0		On Day 2	
Certain Price	-0.7137	$p = 0.149$	-1.1344	$p = 0.025^{**}$
Certain Day	-0.1666	$p = 0.017^{**}$	-0.3268	$p = 0.022^{**}$
Certain Price and Day	0.5418	$p = 0.334$	-0.2155	$p = 0.760$
$\ln R_i$	-4.9766	$p = 0.000^{***}$	-4.2598	$p = 0.000^{***}$
Constant	-0.2193	$p = 0.000^{***}$	-0.2337	$p = 0.000^{***}$
N (Decisions)	511		281	
G (Subjects)	183		109	
N_l (left-censored)	103		63	
N_u (uncensored)	343		189	
N_r (right-censored)	65		29	

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$ Standard errors are clustered on subject, using a two-limit Tobit regression model.

Results: treatment effects by day

- ▶ Day 0 choices:
 - ▶ Subject is told that before deciding on Day 2, she will learn if only her Day 2 choices will matter
 - ▶ On Day 0, this subject chooses 16 fewer tasks for Day 2
 - ▶ This implies a different δ for Certain Day treatment
 - ▶ A surprising result
 - ▶ This may inform our model specification
- ▶ Day 2 choices:
 - ▶ How these choices **change** between Day 0 and Day 2 identifies β
 - ▶ So we will pool both days into a single regression to estimate β

Pooled regression

- ▶ Let's allow for different treatment-by-day effects:

$$\begin{aligned} E_{i,d,s} = & \eta_{\text{delay}} \gamma + \eta_{\text{lnrate}} \ln R_i + \eta_{\text{present}} \mathbb{1}(\text{pr})_d + \eta_{\text{pr-cp}} \mathbb{1}(\text{pr})_d \mathbb{1}(\text{tr-cp})_s \\ & + \eta_{\text{pr-cd}} \mathbb{1}(\text{pr})_d \mathbb{1}(\text{tr-cd})_s + \eta_{\text{pr-cp-cd}} \mathbb{1}(\text{pr})_d \mathbb{1}(\text{tr-cp})_s \mathbb{1}(\text{tr-cd})_s \\ & + \eta_{\text{tr-cp}} \mathbb{1}(\text{tr-cp})_s + \eta_{\text{tr-cd}} \mathbb{1}(\text{tr-cd})_s + \eta_{\text{tr-cp-cd}} \mathbb{1}(\text{tr-cp})_s \mathbb{1}(\text{tr-cd})_s + \varepsilon_{i,d,s} \end{aligned}$$

- ▶ This will permit recovery of **different β and δ** for each treatment:

$$\alpha = 1 - \eta_{\text{lnrate}}^{-1}$$

$$\delta = \exp \frac{\eta_{\text{delay}}}{-\eta_{\text{lnrate}}}$$

$$\delta_{\text{cd}} = \exp \frac{\eta_{\text{delay}} + \eta_{\text{tr-cd}}}{-\eta_{\text{lnrate}}}$$

$$\beta = \exp \frac{\eta_{\text{present}}}{-\eta_{\text{lnrate}}}$$

$$\beta_{\text{cd}} = \exp \frac{\eta_{\text{present}} + \eta_{\text{pr-cd}}}{-\eta_{\text{lnrate}}}$$

$$\delta_{\text{cp}} = \exp \frac{\eta_{\text{delay}} + \eta_{\text{tr-cp}}}{-\eta_{\text{lnrate}}}$$

$$\delta_{\text{cp-cd}} = \exp \frac{\eta_{\text{delay}} + \eta_{\text{tr-cp}} + \eta_{\text{tr-cd}} + \eta_{\text{cp-cd}}}{-\eta_{\text{lnrate}}}$$

$$\beta_{\text{tr-cp}} = \exp \frac{\eta_{\text{present}} + \eta_{\text{pr-cp}}}{-\eta_{\text{lnrate}}}$$

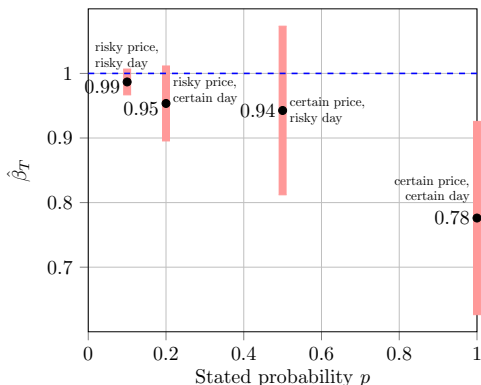
$$\beta_{\text{cp-cd}} = \exp \frac{\eta_{\text{present}} + \eta_{\text{pr-cp}} + \eta_{\text{pr-cd}} + \eta_{\text{pr-cp-cd}}}{-\eta_{\text{lnrate}}}$$

Results from unrestricted pooled model

Param. θ	Estimate	$H_0: \theta = 1$
β	0.9868	$p = 0.1964$
β_{cd}	0.9535	$p = 0.1164$
β_{cp}	0.9426	$p = 0.3885$
β_{cp-cd}	0.7761	$p = 0.0034^{***}$
δ	0.9939	$p = 0.0000^{***}$
δ_{cd}	0.9596	$p = 0.0025^{***}$
δ_{cp}	0.8418	$p = 0.0983^*$
δ_{cp-cd}	0.9113	$p = 0.2171$
α	1.2115	$p = 0.0000^{***}$

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

$N = 792$ observations from $G = 183$ clusters, with $N_l = 166$ left- and $N_r = 94$ right-censored observations. Standard errors are clustered on subject, using a two-limit Tobit regression model.



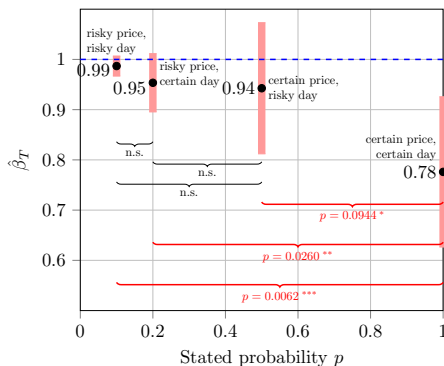
- ▶ Beware: δ_{cp} and δ_{cp-cd} not well-identified
- ▶ I only use the single incented decision at $R_i = 1.25$ in these treatments

Results from unrestricted pooled model

Param.	Est.	Hypothesis that the parameter is equal to			
		1	β_{cd}	β_{cp}	β_{cp-cd}
β	0.9868	$p = 0.1964$	$p = 0.2872$	$p = 0.5113$	$p = 0.0062^{***}$
β_{cd}	0.9535	$p = 0.1164$		$p = 0.8794$	$p = 0.0260^{**}$
β_{cp}	0.9426	$p = 0.3885$			$p = 0.0944^*$
β_{cp-cd}	0.7761	$p = 0.0034^{***}$			
		1	δ_{cd}	δ_{cp}	δ_{cp-cd}
δ	0.9939	$p = 0.0000^{***}$	$p = 0.0175^{**}$	$p = 0.1126$	$p = 0.2518$
δ_{cd}	0.9596	$p = 0.0025^{***}$		$p = 0.2113$	$p = 0.4905$
δ_{cp}	0.8418	$p = 0.0983^*$			$p = 0.4938$
δ_{cp-cd}	0.9113	$p = 0.2171$			
α	1.2115	$p = 0.0000^{***}$			

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

$N = 792$ observations from $G = 183$ clusters, with $N_l = 166$ left- and $N_r = 94$ right-censored observations. Standard errors are clustered on subject, using a two-limit Tobit regression model.



- Suggests a significant interaction between immediacy and certainty

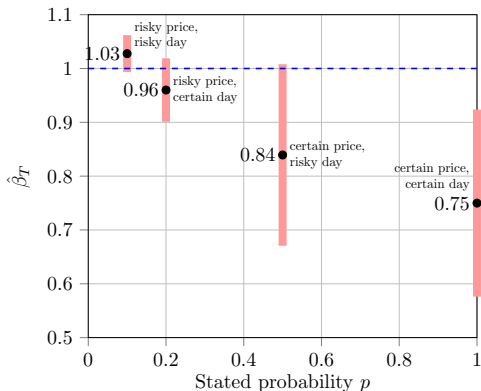
Results from restricted pooled model

- ▶ Now let's restrict δ to be the same for all treatments
- ▶ This was my *ex ante* specification before seeing the data

Param. θ	Estimate	$H_0: \theta = 1$
β	1.0276	$p = 0.1042$
β_{cd}	0.9600	$p = 0.1762$
β_{cp}	0.8393	$p = 0.0602^*$
β_{cp-cd}	0.7499	$p = 0.0046^{***}$
δ	0.9880	$p = 0.0000^{***}$
α	1.2070	$p = 0.0000^{***}$

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

$N = 792$ observations from $G = 183$ clusters, with $N_l = 166$ left- and $N_r = 94$ right-censored observations. Standard errors are clustered on subject, using a two-limit Tobit regression model.

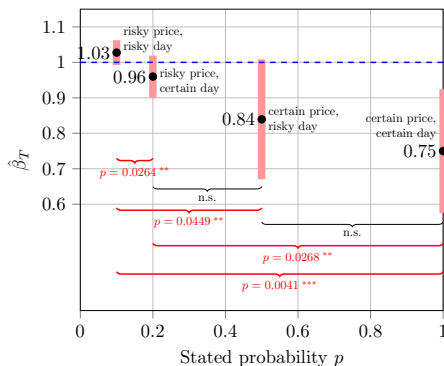


Results from restricted pooled model

Param.	Est.	Hypothesis that the parameter is equal to			
		1	β_{cd}	β_{cp}	β_{cp-cd}
β	1.0276	$p = 0.1042$	$p = 0.0264^{**}$	$p = 0.0449^{**}$	$p = 0.0041^{***}$
β_{cd}	0.9600	$p = 0.1762$		$p = 0.1934$	$p = 0.0268^{**}$
β_{cp}	0.8393	$p = 0.0602$			$p = 0.4333$
β_{cp-cd}	0.7499	$p = 0.0046^{***}$			
δ	0.9880	$p = 0.0000^{***}$			
α	1.2070	$p = 0.0000^{***}$			

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

$N = 792$ observations from $G = 183$ clusters, with $N_l = 166$ left- and $N_r = 94$ right-censored observations. Standard errors are clustered on subject, using a two-limit Tobit regression model.



- Suggests a significant interaction between immediacy and certainty

What have I shown?

- ▶ Clear evidence that present-bias is affected by risk for some risk levels
- ▶ Present-bias is attenuated by two types of risk:
 - ▶ Risk between decisions made on different days (implies dynamic inconsistency)
 - ▶ Risk between decisions made at different prices (standard RDU)
- ▶ I do find evidence of interaction between certainty and immediacy
- ▶ Slightly underpowered, especially with certain-price treatment

Future research

- ▶ Further explore relationship between risk and delay using RDU
- ▶ Are the non-EUT decision-makers also present-biased?
- ▶ Disentangle complexity from risk and time preferences

Appendix

Interface: separate CTB

PRACTICE MODE

You will not have to work these tasks.

Split workload between **Wed, Oct 30** and **Wed, Nov 6**

Choose how you want to split your workload of 360 rows of counting (in addition to the required 10 rows per workday).

In this scenario, *working 1 more row next week reduces work by 1.25 row(s) this week.*

You're making five decisions on how to split the workload for Wed, Oct 30. You'll make five more similar decisions on that day.

A coin flip will determine whether this decision made today or a decision made on Wed, Oct 30 will be selected to actually matter.

This decision may actually matter; the other four decisions today are hypothetical.

The odds of this decision being the decision-that-matters are **50%**.



Try moving the slider around to see how this trade-off rate splits your workload.

If this choice were selected to actually matter, your work schedule would be:

Sun, Oct 27	Mon, Oct 28 (today)	Tue, Oct 29	Wed, Oct 30 10 rows required + 187 rows chosen	Thu, Oct 31	Fri, Nov 1	Sat, Nov 2
Sun, Nov 3	Mon, Nov 4	Tue, Nov 5	Wed, Nov 6 10 rows required + 139 rows chosen	Thu, Nov 7	Fri, Nov 8	Sat, Nov 9

You will be able to adjust this decision before finalizing it.

Continue

Interface: together CTB

PRACTICE MODE

You will not have to work these tasks.

Split workload between **Wed, Oct 30** and **Wed, Nov 6**

You're making five decisions on how to split the workload for Wed, Oct 30. You'll make five more similar decisions on that day.

A coin flip will determine whether today's decision **highlighted in yellow** or a decision made on Wed, Oct 30 will be selected to actually matter.

The highlighted decision may actually matter; the other four decisions today are hypothetical.

The odds of the highlighted decision being the decision-that-matters are **50%**.

Trade-off	Wed, Oct 30		Wed, Nov 6
1 to 0.5	290 rows	<input type="range"/>	140 rows
1 to 0.75	262 rows	<input type="range"/>	131 rows
1 to 1	226 rows	<input type="range"/>	134 rows
1 to 1.25	187 rows	<input type="range"/>	139 rows
1 to 1.5	69 rows	<input type="range"/>	194 rows

Please review your choices and make any final changes.

Finalize

Interface: day implementation

PRACTICE MODE

How today's decisions are used

You made decisions about splitting work between **this Wednesday** and **next Wednesday**.

You will make similar decisions again Wednesday. One day will be selected for its decisions to actually matter.

Sun, Oct 27	Mon, Oct 28 (today)	Tue, Oct 29	Wed, Oct 30	Thu, Oct 31	Fri, Nov 1	Sat, Nov 2
	Decisions made		Decisions made			
Sun, Nov 3	Mon, Nov 4	Tue, Nov 5	Wed, Nov 6	Thu, Nov 7	Fri, Nov 8	Sat, Nov 9

You just made five decisions about how to split work between these days

Choice No.	Trade-off	Wed, Oct 30	Wed, Nov 6
1	1 to 0.5	290 rows	140 rows
2	1 to 0.75	265 rows	134 rows
3	1 to 1.0	240 rows	128 rows
4	1 to 1.25	187 rows	139 rows
5	1 to 1.5	89 rows	194 rows

You will make five similar decisions Wednesday

Choice No.	Trade-off	Wed, Oct 30	Wed, Nov 6
1	1 to 0.5	x rows	x rows
2	1 to 0.75	x rows	x rows
3	1 to 1.0	x rows	x rows
4	1 to 1.25	x rows	x rows
5	1 to 1.5	x rows	x rows

After you make decisions Wednesday, a coin-toss will select which day's decisions are used

Choice No.	Trade-off	Wed, Oct 30	Wed, Nov 6
1	1 to 0.5	290 rows	140 rows
2	1 to 0.75	265 rows	134 rows
3	1 to 1.0	240 rows	128 rows
4	1 to 1.25	187 rows	139 rows
5	1 to 1.5	89 rows	194 rows

Choice No.	Trade-off	Wed, Oct 30	Wed, Nov 6
1	1 to 0.5	x rows	x rows
2	1 to 0.75	x rows	x rows
3	1 to 1.0	x rows	x rows
4	1 to 1.25	x rows	x rows
5	1 to 1.5	x rows	x rows

Continue

In this practice coin toss, today's decisions are selected to matter. Please click the button to continue with this example.

Interface: price implementation

PRACTICE MODE

You will not have to work these tasks.

Implement workload for **Wed, Oct 30** and **Wed, Nov 6**

For this practice round, the coin-toss selected today's decisions to actually matter.

Accordingly, here are the decisions you made today to split the workload of 360 rows of counting.

The decision **highlighted in yellow** will actually matter, the other four decisions are hypothetical.

These work amounts are in addition to the 10 rows of counting required on each day.

Choice No.	Trade-off	Wed, Oct 30	Wed, Nov 6
1	1 to 0.5	290 rows	140 rows
2	1 to 0.75	262 rows	131 rows
3	1 to 1	226 rows	134 rows
4	1 to 1.25	187 rows	139 rows
5	1 to 1.5	69 rows	194 rows

Continue

Attrition and continuation probability

- ▶ Of subjects who completed Day 3, 93.75% completed Day 10
- ▶ Structural estimate of $\hat{\delta}^7 = 92.02\%$, 95% CI of (89.26%, 94.77%)
- ▶ Fail to reject that subjects are sophisticated regarding their own attrition

Compare QHD fit to an RDU model

- ▶ Halevy (2008, AER)
- ▶ Epper Fehr-Duda (2019)
- ▶ Chakraborty, Halevy, and Saito (2020, AERI)

- ▶ Combine stated risk and temporal risk in rank-dependent utility (RDU)
- ▶ $w(p, \tau) = g((1 - r)^\tau p)$, where r is periodic hazard probability
- ▶ Rank outcomes naturally as $R_1 \succ R_2 \succ \dots \succ R_5$
- ▶ Assume that the DM prefers decisions made on the same day

Estimates from two competing models

- ▶ Using single-parameter pr wt fn from Tversky & Kahneman (1992),

$$w(p) := \frac{p^\gamma}{[p^\gamma + (1-p)^\gamma]^{1/\gamma}} \quad \text{where } \gamma \in [1/2, 1]$$

	Pooled RDU	Pooled QHD
α	1.3262 (0.0380)	1.3703 (0.0447)
δ	1.0331 (0.0280)	1.0131 (0.0045)
γ	0.4244 (0.0649)	
q	0.6843 (0.1401)	
β		0.8620 (0.0392)
$\ln L$	-2036.1084	-2039.7689

