Econ 211

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More Evidence on Time Preferences

The Marshmallow Test: Mischel et al (1989)

- 35 preschoolers in lab, each given one marshmallow
- Told that if they can wait 15 minutes without eating marshmallow, they can get another one
- Measure how long they wait before eating marshmallow
- 12 years later, those students take the SAT

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- What parameter is being measured here? β or δ?
  - Combination of both, so can't separate the two

White Noise: Solnik et al (1980)

- College students solving GRE problems in the lab for one hour
- White noise generator intended to cause distraction
- Can press a button that will turn off noise:
  - Button 1: Turn off noise for 60 seconds right now
  - Button 2: Turn off noise for 90 seconds after 90 second delay
- Two treatments:
  - Can push button immediately, choice implemented in 15 seconds
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- Note that we need two treatments to separate effects of two time-preference variables, δ and β

Field Evidence: Meier and Sprenger (2010)

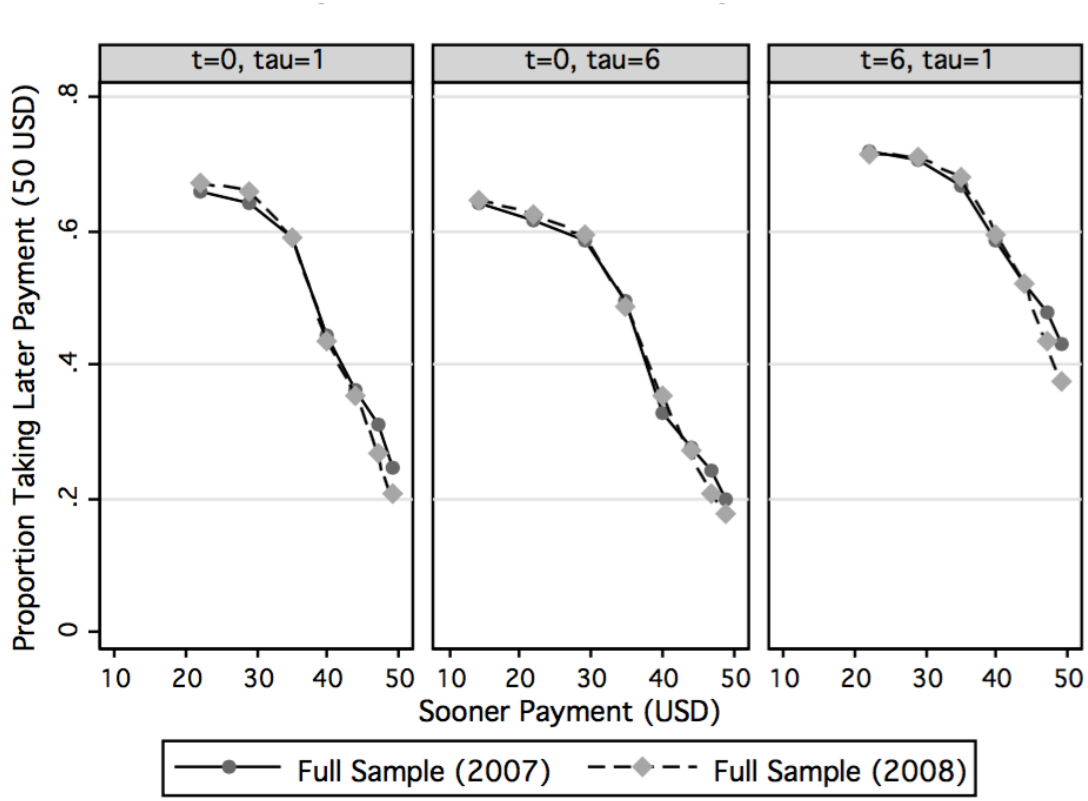
- Give multiple price list instrument to people coming in for tax advice in Boston
- Questions on MPL ask to choose between smaller sooner cash payment and larger later cash payment
- Did same procedure on same population in two different years: 2007 and 2008
- 1500 observations, including 200 people who showed up both years
- Because of setting, had access to income data

Meier and Sprenger (2010): Multiple Price Lists

[Block 1; $t = 0$, $\tau = 1$]: Option A (**TODAY**) or Option B (**IN A MONTH**)
Decision (1): \$ 75 guaranteed **today** - \$ 80 guaranteed **in a month**
Decision (2): \$ 70 guaranteed **today** - \$ 80 guaranteed **in a month**
Decision (3): \$ 65 guaranteed **today** - \$ 80 guaranteed **in a month**
Decision (4): \$ 60 guaranteed **today** - \$ 80 guaranteed **in a month**
Decision (5): \$ 50 guaranteed **today** - \$ 80 guaranteed **in a month**
Decision (6): \$ 40 guaranteed **today** - \$ 80 guaranteed **in a month**
[Block 2; $t = 0$, $\tau = 6$]: Option A (**TODAY**) or Option B (**IN 6 MONTHS**)
Decision (7): \$ 75 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (8): \$ 70 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (9): \$ 65 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (10): \$ 60 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (11): \$ 50 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (12): \$ 40 guaranteed **today** - \$ 80 guaranteed **in 6 months**
Decision (13): \$ 30 guaranteed **today** - \$ 80 guaranteed **in 6 months**
[Block 3; $t = 6$, $\tau = 7$]: Option A (**IN 6 MONTHS**) or Option B (**IN 7 MONTHS**)
Decision (14): \$ 75 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**
Decision (15): \$ 70 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**
Decision (16): \$ 65 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**
Decision (17): \$ 60 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**
Decision (18): \$ 50 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**
Decision (19): \$ 40 guaranteed **in 6 months** - \$ 80 guaranteed **in 7 months**

- t is early period, τ is later period

Meier and Sprenger (2010): Results



- When early reward is immediate, more likely to take early payment
- Estimates of β between 0.672 and 0.792
- Estimates of monthly δ between 0.953 and 0.981
- Estimates remarkably stable between years

Inconsistent Estimates of β in the Literature

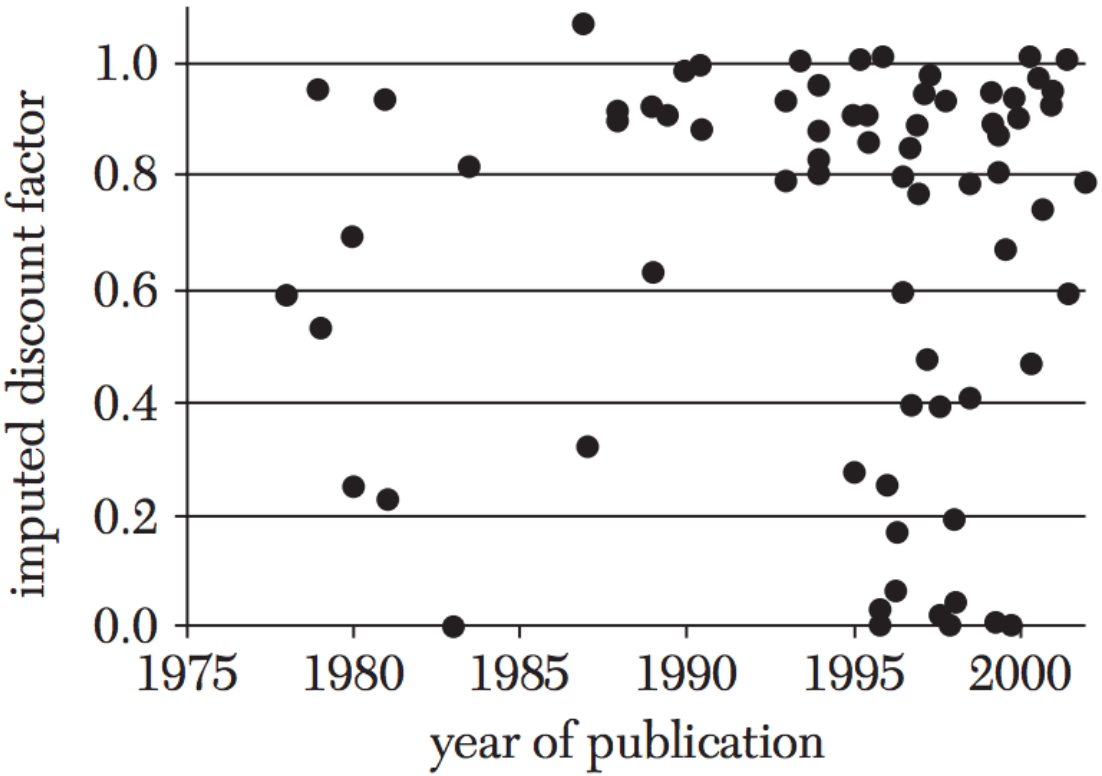


Figure 2. Discount Factor by Year of Study Publication

Source: Frederick et al. (2002)

Potential Problems with the Standard MPL Approach

- Have assumed that transaction costs are same in all time periods
  - But people may avoid getting money in a period of transaction cost is high that period
  - What transaction costs might arise in an experiment over multiple time periods?

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- Have assumed that transaction costs are same in all time periods
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  - What transaction costs might arise in an experiment over multiple time periods?
  - Solution: Andreoni and Sprenger (2012) try to eliminate transaction costs
- Note we are trading off money, not consumption, in most of these experiments
  - So subjects with access to bank accounts should be able to arbitrage if implicit interest rate in experiment is different than actual interest rate
  - Solution: Augenblick, Niederle, and Sprenger (2015) have subjects trade off consumption good (namely leisure time)

Convex Time Budgets: Andreoni and Sprenger (2012)

- Took extreme measures to address transaction cost issue
  - All payments by check, delivered to student mailbox
  - Thank you payment arrives as $5 today, $5 at later period
  - Students self-address both envelopes

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- Took extreme measures to address transaction cost issue
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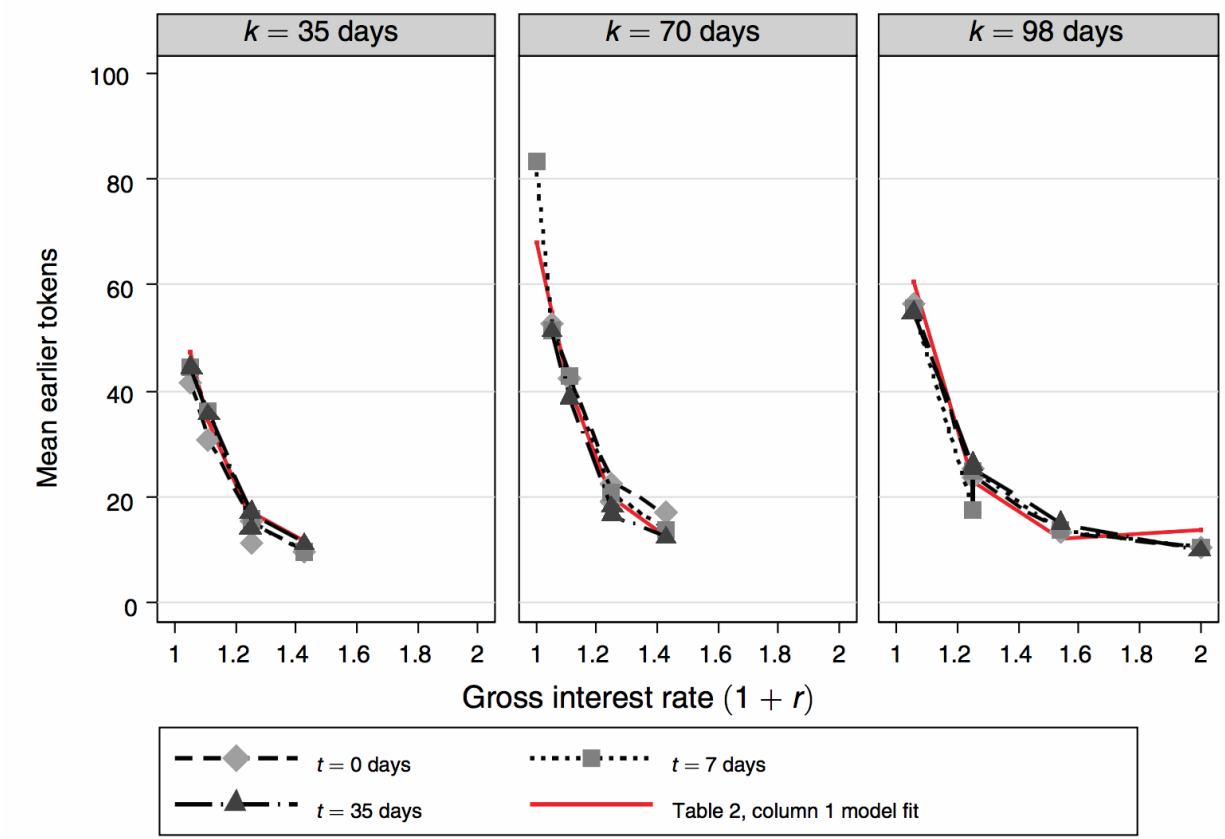
- Rather than make binary (sooner vs later) choice, introduce convex time budgets (CTB)
  - Subject given budget of 100 tokens
  - Tokens worth different amounts $p_1,\ p_2$ in early and later, giving an implicit interest rate $1 + r = \frac{p_2}{p_1}$
  - Allocate tokens as desired between periods
  - Like price list, make decision for a variety possible interest rates

Andreoni and Sprenger (2012): Results

- Estimates of annual discount rate δ between 0.254 and 0.377 (!)
- Estimates of present-bias β very close to 1, ie no apparent aggregate time-inconsistency
- Note: t is earlier period, $t + k$ is later period



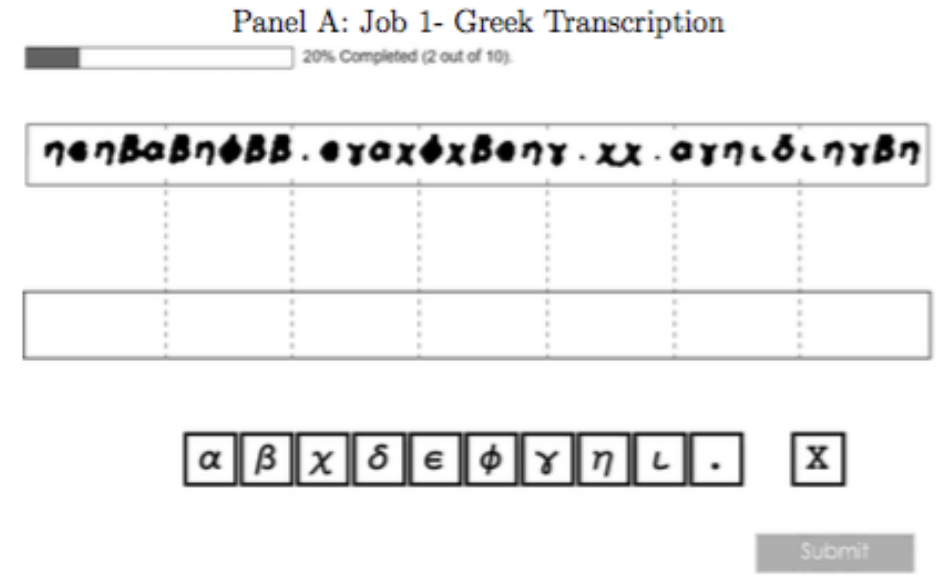
Money vs Consumption

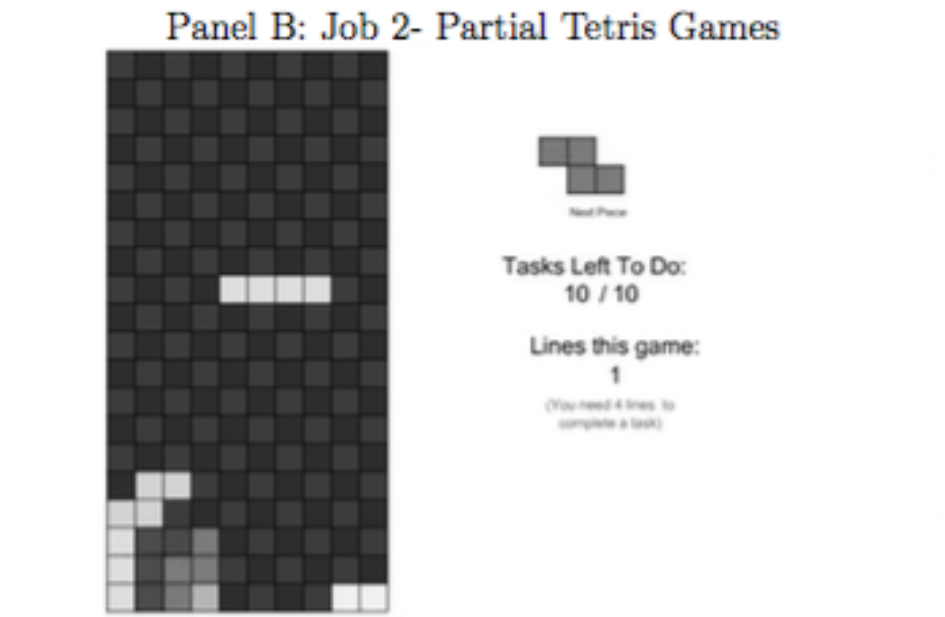
- Recall that time budgets imply interest rate r
- Compare to market interest rate r_m
  - If $r < r_m$, student should put all tokens on sooner payoff, since they could invest all of that money and earn better return in the market
  - If $r > r_m$, student should put all tokens on later payoff, by similar argument
  - This *arbitrage* argument shows that experiment is not really measuring time preferences for students with access to credit markets
- Ideally, subjects would be trading off actual consumption instead of money

Working Over Time

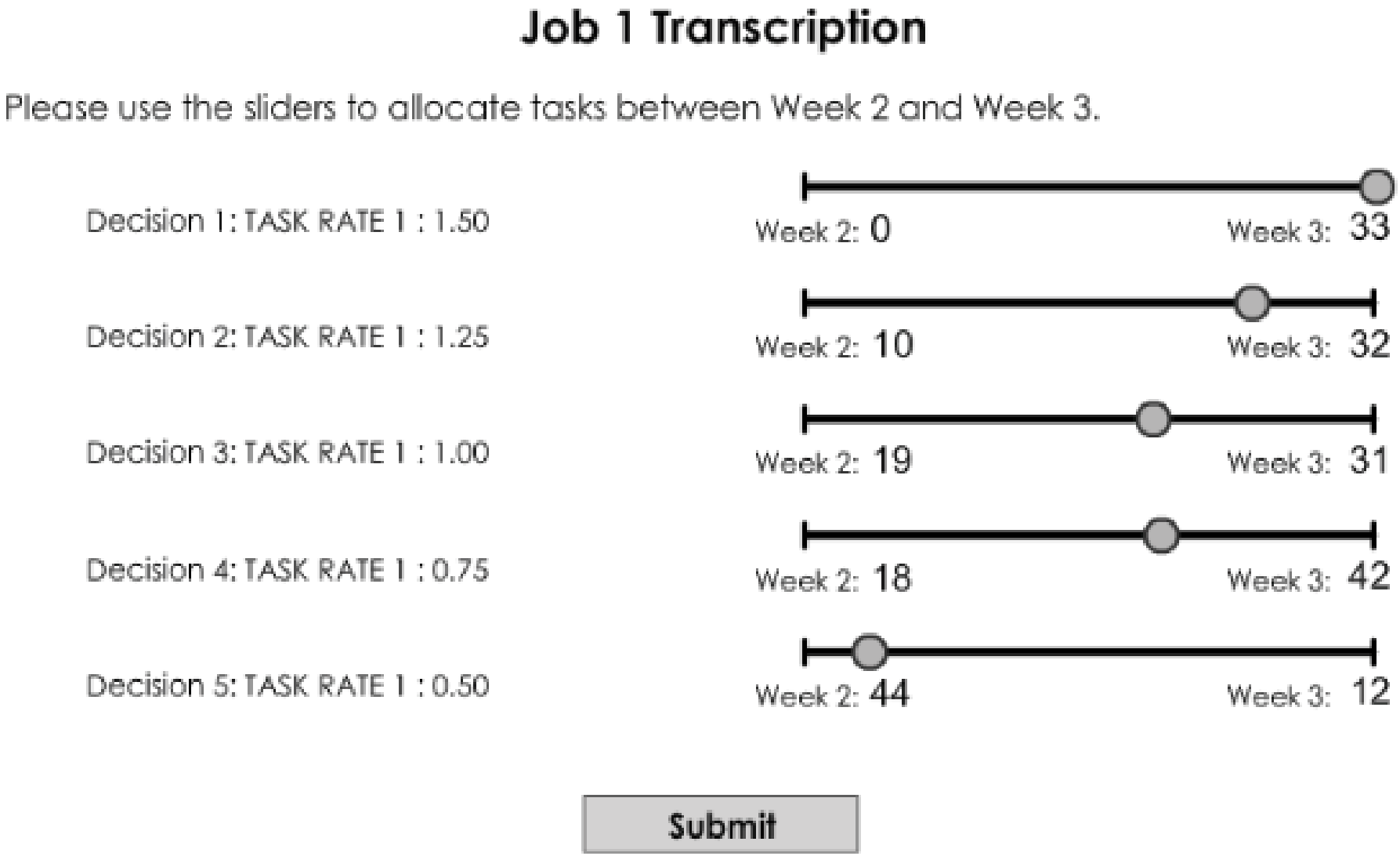
- Lab experiment by Augenblick, Niederle, and Sprenger (2015)
- Real effort task: transcription of Greek characters OR Tetris
  - Must do 50 tasks over course of experiment
- Occurs over several weeks
  - Week 1: make plan to split work over weeks 2 and 3
  - Week 2: allowed to change plan with some probability; do week 2 work
  - Week 3: do remaining work
  - Must do at least 10 tasks in both weeks 2 and 3 (transaction costs)
- Transfer work tasks between weeks 2 and 3 at varying interest rates
  - Only one interest rate actually implemented, much like price lists we have seen
- At same time, making sooner-smaller vs later-larger choices over cash

The Tasks

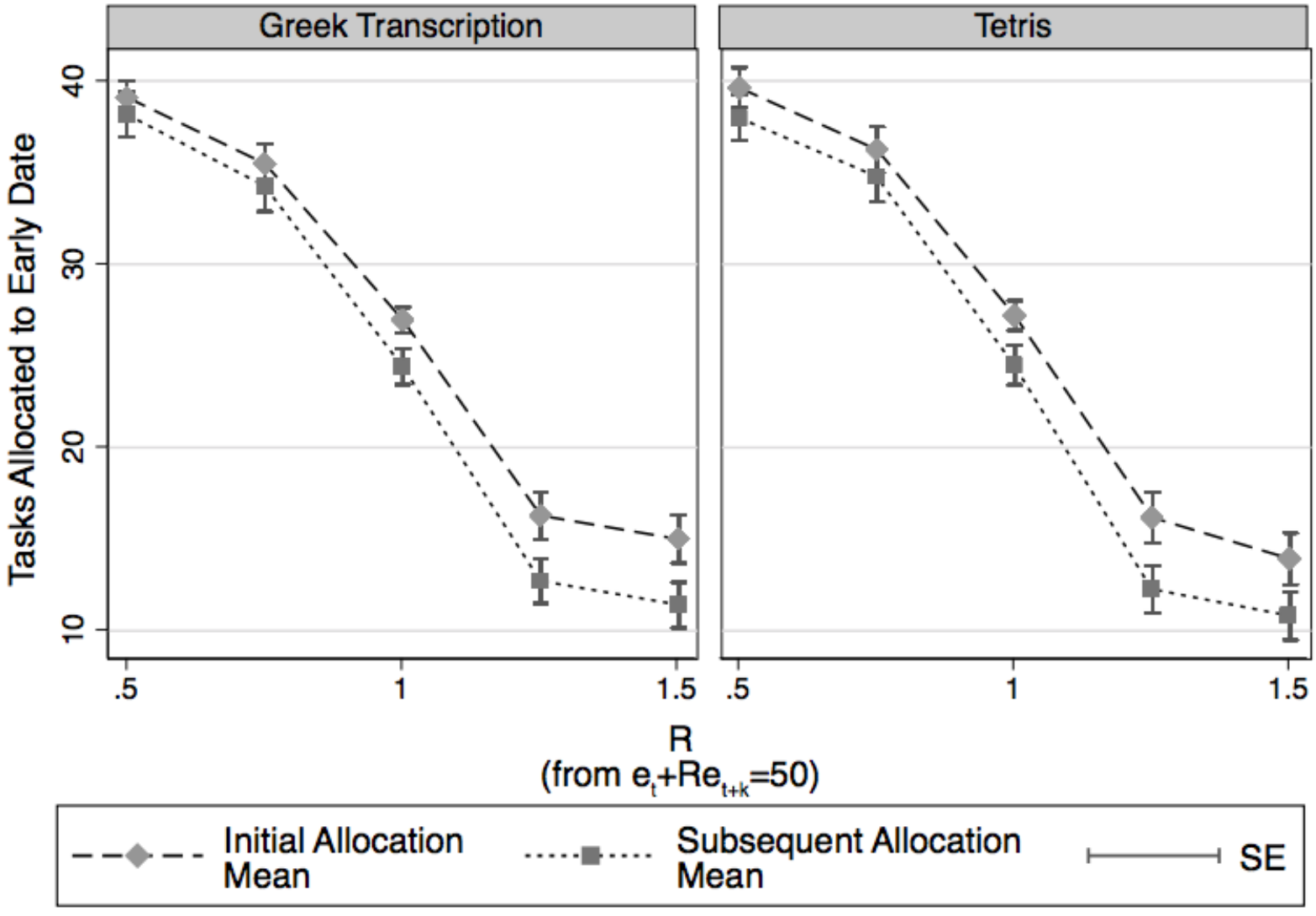

Panel A: Job 1- Greek Transcription
20% Completed (2 out of 10).
α β χ δ ϵ ϕ γ η ι .
X
Submit


Panel B: Job 2- Partial Tetris Games
Tasks Left To Do:
10 / 10
Lines this game:
1

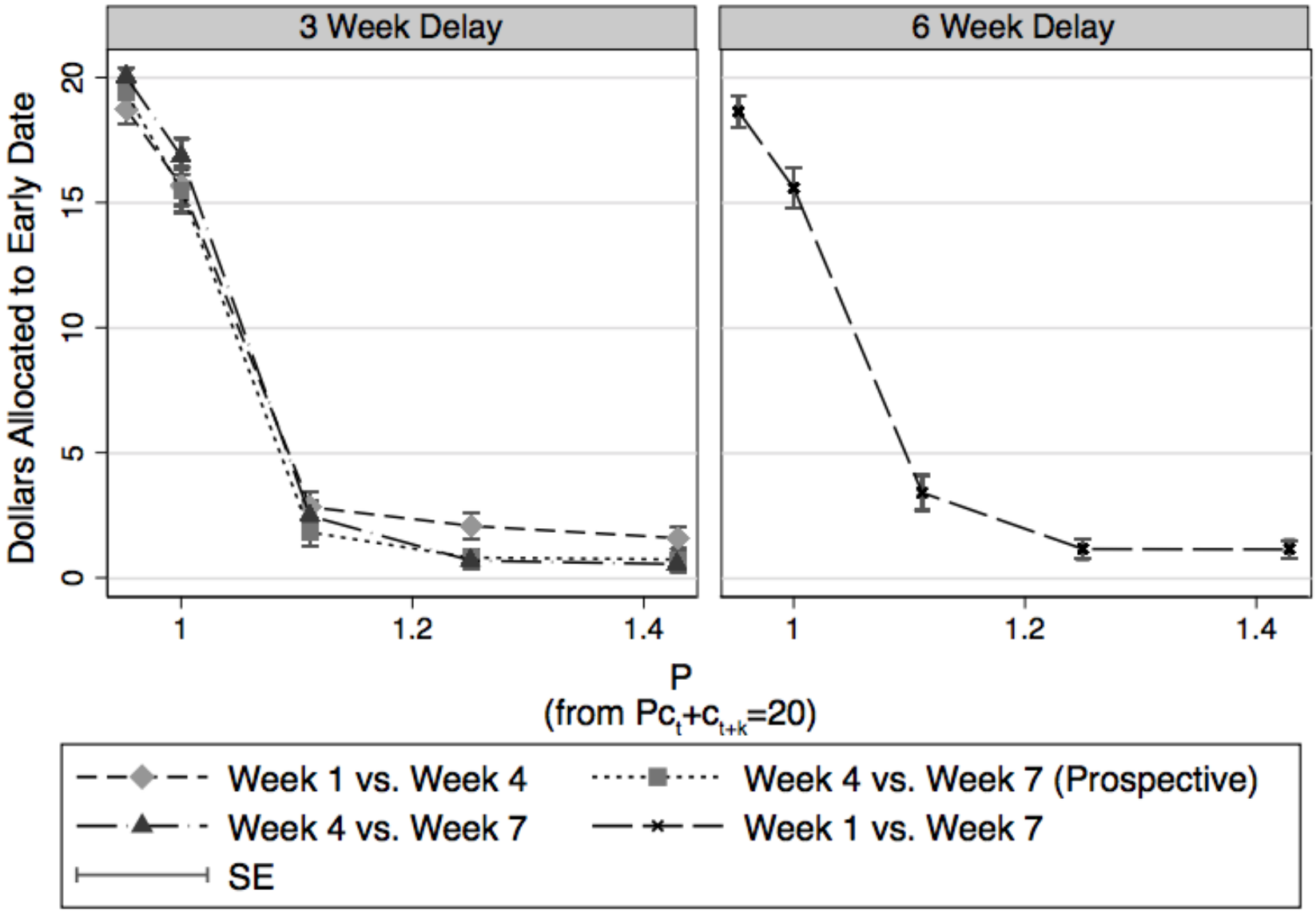
Different task interest rates



Strong Present Bias in Effort Tasks



No Present Bias in Monetary Decisions



Commitment

Motivation

- We have seen lots of evidence that people have time-inconsistent preferences
- How do we know that they are sophisticated, ie aware of their time-inconsistency?
- One answer: allow people to *commit* themselves to an action
  - This allows the present self to restrict the opportunity set of the future self
  - With time-consistent preferences this would make them worse off
  - But with present-biased preferences this restriction can be welfare improving

Example From Last Lecture

- Recall the example writing your paper over the next four weeks
- We showed that a time-consistent student would do paper right away, missing only the really bad movie
- Sophisticated time-inconsistent student would procrastinate somewhat
  - Go to really bad movie in first week
  - Do paper in second week, missing OK movie
  - Overall, they are worse-off then their time-consistent classmate, and they know this
  - Should be willing to undertake costly commitment to force self to do paper in first week, eg by having friend take away movie tickets if they don't do paper in first week
    - Assuming they follow through, the are now as well-off as their time-consistent classmate

Procrastination and Deadlines

- Arielly and Wertenbroch (2002) run study with deadlines for assignments in a real class
  - Students have to write three short papers over course of semester
  - Penalty if don't turn in paper by deadline
  - Treatments assigned at the section level
  - Treatment 1: Fixed, evenly-spaced deadlines imposed
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  - Treatment 1: Fixed, evenly-spaced deadlines imposed
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- Results:
  - Many students in free-choice condition set early deadlines (evidence of sophistication)
  - Average grade lower in free-choice condition (the sophistication is only partial)

Tying Odysseus to the Mast

- Ashraf et al (2006) design a commitment savings product for a bank in Philipines
  - SEED: Save Early Enjoy Deposits
  - Get 4% interest rate
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- Results:
  - 28% of people uptake commitment device overall
  - 16 percentage point (50%) increase in uptake among women if identified as time-inconsistent

Signaling to an Audience: Exley and Naecker (2015)

- Commitment technologies allow people to signal their intentions or goals to others with whom they have repeated interaction:
  - Their professor
  - Their banker
  - Their boss
- By experimentally manipulating the audience, can we change the demand for the commitment technology?

Exley and Naecker: Design

- Haas Center provides support and resources for student groups on Stanford's campus
- Runs regular workshops for development of student leaders
- Sign-ups occur online, days or weeks in advance
- Participants sign up for as many workshops as they want at once

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- Sign-ups occur online, days or weeks in advance
- Participants sign up for as many workshops as they want at once
- Commitment technology
  - After sign-up decision is made, one workshop chosen at random for intervention
  - Participant is immediately informed that if they attend this workshop, they will receive \$15
  - If do not attend workshop, will receive $\$X$, where $0 \leq X \leq 15$
  - Participant chooses amount X
  - Payment will be made several days after workshops

Exley and Naecker: Treatments

Private Student chooses X, and person running workshop is NOT informed of this value

Public Student chooses X, and person running workshop is informed of this value

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- Predictions:
  - Define commitment $C = 15 - X$
  - Due to time inconsistency, we expect demand for commitment in both public and private treatments ($C_{pub} > 0$ and $C_{pri} > 0$)

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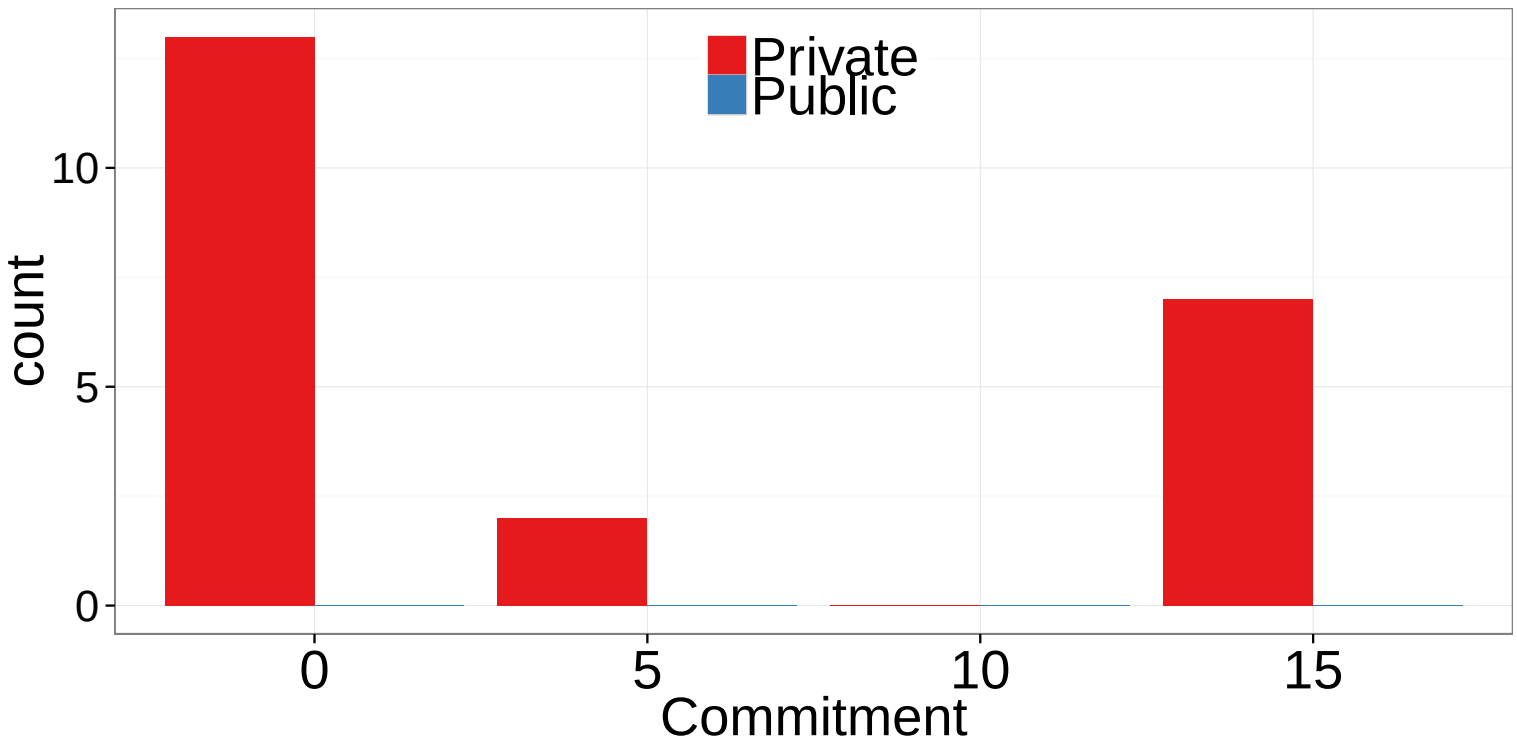
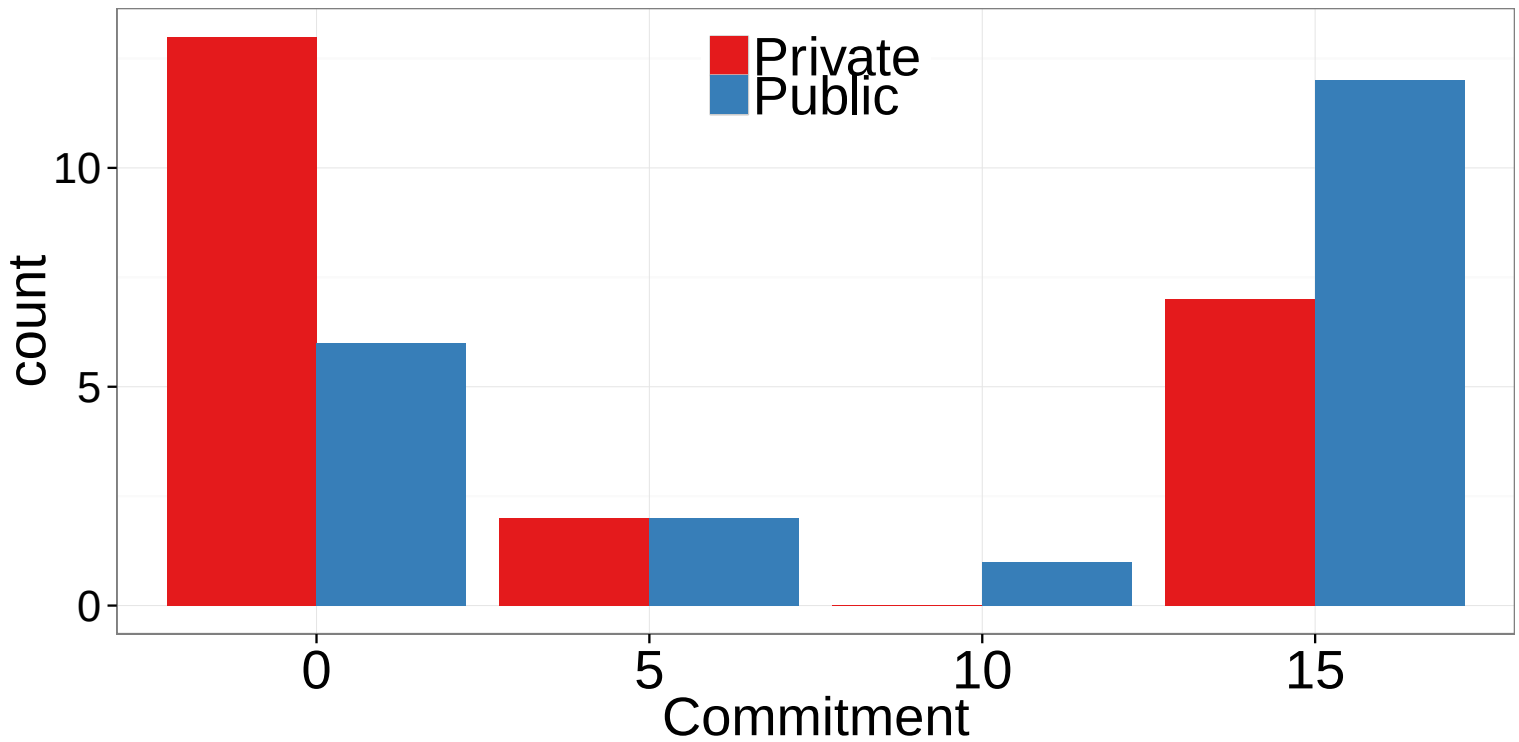
Public Student chooses X, and person running workshop is informed of this value

- Predictions:
  - Define commitment $C = 15 - X$
  - Due to time inconsistency, we expect demand for commitment in both public and private treatments ($C_{pub} > 0$ and $C_{pri} > 0$)
  - Due to audience effect, we expect in addition that demand for commitment is stronger in public treatment ($C_{pub} > C_{pri}$)

Commitment Demand without Audience



Audience Effect is Significant



Summary of Time Preferences

- Standard exponential model of time discounting predicts that people will be impatient but time-consistent
- Present-bias or β-δ model predicts that people will be time-inconsistent
- Time-inconsistency manifests as procrastination or self-control issues
- Commitment devices (such as locked savings accounts) can help people behave more like time-consistent decision-makers