Econ 219B
Psychology and Economics: Applications
(Lecture 2)

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Outline

1. Default Effects and Present Bias
2. Default Effects in Other Decisions
3. Default Effects: Alternative Explanations
4. Present Bias and Consumption
5. Investment Goods: Homework
6. Investment Goods: Exercise
7. Investment Goods: Job Search

Section 1

Default effects and Present Bias

How do we explain the default effects?

- **Present-bias ((quasi-) hyperbolic discounting – (β, δ) preferences)**:

$$U_t = u_t + \beta \sum_{s=1}^{\infty} \delta^s u_{t+s}$$

with $\beta \leq 1$. Discount function: $1,\ \beta\delta,\ \beta\delta^2, \ldots$

- **Time inconsistency.** Discount factor for self t is
  - $\beta\delta$ between t and $t+1 \Longrightarrow$ short-run impatience;
  - δ between $t+1$ and $t+2 \Longrightarrow$ long-run patience.
- **Naiveté about time inconsistency**
  - Agent believes future discount function is $1,\ \hat{\beta}\delta,\ \hat{\beta}\delta^2, \ldots$,with $\hat{\beta} \geq \beta$.

Opt-in Enrollment (OLD Cohort in MS 2001)

- Setup similar to O'Donoghue and Rabin (2001): One-time decision (investment)
  - Decide at $t = 0, 1, 2, ..., T - 1$ whether to invest in retirement
  - If invest at t,
    - Set aside s dollars in each periods from period t until period $T - 1$
    - Effort cost k (deterministic for now) of filling forms at t
    - Earn match μ and accrue interest until period T (retirement) where benefits are paid as lump sum: $s(1 + \mu)(1 + r)^{T-t}$
    - To save, reduce consumption by s in each period, starting from t
    - Consumption utility is linear ($u(x) = x$) and identical in all time periods
- When does investment take place (if ever)?

Utility of investing today

Investing at $t = 0$, from $t = 0$ perspective yields utility

$$U_0(t=0) = -k + \beta\delta^T \sum_{t=0}^{T-1} (1+r)^{T-t} s (1+\mu) - s - \beta \sum_{t=1}^{T-1} \delta^t s$$

Setting for simplicity $\delta = \frac{1}{1+r}$ gives:

$$U_0(t=0) = -k + s(\beta(1+\mu) - 1) + \beta s \mu \frac{\delta - \delta^T}{1-\delta}$$

Utility of investing later

Investing at $\tau > 0$, from the $t = 0$ perspective yields utility

$$U_0(t=\tau) = \beta \left(-\delta^\tau k + \delta^T \sum_{t=\tau}^{T-1} (1+r)^{T-t} s(1+\mu) - \sum_{t=\tau}^{T-1} \delta^t s \right)$$

Setting for simplicity $\delta = \frac{1}{1+r}$ gives:

$$U_0(t=\tau) = -\beta\delta^\tau k + \beta s \mu \frac{\delta^\tau - \delta^T}{1-\delta}$$

Exponential employee ($\beta = \hat{\beta} = 1$)

- Compares investing at $t = 0$ to never investing:

$$-k + s\mu + s\mu\frac{\delta - \delta^T}{1-\delta} = -k + s\mu\frac{1-\delta^T}{1-\delta} \geq 0$$

- Invests if

$$k \leq s\mu\frac{1-\delta^T}{1-\delta}$$

- Also show that investing at $t = 0$ is preferable to investing at any later period

Sophisticated employee ($\beta = \hat{\beta} < 1$)

- War of attrition between selves: Would like future selves to invest, but future selves do not want to!
- Multiple equilibria in the investing period: Invest every t' periods
- Example for $t' = 3$. List strategies to Invest (I) and Not Invest (N) over the time periods $0, 1, 2, 3$, etc.. Set of equilibria:
  - (I, N, N, I, N, N, I, N, N,...) $\rightarrow$ Invest at $t = 0$
  - (N, N, I, N, N, I, N, N, I,...) $\rightarrow$ Invest at $t = 2$
  - (N, I, N, N, I, N, N, I, N,...) $\rightarrow$ Invest at $t = 1$
- In this example, there are no equilibria such that agent delays more than 2 periods

Sophisticated employee ($\beta = \hat{\beta} < 1$)

- Agent prefers investing now to waiting for t' periods if

$$-k + s\left(\beta\left(1+\mu\right) - 1\right) + \beta s\mu\frac{\delta - \delta^{T}}{1-\delta} \geq -\beta\delta^{t'}k + \beta s\mu\frac{\delta^{t'} - \delta^{T}}{1-\delta}$$

$$\begin{aligned} k &\leq \frac{s[\beta(1+\mu) - 1 + \beta\mu\frac{\delta-\delta^{t'}}{1-\delta}]}{1-\beta\delta^{t'}} \\ &\approx \frac{s[\beta(1+\mu) - 1 + \beta\mu\delta(t'-1)]}{1-\beta\delta^{t'}} \\ &\approx s\left[\frac{\beta}{1-\beta}\mu\left(t'-1\right) - 1\right] \end{aligned}$$

[Taylor expansion of $1-\delta^{T}$ for δ going to 1: $1-\delta^{T} \approx (1-\delta)\,T$]

- Maximum delay $\bar{\tau} = \left(\frac{k+s}{s\mu}\right)\left(\frac{1-\beta}{\beta}\right) + 1$

(Fully) **Naive** employee ($\beta < \hat{\beta} = 1$)

- Compares investment today or tomorrow
- *Expects* to invest tomorrow if

$$-k + s\mu \frac{1-\delta^{T-1}}{1-\delta} \geq 0$$

- Therefore compares payoff of investing today or tomorrow and invests today if

$$k \leq \frac{s\left[\beta(1+\mu)-1\right]}{1-\beta\delta}$$

- Expects to invest but delays forever (*i.e., procrastinate*) if

$$\frac{s\left[\beta(1+\mu)-1\right]}{1-\beta\delta} < k \leq s\mu \frac{1-\delta^{T-1}}{1-\delta}$$

Calibration

- Madrian and Shea (2001):
  - 50 percent match ($\mu = .5$),
  - Assume savings up to match: $s = \$5$ (6% out of daily $w = \$83$, given median individual income $\approx \$30{,}000$)
  - Assume time cost $k = \$60$ (3 hrs at \$20/hour)
  - Assume many periods until retirement so $T \to \infty$
  - For baseline calibration assume $\delta^{365} = .97$

Model Simplifications

- No taxes – the tax benefits of 410(k)s introduce an additional incentive to save
- Different marginal utility of consumption in different periods. Can go either way
  - immediate spending needs (e.g., health) could lower the benefit to saving
  - marginal utility could be higher at retirement (especially if people are saving too little)
- Jobs only last, say, 3 years, can incorporate in calibration
- Return to assets r historically has been high (equity premium) $->$ Reason to save
- Return to asset r is stochastic

Model Predictions

What does model predict for different types of agents?

- **Exponential** agent invests if

$$k \leq s\mu \frac{1-\delta^T}{1-\delta} \approx s\mu \frac{1}{1-\delta}$$

  - For $\delta^{365} = .97$, $k^* \approx \$30,000$
  - For $\delta^{365} = .90$, $k^* \approx \$8,700$
  - Invest immediately!
  - Effect of k is dwarfed by size of benefit

Model Predictions

- **Sophisticated** maximum delay in days

$$\bar{\tau} = \left(\frac{k+s}{s\mu}\right)\left(\frac{1-\beta}{\beta}\right)+1$$

  - For $\beta = .9$, $\bar{\tau} \approx 4$ days
  - For $\beta = .8$, $\bar{\tau} \approx 7$ days
  - For $\beta = .5$, $\bar{\tau} \approx 27$ days

  - Sophisticated waits at most a month
  - Present Bias with sophistication induces only limited delay

Model Predictions

- **(Fully) Naive** t.i. invests today if

$$k \leq \frac{s\left[\beta(1+\mu)-1\right]}{1-\beta\delta}$$

  - Calibrated values
    - $\beta = .9 \rightarrow k^* =$\$17.5
    - $\beta = .8 \rightarrow k^* =$\$5
    - $\beta = .5 \rightarrow k^* =$-\$2.5 (!)
  - Relatively small cost k can induce infinite delay (procrastination)
  - Procrastination more likely if agent can change allocation every day

Automatic Enrollment

Automatic Enrollment (NEW Cohort in Madrian-Shea, 2001)

- Model: $k < 0$ – not-enrolling requires effort
- Exp., Soph., and Naive invest immediately (as long as $b > 0$)
- **Fact 1. 40% to 50% investors follow Default Plan**
    - Exponentials and Sophisticates $\rightarrow$ Should invest under either default
    - Naives $\rightarrow$ Invest under NEW, procrastinate under OLD

    - Evidence of default effects consistent with naiveté
    - (Although naiveté predicts procrastination forever – need to introduce stochastic costs)

Active Choice (ACTIVE Cohort)

- Model: $k = 0$ – not-enrolling requires effort
- Exponentials and Sophisticates:
  - Predicted enrollment: OLD$\simeq$ACTIVE$\simeq$NEW
- Naives:
  - Predicted enrollment: OLD$\leq$ACTIVE$\simeq$NEW
- **Fact 3. Active Choice resembles Default Investment (**OLD $<<$ ACTIVE$\simeq$NEW**)**
- Fairly consistent with naivete'

Predictions

- **Fact 4. Effect of default mostly disappears after three years**
- Problem for naivete' with model above: delay *forever*
- Introduce Stochastic cancellation costs $k \sim K \rightarrow$ Dynamic programming
- Solution for **exponential** agent. Threshold k_t^e:
  - enroll if $k \leq k_t^e$;
  - wait otherwise.

Exponential, Dynamic programming

- At time t, indifferent between investing and not if:

$$-k_t^e + s\mu \frac{1-\delta^{T-t}}{1-\delta} = \delta V_{t+1}^e$$

where V^e is continuation payoff for exponential agent assuming that threshold rule k^e is used in the future.

- Solve by backward induction, start from $t = T - 1$

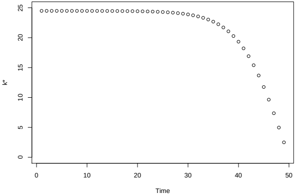
$$-k_{T-1}^e + s\mu = 0$$

- Then iterate backwards
- Investment probability of exponential agent: $\Pr(k \leq k^e) = F(k^e)$
- Survival after t periods (probability that agents has not invested yet after t periods $[1 - F(k^e)]^t$

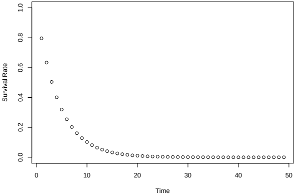
Numerical Examples: Exponential

- $s = 5$, $\mu = 0.5$, $\delta^{365} = 0.97$, $k \sim Uniform(a, b)$, $T = 50$

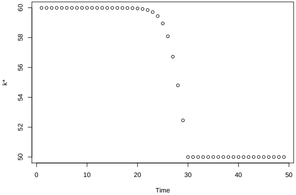
k^*, $k \sim Uniform(0, 120)$



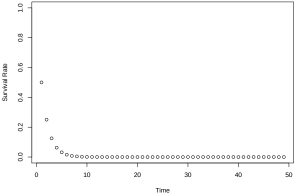
Survival, $k \sim Uniform(0, 120)$



k^*, $k \sim Uniform(50, 70)$



Survival, $k \sim Uniform(50, 70)$



Naive, Dynamic programming

- Threshold k^n for **naive** agent satisfies:

$$-k_t^n + s(\beta(1+\mu)-1) + \beta s\mu\frac{\delta-\delta^{T-t}}{1-\delta} = \beta\delta V_{t+1}^e$$

- This implies $k_t^n = \beta k_t^e - s(1-\beta)$
  - $\rightarrow$ Investment probability of exponential agent: $\Pr(k \leq k^e)$
  - $\rightarrow$ Investment probability of naive agent:

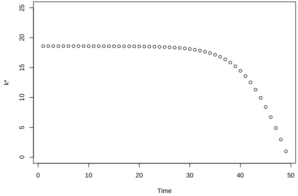
  $\Pr(k \leq \beta k^e - s(1-\beta))$
- This implies that distribution of k has important effect on delay

  $\rightarrow$ Left tail is thin implies larger delays for naives

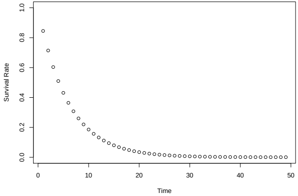
Numerical Examples: Naive

- $\beta = .8,\ s = 5,\ \mu = 0.5,\ \delta^{365} = 0.97,\ k \sim Uniform(a, b),\ T = 50$

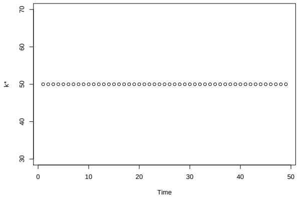
$k^*,\ k \sim Uniform(0, 120)$



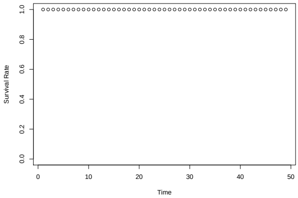
Survival, $k \sim Uniform(0, 120)$



$k^*,\ k \sim Uniform(50, 70)$



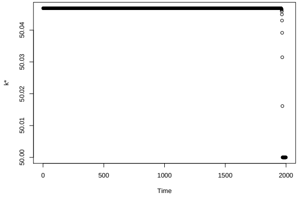
Survival, $k \sim Uniform(50, 70)$



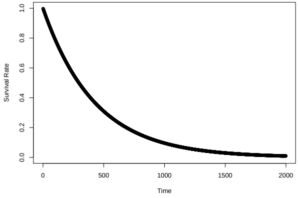
Replicating Empirical Results

- $\beta = .847$, $s = 5$, $\mu = 0.5$, $\delta^{365} = 0.97$, $k \sim Uniform(50, 70)$, $T = 2000$

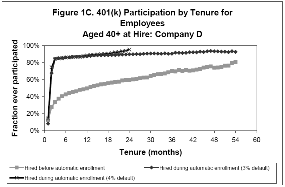
$k*$



Survival



Empirical Probability of Investment



Section 2

Default Effects in Other Decisions

Additional Evidence, other contexts

1. SMRT plan for savings (Thaler and Benartzi, *JPE* 2004)
2. Health-club contracts (DellaVigna and Malmendier, *AER* 2006)
3. TV channel choice (Esteves-Sorenson, *EJ* 2012)
4. Organ donation (Johnson and Goldstein, *Science* 2003; Abadie and Gay, *JHE* 2006)
5. Health Insurance Contracts (Handel, *AER* 2013)

Handel 2013: Introduction

Ben Handel, "Adverse Selection and Switching Costs in Health Insurance Markets: When Nudging Hurts", *AER 2013*

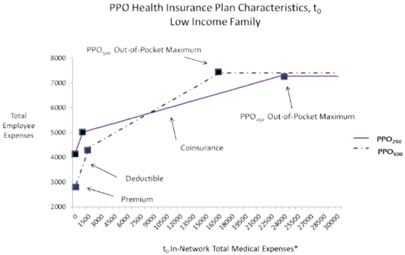
- Administrative data on health insurance choice within a company
- Observe data in years t_{-1}, t_0 and t_1
- Year t_0: introduction of new plans, *active choice* required
- Year t_1: choice by default, but plan benefits changed substantially
- Restrict choice to only PPO plans, *all offered by same insurer*
- Only difference is financial details (premia, co-pay, etc.)
- Estimate individual risk characteristics using t_{-1} data, consider t_0 active choice, then inertial choice at t_1 *as option attractiveness varies*

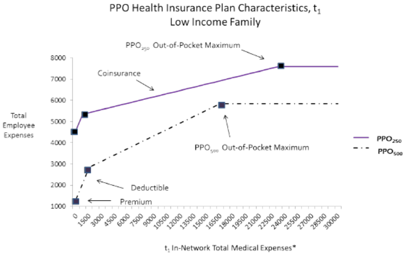
Options Offered

Choice Behavior	t_{-1}	t_0	t_1
PPO_{250}	-	2,199 (25%)	1,937 (21%)
PPO_{500}	-	998 (11%)	1,544 (18%)
PPO_{1200}	-	876 (10%)	824 (9%)
HMO_1	2,094 (25%)	2,050 (23%)	2,031 (22%)
HMO_2	701 (8%)	1,273 (14%)	1,181 (13%)
PPO_{-1}	3,264 (39%)	-	-
HMO_3	668 (8%)	-	-
HMO_4	493 (6%)	-	-
Waive	1,207 (14%)	1,447 (16%)	1,521 (17%)

- In particular, in year t_1 for a group PPO_{250} is dominated – do employees still choose it? Yes!

Plan Expenses





Dominated Plan Choice

- Do employees in the dominated plan still choose it? Yes, a majority still after two years

Dominated Plan Analysis

	t_1 Dominated Stay	t_1 Dominated Switch	t_2 Dominated Stay	t_2 Dominated Switch
N	498	61	378	126
Minimum Money Lost*	\$374	\$453	\$396	\$306
PPO_{500}	-	44 (72%)	-	103 (81%)
PPO_{1200}	-	4 (7%)	-	6(5%)
Any HMO	-	13 (21%)	-	17 (14%)

Inertia

- Descriptive evidence of strong inertia effects when comparing new enrollees

New Enrollee Analysis	New Enrollee t_{-1}	New Enrollee t_0	New Enrollee t_1
N, t_0	1056	1377	-
N, t_1	784	1267	1305
t_0 **Choices**			
PPO_{250}	259 **(25%)**	287 **(21%)**	-
PPO_{500}	205 **(19%)**	306 **(23%)**	-
PPO_{1200}	155 (15%)	236 (17%)	-
HMO_1	238 (23%)	278 (20%)	-
HMO_2	199 (18%)	270 (19%)	-
t_1 **Choices**			
PPO_{250}	182 **(23%)**	253 **(20%)**	142 **(11%)**
PPO_{500}	201 **(26%)**	324 **(26%)**	562 **(43%)**
PPO_{1200}	95 (12%)	194 (15%)	188 (14%)
HMO_1	171 (22%)	257 (20%)	262 (20%)
HMO_2	135 (17%)	239 (19%)	151 (12%)

Model Estimation

- Assumes individuals have a value for insurance based on previous risk
- Allows for asymmetric information
- Models the switching cost in reduced form as a cost k paid to switch – no cost in year t_0 when active choice

Empirical Model Results					
Parameter	Primary	Base	MH Robust	γ Robust	ϵ Robust
Switching Cost - Single, η_0	1729 (28)	1779 (72)	1859 (107)	2430 (116)	1944 (150)
Switching Cost - Family, $\eta_0 + \eta_2$	2480 (26)	2354 (62)	2355 (113)	3006 (94)	2365 (34)

Interpretation

- Estimated cost of about $2,000 is very unlikely to capture administrative costs
  - More likely to capture procrastination, or limited attention
  - Notice though: If no choice by deadline, can make no change until one year later
  - In this setting (see below), no procrastination expected even for naives
- However, consider alternative model:
  - Naive agent forgetful of deadline date
  - Then procrastinate until deadline, with probability of missing the deadline

Conclusions

- Paper also considers impact of *debiasing* which reduces switching costs
- All else equal, this is good for consumers

- BUT: inertia had side effect of limiting the adverse selection into contracts $\rightarrow$ Enables more pooling and therefore 'better' contracts
- Removing the inertia may make things worse in general equilibrium

Section 3

Default Effects: Alternative explanations

Alternative explanations

1. Rational stories
2. Bounded Rationality. Problem is too hard
3. Persuasion. Implicit suggestion of firm
4. Memory. Individuals forget that they should invest
5. Reference point and loss aversion relative to firm-chosen status-quo

Responses I

Some responses to the explanations above:

1. Rational stories
   1. Time effect between 1998 and 1999 / Change is endogenous (political economy)
      - Replicates in Choi et al. (2004) for 4 other firms
   2. Cost of choosing plan is comparatively high (HR staff unfriendly) $\rightarrow$ Switch investment elsewhere
   3. Selection effect (People choose this firm because of default)
      - Why choose a firm with default at 3%?

Responses II

2. Bounded Rationality: Problem is too hard
   - In surveys employees say they would like to save more
   - Replicate where can measure losses more directly (health club data)

3. Persuasion. Implicit suggestion of firm
   - Why should individuals trust firms?
   - **Fact 2.** Window cohort does not resemble New cohort

Responses III

4. Memory. Individuals forget that they should invest

- If individuals are aware of this, they should absolutely invest before they forget!
    - Need limited memory + naiveté

1. Reference point and loss aversion relative to firm-chosen status-quo
    - First couple month people get used to current consumption level
    - Under NonAut., employees unwilling to cut consumption
    - BUT: Why wait for couple of months to chose?

Section 4

Present-Bias and Consumption

Setup

- Consider an agent that at time 1 can choose:
  - A consumption activity A with immediate payoff b_1 and delayed payoff (next period) b_2
  - An outside option O with payoff 0 in both periods
- Activity can be:
  - Investment good (exercise, do homework, sign document): $b_1 < 0, b_2 > 0$
  - Leisure good (borrow and spend, smoke cigarette): $b_1 > 0, b_2 < 0$

Setup

How is consumption decision impacted by present-bias and naiveté?

- **Desired consumption.** A time 0, agent wishes to consume A at $t = 1$ if
$$\beta\delta b_1 + \beta\delta^2 b_2 \geq 0 \text{ or } b_1 \geq -\delta b_2$$
- **Actual consumption.** A time 1, agent consumes A if
$$b_1 \geq -\beta\delta b_2$$
- *Self-control problem* (if $\beta < 1$):
  - Agent under-consumes investment goods ($b_2 > 0$)
  - Agent over-consumes leisure goods ($b_2 < 0$)

Setup

- **Forecasted consumption.** As of time 0, agent expects to consume A if

$$b_1 \geq -\hat{\beta}\delta b_2.$$

- *Naiveté* (if $\beta < \hat{\beta}$):
  - Agent over-estimates consumption of investment goods ($b_2 > 0$)
  - Agent under-estimates consumption of leisure goods ($b_2 < 0$)
- Implications:
  - Sophisticated agent will look for commitment devices to align desired and actual consumption
  - Naive agent will mispredict future consumption

Evidence: Investment Goods

Evidence on these predictions for Investment Goods:

- Homework and Task Completion (Ariely and Wertenbroch, *PS* 2002)
- Exercise (DellaVigna and Malmendier, *QJE* 2006; Royer, Stehr, and Sydnor, *AEJ Applied* 2014; Acland and Levy, *MS* 2015)
- Work Effort (Kaur, Kremer, and Mullainathan *JPE* 2015)
- Job Search (DellaVigna and Paserman *JOLE* 2005; Paserman *EJ* 2008)
- Real Effort Tasks (Augenblick, Niederle, and Sprenger, *QJE* 2015; Augenblick and Rabin, 2016)
- Tax filing (Martinez, Meier, Sprenger, 2017)
- Doctor visits (Bai, Handel, Miguel, Rao, 2017)

Evidence: Leisure Goods

Evidence on these predictions for Leisure Goods:

- Credit Card Usage (Ausubel, 1999; Shui and Ausubel, 2005)
- Consumption and Life-cycle Savings (Laibson, Repetto, and Tobacman, 2006; Ashraf, Karlan, and Yin, *QJE* 2006; Beshears, Choi, Laibson, Madrian, Mekong, 2011)
- Payday Effects in Consumption (Shapiro *JPubE* 2005)
- Smoking (Gine Karlan, and Zinman, 2010, *AEJ Applied*)
- Alcohol (Schilbach, 2016)
- Online Gaming (Chow, 2010)

Section 5

Investment Goods: Homework

Wertenbroch and Ariely 2002: Introduction

Wertenbroch-Ariely, "Procrastination, Deadlines, and Performance," *Psychological Science*, 2002.

- Experiment 1 in classroom:
  - sophisticated people: 51 executives at Sloan (MIT);
  - high incentives: no reimbursement of fees if fail class
  - submission of 3 papers, 1% grade penalty for late submission

Experiment Setup

- Two groups:
  - Group A: evenly-spaced deadlines
  - Group B: set-own deadlines: 68 percent set deadlines prior to last week $\rightarrow$ Demand for commitment (Sophistication)

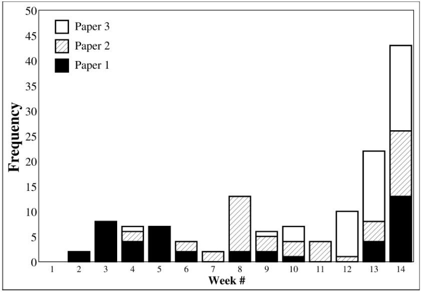


Fig. 1. Frequency distribution of the declared deadlines in Study 1 as a function of the week of class (Week 1 is the first week, and Week 14 the last week), plotted separately for the three papers.

Results

Results on completion and grades:

- No late submissions (!)
- Papers: Grades in Group A (88.7) higher than grades in Group B (85.67)
- Consistent with self-control problems
- However, concerns:
    - Two sessions not randomly assigned
    - Sample size: $n = 2$ (correlated shocks in two sections)

Experiment 2

Experiment 2 deals with issues above. Proofreading exercise over 21 days, $N = 60$

- Group A: evenly-spaced deadlines
- Group B: no deadlines
- Group C: self-imposed deadlines

Predictions:

- Standard Theory: $B = C > A$
- Sophisticated Present-Biased (demand for commitment): $C > A > B$
- Fully Naive Present-Biased: $A > B = C$
- Partially Naive Present-Biased: $A > C > B$

Experiment 2 Results

- Results on Performance: $A > C > B$

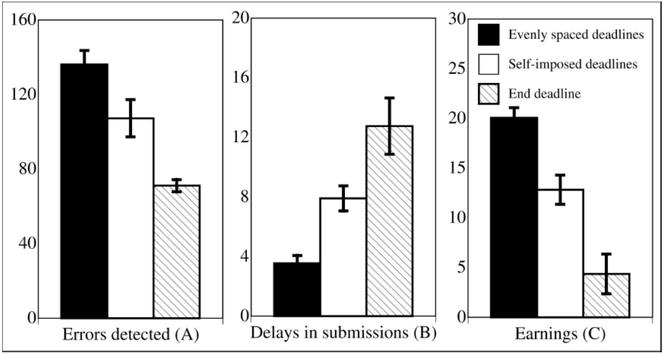


Fig. 2. Mean errors detected (a), delays in submissions (b), and earnings (c) in Study 2, compared across the three conditions (error bars are based on standard errors). Delays are measured in days, earnings in dollars.

Main Results

- Result 1. *Deadline setting helps performance*
  - Self-control Problem: $\beta < 1$
  - (Partial) Sophistication: $\hat{\beta} < 1$
- Result 2. *Deadline setting sub-optimal*
  - (Partial) Naiveté: $\beta < \hat{\beta}$
- Support for $(\beta, \hat{\beta}, \delta)$ model with partial naiveté

Section 6

Investment Goods: Exercise

DellaVigna Malmendier 2006

DellaVigna and Malmendier, “Paying Not To Go To The Gym” *AER*, 2006

- Exercise as an investment good
- Present-Bias: Temptation not to exercise

Choice of flat-rate vs. per-visit contract

- *Contractual elements:* Per visit fee p, Lump-sum periodic fee L
- *Menu of contracts*
  - Flat-rate contract: $L > 0$, $p = 0$
  - Pay-per-visit contract: $L = 0$, $p > 0$
- *Health club attendance*
  - Immediate cost c_t
  - Delayed health benefit $h > 0$
  - Uncertainty: $c_t \sim G$, c_t i.i.d. $\forall t$.

Attendance decision

- Long-run plans at time 0:
  Attend at $t \iff \beta\delta^t(-p - c_t + \delta h) > 0 \iff c_t < \delta h - p$.
- Actual attendance decision at $t \geq 1$:
  Attend at $t \iff -p - c_t + \beta\delta h > 0 \iff c_t < \beta\delta h - p$.
  (Time Incons.)
  $$\text{Actual } P(\text{attend}) = G(\beta\delta h - p)$$
- Forecast at $t = 0$ of attendance at $t \geq 1$:
  Attend at $t \iff -p - c_t + \hat{\beta}\delta h > 0 \iff c_t < \hat{\beta}\delta h - p$.
  (Naiveté)
  $$\text{Forecasted } P(\text{attend}) = G(\hat{\beta}\delta h - p)$$

Choice of contracts at enrollment

Proposition 1. If an agent chooses the flat-rate contract over the pay-per-visit contract, then

$$\begin{aligned} a(T)L \leq \quad & pTG(\beta\delta h) \\ & + (1-\hat{\beta})\delta hT\left(G(\hat{\beta}\delta h) - G(\hat{\beta}\delta h - p)\right) \\ & + pT\left(G(\hat{\beta}\delta h) - G(\beta\delta h)\right) \end{aligned}$$

Intuition:

1. *Exponentials* ($\beta = \hat{\beta} = 1$) pay at most p per expected visit.
2. *Hyperbolic* agents may pay more than p per visit.
    1. *Sophisticates* ($\beta = \hat{\beta} < 1$) pay for commitment device ($p = 0$). Align actual and desired attendance.
    2. *Naïves* ($\beta < \hat{\beta} = 1$) overestimate usage.

Price per Attendance

Estimate average attendance and price per attendance in flat-rate contracts

TABLE 3—PRICE PER AVERAGE ATTENDANCE AT ENROLLMENT

	Sample: No subsidy, all clubs		
	Average price per month (1)	Average attendance per month (2)	Average price per average attendance (3)
	Users initially enrolled with a monthly contract		
Month 1	55.23	3.45	16.01
	(0.80)	(0.13)	(0.66)
	N = 829	N = 829	N = 829
Month 2	80.65	5.46	14.76
	(0.45)	(0.19)	(0.52)
	N = 758	N = 758	N = 758
Month 3	70.18	4.89	14.34
	(1.05)	(0.18)	(0.58)
	N = 753	N = 753	N = 753
Month 4	81.79	4.57	17.89
	(0.26)	(0.19)	(0.75)
	N = 728	N = 728	N = 728
Month 5	81.93	4.42	18.53
	(0.25)	(0.19)	(0.80)
	N = 701	N = 701	N = 701
Month 6	81.94	4.32	18.95
	(0.29)	(0.19)	(0.84)
	N = 607	N = 607	N = 607
Months 1 to 6	75.26	4.36	17.27
	(0.27)	(0.14)	(0.54)
	N = 866	N = 866	N = 866
	Users initially enrolled with an annual contract, who joined at least 14 months before the end of sample period		
Year 1	66.32	4.36	15.22
	(0.37)	(0.36)	(1.25)
	N = 145	N = 145	N = 145

Price per Attendance Distribution

- Result is not due to small number of outliers
- 80 percent of people would be better off in pay-per-visit

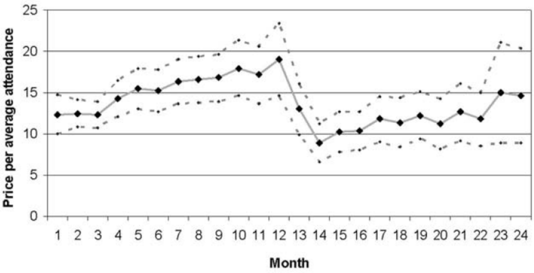
TABLE 4—DISTRIBUTION OF ATTENDANCE AND PRICE PER ATTENDANCE AT ENROLLMENT

	Sample: No subsidy, all clubs			
	First contract monthly, months 1–6 (monthly fee ≥ $70)		First contract annual, year 1 (annual fee ≥ $700)	
	Average attendance per month (1)	Price per attendance (2)	Average attendance per month (3)	Price per attendance (4)
Distribution of measures				
10th percentile	0.24	7.73	0.20	5.98
20th percentile	0.80	10.18	0.80	8.81
25th percentile	1.19	11.48	1.08	11.27
Median	3.50	21.89	3.46	19.63
75th percentile	6.50	63.75	6.08	63.06
90th percentile	9.72	121.73	10.86	113.85
95th percentile	11.78	201.10	13.16	294.51
	N = 866	N = 866	N = 145	N = 145

Choice of contracts over time

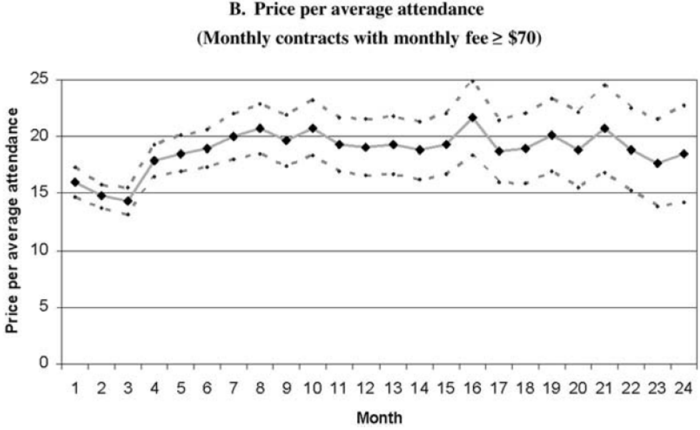
- Choice at enrollment explained by sophistication or naiveté
- And over time? We expect some switching to payment per visit
- **Annual contract.** Switching after 12 months

A. Price per average attendance
(Annual contracts with annual fee ≥ \$700)



Choice of contracts over time

- **Monthly contract.** No evidence of selective switching



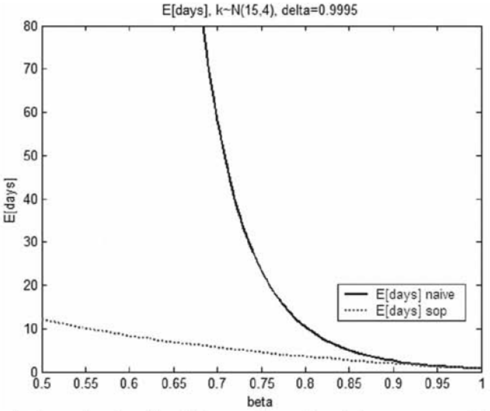
- Puzzle. Why the different behavior?

Explanation

- Simple Explanation – Again the power of defaults
  - Switching out in monthly contract takes active effort
  - Switching out in annual contract is default
- Model this as for 401(k)s with cost k of effort and benefit b (lower fees)
- In DellaVigna and Malmendier (2006), model with stochastic cost $k \sim N(15, 4)$
- Assume $\delta = .9995$ and $b = \$1$ (low attendance – save \$1 per day)
- How may days on average would it take between last attendance and contract termination? Observed: 2.31 months

Explanation

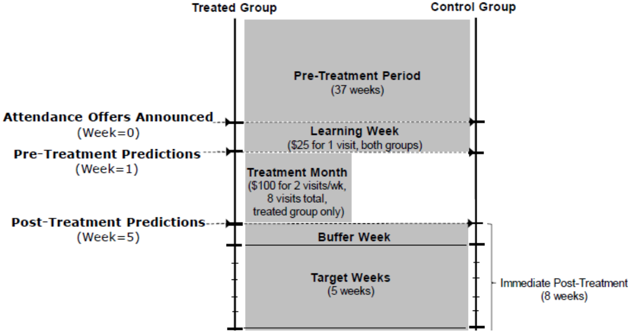
- Calibration for different β and different types



A. Simulated expected number of days before a monthly member switches to payment per visit
Assumptions: cost *k~N(15,4)*, daily savings *s=1*, and daily discount factor delta = 0.9995. The observed average delay is 2.31 months (70 days) (Finding 4)

Explanation

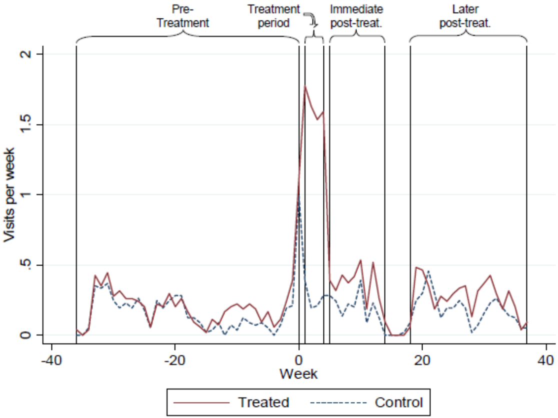
- Present-Biased preferences *with* naiveté explains magnitudes, not just qualitative patterns
- Related: **Acland and Levy** (*MS* 2015) field experiment
  - Pay a treatment group $100 to attend the gym for 4 weeks
  - Control group not paid



Results

- Moderate habit formation (as in **Charness and Gneezy** *EMA*)

Figure 2: Gym Attendance



Notes: Average weekly gym attendance, by treatment group status. Weeks in which a subject received a p-coupon for attendance are omitted from this figure.

Expectation of Future Attendance

- Also: Elicit expectation of future attendance as WTP for p-coupons
- How much are you willing to pay for coupon below?
- Also elicit unincentivized forecasts

\$1 Daily RSF-Reward Certificate **\$1**

This certificate entitles the holder to

\$1

for every day that he or she attends the RSF during the week of

Monday, Oct 13 *through* **Sunday, Oct 19.**

\$1 **\$1**

For each question, check which option you prefer, A or B.

		Option A			Option B
1. Would you prefer	☐	\$1 for certain, paid Monday, Oct 20.	or	☐	The Daily RSF-Reward Certificate shown above.
2. Would you prefer	☐	\$2 for certain, paid Monday, Oct 20.	or	☐	The Daily RSF-Reward Certificate shown above.
3. Would you prefer	☐	\$3 for certain, paid Monday, Oct 20.	or	☐	The Daily RSF-Reward Certificate shown above.

Clear Evidence of Naiveté

- Evidence of naiveté consistent with DVM
- Also some evidence of projection bias (see later lectures)

Table 2: Misprediction of attendance — Predicted and actual target-week attendance.

	Control group			Treatment group		
	Coupon Value $p > 0$	Un-Incent'd $p > 0$	Un-Incent'd $p = 0$	Coupon Value $p > 0$	Un-Incent'd $p > 0$	Un-Incent'd $p = 0$
Pre-trmt prediction (Pre)	3.868	4.053	1.453	3.63	3.963	1.333
Post-trmt prediction (Post)	3.395	3.614	1.058	3.185	3.056	1.313
Actual attendance	1.561	1.561	0.264	1.463	1.463	0.396
Pre minus Actual	2.307	2.491	1.189	2.167	2.500	0.934
(St. Error)	(0.297)	(0.235)	(0.153)	(0.350)	(0.318)	(0.189)
Post minus Actual	1.833	2.053	0.774	1.722	1.593	0.917
(St. Error)	(0.321)	(0.299)	(0.142)	(0.315)	(0.299)	(0.171)
Pre minus Post	0.474	0.439	0.415	0.444	0.907	0.021
(St. Error)	(0.159)	(0.179)	(0.160)	(0.243)	(0.220)	(0.135)
No. of observations	57	57	53	54	54	48

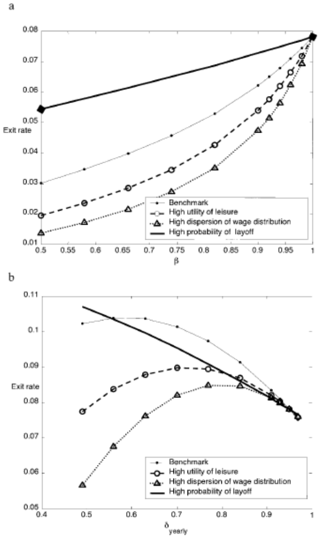
Notes: Coupon value refers to subjects' valuations of coupon-week p-coupons divided by the face value of those coupons. Un-incent'd refers to subjects' un-incentivized predictions of target-week attendance, and is separated into coupon weeks ($p > 0$) and zero weeks ($p = 0$).

Section 7

Investment Goods: Job Search

DellaVigna and Paserman (*JOLE* 2005)

- Stylized facts:
  - time devoted to job search by unemployed workers: 9 hours/week
  - search effort predicts exit rates from unemployment better than reservation wage choice
- Model with costly search effort and reservation wage decision:
  - search effort — immediate cost, benefits in near future — driven by β
  - reservation wage — long-term payoffs — driven by δ


a
0.08
0.07
0.06
0.05
Exit rate
0.04
0.03
0.02
0.01
0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1
β
Benchmark
High utility of leisure
High dispersion of wage distribution
High probability of layoff
b
0.11
0.1
0.09
Exit rate
0.08
0.07
0.06
0.05
0.4 0.5 0.6 0.7 0.8 0.9 1
δ yearly
Benchmark
High utility of leisure
High dispersion of wage distribution
High probability of layoff

Correlations

- Correlation between measures of impatience (smoking, impatience in interview, vocational clubs) and job search outcomes:
  - Impatience $\uparrow \Longrightarrow$ search effort $\downarrow$
  - Impatience $\uparrow \Longrightarrow$ reservation wage $\longleftrightarrow$
  - Impatience $\uparrow \Longrightarrow$ exit rate from unemployment $\downarrow$
- Impatience captures variation in β
- Sophisticated or naive – does not matter

Correlations

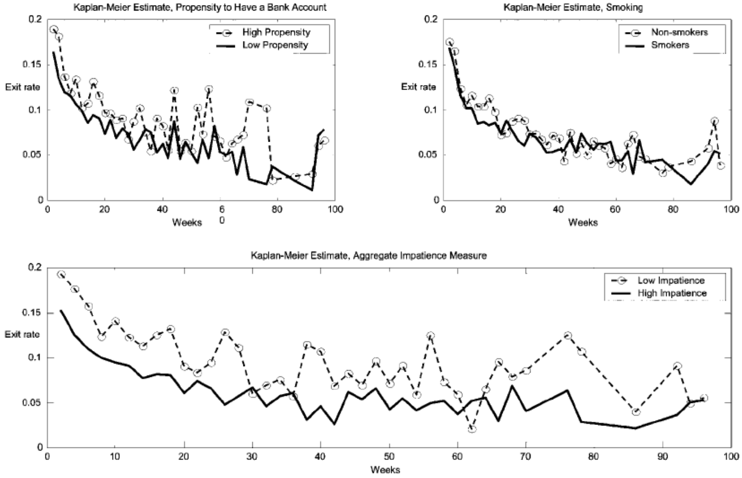


FIG. 3.—Exit rates in the NLSY

Paserman (*EJ* 2008)

- Structural model estimated by max. likelihood
- Estimation exploits non-stationarity of exit rate from unemployment

Table 2: Estimated Model Parameters †

		Low Wage Sample	Medium Wage Sample		High Wage Sample
		Lognormal	Lognormal	Normal	Lognormal
Discounting Parameters					
	β	**0.4021**	**0.4833**	**0.8140**	**0.8937**
		(0.1075)	**(0.1971)**	**(0.1672)**	**(0.1441)**
	δ	0.9962	1.0000*	1.0000*	0.9989
		(0.1848)	(0.0001)	(0.0019)	(0.1798)
Value of time when unemployed					
	b_0	-141.61	-164.31	-7.38	-308.78
		(61.16)	(61.43)	(16.54)	(193.53)

Section 8

Next Week

Next Week

- Present-Bias, Part 3:
  - Investment Goods: Work Effort
  - Leisure Goods: Credit Card Borrowing
  - Leisure Goods: Consumption
  - Leisure Goods: Smoking
  - Summary of the Present-Bias Applications
- Methodological Topic 2: Errors in Applying (β, δ) model