Time Preferences:
Present-biased preferences

EE416 Sem2/2019

Paying Not to Go to the Gym

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How do consumers choose from a menu of contracts? We analyze a novel dataset from three U.S. health clubs with information on both the contractual choice and the day-to-day attendance decisions of 7,752 members over three years. The observed consumer behavior is difficult to reconcile with standard preferences and beliefs. First, members who choose a contract with a flat monthly fee of over $70 attend on average 4.3 times per month. They pay a price per expected visit of more than $17, even though they could pay $10 per visit using a 10-visit pass. On average, these users forgo savings of $600 during their membership. Second, consumers who choose a monthly contract are 17 percent more likely to stay enrolled beyond one year than users committing for a year. This is surprising because monthly members pay higher fees for the option to cancel each month. We also document cancellation delays and attendance expectations, among other findings. Leading explanations for our findings are overconfidence about future self-control or about future efficiency. Overconfident agents overestimate attendance as well as the cancellation probability of automatically renewed contracts. Our results suggest that making inferences from observed contract choice under the rational expectation hypothesis can lead to biases in the estimation of consumer preferences. (*JEL* D00, D12, D91)

"Saturday 31 December. New Year's Resolutions. I WILL [...] go to the gym three times a week not merely to buy sandwich."
Bridget Jones's Diary: A Novel

"Monday 28 April. [...] Gym visits 0, no. of gym visits so far this year 1, cost of gym membership per year £370; cost of single gym visit £123 (v. bad economy)."
Bridget Jones: The Edge of Reason

Many firms offer consumers a menu of contracts. Cellular phone users choose combinations of monthly airtime minutes and prices. Credit card users choose between teaser rate offers and contracts with a constant interest rate. A large literature in industrial organization analyzes the profit-maximizing contract design (Jean Tirole, 1988). A standard assumption in this literature is that consumers have rational expectations about their future consumption frequency and choose the utility-maximizing contract.

In this paper, we provide evidence that this may not always be the case. We present a novel dataset from three U.S. health clubs that allows

DellaVigna and Malmendier (2006)

- Exercise as an investment good
- Immediate cost, future benefit
- Present-Bias: Temptation not to exercise

DellaVigna and Malmendier (2006)

- DellaVigna and Malmendier (2006) look at different gym membership contracts
- (i) Pay-as-you-go: $10 per visit
- (ii) Monthly membership: $70/month

- Standard model says buy membership if you plan to go more than 7 times per month.

- Finding: the average member only goes 4 times!

Dellavigna&Malmendier(2006)

- Choice of flat-rate vs. per-visit contract
- Per visit fee p
- Lump-sum periodic fee L

- Menu of contracts
  - Flat-rate contract: $L > 0, p = 0$
  - Pay-per-visit contract: $L = 0, p > 0$

Dellavigna&Malmendier(2006)

- Choice of flat-rate vs. per-visit contract
- Per visit fee p
- Lump-sum periodic fee L

- Health club attendence
  - Immediate cost c_t
  - Delayed health benefit $h > 0$

Dellavigna&Malmendier(2006)

- Attendance decision:
- Long-run plans at time 0:
  - Attend at t iff
  - $\beta\delta^t(-p - c_t + \delta h) > 0 \leftrightarrow c_t < \delta h - p$
- Actual attendance decision at $t \geq 1$:
  - Attend at t iff
  - $-p - c_t + \beta\delta h > 0 \leftrightarrow c_t < \beta\delta h - p$
- This shows time inconsistency.

Partial naivete (O’Donoghue & Rabin, QJE 2001)

- The person who is “partial naivete” is aware that she’ll have a present bias in the future, but she underestimates its magnitude.

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- With (β, δ) preferences:
- Since β captures the magnitude of the person's present bias, we can think of the person as having a perception $\hat{\beta}$ of her future present bias.

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- Sophisticates have $\hat{\beta} = \beta$.
- Naifs have $\hat{\beta} = 1$.
- Partial naifs have $\hat{\beta} \in (\beta, 1)$.
  - They underestimate the extent of their present bias.
  - They perceive that their discount factors are close to 1, than they actually are.

Partial naivete(O'Donoghue & Rabin, QJE 2001)

- Definition of Partial naifs
- A person with perceptions $\hat{\beta}$ believes that in the future she will behave like a sophisticate with present bias $\hat{\beta}$. Given this prediction about future behavior, she chooses her current action to maximize her current preferences, which depend on β.
- Also assume that the future selves are also sophisticates.

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- Example: Suppose you must complete a task within three days:
- If complete on day 1, $u_1 = -3, u_2 = u_3 = 0.$
- If complete on day 2, $u_2 = -5, u_1 = u_3 = 0.$
- If complete on day 3, $u_3 = -8, u_1 = u_2 = 0.$

- This is equivalent to having the immediate cost schedule:

$$c \equiv (3, 5, 8)$$

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- Behave like sophisticates with $\hat{\beta}$
- On day 1, what are your beliefs about day-2 behavior?

- I will be present bias with $\hat{\beta}$.
- $U^2(2|\hat{\beta}) = -5$
- $U^2(3|\hat{\beta}) = -\hat{\beta}8$

	$\tau = 1$	$\tau = 2$	$\tau = 3$
At t = 1: $U^1(\tau)$			
At t = 2: $U^2(\tau)$		$U^2(2\|\hat{\beta}) = -5$	$U^2(3\|\hat{\beta}) = -\hat{\beta}8$
At t = 3: $U^3(\tau)$			

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- Behave like sophisticates with $\hat{\beta}$
- On day 1, what are your beliefs about day-2 behavior?
  - Expect to complete task on day 2 if:
  - $U^2(2|\hat{\beta}) = -5 > U^2(3|\hat{\beta}) = -\hat{\beta}8$
  - $5 < \hat{\beta}8$
  - $\hat{\beta} > \frac{5}{8}$

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- Behave like sophisticates with $\hat{\beta}$
- On day 1, what are your beliefs about day-2 behavior?
  - Expect to wait on day 2 and complete task on day 3 if:
  - $U^2(2|\hat{\beta}) = -5 < U^2(3|\hat{\beta}) = -\hat{\beta}8$
  - $5 > \hat{\beta}8$
  - $\hat{\beta} < \frac{5}{8}$

Partial naivete(O'Donoghue & Rabin, QJE 2001)

- She chooses her current action to maximize her current preferences, which depend on β.
- What are your day-1 preferences?

	$\boldsymbol{\tau = 1}$	$\boldsymbol{\tau = 2}$	$\boldsymbol{\tau = 3}$
At t = 1: $U^1(\tau)$	$U^1(1\|\beta) = -3$	$U^1(2\|\beta) = -5/2$	$U^1(3\|\beta) = -8/2$
At t = 2: $U^2(\tau)$		$U^2(2\|\hat{\beta}) = -5$	$U^2(3\|\hat{\beta}) = -\hat{\beta}8$
At t = 3: $U^3(\tau)$			

- $(day\ 2) \succ (day 1) \succ (\text{day } 3)$

Partial naivete (O'Donoghue & Rabin, QJE 2001)

- She chooses her current action to maximize her current preferences, which depend on β.
- Conclusion:
- If $\hat{\beta} < \frac{5}{8}$,
  - On day 1, I expect to wait on day 2 and complete task on day 3.
  - On day 1, I prefer day 1 than day 3.
  - I complete the task on day 1.

Partial naivete(O'Donoghue & Rabin, QJE 2001)

- She chooses her current action to maximize her current preferences, which depend on β.
- Conclusion:
- If $\hat{\beta} > \frac{5}{8}$,
  - On day 1, I expect to complete task on day 2.
  - On day 1, I prefer day 2 than day 1.
  - I wait on day 1.
  - When day 2 arrives, I wait on day 2, and complete the task on day 3, because

$$-5 < -\beta 8, where\ \beta = \frac{1}{2}$$

Dellavigna&Malmendier(2006) cont.: Attendance decision

- Long-run plans at time 0:

Attend at t iff $\beta\delta^t(-p - c_t + \delta h) > 0 \leftrightarrow c_t < \delta h - p$

- Actual attendance decision at $t \geq 1$:

Attend at t iff $-p - c_t + \beta\delta h > 0 \leftrightarrow c_t < \beta\delta h - p$

- Forecast at $t = 0$ of attendance at $t \geq 1$:

Attend at t iff $-p - c_t + \hat{\beta}\delta h > 0 \leftrightarrow c_t < \hat{\beta}\delta h - p$

Dellavigna&Malmendier(2006) cont.: Attendance decision

- An exponential agent has time-consistent preferences

$(\beta = 1)$ and is aware of it $(\hat{\beta} = 1)$.

- A sophisticated agent has time-inconsistent preferences

$(\beta < 1)$ and is aware of it $(\hat{\beta} = \beta)$.

- A fully naive agent has time-inconsistent preferences

$(\beta < 1)$, but is completely unaware of it $(\hat{\beta} = 1)$. She believes that she will behave like a time-consistent agent in the future.

- A partial naïve agent has time-inconsistent preferences

$(\beta < 1)$, and underestimate their present bias $(\beta < \hat{\beta})$.

$\hat{\beta} - \beta$ reflects the overconfidence about future self-control.

Dellavigna&Malmendier(2006): Attendance decision

- Let the effort cost at day t vary according to a cumulative distribution function G
- $c_t \sim G, c_t \; i.i.d. \, \forall t$

Dellavigna&Malmendier(2006): Attendance decision

- Long-run plans at time 0: Attend at t iff $c_t < \delta h - p$

Attend at t with probability $G(\delta h - p)$

- Actual attendance decision at $t \geq 1$: Attend at t iff $c_t < \beta\delta h - p$

Attend at t with probability $G(\beta\delta h - p)$

The smaller is β, the larger is the difference between benchmark and actual attendance probability $G(\delta h - p) - G(\beta\delta h - p)$, and the more serious is the time inconsistency.

- Forecast at $t = 0$ of attendance at $t \geq 1$: Attend at t iff $c_t < \hat{\beta}\delta h - p$

Attend at t with probability $G(\hat{\beta}\delta h - p)$

Dellavigna&Malmendier(2006): Attendance decision

- At time 0, a partial naive overestimates the probability with which she will attend in future periods.

- She expects to attend with probability $G(\hat{\beta}\delta h - p)$
- The larger is the difference $\hat{\beta} - \beta$, the large is the overestimation of the future attendance probability $G\left(\hat{\beta}\delta h - p\right) - G(\beta\delta h - p) \geq 0.$

Dellavigna&Malmendier(2006): Attendance decision

- Time-consistent $\hat{\beta} = \beta = 1$ and sophisticated agents $\hat{\beta} = \beta < 1$ have rational expectations about their future time preferences and therefore do not overestimate future attendance.

Dellavigna&Malmendier(2006): Contract choice

A contract (L, p, T) gives customers the right to exercise for a fee p, for T days, once the flat fee L is paid.

The choice at enrollment between:

>> flat-fee contract (e.g. monthly, annual contract)

$(L > 0, p = 0, T)$

>> pay-per-visit contract

$(L = 0, p > 0, T)$

Let $E[v]$ is the expected number of visits over T days.

Dellavigna&Malmendier(2006): Contract choice

- For agents who choose a flat-rate contract,

$$\frac{L}{E[v]} \leq p$$

,i.e.

$$L \leq pE[v]$$

- Payment per expected visit under the flat-rate contract should be smaller than the per-visit-fee p.

Dellavigna&Malmendier(2006): Contract choice

- Proposition 1: If an agent chooses the at-rate contract over the pay-per-visit contract and if $T < 30$, then

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

Dellavigna&Malmendier(2006): Contract choice

- For time-consistent agent $\hat{\beta} = \beta = 1$

$$L \quad \leq \quad pTG(\delta h)$$

- The time-consistent agent chooses the flat-fee contract at t = 0 only if the fee L is smaller than p times the expected number of attendances.
- In other words, a time-consistent agent is willing to pay per expected attendance at most p.

Dellavigna&Malmendier(2006): Contract choice

- A time-inconsistent agent may instead pay more than p for two distinct reasons.

The first reason:

- To the extent that she is sophisticated ($\hat{\beta} < 1$), she values the flat-rate contract as a commitment device to overcome her short-run impatience.

- $(1-\hat{\beta})\delta hT\left[G\left(\hat{\beta}\delta h\right) - G\left(\hat{\beta}\delta\, h - p\right)\right]$ is the price that the consumer is willing to pay for this commitment.

Dellavigna&Malmendier(2006): Contract choice

- $(1-\hat{\beta})\delta h$ is the additional utility of each extra attendance on top of the utility for the future impatient self.

- $T\left[G\left(\hat{\beta}\delta h\right)-G\left(\hat{\beta}\delta\ h-p\right)\right]$ is the expected increase in attendance induced by the zero per-visit price.

Dellavigna&Malmendier(2006): Contract choice

- A time-inconsistent agent may instead pay more than p for two distinct reasons.

The second reason:

- To the extent that the agent is naive about the future time preferences ($\beta < \hat{\beta}$), she believes that she will attend more than she actually does. That is, $\mathrm{T}[G(\hat{\beta}\delta h) - G(\beta\delta\, h)] > 0$.

- Therefore, her additional willingness to pay (relative to a time-consistent agent) equals the overestimation of attendance times the willingness to pay for an attendance, p.

Dellavigna&Malmendier(2006):Prediction 1

Prediction 1. (Price per expected attendance at enrollment) *If the agents have time-consistent preferences ($\beta = \hat{\beta} = 1$), the ratio of the flat rate adjusted for discounting, $\frac{(1-\delta)T'}{1-\delta^{T'}}L$, and of the expected attendance under the flat-rate contract, $T'G(\beta\delta b)$, is smaller than the price of a visit p under the pay-per-visit contract. The opposite is true for time-inconsistent agents if $(1-\beta)$ is sufficiently large.*

Dellavigna&Malmendier(2006):Result

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 (0.80) N = 829	3.45 (0.13) N = 829	16.01 (0.66) N = 829
Month 2	80.65 (0.45) N = 758	5.46 (0.19) N = 758	14.76 (0.52) N = 758
Month 3	70.18 (1.05) N = 753	4.89 (0.18) N = 753	14.34 (0.58) N = 753
Month 4	81.79 (0.26) N = 728	4.57 (0.19) N = 728	17.89 (0.75) N = 728
Month 5	81.93 (0.25) N = 701	4.42 (0.19) N = 701	18.53 (0.80) N = 701
Month 6	81.94 (0.29) N = 607	4.32 (0.19) N = 607	18.95 (0.84) N = 607
Months 1 to 6	75.26 (0.27) N = 866	4.36 (0.14) N = 866	17.27 (0.54) 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 (0.37) N = 145	4.36 (0.36) N = 145	15.22 (1.25) N = 145

TYING ODYSSEUS TO THE MAST: EVIDENCE FROM A COMMITMENT SAVINGS PRODUCT IN THE PHILIPPINES*

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We designed a commitment savings product for a Philippine bank and implemented it using a randomized control methodology. The savings product was intended for individuals who want to commit now to restrict access to their savings, and who were sophisticated enough to engage in such a mechanism. We conducted a baseline survey on 1777 existing or former clients of a bank. One month later, we offered the commitment product to a randomly chosen subset of 710 clients; 202 (28.4 percent) accepted the offer and opened the account. In the baseline survey, we asked hypothetical time discounting questions. Women who exhibited a lower discount rate for future relative to current trade-offs, and hence potentially have a preference for commitment, were indeed significantly more likely to open the commitment savings account. After twelve months, average savings balances increased by 81 percentage points for those clients assigned to the treatment group relative to those assigned to the control group. We conclude that the savings response represents a lasting change in savings, and not merely a short-term response to a new product.

Motivation

- It can be difficult to save. Why?

- Three broad classes of reasons:
  1. Pressure from others
  2. Pressure from yourself
  3. Lack of secure ways to save

- If savings is useful for *ex ante* consumption smoothing (among other things), then devices that help overcome 1, 2 or 3 may increase welfare by facilitating smoothing

- Of course, informal financial institutions do exist and for some savers they are likely to be sufficient.

Program and design

- Commitment savings product offered by a local bank
- “SEED: Save, Earn, Enjoy Deposits”
  - Two ways to set goals: specify amount, or date
  - Participants also wrote down a “savings goal” indicating desired use of savings
  - Lockbox provided upon request

Program and design

- Lockbox provided upon request
  - Physical 'piggy bank' to keep at home
  - Bank holds the key
  - Allowed for frequent small deposits without traveling to bank
  - Breakable if necessary
- Automatic transfers available but not used

- Interest rate same as on normal savings accounts: 4%
- This account was a pure commitment savings product that restricted access to deposits as per the client's instructions upon opening the account, but did not compensate the client for this restriction.

Results

- Uptake is higher for those found to be time inconsistent
- Effect is only present for women
- Effects of education and income are statistically significant
- Female effect is driven by single women, so likely not a spousal control story

TABLE V
DETERMINANTS OF SEED TAKE-UP
PROBIT

	(1) All	(2) All	(3) Female	(4) Male
Time inconsistent	0.125*	0.005	0.158*	0.046
	(0.067)	(0.080)	(0.085)	(0.098)
Impatient, now versus 1 month	−0.030	−0.039	−0.036	−0.041
	(0.050)	(0.050)	(0.062)	(0.075)
Patient, now versus 1 month	0.076	0.070	0.035	0.119
	(0.072)	(0.072)	(0.089)	(0.110)
Impatient, 6 months versus 7 months	0.097	0.108*	0.124	0.078
	(0.065)	(0.065)	(0.087)	(0.091)
Patient, 6 months versus 7 months	0.015	0.022	0.057	−0.021
	(0.064)	(0.064)	(0.081)	(0.093)
Female	0.099	0.070		
	(0.137)	(0.138)		
Female X time inconsistent		0.191**		
		(0.090)		
Married X female	−0.113	−0.117		
	(0.091)	(0.090)		
Married	0.049	0.050	−0.080	0.054
	(0.077)	(0.076)	(0.051)	(0.068)
Some college	0.083**	0.081**	0.081	0.079
	(0.038)	(0.038)	(0.050)	(0.055)
Number of household members	0.000	−0.000	0.003	−0.006
	(0.008)	(0.008)	(0.010)	(0.011)
Unemployed	0.040	0.033	0.039	0.059
	(0.109)	(0.108)	(0.115)	(0.290)
Age	−0.002	−0.002	−0.001	−0.003
	(0.001)	(0.001)	(0.002)	(0.002)
Lending client from bank	−0.014	−0.014	−0.059	0.036
	(0.036)	(0.036)	(0.046)	(0.053)
Lending client with default	−0.032	−0.036	−0.019	−0.057
	(0.072)	(0.071)	(0.088)	(0.103)
Total household income	0.049	0.050	0.136***	−0.026
	(0.031)	(0.031)	(0.045)	(0.043)
Total household monthly income—squared	−0.008*	−0.008*	−0.024***	0.001
	(0.004)	(0.004)	(0.008)	(0.004)