

Non-standard Preferences

Time preferences

Advanced course in Behavioural and Psychological Economics

Tampere University

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[Link to updated version](#)

Bibliography:

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Topics

Introduction

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Deadlines

Credit

Savings

Default effects

Introduction

Standard theory poses:

$$\max_{x_t^i \in X_t} \sum_{t=0}^{\infty} \delta^t \sum_{s_t \in S_t} p(s_t) U(x_t^i \mid s_t) \quad (1)$$

- $U(x \mid s)$: utility
- x^t : period t payoffs
- $p(s)$: probability of state s
- δ : (time-consistent) discount factor

Introduction

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- x^t : period t payoffs
- $p(s)$: probability of state s
- δ : (time-consistent) discount factor

... but utility discounting is **not just exponential**

Time Preferences

Theory

- Standard model assumes a **discount factor** (δ) that:
 - Allows comparing utility in different periods
 - Is independent of when utility is evaluated
 - i.e., *time consistency*

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Empirical Evidence

- Discounting is **steeper in the immediate future** than further ahead

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Empirical Evidence

- Discounting is **steeper in the immediate future** than further ahead
 - Thaler (1981) finds people are indifferent between:
 - \$15 now and \$20 in one month
 - \$15 now and \$100 in ten years

Discount Rate

We can compute the annualized discount rate $(\delta) = \left(\frac{F}{P}\right)^{\frac{1}{t}} - 1$

① 15 now versus 20 in one month

- For $P = 15$ (Present value), $F = 20$ (Future value), and $t = 1$ month ($\frac{1}{12}$ years)

$$\delta_1 = \left(\frac{20}{15}\right)^{\frac{1}{\frac{1}{12}}} - 1 = 1.333^{12} - 1 \approx 30.57 = \boxed{3,057\%}$$

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2 15 now versus 100 in ten years

- For $P = 15$ (Present value), $F = 100$ (Future value), $t = 10$ years

$$\delta_2 = \left(\frac{100}{15}\right)^{\frac{1}{10}} - 1 = 6.67^{\frac{1}{10}} - 1 \approx .21 = \boxed{21\%}$$

Time Preferences

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Empirical Evidence

- Discounting is **steeper in the immediate future** than further ahead
 - Thaler (1981) finds people are indifferent between:
 - \$15 now and \$20 in one month (3,057% annual discount!)
 - \$15 now and \$100 in ten years (21% annual discount)

Time Preferences

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- Standard model assumes a **discount factor** (δ) that:
 - Allows comparing utility in different periods
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Empirical Evidence

- Discounting is **steeper in the immediate future** than further ahead
 - Thaler (1981) finds people are indifferent between:
 - \$15 now and \$20 in one month (3,057% annual discount!)
 - \$15 now and \$100 in ten years (21% annual discount)
 - McClure et al. (2004) explores the neural underpinnings:
 - Payoffs in the present activate different neural systems than decisions involving only payoffs in future periods

Self-Control Problems

- When evaluating the **distant future**:

- More patience
- People make plans to:
 - Exercise
 - Stop smoking
 - Improve themselves

- When the **future gets near**:

- Discounting gets steeper
- People:
 - Binge-eat
 - Light (last) cigarette
 - Stay put

Theoretical Framework

Following Laibson (1997) and O'Donoghue & Rabin (1999)

Suppose that an individual considers her utility throughout many periods:

$$U_t = u_t + \beta \sum_{t=1}^{\infty} \delta^t u_t = u_t + \beta \delta u_{t+1} + \beta \delta^2 u_{t+2} + \beta \delta^3 u_{t+3} + \dots \quad (2)$$

- u_t : period t utility
- δ : discount factor
- β : captures self-control problems, restricted to $\beta \leq 1$

Theoretical Framework

This model (*quasi-hyperbolic preferences*) differs from the *standard model* in β

- if $\beta < 1$ the discounting between present and future is higher

- e.g., if $T = 2$, $\beta = .5$ and $\delta = .9$

$$U_t = u_t + \beta\delta u_{t+1} = u_t + (.5) \times (.9)u_{t+1} = u_t + (.45)u_{t+1}$$

Period 2 utility is weighted at 45% of period 1 utility

- if $\beta = 1$ we have the *standard model*

- e.g., if $T = 2$, $\beta = 1$ and $\delta = .9$

$$U_t = u_t + \beta\delta u_{t+1} = u_t + (1) \times (.9)u_{t+1} = u_t + (.9)u_{t+1}$$

Period 2 utility is weighted at 90% of period 1 utility

Theoretical Framework

Following O'Donoghue & Rabin (2001)

Suppose that an individual expects her utility to be:

$$\hat{U}_{t+s} = u_{t+s} + \hat{\beta}\delta u_{t+s+1} + \hat{\beta}\delta^2 u_{t+s+2} + \hat{\beta}\delta^3 u_{t+s+3} + \dots \quad (3)$$

- $\hat{\beta}$: captures expectations about time preferences, restricted to $\hat{\beta} \geq \beta$

Theoretical Framework

- if $\hat{\beta} = 1$ the individual is *fully naive* about self-control problems
 - Will decide without considering that in the future she will have self-control problems
- if $\hat{\beta} > \beta$ the individual is *partially naive* about self-control problems
- if $\hat{\beta} = \beta$ the individual is *sophisticated*
 - Will take into account her self-control problems when deciding

An example

Consider the choice between eating a fruit or a chocolate bar as a dessert



An example

Consider the choice between eating a fruit or a chocolate bar as a dessert

- **Chocolate bar**

- Immediate reward: $u_1 > 0$
- Future cost: $u_2 < 0$

- **Fruit**

- Immediate cost: $u_1 < 0$
- Future reward: $u_2 > 0$

An example

Consider the choice between eating a fruit or a chocolate bar as a dessert

- Focusing on the **chocolate bar** ($u_1 > 0, u_2 < 0$):
 - Planning ahead
 - Consume chocolate bar if $u_1 + \delta u_2 \geq 0$
 - Deciding in the moment
 - Consume chocolate bar if $u_1 + \beta \delta u_2 \geq 0$
 - Remember $\beta < 0$, so $|\beta \delta u_2| \leq |\delta u_2|$
- I would consume more than what I would want to do beforehand!

An example

Consider the choice between eating a fruit or a chocolate bar as a dessert

- Focusing on the **fruit** ($u_1 < 0, u_2 > 0$):
 - Planning ahead
 - Consume fruit if $u_1 + \delta u_2 \geq 0$
 - Deciding in the moment
 - Consume fruit if $u_1 + \beta \delta u_2 \geq 0$
 - Remember $\beta < 0$, so $|\beta \delta u_2| \leq |\delta u_2|$
- I would consume less than what I would want to do beforehand!

An example

Consider the choice between eating a fruit or a chocolate bar as a dessert

- How can sophisticated agents solve this?
 - Look for **commitment devices** to:
 - Increase investments
 - Reduce present consumption
- Partially naive agents would still mispredict their consumption/investment decisions
 - Planning ahead (and focusing on fruit)
 - Consume fruit if $u_1 + \hat{\beta}\delta u_2 \geq 0$
 - Deciding in the moment
 - Consume fruit if $u_1 + \beta\delta u_2 \geq 0$
 - With $\hat{\beta} > \beta$, then $|\beta\delta u_2| \leq |\hat{\beta}\delta u_2|$
- Would still consume less than what wanted to do beforehand!

Cases

- ① Exercise
- ② Deadlines
- ③ Credit
- ④ Savings
- ⑤ Default effects

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Exercise

DellaVigna & Malmendier (2006): Health clubs in the US



Exercise

DellaVigna & Malmendier (2006): Health clubs in the US

- Setup:
 - X_M : Monthly membership for $L = \$80$
 - X_P : Pay-per-visit membership with \$10 per visit
- Optimal choice:
 - Choose monthly membership $\Leftrightarrow p \times E(x_M|X_M) \geq L$
 - Expected price per attendance (x_M) under X_M is lower than X_P

Exercise

DellaVigna & Malmendier (2006): Health clubs in the US

- Evidence:
 - Users choosing the monthly membership visit 4.4 times per month
 - This implies a cost of $\sim \$17$ per visit
 - Choosing X_M is more expensive than choosing X_P (\$10 per visit)
- Explanation:
 - Users are purchasing a **commitment device** to exercise more:
 - Marginal cost of each visit is \$0 under the monthly membership
 - **Overestimation of attendance**
 - Most consistent with post-intervention survey

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Deadlines

Ariely & Wertenbroch (2002): Professionals enrolled in executive education at MIT



Deadlines

Ariely & Wertenbroch (2002): Professionals enrolled in executive education at MIT

- Setup:
 - Course with 3 homework assignments required
 - Possibility to set binding deadlines:
 - Delays imply lower grades
 - No feedback until the end of the course
- Evidence:
 - 68% of deadlines were set before the end of the semester

Deadlines

Ariely & Wertenbroch (2002): Professionals enrolled in executive education at MIT

- Theory:
 - *Standard Model:*
 - Incentive to set the last day of the semester as the deadline
 - No constraints are better than constraints
 - *Self-Control:*
 - Homework is an investment
 - People spend less time than wished *ex ante*
 - Deadlines force future self to spend more time

Deadlines

Ariely & Wertenbroch (2002): Professionals enrolled in executive education at MIT

- Open questions:
 - Does self-control improve performance?
 - Are chosen deadlines optimal?
- Experiment:
 - 3 error-detection homework assignments with 3 treatment conditions:
 - T0: No deadlines (all due after 3 weeks)
 - T1: Possibility to set binding deadlines
 - T2: Equal-spaced deadlines (one every week)
 - Evidence:
 - Self-set **deadlines improve performance**: score of 105 in T1 vs. 70 in T0
 - Self-set deadlines are not optimal (**partial naïveté in self-control**): 105 in T1 vs. 130 in T2

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Credit

Ausubel (1999): Credit card offers



Credit

Ausubel (1999): Credit card offers

- Setup:
 - Credit card company randomly mailed offers:
 - T0: 6.9% interest for first 6 months, 16% afterwards
 - T1: 4.9% interest for first 6 months, 16% afterwards
 - T2: 6.9% interest for first 6 months, 14% afterwards
- Evidence:
 - Average borrowings:
 - \$2000 during the first 6 months
 - \$1000 afterwards (up to 15 months after change of rate)

Credit

Ausubel (1999): Credit card offers

- Theory:
 - *Standard Model:*
 - In **T1** the offer is 2% rate for first 6 months
 - In **T2** the offer is 2% rate for last 15 months
 - Response to **T1** should be smaller than to **T2**
 - Calculation:
 - in **T1**: $2000 \times \left(\frac{6}{12}\right) \times 2\% = 20$
 - in **T2**: $1000 \times \left(\frac{15}{12}\right) \times 2\% = 25$

Credit

Ausubel (1999): Credit card offers

- Evidence:
 - Increase in take-up for T1: 386 per 100k
 - Increase in take-up for T2: 154 per 100k
 - T1 vs. T0 is 2.5 times larger than for T2 vs. T0
 - Individuals over-respond to the first six-months discount
- Interpretation:
 - Individuals **naively believe** they will not borrow much after the discount period ends

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Savings

Ashraf, Karlan, & Wesley (2006): Savings behavior in the Philippines



Savings

Ashraf, Karlan, & Wesley (2006): Savings behavior in the Philippines

- Motivation:
 - How to reconcile?
 - Liquid debt: $\sim 12\%$ of annual income, implies high impatience
 - Illiquid wealth accumulation: $> 200\%$ of annual income towards retirement, implies high patience
 - Proposed solution: **Commitment device**
- Setup:
 - Philippine bank randomly assigned customers to:
 - **T0**: Verbal encouragement to save
 - **T1**: Commitment device

Customers could not access savings until reaching a self-specified goal

Savings

Ashraf, Karlan, & Wesley (2006): Savings behavior in the Philippines

- Evidence:
 - High demand for commitment: ~25% of customers accepted the commitment device
 - Savings increased:
 - T1: 33.3% increase
 - T0: 27.7% increase

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Default effects

Default effects

- Tendency for an agent to generally accept the default option
- One of the most robust findings in applied economics since 2000!
- Observed in contexts such as:
 - Health clubs
 - Organ donation
 - Insurance plan choice
 - Retirement plan choice
- Widely applied in public (and private) policy

Default effects

Madrian & Shea (2001): Company-offered 401(k) plans in the US

- Setup:
 - T0: Default is non-participation
 - Employer match-up: 50% of contributions
 - T1: Default is participation at 3%
 - Employer match-up: 50% of contributions
 - Employees can override default via phone call or form submission
- Evidence:
 - Participation rate:
 - T0: 49%
 - T1: 86%

Default effects

Madrian & Shea (2001): Company-offered 401(k) plans in the US

- Explanation:
 - **Transaction costs?**
 - Unlikely: Costs are too low compared to benefits
 - e.g., *Average match-up provides \$1.2k in annual benefits*
 - **Self-control and naïveté?**
 - Decisions involves:
 - Immediate disutility (i.e., *transaction cost*)
 - Delayed benefit
 - Agent behavior:
 - Postpones decision (i.e., *self-control problem*)
 - Believes they will act tomorrow (i.e., *naïveté*)
 - Can result in infinite procrastination

Default effects

Carroll et al. (2009): Forcing Choice as a Solution

- Setup:
 - New hires at a company:
 - T0: Free to choose a retirement plan
 - T1: Required to choose a retirement plan
- Evidence:
 - Participation rate:
 - T0: 50% choose a 401(k) plan
 - T1: 80% choose a 401(k) plan