Non-standard Preferences

Time preferences

Advanced course in Behavioural and Psychological Economics

Tampere University

January, 2025

Link to updated version

Bibliography:

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Topics

Introduction

Standard theory poses:

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

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

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

Discounted Utility

Suppose:

$x \perp s$ (x is orthogonal to s)

- *Payoffs do not depend on states of the world*

- Individual i maximize $\sum_{t=0}^{\infty} \delta^t U(x_{i,t})$

  $\sum_{t=0}^{\infty} \delta^t U(x_{i,t}) = \delta^0 U(x_{i,t}) + \delta U(x_{i,t+1}) + \delta^2 U(x_{i,t+2}) + \delta^3 U(x_{i,t+3}) + \dots$

- For $\delta = .9$

  $\sum_{t=0}^{\infty} \delta^t U(x_{i,t}) = (1)U(x_t) + (.9)U(x_{t+1}) + (.81)U(x_{t+2}) + (.729)U(x_{t+3}) + \dots$

Time Preferences

Theory

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

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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)

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

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① 15 now versus 20 in one month

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

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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    - Allows comparing utility in different periods
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        → i.e., *time consistency*

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:
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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:
    - $\rightarrow$ Exercise
    - $\rightarrow$ Stop smoking
    - $\rightarrow$ Improve themselves

- When the **future gets near**:
  - Discounting gets steeper
  - People:
    - $\rightarrow$ Binge-eat
    - $\rightarrow$ Light (last) cigarette
    - $\rightarrow$ Stay put

Theoretical Framework

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

Suppose that an individual considers her utility throughout many periods:

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

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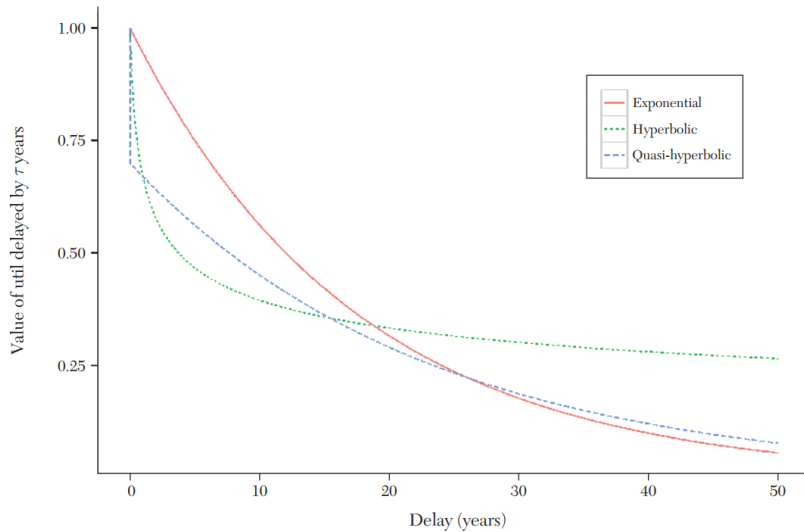
    - e.g., *if $T = 2$, $\beta = 1$ and $\delta = .9$*

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

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

Theoretical Framework

Theoretical Framework

Following O'Donoghue & Rabin (2001)

Suppose that an individual expects her utility to be:

$$\hat{U}_{t+s} = u_{t+s} + \hat{\beta}\delta u_{t+s+1} + \hat{\beta}\delta^2 u_{t+s+2} + \hat{\beta}\delta^3 u_{t+s+3} + \ldots \tag{3}$$

- $\hat{\beta}$: 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

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- **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
    - $\rightarrow$ Consume chocolate bar if $u_1 + \delta u_2 \geq 0$
  - Deciding in the moment
    - $\rightarrow$ Consume chocolate bar if $u_1 + \beta \delta u_2 \geq 0$
    - $\rightarrow$ Remember $\beta \leq 1$, 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
    - $\rightarrow$ Consume fruit if $u_1 + \delta u_2 \geq 0$
  - Deciding in the moment
    - $\rightarrow$ Consume fruit if $u_1 + \beta \delta u_2 \geq 0$
    - $\rightarrow$ Remember $\beta \leq 1$, 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:
    - $\rightarrow$ Increase investments
    - $\rightarrow$ Reduce present consumption
- Partially *naive* agents would still mispredict their consumption/investment decisions
  - Planning ahead (and focusing on fruit)
    - $\rightarrow$ Consume fruit if $u_1 + \hat{\beta}\delta u_2 \geq 0$
  - Deciding in the moment
    - $\rightarrow$ Consume fruit if $u_1 + \beta\delta u_2 \geq 0$
    - $\rightarrow$ With $\beta \leq \hat{\beta}$, 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

Topics

Exercise

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

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- Setup:
    - X_M: Monthly membership for $L = \$80$
    - X_P: Pay-per-visit membership with $10 per visit

- Optimal choice:
    - Choose monthly membership $\Leftrightarrow p \times E(x_M | X_M) \geq L$
        - $\rightarrow$ 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
        - $\rightarrow$ Choosing X_M is more expensive than choosing X_P (\$10 per visit)

- Explanation:
    - Users are purchasing a **commitment device** to exercise more:
        - $\rightarrow$ Marginal cost of each visit is \$0 under the monthly membership
    - **Overestimation of attendance**
        - $\rightarrow$ Most consistent with post-intervention survey

Topics

Deadlines

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

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- Setup:
  - Course with 3 homework assignments required
  - Possibility to set binding deadlines:
    - $\rightarrow$ Delays imply lower grades
    - $\rightarrow$ 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*:
        - $\rightarrow$ Incentive to set the last day of the semester as the deadline
        - $\rightarrow$ No constraints are better than constraints
    - *Self-Control:*
        - $\rightarrow$ Homework is an investment
        - $\rightarrow$ People spend less time than wished *ex ante*
        - $\rightarrow$ 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`

Topics

Credit

Ausubel (1999): Credit card offers

Credit

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- Setup:
  - Credit card company randomly mailed offers:
    - $\rightarrow$ T0: 6.9% interest for first 6 months, 16% afterwards
    - $\rightarrow$ T1: 4.9% interest for first 6 months, 16% afterwards
    - $\rightarrow$ T2: 6.9% interest for first 6 months, 14% afterwards

- Evidence:
  - Average borrowings:
    - $\rightarrow$ \$2000 during the first 6 months
    - $\rightarrow$ \$1000 afterwards (up to 15 months after change of rate)

Credit

Ausubel (1999): Credit card offers

- Theory:
  - *Standard Model:*
    - $\rightarrow$ In `T1` the offer is 2% rate for first 6 months
    - $\rightarrow$ In `T2` the offer is 2% rate for last 15 months
    - $\rightarrow$ Response to `T1` should be smaller than to `T2`
    - $\rightarrow$ 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

Topics

Savings

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

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

- Motivation:
  - How to reconcile?
    - $\rightarrow$ Liquid debt: $\sim$12% of annual income, implies <u>high impatience</u>
    - $\rightarrow$ Illiquid wealth accumulation: >200% of annual income towards retirement, implies <u>high patience</u>
  - Proposed solution: **Commitment device**

- Setup:
  - Philippine bank randomly assigned customers to:
    - $\rightarrow$ `T0`: Verbal encouragement to save
    - $\rightarrow$ `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: $\sim$25% of customers accepted the commitment device
  - Savings increased:
    - $\rightarrow$ `T1`: 33.3% increase
    - $\rightarrow$ `T0`: 27.7% increase

Topics

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