Present-Biased Preferences

January 20, 2011
Today

- Ryan and Mads on cab drivers
- Intertemporal choice: background
- Discounted utility “anomalies” & present bias
- Quasi-hyperbolic discounting: $\beta, \delta$ model
- Example
- Self-awareness: Sophistication vs. Naivete
Next time(s)

- More examples
- Welfare
- Some applications
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor
- Joint determinants of desire for wealth accumulation:
  - Bequest motive
  - Self-restraint
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor

- Joint determinants of desire for wealth accumulation:
  - Bequest motive *promotes*
  - Self-restraint *promotes*
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor.
- Joint determinants of desire for wealth accumulation:
  - Bequest motive *promotes*
  - Self-restraint *promotes*
  - Uncertainty of human life
  - excitement/passion of immediate consumption, discomfort of delayed gratification
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor
- Joint determinants of desire for wealth accumulation:
  - Bequest motive *promotes*
  - Self-restraint *promotes*
  - Uncertainty of human life *limits*
  - excitement/passion of immediate consumption, discomfort of delayed gratification *limits*
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor
- Joint determinants of desire for wealth accumulation:
  - Bequest motive *promotes*
  - Self-restraint *promotes*
  - Uncertainty of human life *limits*
  - excitement/passion of immediate consumption, discomfort of delayed gratification *limits*
- Time preference is an amalgamation of motives
Intertemporal Choice: Background

Early perspective:

- Rae: wealth differences across nations can be traced to “the effective desire of accumulation”, a psychological factor.
- Joint determinants of desire for wealth accumulation:
  - Bequest motive promotes
  - Self-restraint promotes
  - Uncertainty of human life limits
  - excitement/passion of immediate consumption, discomfort of delayed gratification limits
- Time preference is an amalgamation of motives.
- DU model condenses all these into one parameter, discount rate, but resurrection distinct motives is crucial for understanding intertemporal choices.
Semantics

*Time discounting vs. time preference*

- *Time discounting* encompasses any reason for caring less about future consequence.
- Includes uncertainty, possibility of changing tastes (*hueristic discounting*)

\[ \delta = 1 - p \]
Semantics

*Time discounting vs. time preference*

- *Time discounting* encompasses *any* reason for caring less about future consequence.
- Includes uncertainty, possibility of changing tastes (*heuristic discounting*)
- E.g. If each period, world will end w/ prob. $p \rightarrow$ discount factor $\delta = 1 - p$ makes sense
Semantics

Time discounting vs. time preference

- *Time discounting* encompasses *any* reason for caring less about future consequence.
- Includes uncertainty, possibility of changing tastes (*heuristic discounting*)
- E.g. If each period, world will end w/ prob. \( p \) \( \Rightarrow \) discount factor \( \delta = 1 - p \) makes sense
- E.g. If inner-city 10-year-old has 1% chance of being murdered by age 25, ought to discount “life utility” more than 10-year-old suburban child w/ 0% chance of being murdered.
Semantics

Time discounting vs. time preference

- *Time discounting* encompasses *any* reason for caring less about future consequence.
- Includes uncertainty, possibility of changing tastes (*heuristic discounting*)
- E.g. If each period, world will end w/ prob. $p \implies$ discount factor $\delta = 1 - p$ makes sense
- E.g. If inner-city 10-year-old has 1% chance of being murdered by age 25, ought to discount “life utility” more than 10-year-old suburban child w/ 0% chance of being murdered.
- *Time preference* refers to the preference for immediate utility over delayed utility (*hedonic discounting*)
Semantics

*Time discounting vs. time preference*

- *Time discounting* encompasses any reason for caring less about future consequence.
- Includes uncertainty, possibility of changing tastes (*heuristic discounting*)
- E.g. If each period, world will end w/ prob. $p \implies$ discount factor $\delta = 1 - p$ makes sense
- E.g. If inner-city 10-year-old has 1% chance of being murdered by age 25, ought to discount “life utility” more than 10-year-old suburban child w/ 0% chance of being murdered.
- *Time preference* refers to the preference for immediate utility over delayed utility (*hedonic discounting*)
- Aside/strong claim: once we account for the heuristic component of intertemporal choice, the proper welfare measure should feature no time discounting.
Intertemporal Choice: Background

(Exponential) Discounted Utility model (Samuelson, 1937):

\[
U^t(c_t, \ldots, c_T) = \sum_{k=0}^{T-t} \delta^k u(c_{t+k}),
\]

where \( \delta = \frac{1}{1+\rho} \).

- Can be applied more generally than 2-period indifference curve analysis, make connection to investment decisions
- Condenses psychological motives into one parameter
- Not endorsed as normative, descriptive model
- Rapidly gained popularity and perceived legitimacy
- Features constant, stationary discounting
Discounted Utility “Anomalies”

- Best documented is hyperbolic discounting: a declining rate of time preference over longer horizons.

- ‘Hyperbolic’ because hyperbolic functional form, featuring declining discount rate, fits data better than exponential form, with constant discount rate.

- Others: gains discounted more than losses; small outcomes discounted more than large ones; preference for improving sequences, etc. (see FLO (2002))

- Unlike other expected-utility anomalies, these “anomalies” do not necessarily violate any standard or principle. They are merely incompatible with the DU model.
Discounted Utility “Anomalies”

A calibration argument:

- \(0.99^{365 \times 2} \approx \frac{1}{1536}\)
- \(0.99^{52 \times 2} \approx \frac{1}{2.8}\)
- \(0.999^{365 \times 2} \approx \frac{1}{2.1}\)
- \(0.999^{365 \times 24 \times 2} \approx \frac{1}{40,987,013}\)
- \(0.9999^{365 \times 24 \times 2} \approx \frac{1}{5.7}\)
Discounted Utility “Anomalies”

A calibration argument:

- \(.99^{365 \times 2} \approx \frac{1}{1536}\)
- \(.99^{52 \times 2} \approx \frac{1}{2.8}\)
- \(.999^{365 \times 2} \approx \frac{1}{2.1}\)
- \(.999^{365 \times 24 \times 2} \approx \frac{1}{40,987,013}\)
- \(.9999^{365 \times 24 \times 2} \approx \frac{1}{5.7}\)

- What is your propensity to favor your well-being today over your well-begin tomorrow?
- What is your propensity to favor your well-being on a day 20 years from now over a day 22 years from now?
A Simple Model of Present-Biased Preferences


\[
U^t(c_t, \ldots, c_T) = \delta^t u(c_t) + \beta \sum_{k=1}^{T-t} \delta^k u(c_{t+k}),
\]

where \( \beta, \delta \in [0, 1] \).

- \textit{delta} \approx 1 is the standard discount factor
- \( \beta = 1 \) implies standard, time-consistent (exponential) preferences
- \( \beta < 1 \) implies time-inconsistent, present-biased preferences
Example

Tenzin has to decide how to allocate lentils across time: one lentil today vs. two lentils tomorrow

His consumption utility of eating lentils on each day is

\[ u(1) = c \]
\[ u(2) = \frac{3}{2}c \]
\[ u(0) = 0 \]
Example

Tenzin has to decide how to allocate lentils across time: one lentil today vs. two lentils tomorrow

- Time-consistent Lama: $\beta = 1$ implies that a lentil in period $t$ is better than two lentils in period $t + 1$ $\iff$

$$\delta^t c + 0 > 0 + \delta^{t+1} \left(\frac{3}{2}\right)c,$$

or $\delta > \frac{2}{3}$.

- It doesn’t matter whether $t$ is today, tomorrow, or any time in the future
Example

Tenzin has to decide how to allocate lentils across time: one lentil today vs. two lentils tomorrow

- Time-inconsistent Lama: what if $\beta = \frac{1}{2}$ and $\delta = 1$?
- When $t = 1$, he prefers one lentil on day 1 to two lentils on day 2:
  \[ c + \frac{1}{2} \cdot 0 > 0 + \frac{1}{2} \cdot \frac{3}{2} \cdot c \]
- He also prefers two lentils on day 3 to one lentil on day 2:
  \[ 0 + \frac{1}{2} \cdot \frac{3}{2} \cdot c > 0 + \frac{1}{2} \cdot (c + 0) \]
- However, when $t = 2$, his preference reverses, and he prefers one lentil on day 2 to two lentils on day 3:
  \[ c + \frac{1}{2} \cdot 0 > 0 + \frac{1}{2} \cdot \frac{3}{2} \cdot c \]
Example

Tenzin has to decide how to allocate lentils across time: one lentil today vs. two lentils tomorrow

- Time-inconsistent Lama: what if $\beta = \frac{1}{2}$ and $\delta = 1$?
- When $t = 1$, he prefers one lentil on day 1 to two lentils on day 2:
  \[ c + \frac{1}{2} \cdot 0 > 0 + \frac{1}{2} \left( \frac{3}{2}c \right) \]
- He also prefers two lentils on day 3 to one lentil on day 2:
  \[ 0 + \frac{1}{2} \left( 0 + \frac{3}{2}c \right) > 0 + \frac{1}{2} (c + 0) \]
- However, when $t = 2$, his preference reverses, and he prefers one lentil on day 2 to two lentils on day 3:
  \[ c + \frac{1}{2} \cdot 0 > 0 + \frac{1}{2} \left( \frac{3}{2}c \right) \]

**Time-inconsistency**: Tenzin will delay gratification in the future, but not today. So when the moment arrives, he changes his mind.
Self-Awareness

• A person with time-inconsistent preferences may or may not be aware of her inconsistency.

• Let $\hat{\beta}$ be the person’s beliefs about the true value of $\beta$.

• A person is **sophisticated** if $\hat{\beta} = \beta$.

• A person is **naive** if $\beta < \hat{\beta} \leq 1$. 
Self-Awareness: Example

- Four-day trekkie convention film festival
  - Thursday (day 1): The Motion Picture
  - Friday (day 2): The Wrath of Khan
  - Saturday (day 2): The Search For Spock
  - Sunday (day 4): The Voyage Home

- Pam and Paige must each miss one movie

- Cannot commit in advance, must make decision day-by-day