Economics 101A
(Lecture 13)

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Outline

1. Time Consistency

2. Time Inconsistency

3. Health Club Attendance
1 Time consistency

• Intertemporal choice

• Three periods, $t = 0$, $t = 1$, and $t = 2$

• At each period $i$, agents:
  
  – have income $M_i' = M_i + \text{savings/debts from previous period}$

  – choose consumption $c_i$;

  – can save/borrow $M_i' - c_i$

  – no borrowing in last period: at $t = 2$ $M_2' = c_2$
• Utility function at \( t = 0 \)

\[
u(c_0, c_1, c_2) = U(c_0) + \frac{1}{1 + \delta} U(c_1) + \frac{1}{(1 + \delta)^2} U(c_2)
\]

• Utility function at \( t = 1 \)

\[
u(c_1, c_2) = U(c_1) + \frac{1}{1 + \delta} U(c_2)
\]

• Utility function at \( t = 2 \)

\[
u(c_2) = U(c_2)
\]

• \( U' > 0, \ U'' < 0 \)
• Question: Do preferences of agent in period 0 agree with preferences of agent in period 1?

• **Period 1.**

• Budget constraint at $t = 1$:

$$c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2$$

• Maximization problem:

$$\max U(c_1) + \frac{1}{1 + \delta} U(c_2)$$

$$s.t. \ c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2$$

• First order conditions:

• Ratio of f.o.c.s:

$$\frac{U''(c_1)}{U''(c_2)} = \frac{1 + r}{1 + \delta}$$
• Back to **period 0**.

• Agent at time 0 can commit to consumption at time 1 as function of uncertain income $M_1$.

• Anticipated budget constraint at $t = 1$:

$$c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2$$

• Maximization problem:

$$\max U(c_0) + \frac{1}{1 + \delta} U(c_1) + \frac{1}{(1 + \delta)^2} U(c_2)$$

$$s.t. \ c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2$$

• First order conditions:

• Ratio of f.o.c.s:

$$\frac{U''(c_1)}{U''(c_2)} = \frac{1 + r}{1 + \delta}$$
• The two conditions coincide!

• **Time consistency.** Plans for future coincide with future actions.

• To see why, rewrite utility function $u(c_0, c_1, c_2)$:

$$U(c_0) + \frac{1}{1 + \delta} U(c_1) + \frac{1}{(1 + \delta)^2} U(c_2)$$

$$= U(c_0) + \frac{1}{1 + \delta} \left[ U(c_1) + \frac{1}{1 + \delta} U(c_2) \right]$$

• Expression in brackets coincides with utility at $t = 1$

• Is time consistency right?

  – addictive products (alcohol, drugs);
  
  – good actions (exercising, helping friends);
  
  – immediate gratification (shopping, credit card borrowing)
2 Time Inconsistency

- Alternative specification (Akerlof, 1991; Laibson, 1997; O’Donoghue and Rabin, 1999)

- Utility at time $t$ is $u(c_t, c_{t+1}, c_{t+2})$:

  $$u(c_t) + \frac{\beta}{1 + \delta} u(c_{t+1}) + \frac{\beta}{(1 + \delta)^2} u(c_{t+2}) + \ldots$$

- Discount factor is

  $$1, \frac{\beta}{1 + \delta}, \frac{\beta}{(1 + \delta)^2}, \frac{\beta}{(1 + \delta)^3}, \ldots$$

  instead of

  $$1, \frac{1}{1 + \delta}, \frac{1}{(1 + \delta)^2}, \frac{1}{(1 + \delta)^3}, \ldots$$

- What is the difference?

- *Immediate gratification:* $\beta < 1$
• Back to our problem: **Period 1.**

• Maximization problem:

\[
\max U(c_1) + \frac{\beta}{1 + \delta} U(c_2)
\]

\[
s.t. \ c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2
\]

• First order conditions:

• Ratio of f.o.c.s:

\[
\frac{U'(c_1^*)}{U'(c_2^*)} = \beta \frac{1 + r}{1 + \delta}
\]
• Now, **period 0** with commitment.

• Maximization problem:

\[
\max U(c_0) + \frac{\beta}{1+\delta} U(c_1) + \frac{\beta}{(1+\delta)^2} U(c_2)
\]

\[
s.t. \ c_1 + \frac{1}{1+r} c_2 \leq M'_1 + \frac{1}{1+r} M_2
\]

• First order conditions:

• Ratio of f.o.c.s:

\[
\frac{U'(c^{*,c}_1)}{U'(c^{*,c}_2)} = \frac{1+r}{1+\delta}
\]

• The two conditions differ!

• Time inconsistency: \(c^{*,c}_1 < c^*_1 \) and \(c^{*,c}_2 > c^*_2\)

• The agent allows him/herself too much immediate consumption and saves too little
• Ok, we agree. but should we study this as economists?

• YES!
  
  – One trillion dollars in credit card debt;
  
  – Most debt is in teaser rates;
  
  – Two thirds of Americans are overweight or obese;
  
  – $10bn health-club industry

• Is this testable?
  
  – In the laboratory?
  
  – In the field?
3 Health Club Attendance


- 3 health clubs

- Data on attendance from swiping cards

- Choice of contracts:
  - Monthly contract with average price of $75
  - 10-visit pass for $100

- Consider users that choose monthly contract. Attendance?
<table>
<thead>
<tr>
<th>Month</th>
<th>Average price per month (1)</th>
<th>Average attendance per month (2)</th>
<th>Average price per average attendance (3)</th>
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<td>55.23</td>
<td>3.45</td>
<td>16.01</td>
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Table 3—Price per Average Attendance at Enrollment

- Attend on average 4.8 times per month
- Pay on average over $17
• Average delay of 2.2 months ($185) between last attendance and contract termination

• Over membership, user could have saved $700 by paying per visit
• Health club attendance:
  
  – immediate cost $c$
  
  – delayed benefit $b$

• At sign-up (attend tomorrow):

$$NB^t = -\frac{\beta}{1+\delta}c + \frac{\beta}{(1+\delta)^2}b$$

• Plan to attend if $NB^t > 0$

$$c < \frac{1}{(1+\delta)}b$$
• Once moment to attend comes:

\[ NB = -c + \frac{\beta}{(1 + \delta)}b \]

• Attend if \( NB > 0 \)

\[ c < \frac{\beta}{(1 + \delta)}b \]
• Interpretations?

• Users are buying a commitment device

• User underestimate their future self-control problems:
  – They overestimate future attendance
  – They delay cancellation
4 Next Lecture

- Production
- Cost Minimization