

# Economics 101A

## (Lecture 12)

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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:

$$\begin{aligned} \max & U(c_1) + \frac{1}{1+\delta}U(c_2) \\ \text{s.t.} & c_1 + \frac{1}{1+r}c_2 \leq M'_1 + \frac{1}{1+r}M_2 \end{aligned}$$

- 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:

$$\begin{aligned} \max & U(c_0) + \frac{1}{1+\delta}U(c_1) + \frac{1}{(1+\delta)^2}EU(c_2) \\ \text{s.t.} & c_1 + \frac{1}{1+r}c_2 \leq M'_1 + \frac{1}{1+r}M_2 \end{aligned}$$

- 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  $u(c_0, c_1, c_2)$ :

$$\begin{aligned}
 & U(c_0) + \frac{1}{1 + \delta} U(c_1) + \frac{1}{(1 + \delta)^2} EU(c_2) \\
 = & U(c_0) + \frac{1}{1 + \delta} \left[ U(c_1) + \frac{1}{1 + \delta} EU(c_2) \right]
 \end{aligned}$$

- 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  $u(c_t, c_{t+1}, c_{t+2})$  :

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

- Discount factor is

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

instead of

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

- What is the difference?
- *Immediate gratification*:  $\beta < 1$



- Back to our problem: **Period 1.**

- Maximization problem:

$$\begin{aligned} \max U(c_1) + \frac{\beta}{1 + \delta} U(c_2) \\ \text{s.t. } c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2 \end{aligned}$$

- 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:

$$\begin{aligned} \max U(c_0) + \frac{\beta}{1 + \delta} U(c_1) + \frac{\beta}{(1 + \delta)^2} U(c_2) \\ \text{s.t. } c_1 + \frac{1}{1 + r} c_2 \leq M'_1 + \frac{1}{1 + r} M_2 \end{aligned}$$

- First order conditions:

- Ratio of f.o.c.s:

$$\frac{U'(c_1^{*,c})}{U'(c_2^{*,c})} = \frac{1 + r}{1 + \delta}$$

- The two conditions differ!

- Time inconsistency:  $c_1^{*,c} < c_1^*$  and  $c_2^{*,c} > c_2^*$

- 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

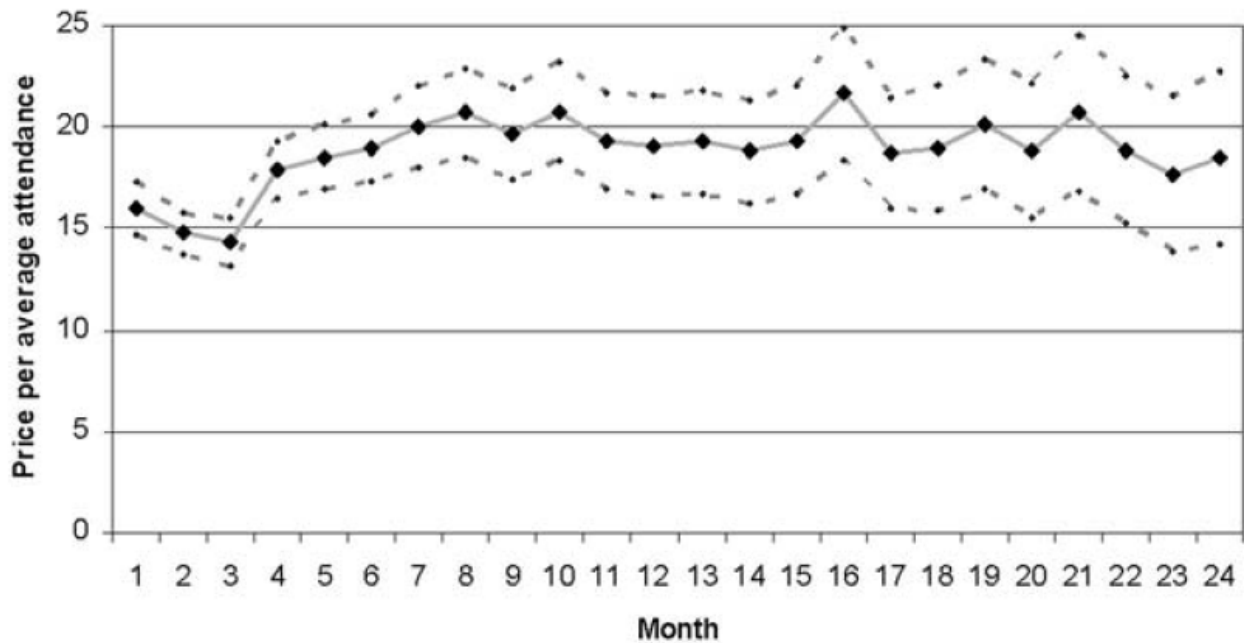
- Health club industry study (DellaVigna and Malmendier, *American Economic Review*, 2006)
- 3 health clubs
- Data on attendance from swiping cards
- Choice of contracts:
  - Monthly contract with average price of \$75
  - 10-visit pass for \$100
- Consider users that choose monthly contract. Attendance?

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

- Attend on average 4.8 times per *month*
- Pay on average over \$17

**B. Price per average attendance**  
(Monthly contracts with monthly fee  $\geq$  \$70)



- 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

- Expected Utility
- Insurance
- Portfolio Choice
- Then start Profit Maximization