Economics 101A
(Lecture 14)

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Outline

1. Time Consistency II
2. Time Inconsistency
3. Health Club Attendance
4. Production: Introduction
5. Production Function

1 Time Consistency II

- **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 $u\left(c_t, c_{t+1}, c_{t+2}\right)$:

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

- Discount factor is

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

  instead of

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

- What is the difference?

- *Immediate gratification:* $\beta < 1$

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

- Maximization problem:

$$\max U(c_1) + \frac{\beta}{1+\delta} EU(c_2)$$
$$s.t.\ c_1 + \frac{1}{1+r} c_2 \leq M_1' + \frac{1}{1+r} M_2$$

- First order conditions:

- Ratio of f.o.c.s:

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

- Now, **period 0** with commitment.

- Maximization problem:

$$\max U(c_0) + \frac{\beta}{1+\delta} U(c_1) + \frac{\beta}{(1+\delta)^2} EU(c_2)$$
$$s.t.\ c_1 + \frac{1}{1+r} c_2 \leq M_1' + \frac{1}{1+r} M_2$$

- First order conditions:

- Ratio of f.o.c.s:

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

- 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 overwight or obese;
  - $10bn health-club industry

- Is this testable?
  - In the laboratory?
  - In the field?

3 Health Club Attendance

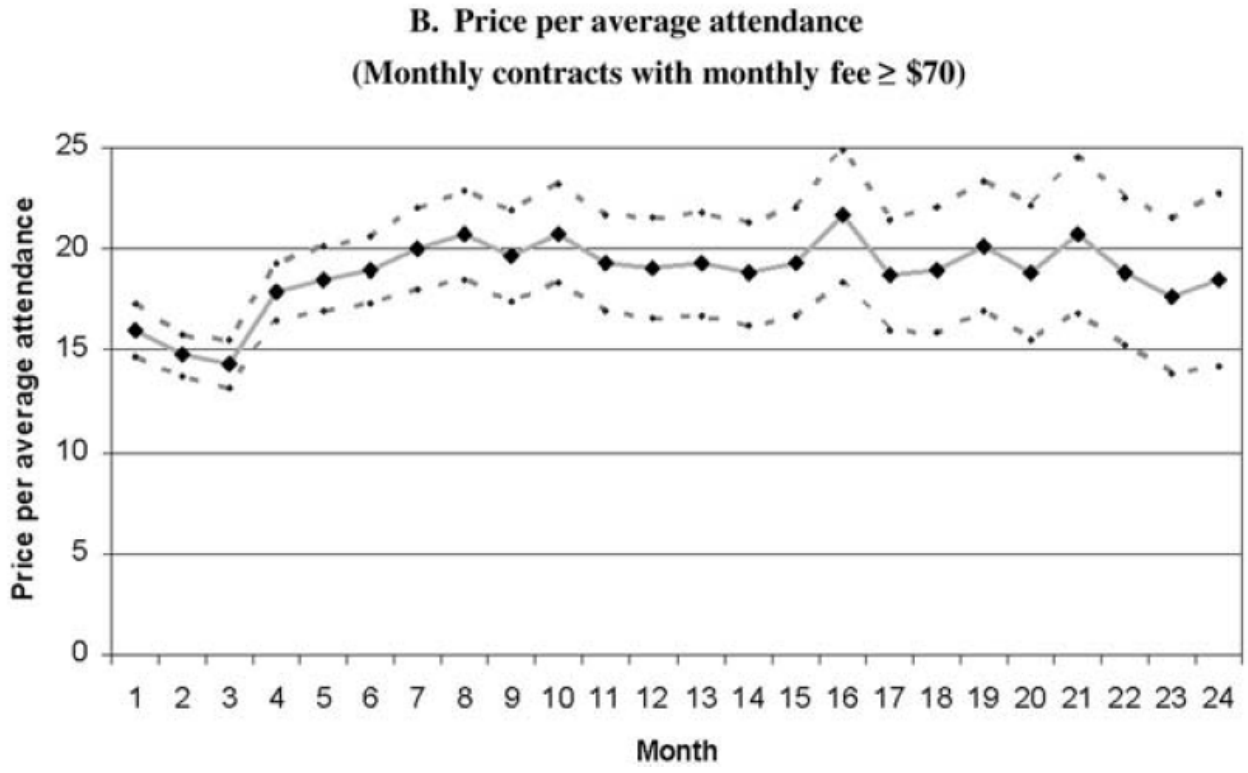
- Health club industry study (DellaVigna and Malmendier, 2002)
- 3 health clubs
- Data on attendance from swiping cards
- Choice of contracts:
  - Monthly contract with average price of $75
  - 10-visit pass for $100
- Consider users that choose monthly contract. Attendance?

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	3.45	16.01
	(0.80)	(0.13)	(0.66)
	$N = 829$	$N = 829$	$N = 829$
Month 2	80.65	5.46	14.76
	(0.45)	(0.19)	(0.52)
	$N = 758$	$N = 758$	$N = 758$
Month 3	70.18	4.89	14.34
	(1.05)	(0.18)	(0.58)
	$N = 753$	$N = 753$	$N = 753$
Month 4	81.79	4.57	17.89
	(0.26)	(0.19)	(0.75)
	$N = 728$	$N = 728$	$N = 728$
Month 5	81.93	4.42	18.53
	(0.25)	(0.19)	(0.80)
	$N = 701$	$N = 701$	$N = 701$
Month 6	81.94	4.32	18.95
	(0.29)	(0.19)	(0.84)
	$N = 607$	$N = 607$	$N = 607$
Months 1 to 6	75.26	4.36	17.27
	(0.27)	(0.14)	(0.54)
	$N = 866$	$N = 866$	$N = 866$
	Users initially enrolled with an annual contract, who joined at least 14 months before the end of sample period		
Year 1	66.32	4.36	15.22
	(0.37)	(0.36)	(1.25)
	$N = 145$	$N = 145$	$N = 145$

- 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 Production: Introduction

- Second half of the economy. **Production**

- Example. Ford and the Minivan (Petrin, 2002):
  - Ford had idea: "Mini/Max" (early '70s)
  - Did Ford produce it?
  - No!
  - Ford was worried of cannibalizing station wagon sector
  - Chrysler introduces Dodge Caravan (1984)
  - Chrysler: $1.5bn profits (by 1987)!

- Why need separate treatment?

- Perhaps firms maximize utility...

- ...we can be more precise:
  - Competition
  - Institutional structure

5 Production Function

- Nicholson, Ch. 7, pp. (183–190; 195–200, 9th)
- Production function: $y = f(\mathbf{z})$. Function $f : R_+^n \to R_+$
- Inputs $\mathbf{z} = (z_1, z_2, ..., z_n)$: labor, capital, land, human capital
- Output y: Minivan, Intel Pentium III, mangoes (Philippines)
- Properties of f:
  - no free lunches: $f(0) = 0$
  - positive marginal productivity: $f_i'(\mathbf{z}) > 0$
  - decreasing marginal productivity: $f_{i,i}''(\mathbf{z}) < 0$

- Isoquants $Q(y) = \{\mathbf{x} | f(\mathbf{x}) = y\}$

- Set of inputs $\mathbf{z}$ required to produce quantity y

- Special case. Two inputs:
  - $z_1 = L$ (labor)
  - $z_2 = K$ (capital)

- Isoquant: $f(L, K) - y = 0$

- Slope of isoquant $dK/dL = MRTS$

- Convex production function if convex isoquants

- Reasonable: combine two technologies and do better!

- Mathematically, $d^2K/d^2L =$

6 Next Lecture

- Two-Step Cost Minimization
- Solve an Example
- Cases in which s.o.c. are not satisfied
- Start Profit Maximization