Economics 101A
(Lecture 10)

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February 16, 2017

Outline

1. Application 2: Intertemporal choice

2. Application 3: Altruism and charitable donations

1 Intertemporal choice

- Nicholson Ch. 17, pp. 609-613

- So far, we assumed people live for one period only

- Now assume that people live for two periods:
  - $t = 0$ – people are young
  - $t = 1$ – people are old

- $t = 0$: income M_0, consumption c_0 at price $p_0 = 1$

- $t = 1$: income $M_1 > M_0$, consumption c_1 at price $p_1 = 1$

- Credit market available: can lend or borrow at interest rate r

- Budget constraint in period 1?

- Sources of income:

  - M_1

  - $(M_0 - c_0) * (1 + r)$ (this can be negative)

- Budget constraint:

$$c_1 \leq M_1 + (M_0 - c_0) * (1 + r)$$

or

$$c_0 + \frac{1}{1+r} c_1 \leq M_0 + \frac{1}{1+r} M_1$$

- Utility function?

- Assume
$$u(c_0, c_1) = U(c_0) + \frac{1}{1+\delta} U(c_1)$$

- $U' > 0$, $U'' < 0$

- δ is the discount rate

- Higher δ means higher impatience

- Elicitation of δ through hypothetical questions

- Person is indifferent between 1 hour of TV today and $1 + \delta$ hours of TV next period

Maximization problem:

$$\max U(c_0) + \frac{1}{1+\delta} U(c_1)$$
$$s.t.\ c_0 + \frac{1}{1+r} c_1 \leq M_0 + \frac{1}{1+r} M_1$$

- Lagrangean

- First order conditions:

- Ratio of f.o.c.s:

$$\frac{U'(c_0)}{U'(c_1)} = \frac{1+r}{1+\delta}$$

- Case $r = \delta$
  - $c_0^* \qquad c_1^*$?
  - Substitute into budget constraint using $c_0^* = c_1^* = c^*$:
  $$\frac{2+r}{1+r}c^* = \left[M_0 + \frac{1}{1+r}M_1\right]$$
  or
  $$c^* = \frac{1+r}{2+r}M_0 + \frac{1}{2+r}M_1$$
  - We solved problem virtually without any assumption on U!
  - Notice: $M_0 < c^* < M_1$

- Case $r > \delta$
  - $c_0^* \qquad c_1^*$?

- Comparative statics with respect to income M_0

- Rewrite ratio of f.o.c.s as

$$U'(c_0) - \frac{1+r}{1+\delta} U'(c_1) = 0$$

- Substitute c_1 in using $c_1 = M_1 + (M_0 - c_0)(1+r)$ to get

$$U'(c_0) - \frac{1+r}{1+\delta} U'(M_1 + (M_0 - c_0)(1+r)) = 0$$

- Apply implicit function theorem:

$$\frac{\partial c_0^*(r, \mathbf{M})}{\partial M_0} = -\frac{-\frac{1+r}{1+\delta} U''(c_1)(1+r)}{U''(c_0) - \frac{1+r}{1+\delta} U''(c_1) * (-(1+r))}$$

- Denominator is always negative

- Numerator is positive

- $\partial c_0^* (r, \mathbf{M}) / \partial M_0 > 0$ — consumption at time 0 is a normal good.

- Can also show $\partial c_0^* (r, \mathbf{M}) / \partial M_1 > 0$

- Comparative statics with respect to interest rate r

- Apply implicit function theorem:

$$
\begin{aligned}
\frac{\partial c_0^*(r, \mathbf{M})}{\partial r} &= -\frac{-\frac{1}{1+\delta}U'(c_1)}{U''(c_0) - \frac{1+r}{1+\delta}U''(c_1) * (-(1+r))} \\
&\quad -\frac{-\frac{1+r}{1+\delta}U''(c_1) * (M_0 - c_0)}{U''(c_0) - \frac{1+r}{1+\delta}U''(c_1) * (-(1+r))}
\end{aligned}
$$

- Denominator is always negative

- Numerator: First term negative (substitution eff.)

- Numerator: Second term (income effect:)
  - positive if $M_0 > c_0$
  - negative if $M_0 < c_0$

2 Altruism and Charitable Donations

- Maximize utility = satisfy self-interest?

- No, not necessarily

- 2-person economy:

  - Mark has income M_M and consumes c_M

  - Wendy has income M_W and consumes c_W

- One good: c, with price $p = 1$

- Utility function: $u(c)$, with $u' > 0$, $u'' < 0$

- Wendy is altruistic: she maximizes $u(c_W)+\alpha u\,(c_M)$ with $\alpha > 0$

- Mark simply maximizes $u(c_M)$

- Wendy can give a donation of income D to Mark.

- Wendy computes the utility of Mark as a function of the donation D

- Mark maximizes

$$\max_{c_M} u(c_M)$$
$$s.t.\ c_M \leq M_M + D$$

- Solution: $c_M^* = M_M + D$

- Wendy maximizes

$$\max_{c_M, D} u(c_W) + \alpha u\left(M_M + D\right)$$
$$s.t.\ c_W \leq M_W - D$$

- Rewrite as:

$$\max_{D} u(M_W - D) + \alpha u\left(M_M + D\right)$$

- First order condition:

$$-u'(M_W - D^*) + \alpha u'\left(M_M + D^*\right) = 0$$

- Second order conditions:

$$u''(M_W - D^*) + \alpha u''\left(M_M + D^*\right) < 0$$

- Assume $\alpha = 1$.
  - Solution?
  - $u'(M_W - D) = u'(M_M + D^*)$
  - $M_W - D^* = M_M + D^*$ or $D^* = (M_W - M_M)/2$
  - Transfer money so as to equate incomes!
  - Careful: $D < 0$ (negative donation!) if $M_M > M_W$

- Corrected maximization:

$$\max_D u(M_W - D) + \alpha u(M_M + D)$$
$$s.t. D \geq 0$$

- Solution ($\alpha = 1$):

$$D^* = \begin{cases} (M_W - M_M)/2 & \text{if } M_W - M_M > 0 \\ 0 & \text{otherwise} \end{cases}$$

- Assume interior solution. ($D^* > 0$)

- Comparative statics 1 (altruism):

$$\frac{\partial D^*}{\partial \alpha} = -\frac{u'(M_M + D^*)}{u''(M_W - D^*) + \alpha u''(M_M + D^*)} > 0$$

- Comparative statics 2 (income of donor):

$$\frac{\partial D^*}{\partial M_W} = -\frac{-u''(M_W + D^*)}{u''(M_W - D^*) + \alpha u''(M_M + D^*)} > 0$$

- Comparative statics 3 (income of recipient):

$$\frac{\partial D^*}{\partial M_M} = -\frac{\alpha u''(M_M + D^*)}{u''(M_W - D^*) + \alpha u''(M_M + D^*)} < 0$$

- A quick look at the evidence

- From Andreoni (2002)

3 Next Lectures

- After the midterm...

- Introduction to Probability

- Risk Aversion

- Coefficient of risk aversion