Lectures on Economic Inequality

Warwick, Summer 2016, Supplement to Slides 3

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- Overview: Convergence and Divergence
- Inequality and Divergence: Economic Factors
- Inequality and Divergence: Psychological Factors, Part 2
- Inequality, Polarization and Conflict
- Uneven Growth and Conflict

- Recall alternative approaches to the study of poverty
- Constraints
  - absence of credit
  - absence of insurance
  - nonconvexities (nutrition, health, education)
- Psychology
  - failed aspirations
  - informational biases
  - temptation, lack of self-control

Two Examples from Developing Countries

- Poor forego profitable small investments
  - Agricultural investment in Ghana (Udry-Anagol, 2006)
  - Fertilizer use in Kenya (Duflo-Kremer-Robinson, 2010)
  - Microenterprises in Sri Lanka (Mel-McKenzie-Woodruff, 2008)
- Public distribution debate
  - Public food distribution system in India
  - Huge debate on food versus cash transfers
  - Impulsive spending from cash (Khera 2011 survey)

Self-Control or Just Present Bias?

- Demand for commitment products in LDCs.
  - Lockboxes in the Gambia (Shipton, 1992)
  - Commitment savings in the Philippines (Ashraf-Karlan-Yin, 2006)
  - ROSCAS (Aliber, 2001, Gugerty, 2001, 2007, Anderson-Baland, 2002)
- Pressures to share
  - Extended-family demands on wealth
  - (Platteau 2000, Hoff-Sen 2006, Brune et al 2011)

Self-Control

- Intuitive idea:
  - Ability to follow through on an intended plan
  - (operationally, match a choice made with full precommitment)

- External versus internal devices.
  - External: locked savings, retirement plans, Roscas etc.
  - Internal: the use of psychological private rules (Ainslee).
  - see Strotz (1956), Phelps-Pollak (1968), or Laibson (1997).

- Other possibilities:
  - Dual self (Thaler-Shefrin 1981, Fudenberg-Levine 2006)
  - Resisting temptation (Gul-Pesendorfer, 2003)
  - Ainslee private rules as self-discovery (Ali 2011)

- Literature on the particular question pursued here:
  - Direct assumptions on preferences

    Banerjee-Mullainathan, 2010
  - Capital market imperfections that generate non-homotheticity

    Bernheim-Ray-Yeltekin, 1999, 2013

Preferences: The "Shape" of Temptation

Based on Banerjee-Mullainathan (2010) [BM]

- "The link to poverty within this framework comes from assuming that the fraction of the marginal dollar that is spent on temptation goods can depend on the level of consumption."

- Divide assets A into consumption c and bequest b:

$$A = c + b$$

while new assets A' are a random variable given by

$$A' = f(b, \theta).$$

- View as wealth plus labor income, so $f(0, \theta)$ generally positive.

- BM write

$$c = x + z$$

where x is a standard good and z is a temptation good.

- Two-period model. In period 2, agent maximizes

$$U(x_2) + V(z_2), \text{ subject to } x_2 + z_2 = A'.$$

- Let $x(A')$ and $z(A')$ be resulting consumption functions.

- In period 1, agent does not value $V(z_2)$, so maximizes

$$U(x_1) + V(z_1) + \delta \mathrm{E} U(x(A')) = U(x_1) + V(z_1) + \delta \mathrm{E} U(x(f(b, \theta)),$$

subject to the constraint $x_1 + z_1 + b = A$.

- Leads to the first-order condition:

$$\begin{aligned} U'(x_1) = V'(z_1) &= \delta \mathrm{E} U'(x(f(b,\theta)) f'(b,\theta) x'(f(b,\theta)) \\ &= \delta \mathrm{E} U'(x(f(b,\theta)) f'(b,\theta) [1 - z'(f(b,\theta))], \end{aligned}$$

which BM call the modified Euler equation.

- Obviously, similar equation would hold in multi-period model.

Some Immediate Implications

- The desire to commit.
  - Doesn't fully emerge in this framework because commitment blocks both x- and z-consumption.
  - But would commit if it could protect x-consumption and hinder z-consumption.
  - Example: purchase of durable goods today.
- The effect of sin taxes.
  - Imagine a future tax on period-2 consumption of z.
  - Effect on savings will depend on what happens to derivative $x'(A')$.
  - Could go up or down.

The Shape Assumption

- Note that the formulation does not restrict curvature of $x(A')$ or $z(A')$ in any way.
- Main assumption. z is strictly concave.
  - Temptation matters less at the margin as assets go up.
- BM justify this by saying that:
  - temptations are visceral and kick in more at low incomes.
  - temptation goods are more divisible
  - "it may be easier for a rich person to say no to a relative who wants a few hundred dollars . . . than for a poor person to refuse one who wants just a couple of dollars for a meal."
- Without commenting on any of this, let's just say it's an empirical question.

Implications of the Shape Assumption

- (Under additional presumption that Euler equation still valid.)
- The poor appear more impatient.
- Proof: effective discount factor given by

$$\hat{\delta} = \delta x'(A').$$

- Possible anti-smoothing of consumption.
- Raise future labor income by uniformly raising $f(0, \theta)$.
- In standard model with no z, consumption today $\uparrow$ (smoothing).
- Here this might flip: countervailing effect given by the fact that $z'(A')$ flattens.
- So modified Euler equation could generate more saving.

- Poverty traps.
- Reconsider maximization problem:

$$U(x_1) + V(z_1) + \delta \mathrm{E} U(x(f(b, \theta)),$$

subject to the constraint $x_1 + z_1 + b = A$.

- Write $c_1 = x_1 + z_1$ let W be indirect utility function, so maximize

$$W(c_1) + \delta \mathrm{E} U(x(f(b, \theta)),$$

subject to $c_1 + b = A$.

- Recall monotonicity lemma: $b(A)$ nondecreasing in A.
- If x is concave, then the problem is concave and no jump in b.
- But if z is concave, b could jump up.
- Interpreted as a "poverty trap."

- Possible Lack of Prudence.

  - An increase in income uncertainty encourages savings in a safe technology:

  - Needs a third-derivative restriction on the utility function.

  - No longer sufficient in this case.

- Investment Scale.

  - Suppose an investment is feasible, has a given return and upper bound on scale.

  - In standard model, the upper bound is unimportant in decision to invest.

  - Here an increase in the bound can matter, as it lowers the "temptation derivative" $z'(A')$.

- Adverse effects of credit.

  - Today's self can become worse off if tomorrow's self has access to credit.

  - Need a three-period model (at least) for this.

  - BM show that with declining temptations, period-0 self might allow period-1 self to have a big loan (and so get temptation to decline) rather than a small loan which will all be blown on the z-good.

- All the results depend on assuming that the poor are more tempted than the rich.
  - This begs the main question.
- Bernheim, Ray and Yeltekin (1999, 2013) take a different approach.
  - They assume that the underlying model is homothetic in preferences.
  - The only non-homothetic feature is an imperfect credit market.

Assets and Incomes

- Accumulation

$$A_t = c_t + \frac{A_{t+1}}{\alpha}.$$

- Imperfect credit market

$$A_t \geq B > 0.$$

  - Interpretation: A = financial assets + pv of labor income

$$P = \frac{\alpha}{\alpha - 1} y,$$

  - and

$$B = \Psi(P)$$

  - e.g.,

$$B = \psi P \text{ for some } \psi \in (0, 1]$$

Preferences $u(c) = c^{1-\sigma}/(1-\sigma)$, for $\sigma > 0$.

$$u(c_0) + \beta \sum_{t=1}^{\infty} \delta^t u(c_t), \quad 0 < \beta < 1.$$

- Standard model: $\beta = 1$.
  - If $\delta\alpha > 1$ [growth] and $\mu \equiv \frac{1}{\alpha}(\delta\alpha)^{1/\sigma} < 1$ [discounting], then

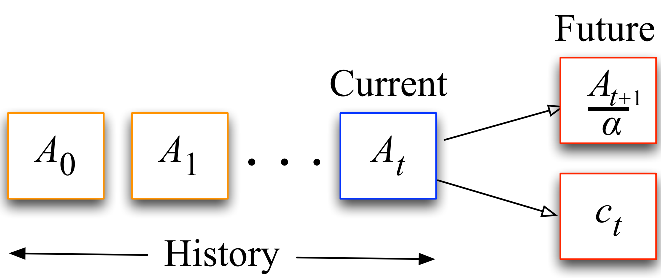
$$A_{t+1} = (\delta\alpha)^{1/\sigma} A_t$$

$$c_t = (1-\mu)A_t.$$

  - $\longrightarrow$ Ramsey policy.
- If $\beta < 1$, optimal plan is time-inconsistent.

Policies and Values

- Policy ϕ specifies continuation asset A_{t+1} after every history



- And so generates values and payoffs:

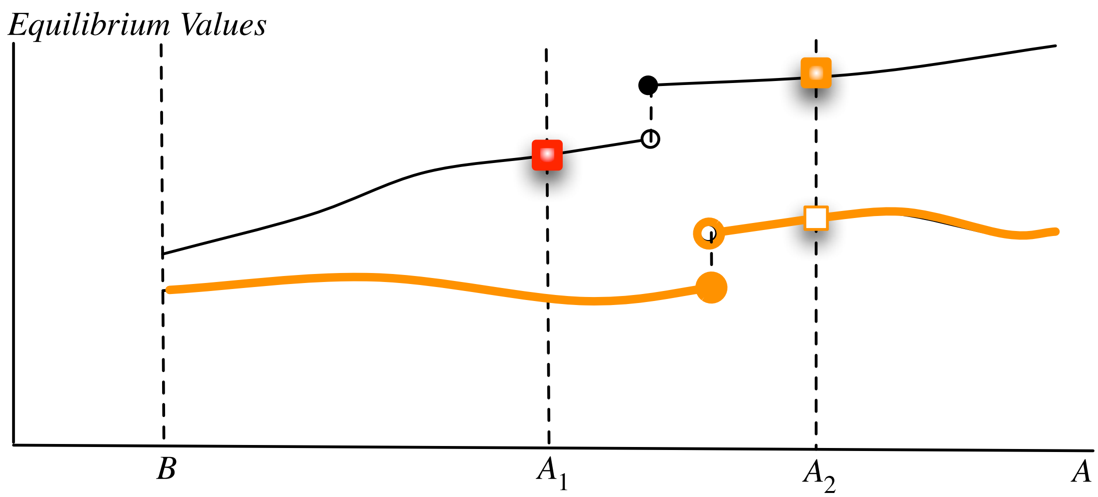
$V(h_t) \equiv u(c_t) + \delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \ldots$

$P(h_t) \equiv u(c_t) + \beta\left[\delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \ldots\right] = u(c_t) + \beta\delta V(h_t.\phi(h_t))$

- No self-starvation: $c \geq \nu A$ for some ν tiny but positive.

Equilibrium

- Following the policy is better than trying something else.
- $P(h_t) \geq u\left(A(h_t) - \frac{x}{\alpha}\right) + \beta\delta V(h_t.x)$ for every $x \in [B, \alpha A(h_t)]$.



Self-Control Definition

- Self-control at A:

$\Rightarrow$ Accumulation at A in some equilibrium.

- Strong self-control at A:

$\Rightarrow$ $A_t \to \infty$ from A, in some equilibrium.

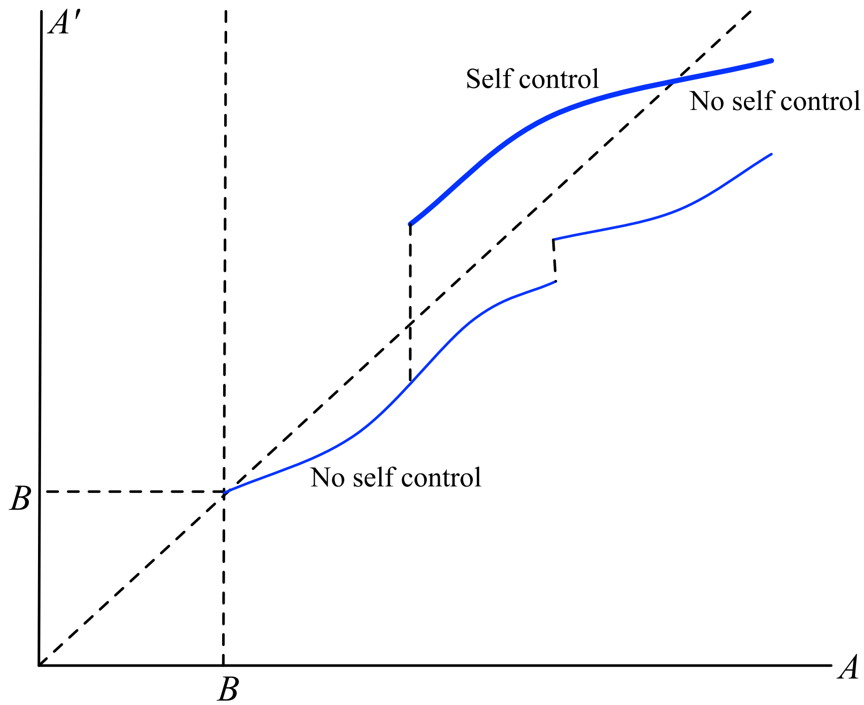
- No self-control at A:

$\Rightarrow$ No accumulation at A in any equilibrium.

- Poverty trap at A:

$\Rightarrow$ Slide to credit limit B from A in every equilibrium.

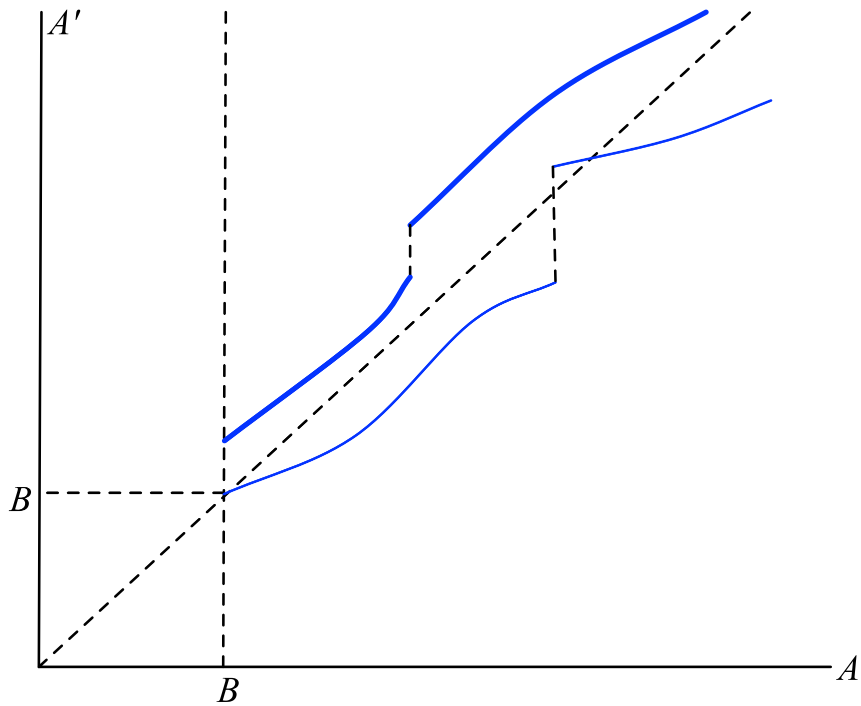
Self-Control and No Self-Control



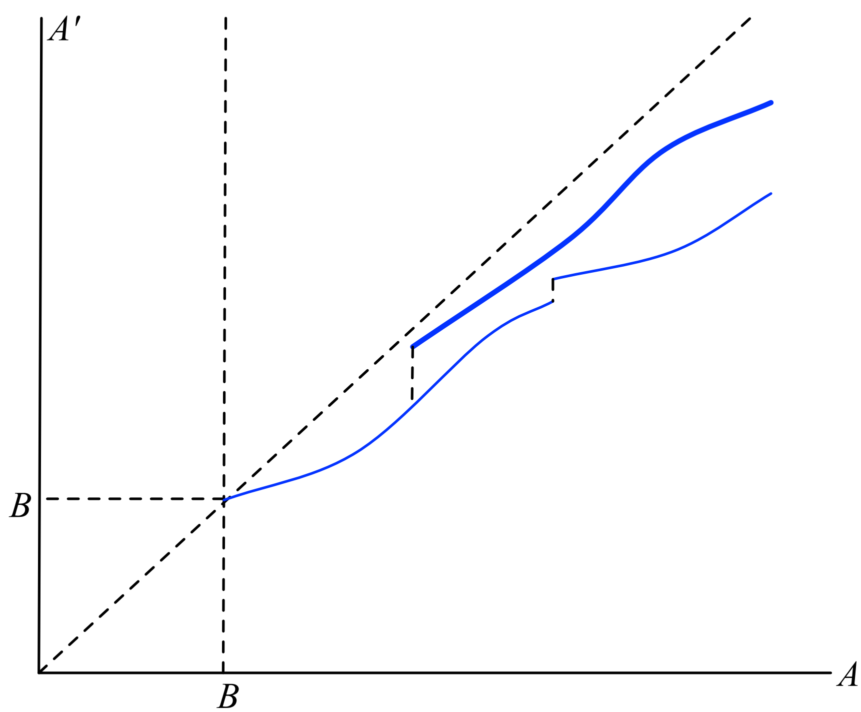
Uniformity and Nonuniformity

- Uniform case:
  - Self control at every A, or its absence at every A.
- Nonuniform case:
  - Self-control at A, no self-control at A'.

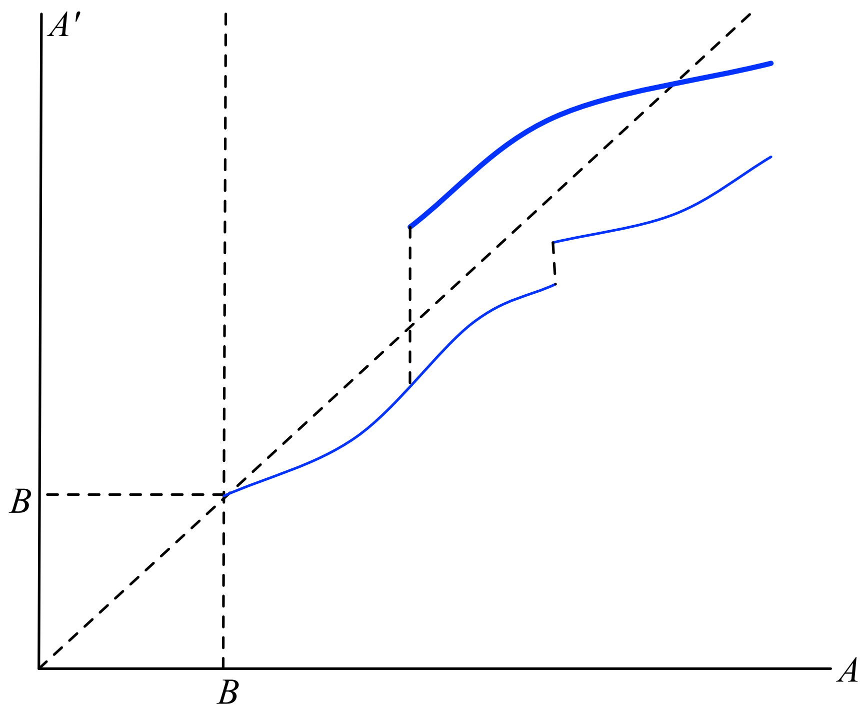
Uniformity and Nonuniformity



Uniformity and Nonuniformity



Uniformity and Nonuniformity



Uniformity and Nonuniformity

- Uniform case:
  - Self control at every A, or its absence at every A.
- Nonuniform case:
  - Self-control at A, no self-control at A'.

- Theorem. Suppose no credit constraints, so that $B = 0$.
  - Then every case is uniform.

- Poverty bias not built in; contrast Banerjee and Mullainathan (2010).

Credit Constraints and Non-Uniformity

- $B > 0$ destroys scale-neutrality (in A), but how exactly?

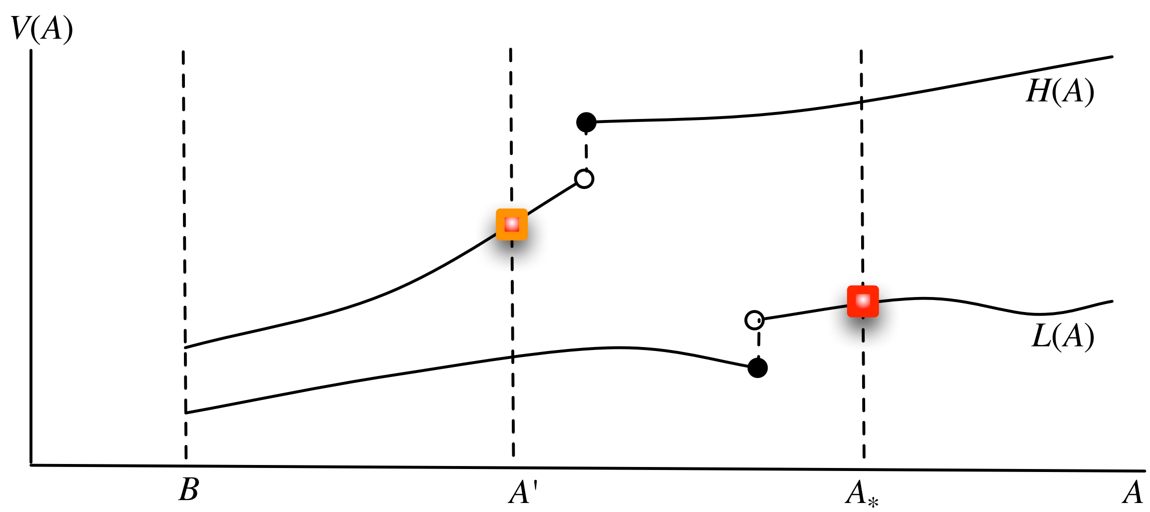
- Some intuition:

  - Think of the consequences of a lapse in self-control.
  - More severe when the individual has more assets; hence more to lose.

- Problem:

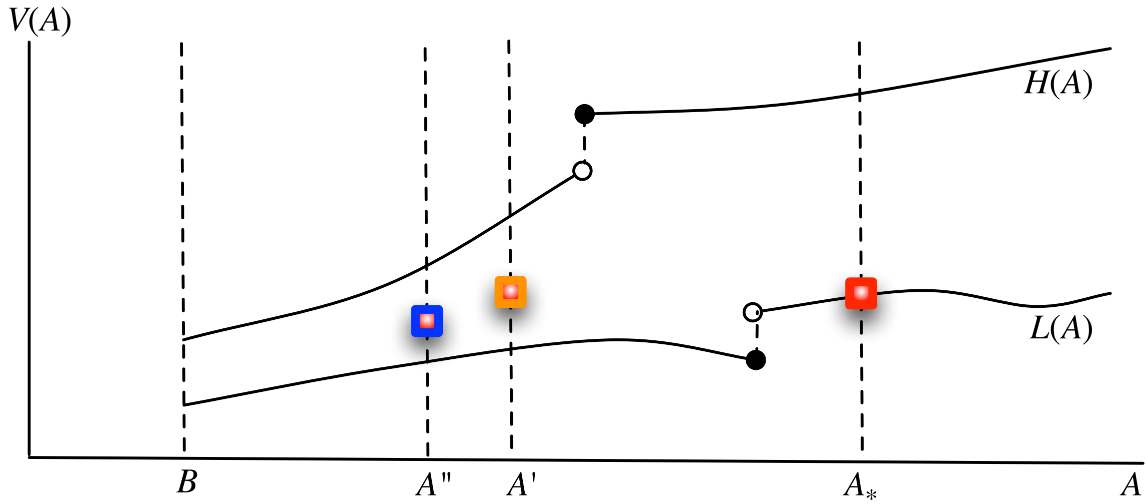
  - Not bad as intuition, but unfortunately does not work.
  - Severity isn't monotone in assets.
  - To see this, first we understand the structure of worst punishments.

The Structure of Lowest Values



- Theorem. If $A' > B$ is continuation for A_* under lowest value at A_*, then A' is followed by value $H^-(A')$.

The Structure of Lowest Values



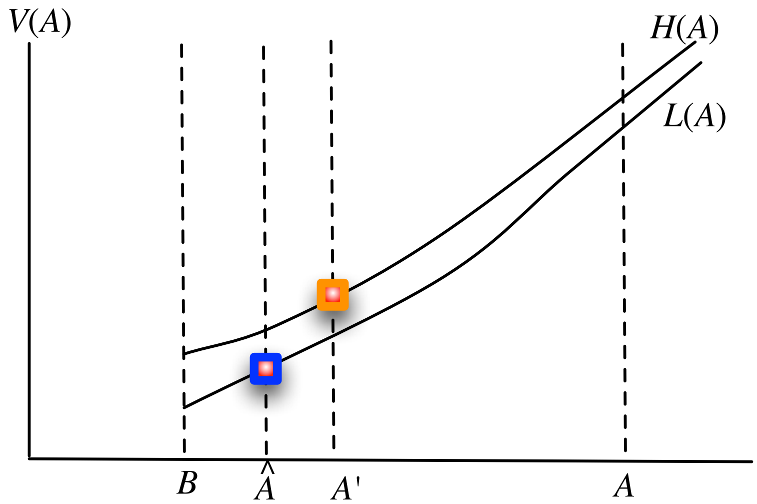
Theorem. If $A' > B$ is continuation for A_* under lowest value at A_*, then A' is followed by value $H^-(A')$.

$u(c''_t) + \beta\delta\text{Blue} = u(c'_t) + \beta\delta\text{Orange} \Rightarrow u(c''_t) + \delta\text{Blue} < u(c'_t) + \delta\text{Orange}$.

Lowest Values

- Simple structure. Following a deviation:
- One more binge, then the highest-value program.
- Like Abreu penal codes, but for entirely different reasons.
- Argument also reveals why $L(A)$ jumps up occasionally.

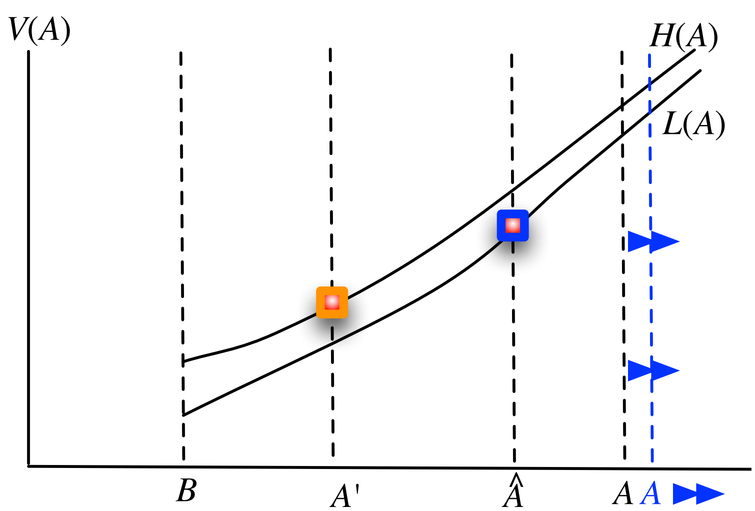
- maximize $u(A - x/\alpha) + \beta\delta L(x)$, say max at $x = \hat{A}$.



- Not possible; get a contradiction:

$u(\hat{c}_t) + \beta\delta\text{Blue} \leq u(c'_t) + \beta\delta\text{Orange} \Rightarrow u(\hat{c}_t) + \delta\text{Blue} < u(c'_t) + \delta\text{Orange}$.

- maximize $u(A - x/\alpha) + \beta\delta L(x)$, say max at $x = \hat{A}$.

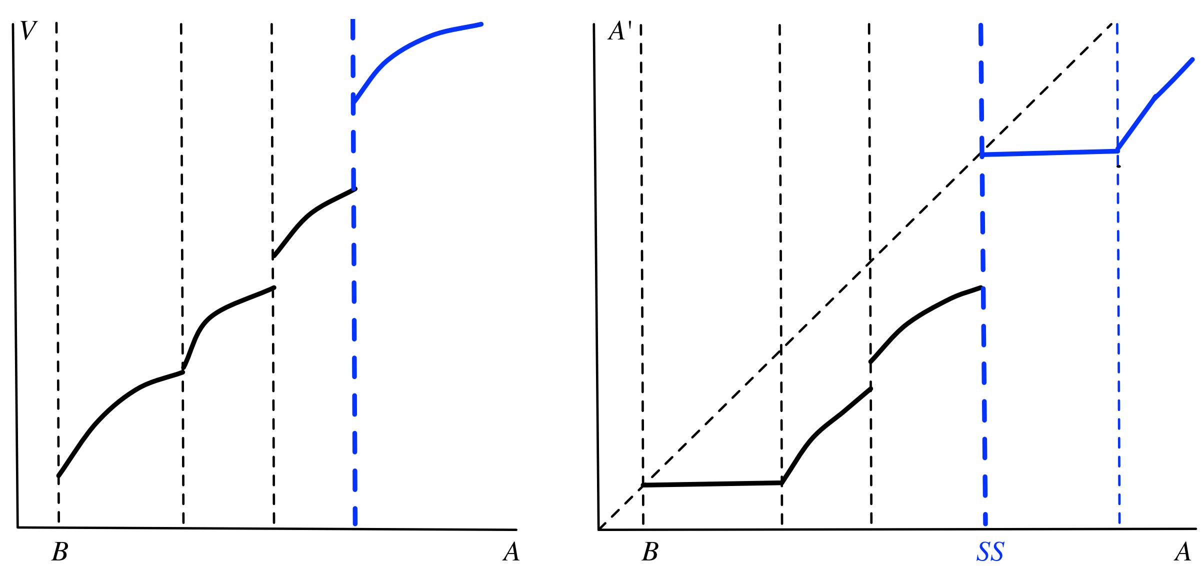


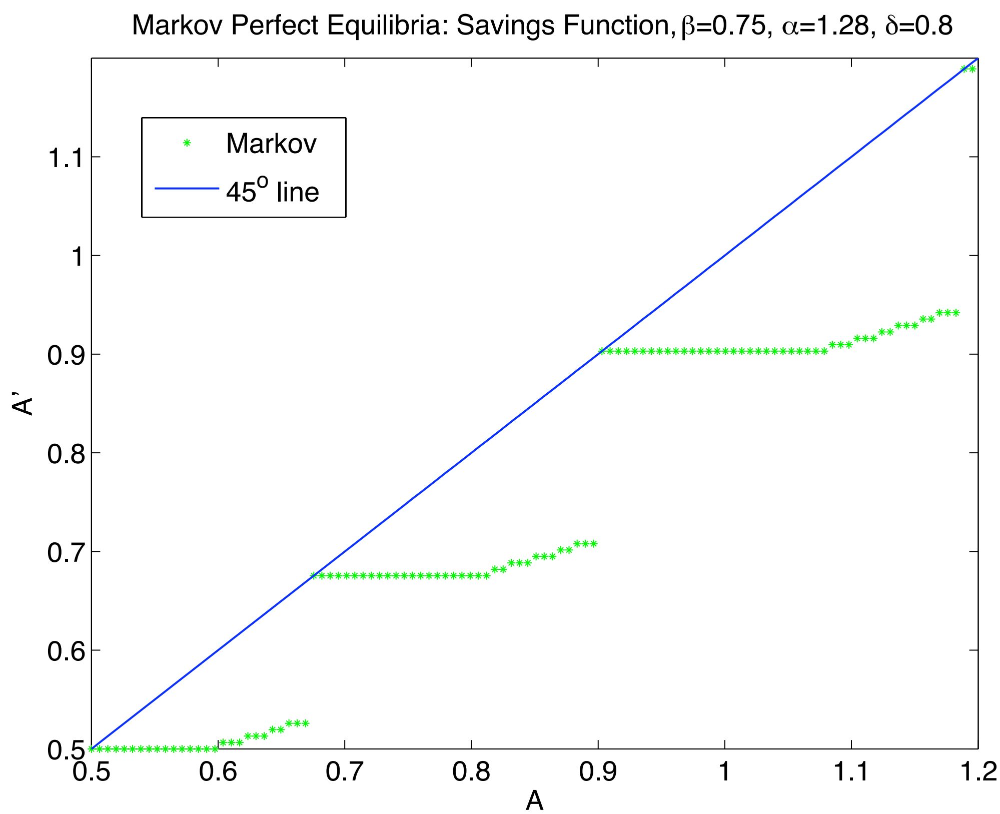
- So $\hat{A} > A'$, and $u(\hat{c}_t) + \beta\delta\text{Blue} = u(c'_t) + \beta\delta\text{Orange}$.
- By concavity of u, A' may need to jump up, so $L(A)$ jumps too.

Argument So Far

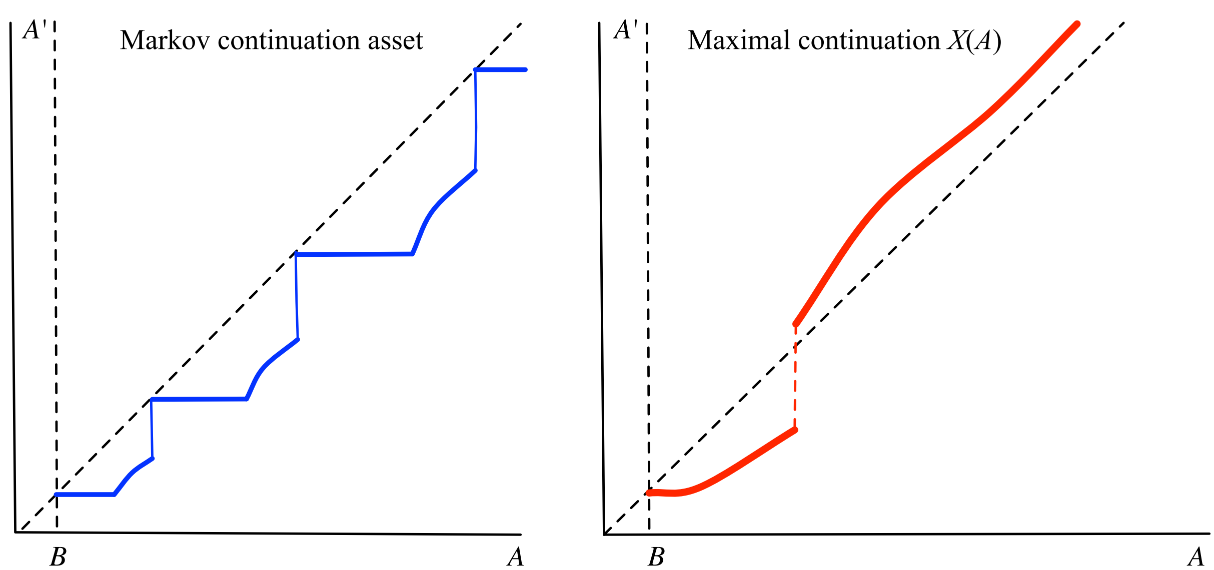
- The problem of internal self-control is both simple and complex.
- Simple: what happens after lapse of control is easy to describe.
  - Lapse followed by one round of high c, then back to best path.
- Complex: jump in worst values makes comparative statics hard.
  - As wealth goes up, can get cycles of control / failure of control.

Markov Equilibrium: Values and Continuations

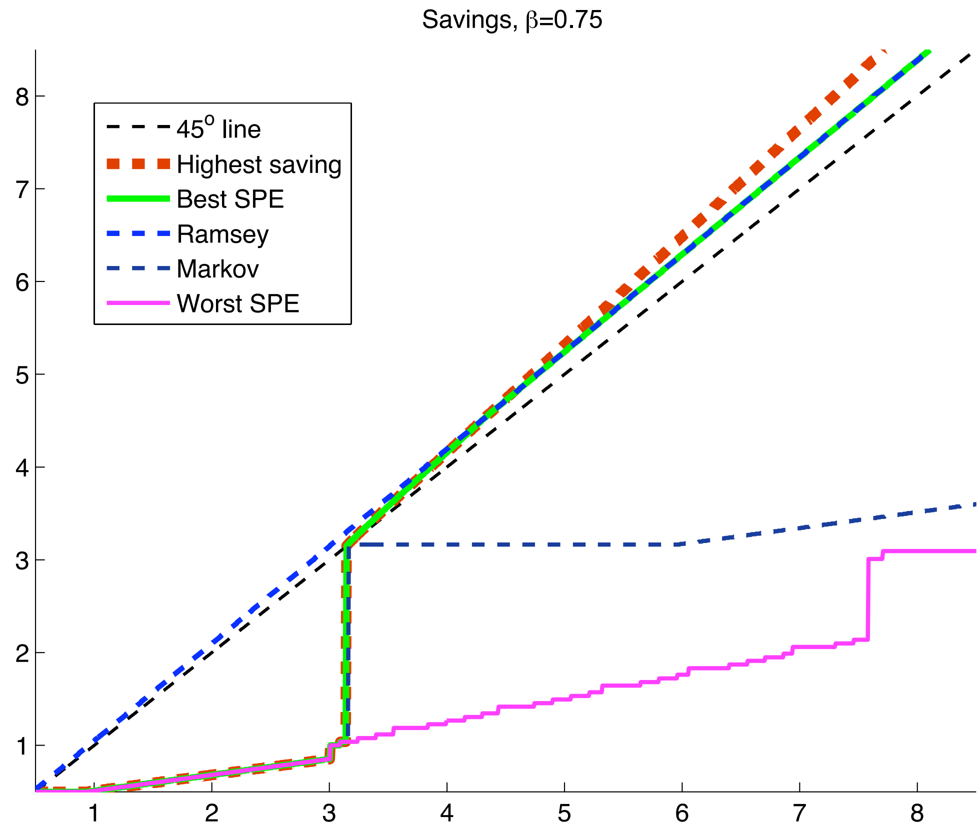




- Illustration of the nonuniform case:



- But the simulations suggest that this is not true with history-dependent strategies.


Savings, β=0.75
45° line
Highest saving
Best SPE
Ramsey
Markov
Worst SPE
1
2
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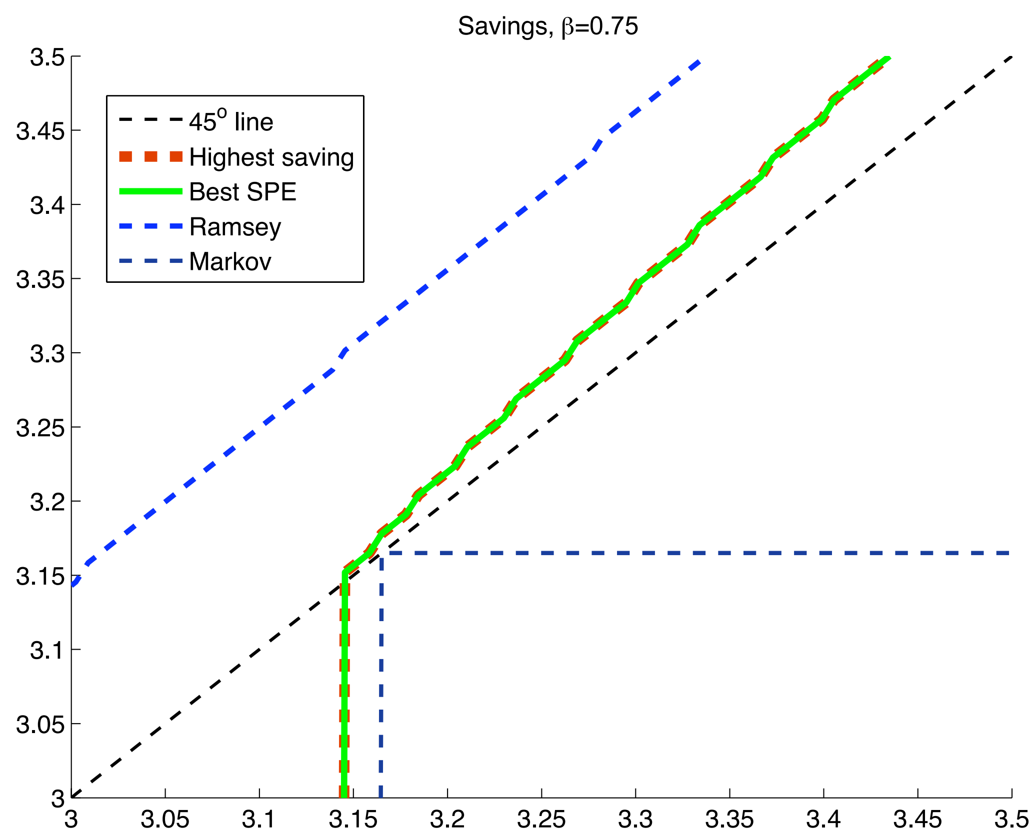
Savings, β=0.75
45° line
Highest saving
Best SPE
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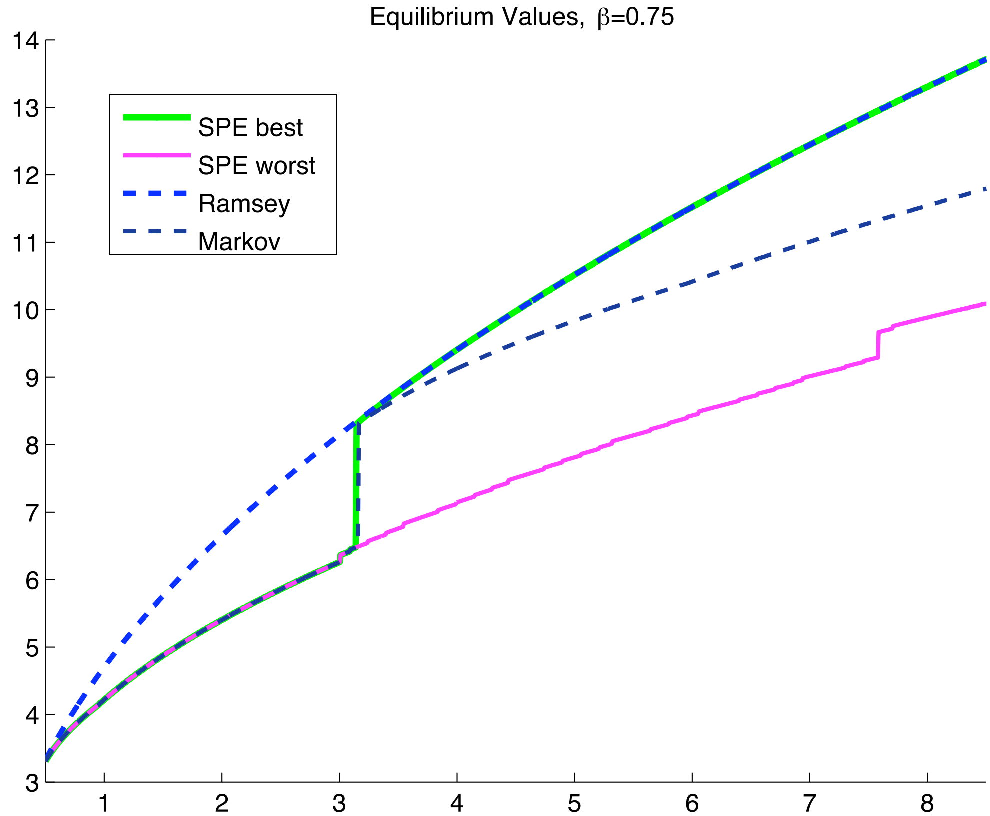
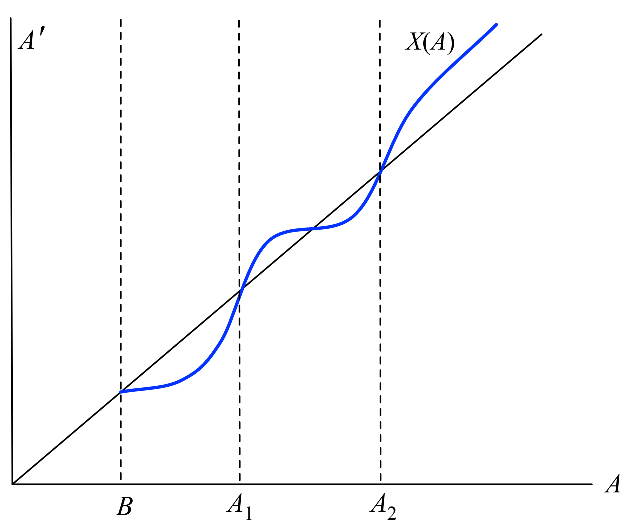


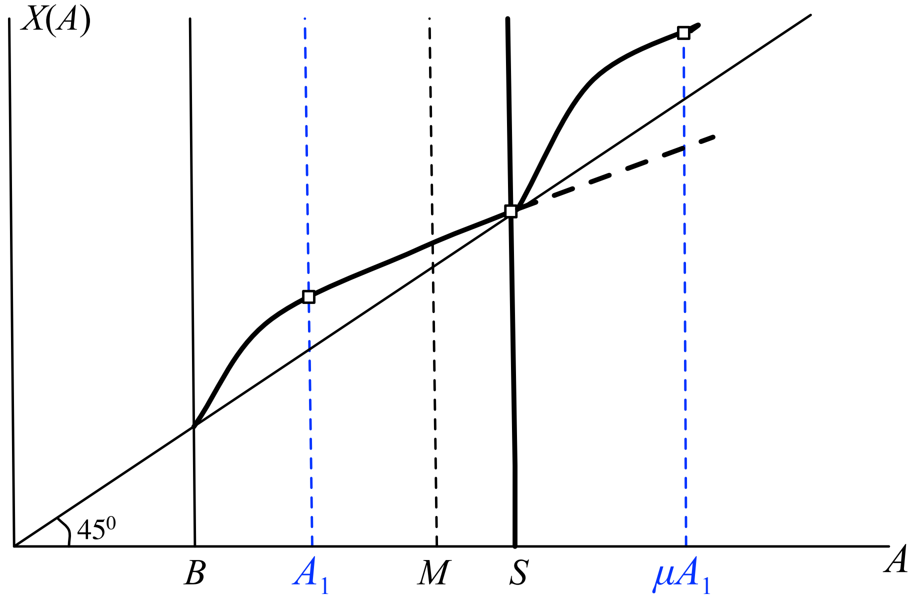
Theorem. [Central Result]. In the non-uniform case,

- There is $A_1 > B$ such that every $A \in [B, A_1)$ exhibits a poverty trap.
- There is $A_2 \geq A_1$ such that every $A \geq A_2$ exhibits strong self-control.

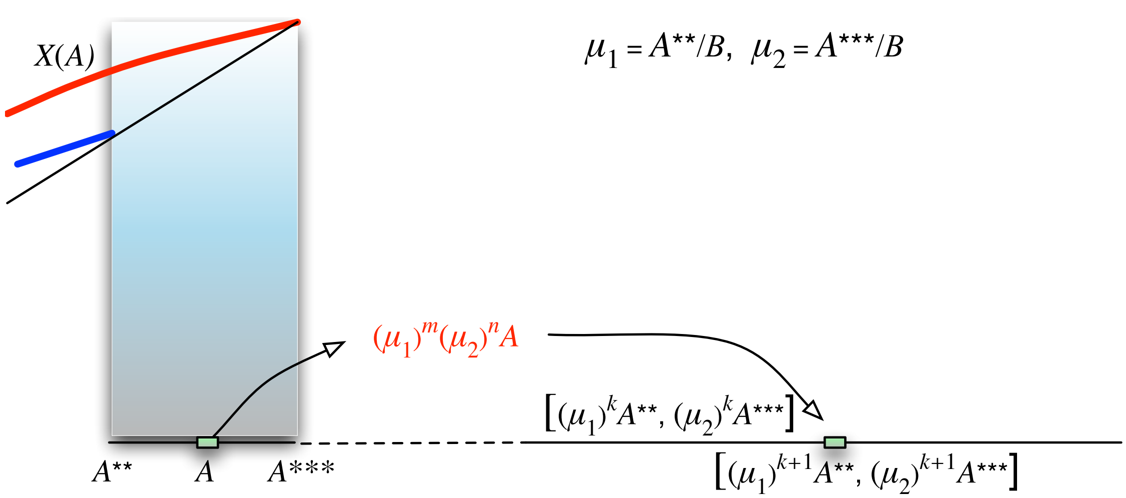


- Proof Outline I. The Poverty Trap

- $X(A)$: maximum wealth choice. Then $X(A) < A$ close to B.



- Proof Outline II. Strong Self-Control, contd.



Some Implications

1. Easier Access to Credit Has Ambiguous Effects

- Conventional theory: more abundant credit reduces saving.
- Implications here are more nuanced.
- Modified neutrality: only B/A matters.
- Easier credit (lower B) reduces A_1 and A_2 thresholds:
- More individuals successfully exercise self-control
- Offsetting effect: those who fall into trap will fall further.
- Summary: ambiguous effects, depending on where you start.

2. The Demand for Commitment Devices

- Demand for external commitment devices by poor households.
- Surprisingly little evidence that this demand is more widespread.
- (But: Ariely-Wertenbroch 2002, Beshears-Choi-Laibson-Madrian 2011)
- Need some reliance on internal mechanisms (value of flexibility).
- But external devices undermine efficacy of internal mechanisms.
- Who demands external devices?
- The asset-poor, and the income-rich if $B \propto$ permanent income.
- The asset-rich or the income-poor prefer internal mechanisms.
- Income-rich generally also asset-rich, so net effect is ambiguous.

3. Designing Accounts to Promote Saving

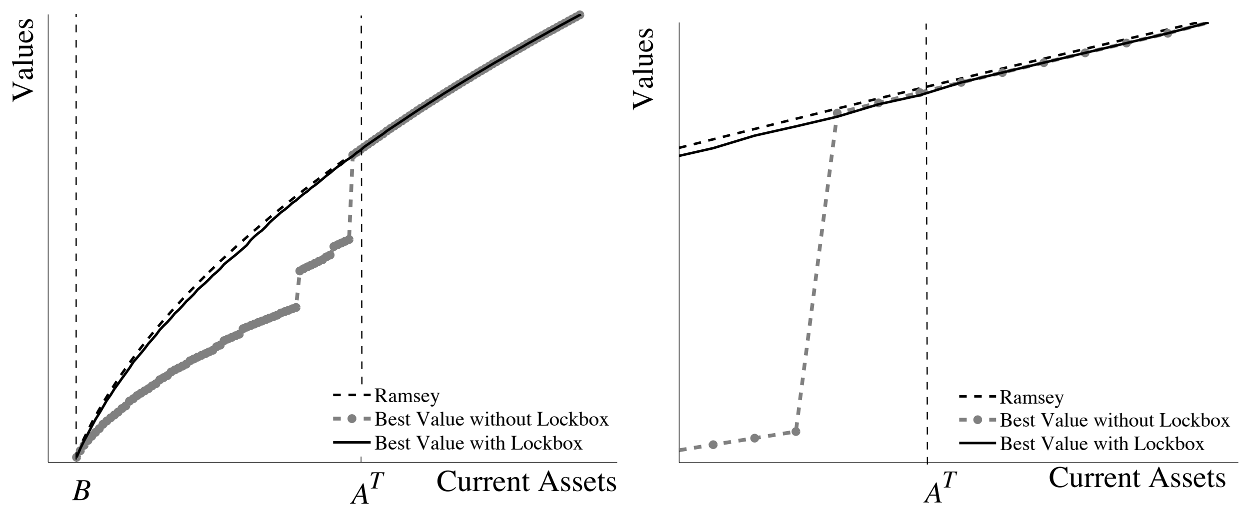
- Example: retirement savings programs.
  - Significant variation in lock-up across plans
  - In addition, large variation in stringency of contributions.
- Recall: lock-up has both upside and downside.
  - Programs that capitalize on upside while avoiding downside?
  - Idea: lock up funds until some target, then remove the lock.
  - Can (should) allow each individual to select personal target.

- To formalize, use taste shock for uncertain environment:

$$u(c, \eta) = \eta \frac{c^{1-\sigma}}{1-\sigma},$$

  - Lock-up account that unlocks once a threshold is reached.
  - Threshold slightly higher than the threshold that permits accumulation.
  - If lower, the agent will slide back once the account is unlocked.
  - Note: nowhere close to solving the optimal design problem.

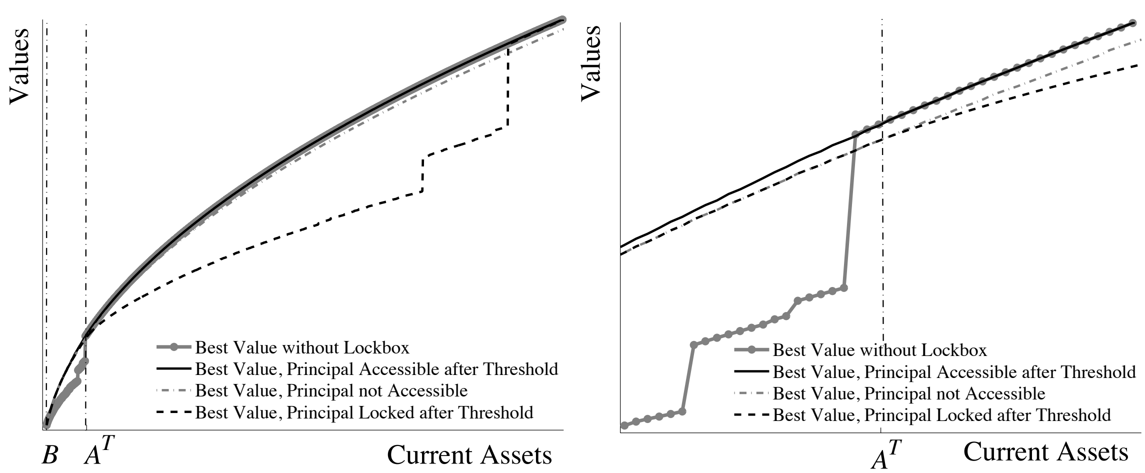
Alternative A. commitment savings up to threshold, full release thereafter.



- Both the lock-up and the release are important . . .

Alternative B: commitment savings forever, principal always locked.

Alternative C: usual saving after threshold, commitment principal locked.



Note: Alternative C can be worse than Alternative B.

4. Asset-Specific MPCs

- Hatsopoulos-Krugman-Poterba (1989), Thaler (1990), Laibson (1997)

- $A =$ financial assets $+$ permanent income.

- Jump in financial assets

- $B/A = B/($financial assets $+$ permanent income$)$.

- B/A falls: can switch from decumulation to accumulation.

- So low MPC from financial assets.

- Jump in income. If $B/($perm inc$)$ constant, $B/A \uparrow$.

- High MPC in non-uniform case.

- At best B unchanged; then identical MPCs.

Summary

- We know that a failure of self-control can lead to poverty.

- Is the opposite implication true?

- Model constructed for scale-neutrality:

- Result isn't "built-in" by presuming that the poor are tempted more.

- Ainslee's personal rules as history-dependent equilibria

- Structure of optimal personal rules is remarkably simple:

- Deviations entail "falling off" the wagon, then "climbing back on".

- Main result: ability to impose self-control rises with wealth.
  - In fact, the model generates a poverty/self-control trap.
- Novel policy implications:
  - Among them: interplay between external and internal commitments
  - External self-control devices can undermine internal self-control
  - Lock-box savings accounts with self-established targets and unlocking of principal may be particularly effective devices for increasing saving