Poverty and Self-Control

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with Doug Bernheim, Stanford, and Sevin Yeltekin, Carnegie Mellon

Alternative Approaches to the Study of Poverty

- Constraints:

- absence of credit: low investments
- absence of insurance: vulnerability to stochastic shocks
- nonconvexity in feasible set (nutrition, health, education)

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- Constraints:
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  - nonconvexity in feasible set (nutrition, health, education)
- Psychology
  - failed aspirations
  - lack of or biases in information
  - temptation, lack of self-control, inability to commit
- Poverty / self-control trap? poverty $\Rightarrow$ limited self-control.

Two Examples from Developing Countries

- Investments

- Poor forego profitable small investments

- Goldstein-Udry (1999), Udry-Anagol (2006): agricultural investment in Ghana

- Duflo-Kremer-Robinson (2010): fertilizer use in Kenya

- de Mel-McKenzie-Woodruff (2008): Sri Lankan microenterprise

- Survey in Banerjee-Duffo (2011)

Two Examples from Developing Countries, contd.

- Public Distribution Debate
  - Public food distribution system in India
  - Huge debate on food versus cash transfers
  - Khera (2011) survey: impulsive spending from cash.
- Similar issues elsewhere:
  - e.g. conditional transfers, Progresa/Oportunidades
  - microfinance: lending to women

Self-Control or Just Present Bias?

- Use of commitment products in LDCs.
  - Ashraf et al (2003) review
  - Shipton (1992) on the use of lockboxes in the Gambia.
  - Ashraf-Karlan-Yin (2006) field experiment on commitment savings in the Philippines
  - ROSCAS: Aliber (2001), Gugerty (2001, 2007), Anderson-Baland (2002).
  - (see also theory in Ambec and Treich (2007) and Basu (2010)).

Poverty and Self-Control:

- If self-control is a fixed trait, policy outlook not good.

- Another possibility: poverty *per se* may damage self-control.

- Source of poverty traps that complements nonconvexities or aspirations failure.

- Policies that help the poor begin to accumulate assets may be highly effective, even if they are temporary.

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- More specifically:
- 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:
  - Costly will-power, e.g., dual self models (Thaler-Shefrin 1981, Fudenberg-Levine 2006)
  - Resisting tempting alternatives (Gul and Pesendorfer 2003)
  - Ainslee private rules as self-discovery (Ali 2011)
- Theoretical literature on the approach pursued here:
  - Bernheim-Ray-Yeltekin (1999)
  - Banerjee-Mullainathan (2010)

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- Credit Constraint:

$$A_t \geq B = \Psi(P) > 0.$$

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- Standard model: $\beta = 1$.

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

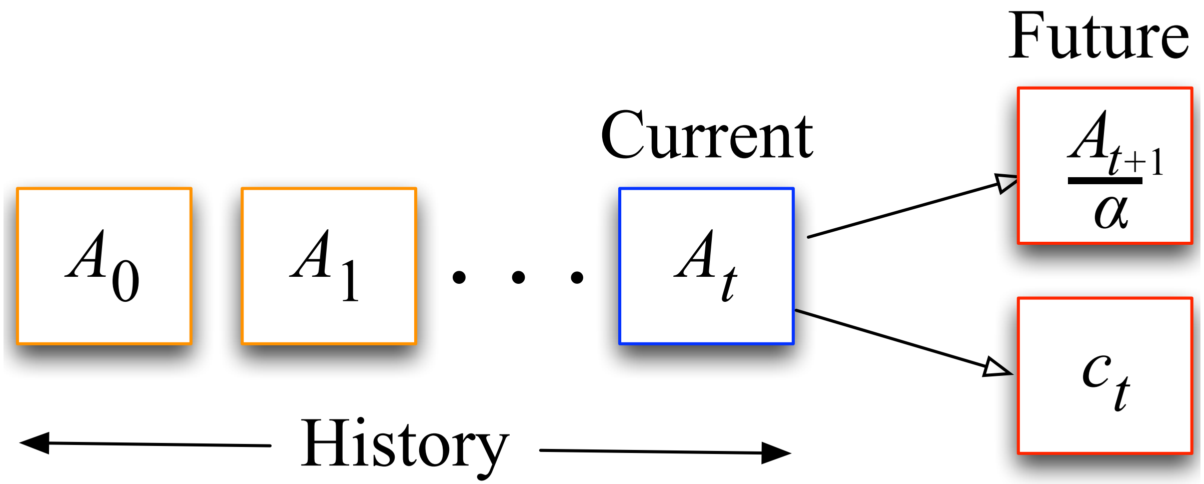
$$A_{t+1} = (\delta\alpha)^{1/\sigma} A_t$$

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

- $\longrightarrow$ Ramsey policy.

Policies and Values

- A policy ϕ specifies continuation asset A_{t+1} after every history.



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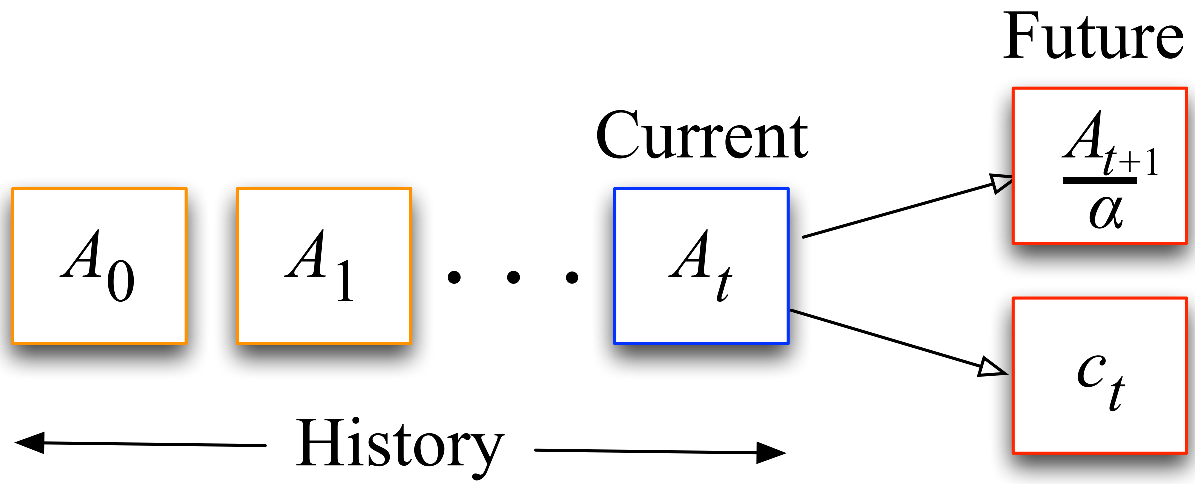

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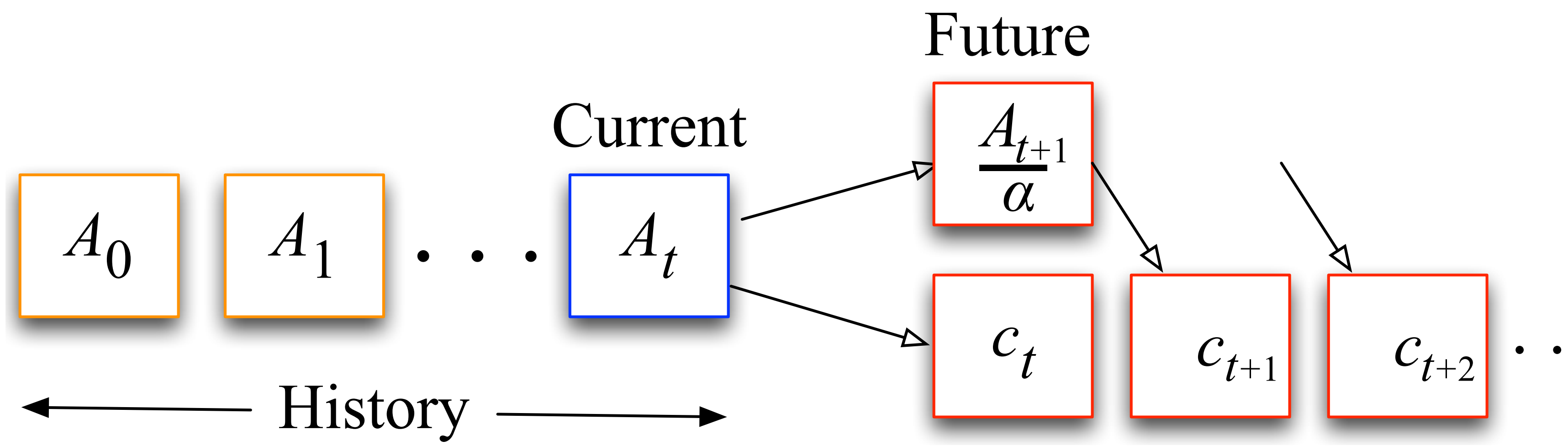

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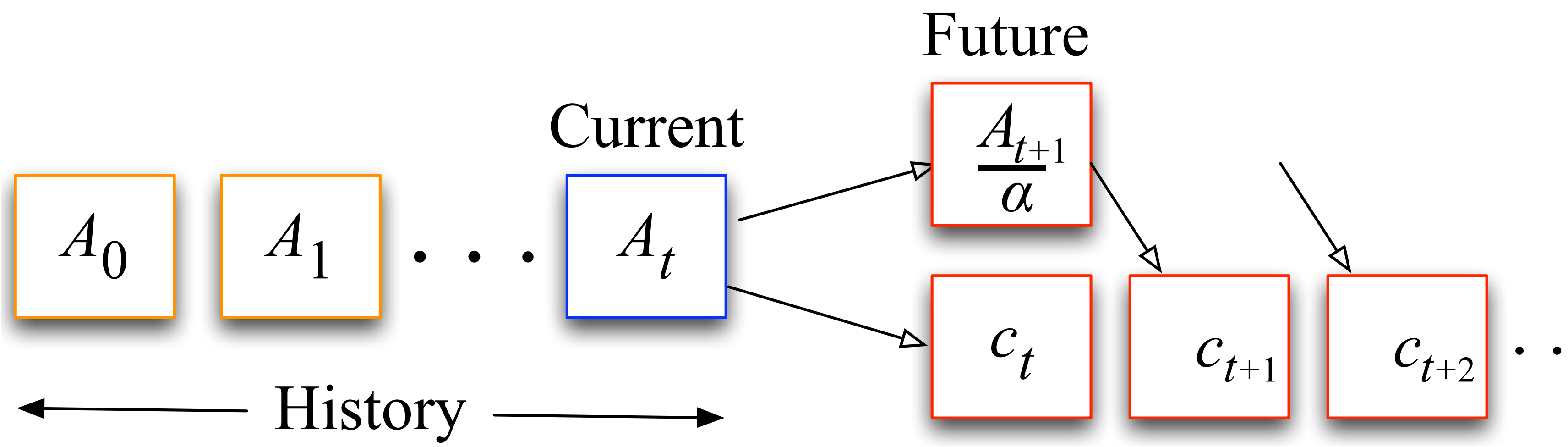

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$$V(h_t) \equiv u(c_t) + \delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \ldots$$

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

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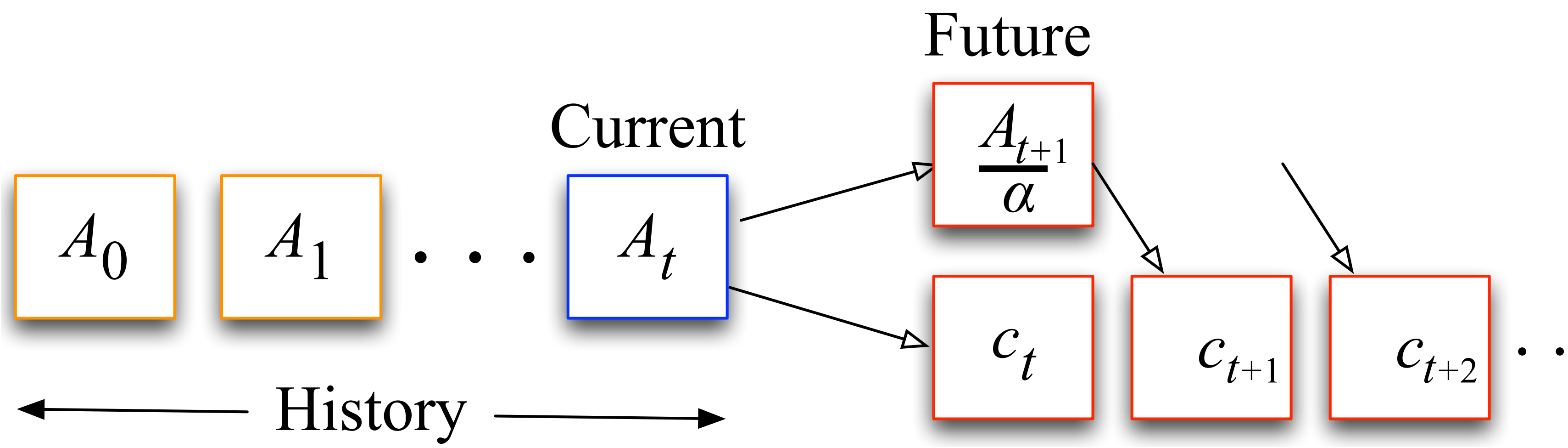

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- No self-starvation: $c \geq \nu A$ for some ν tiny but positive.

Equilibrium Policy

- 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 $x \in [B, \alpha(1-\nu)A(h_t)]$.

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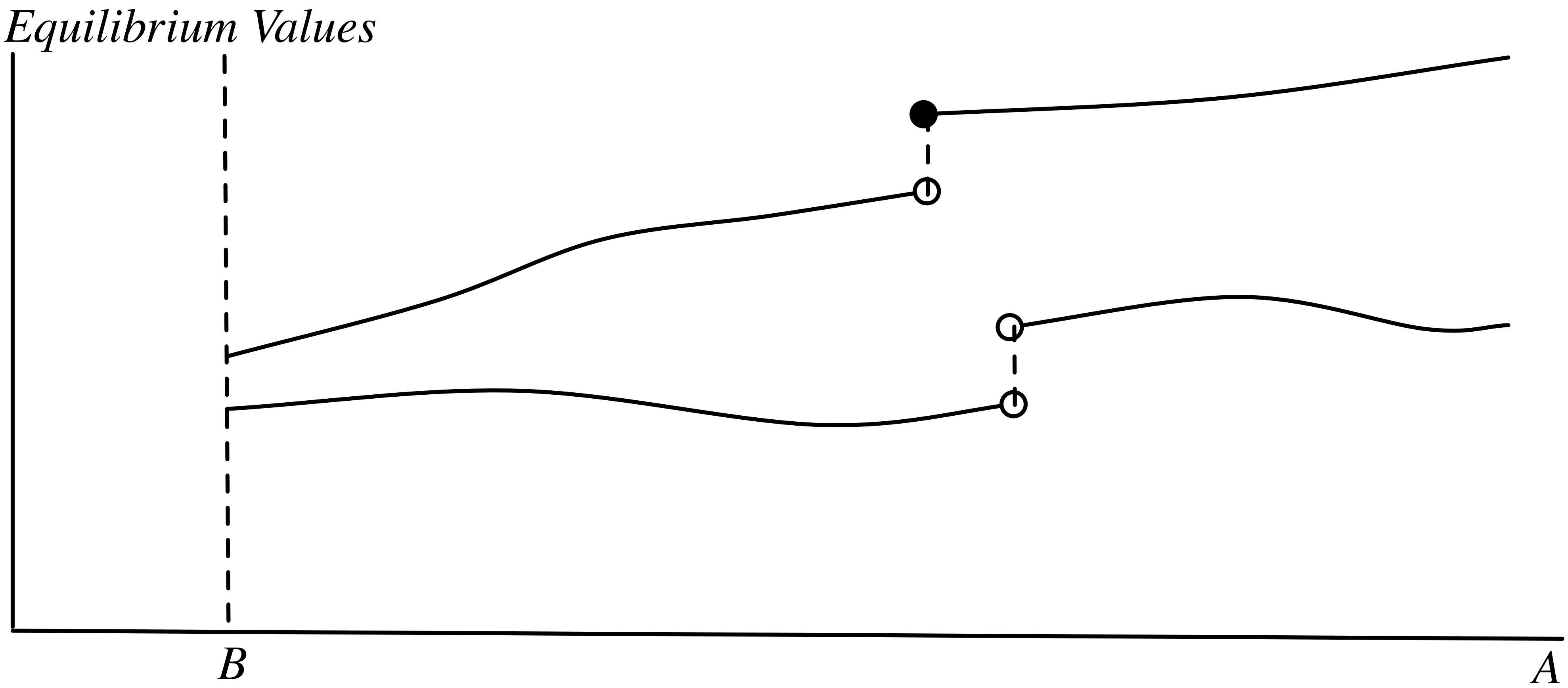

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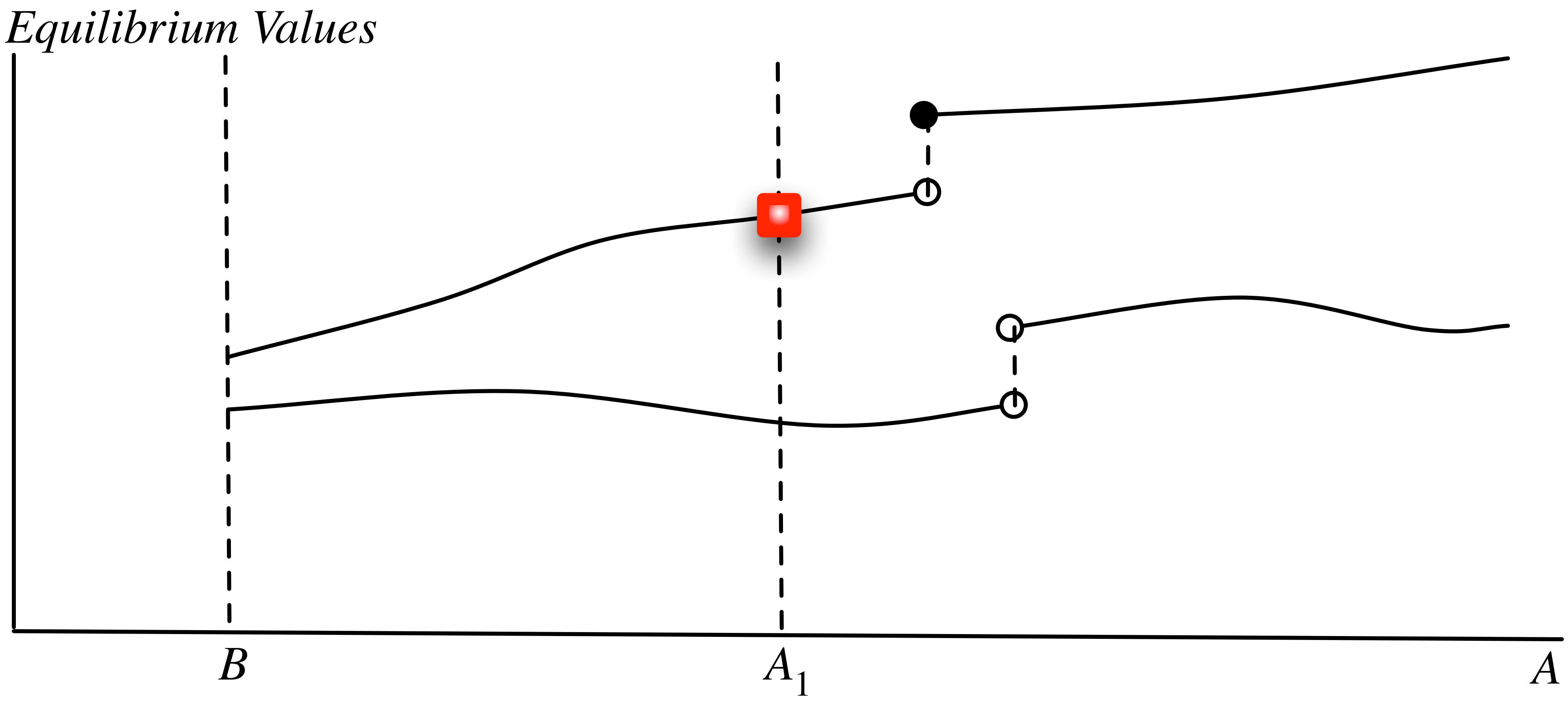

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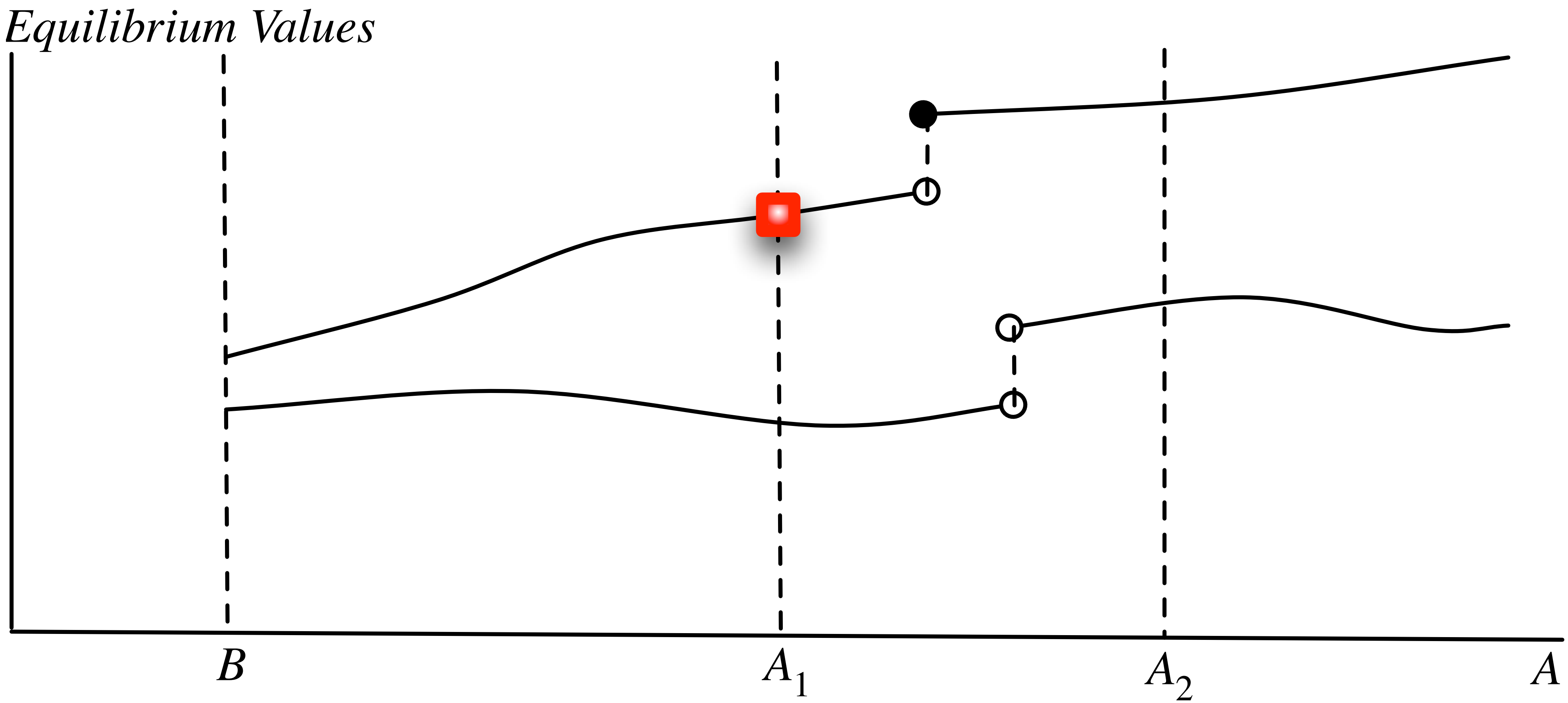

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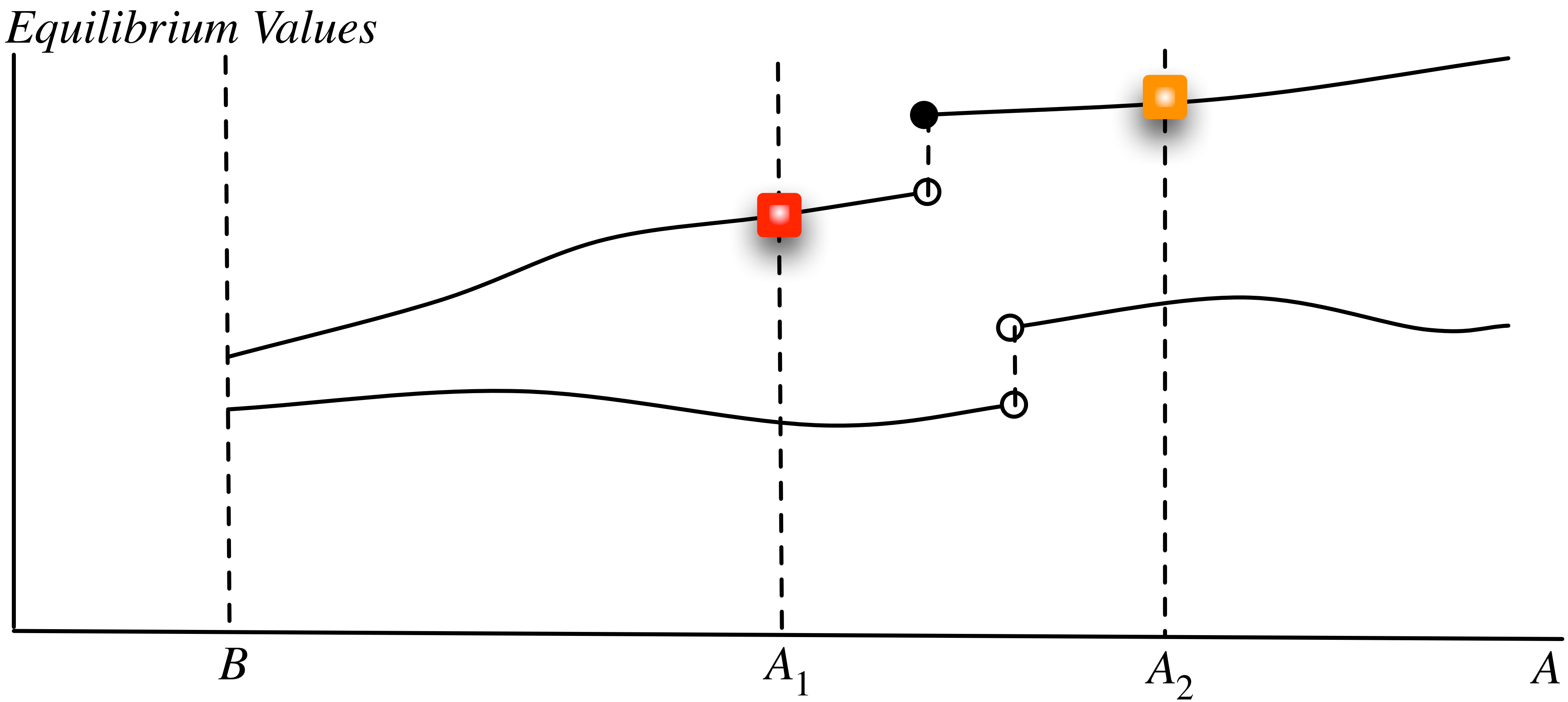

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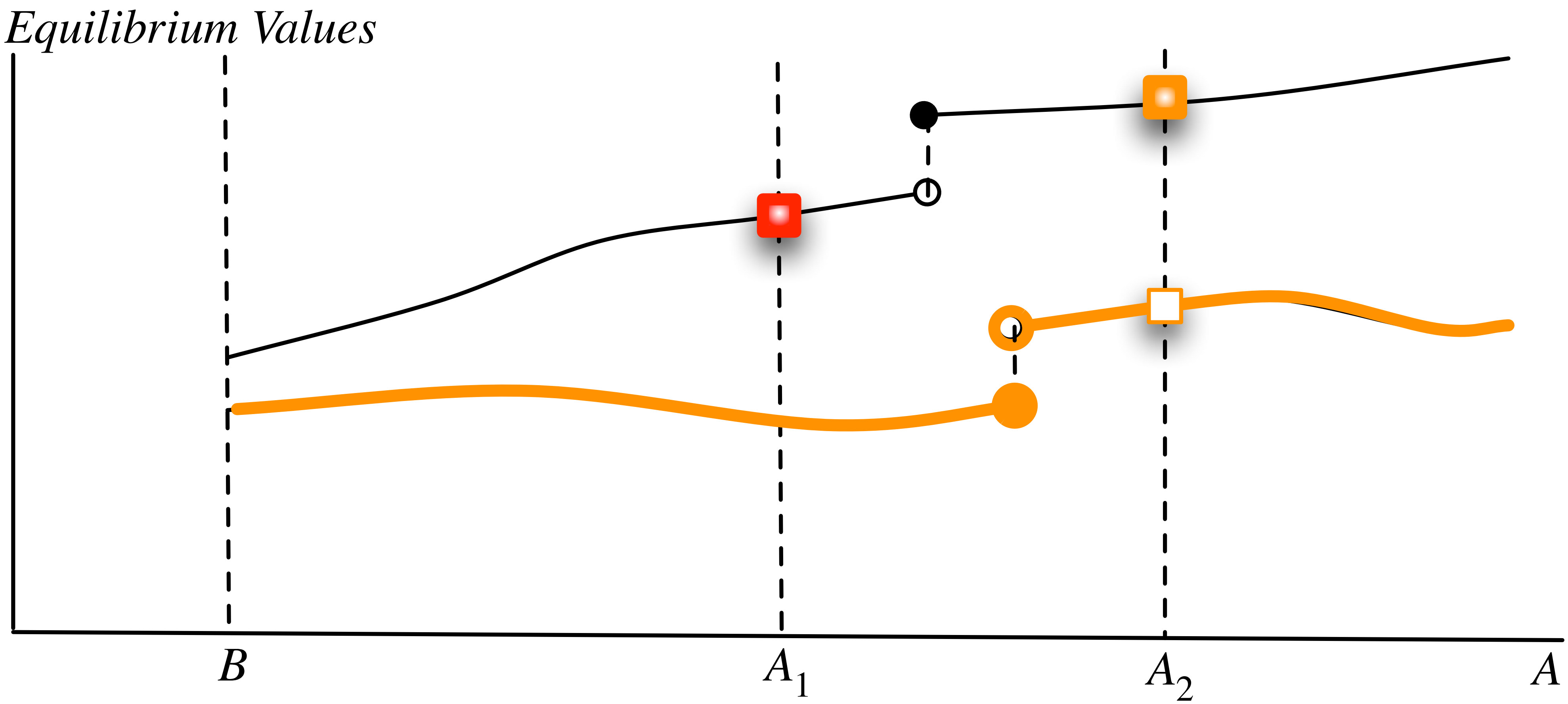

Generating Equilibrium Values

- Lower bound on infimum values:

$$L_0(A) \equiv u\left(A - \frac{B}{\alpha}\right) + \frac{\delta}{1-\delta} u\left(\frac{\alpha - 1}{\alpha} B\right).$$

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- Recursive sequence of correspondences on $[B, \infty)$, $\{\mathcal{V}_k\}$:

  - $\mathcal{V}_0(A) = [L_0(A), \text{Ramsey}(A)]$.

  - $\mathcal{V}_k$ generates $\mathcal{V}_{k+1}$ for all $k \geq 0$. Then $\mathcal{V}(A) = \bigcap_{t=0}^{\infty} \mathcal{V}_k(A)$.

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- Proposition 1. An equilibrium exists: $\mathcal{V}(A) \neq \emptyset$ for all A.

- $\mathcal{V}$ compact-valued closed graph; max $H(A)$, min $L(A)$.

Self-Control Definition

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$\Rightarrow$ Accumulation at A in some equilibrium.

- Strong self-control at A:

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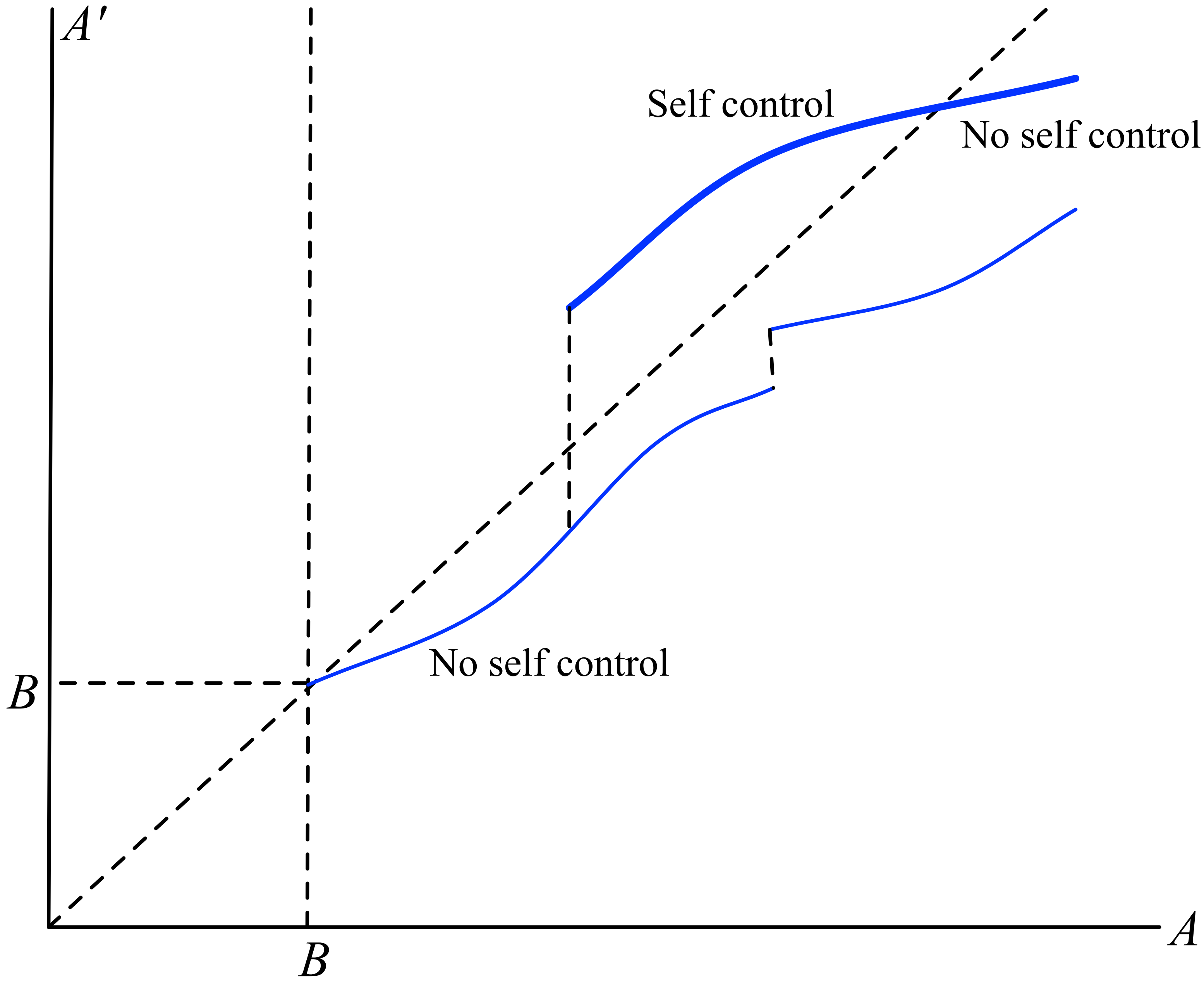
- No self-control at A:

$\Rightarrow$ 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:
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- Nonuniform case:
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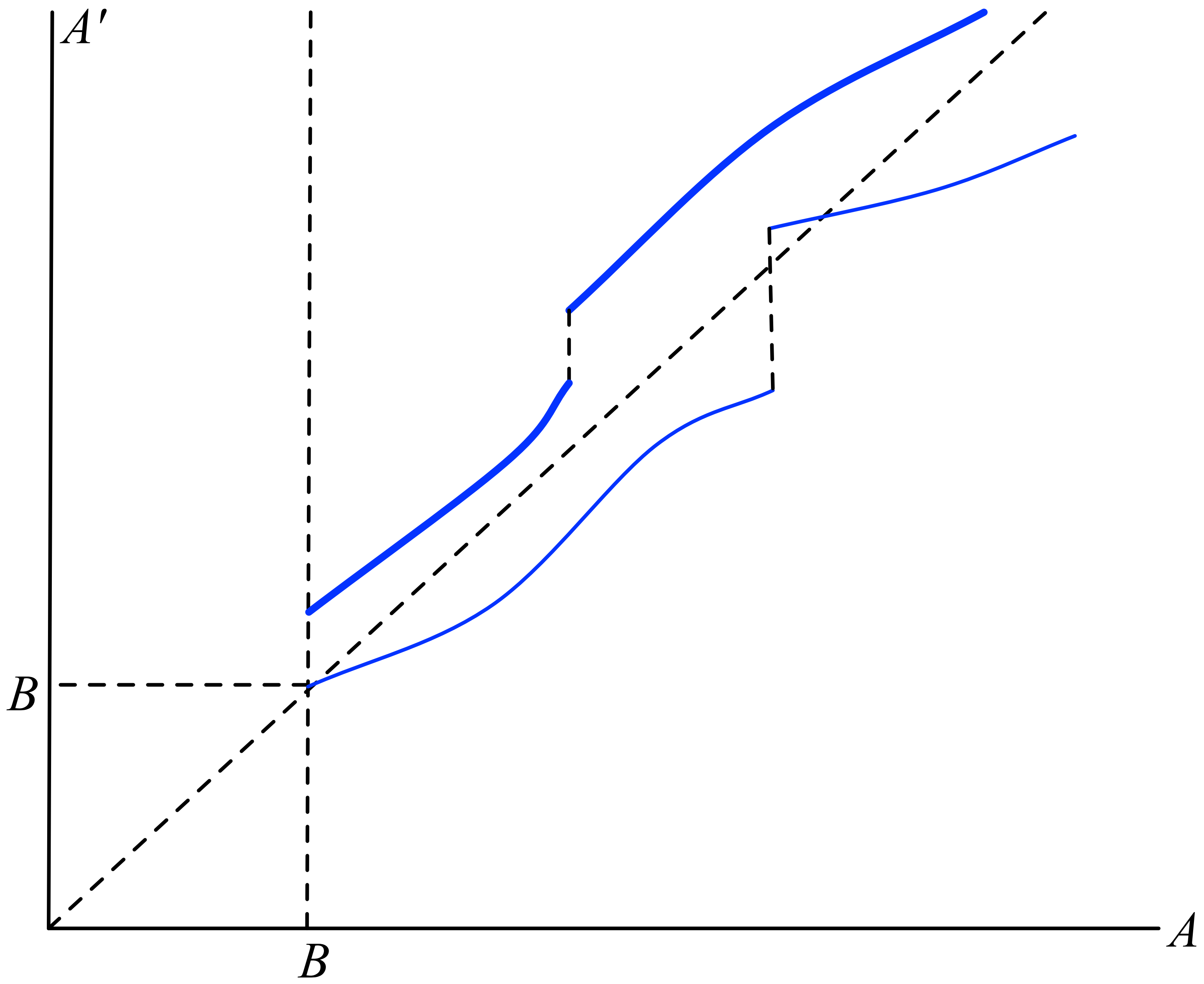

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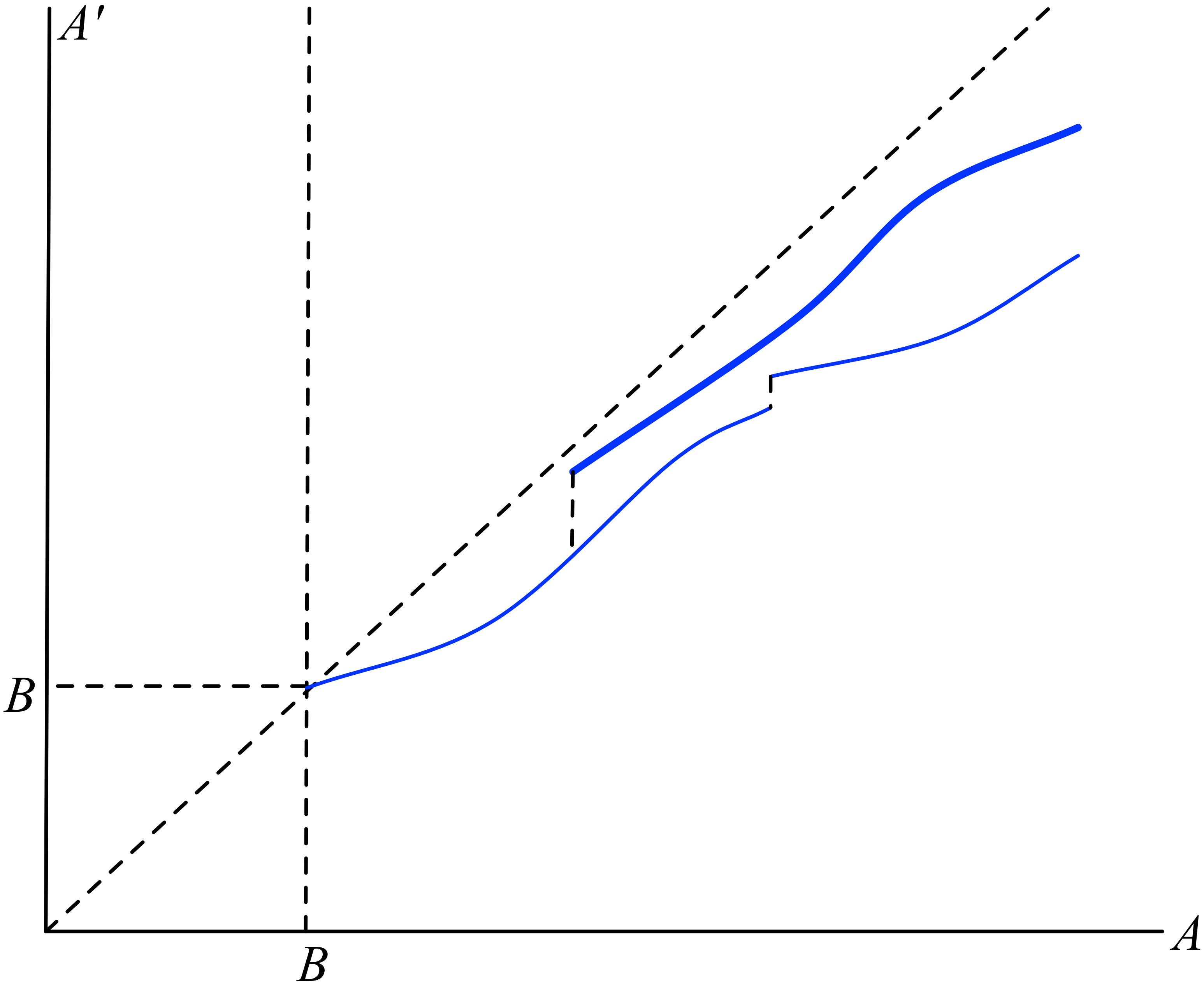

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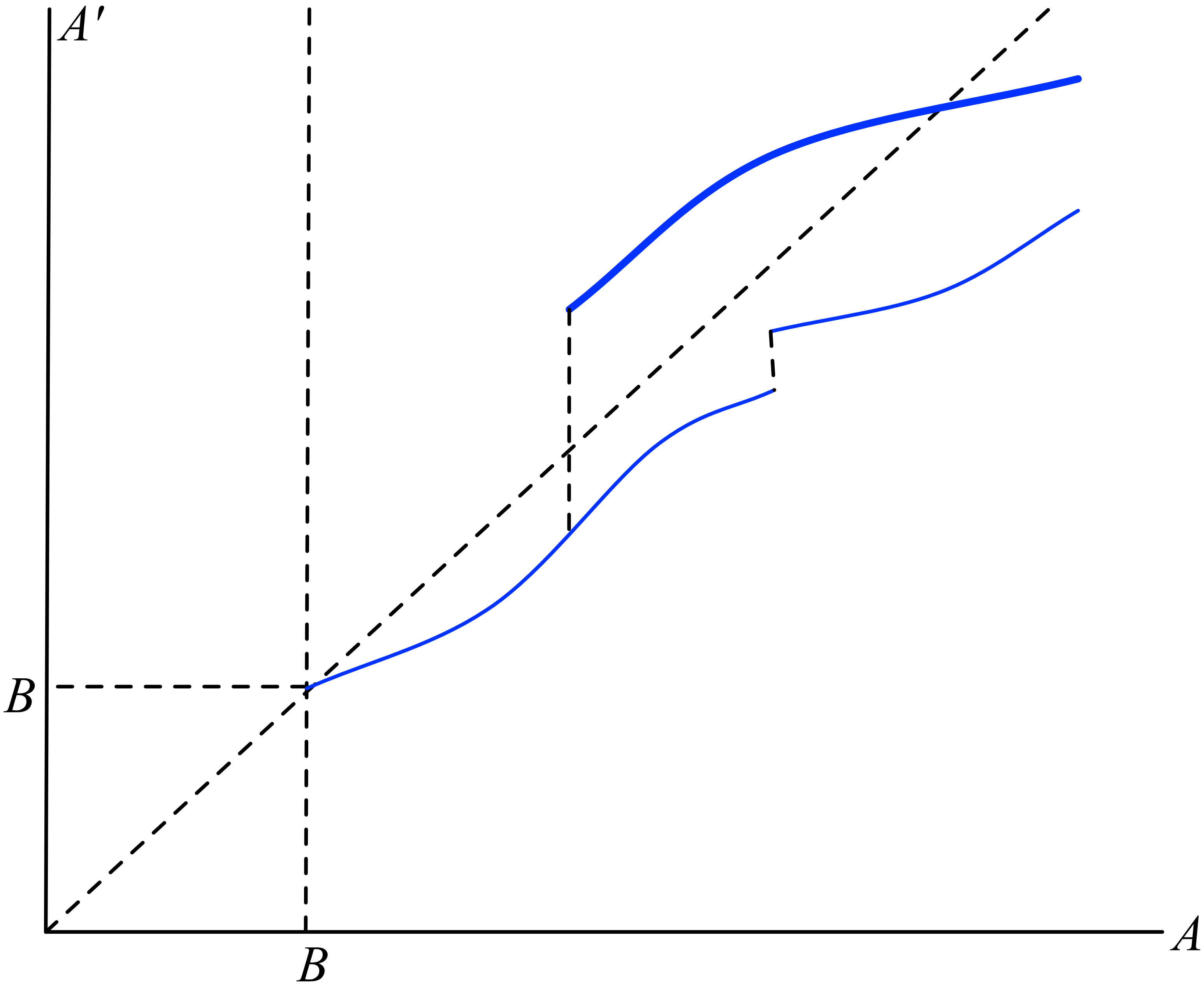

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- **Proposition 2.** Suppose no credit constraints, so that $B = 0$.

  - Then every case is uniform.

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

Credit Constraints and Non-Uniformity

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- Some intuition:

  - Self-control depends on the severity of the consequences of a lapse in self-control.

  - Consequences more severe when the individual has more assets; hence more to lose.

- Problem:

  - Severity (suitably normalized) isn't monotonic in assets.

The Structure of Lowest Values

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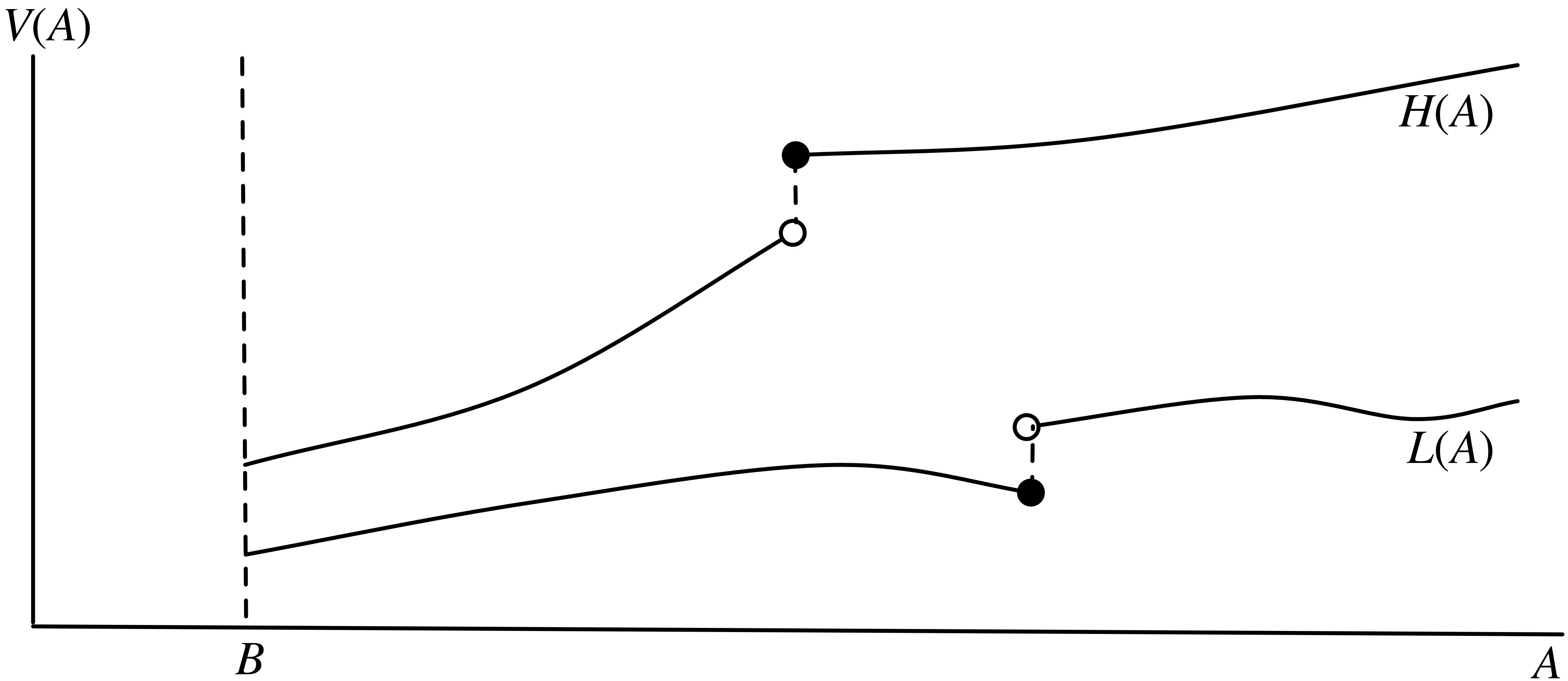

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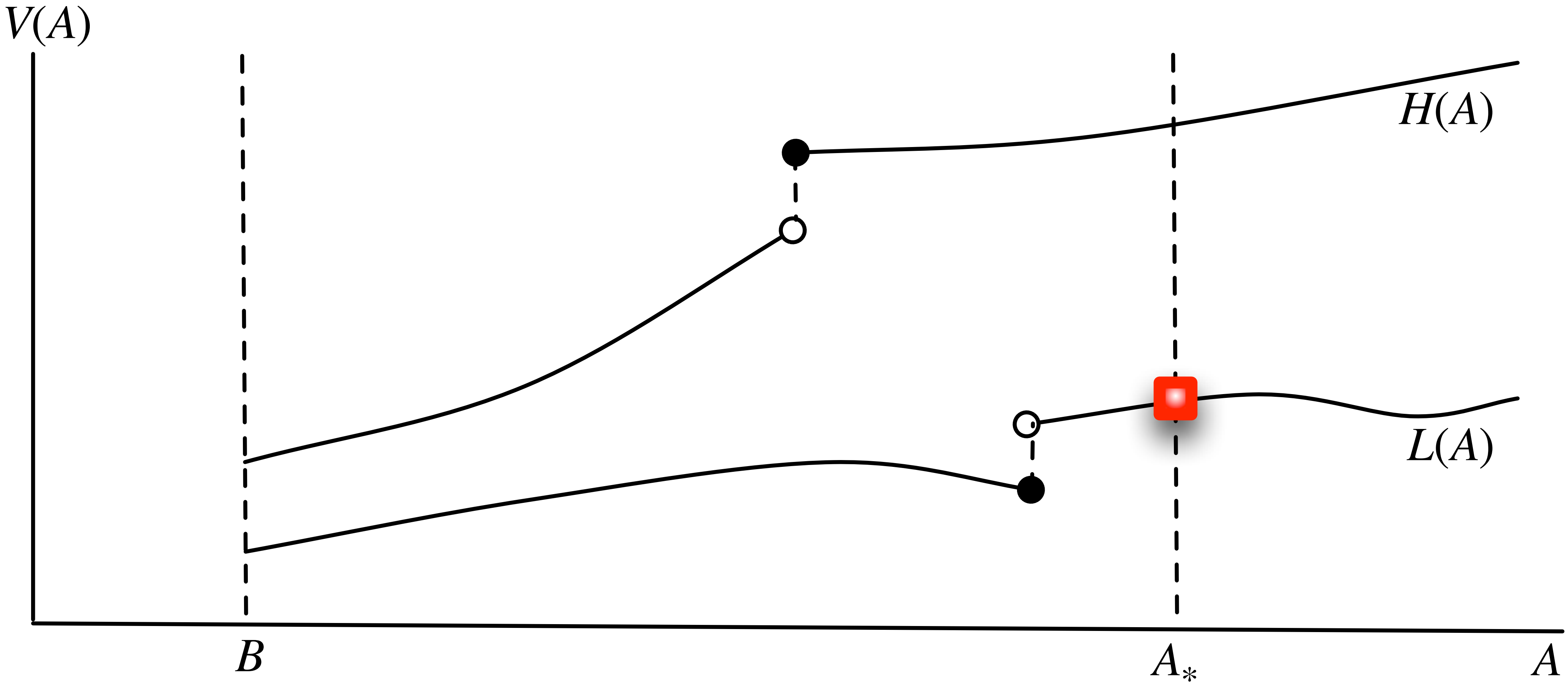

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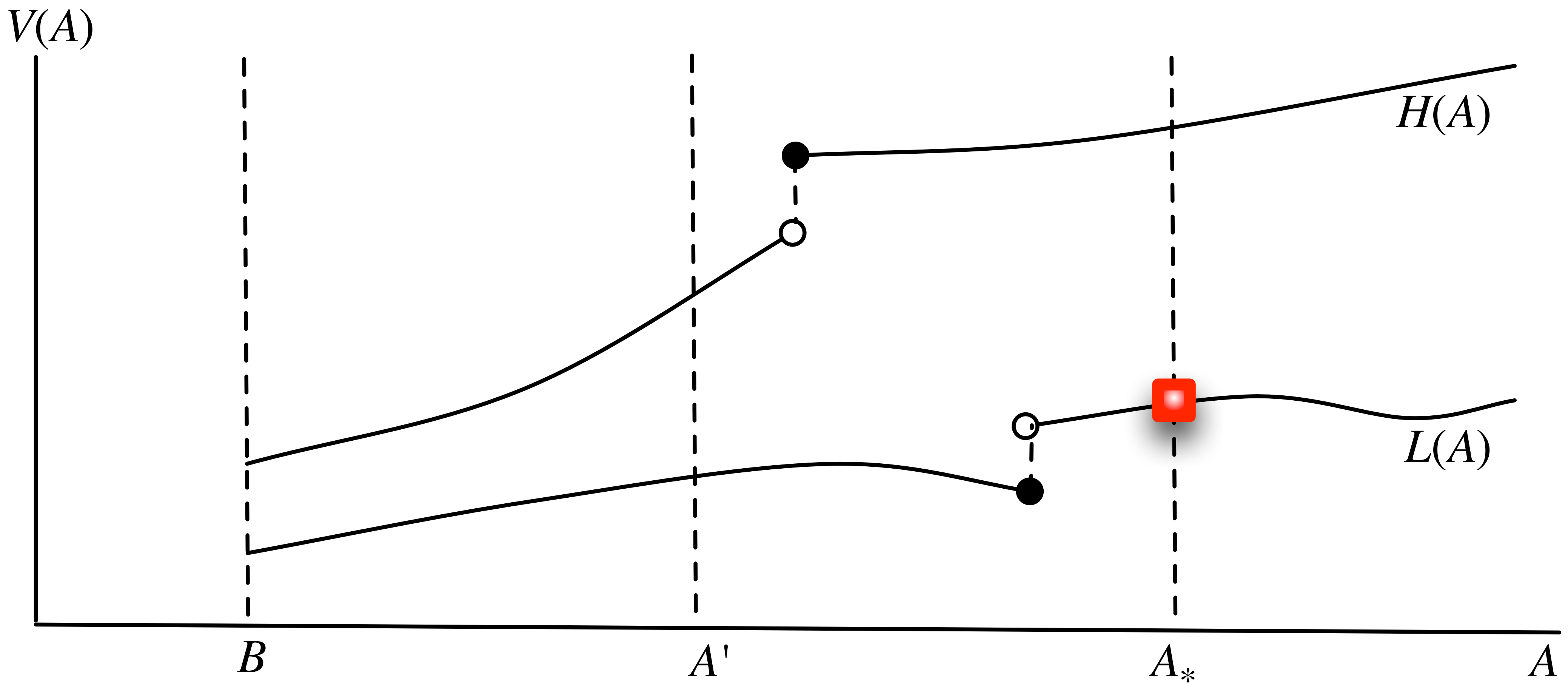

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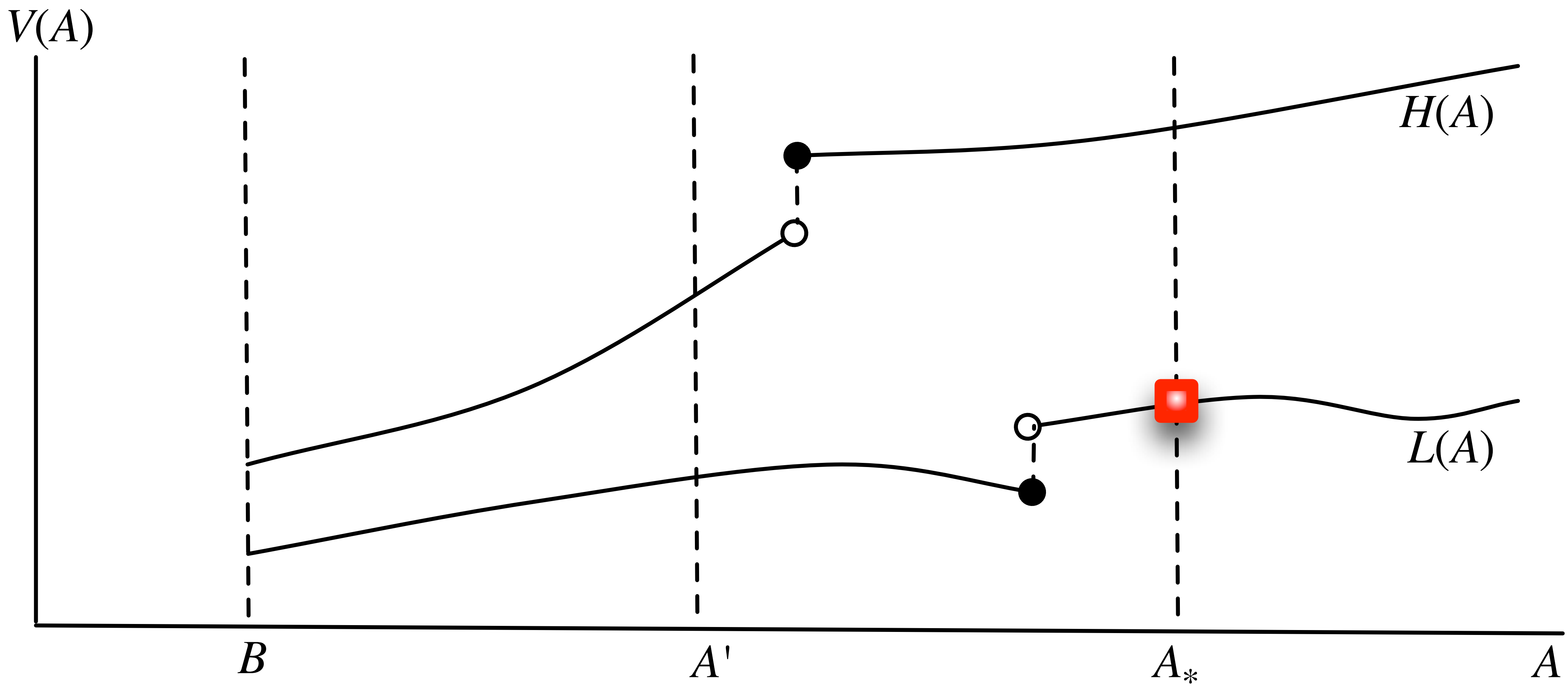

■ Proposition 3. If $A' > B$ is continuation for A_* under lowest value at A_*, then A' is followed by value $H^{-}(A')$.

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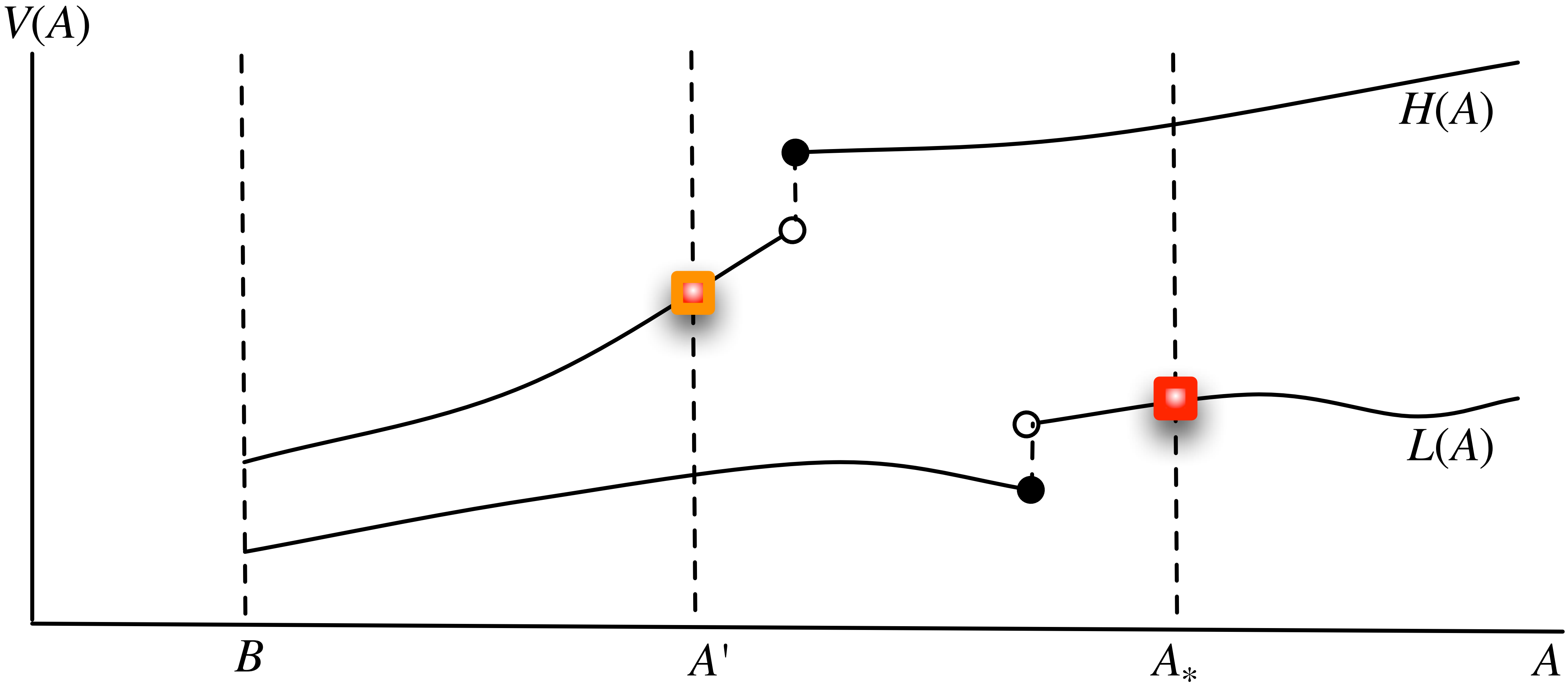

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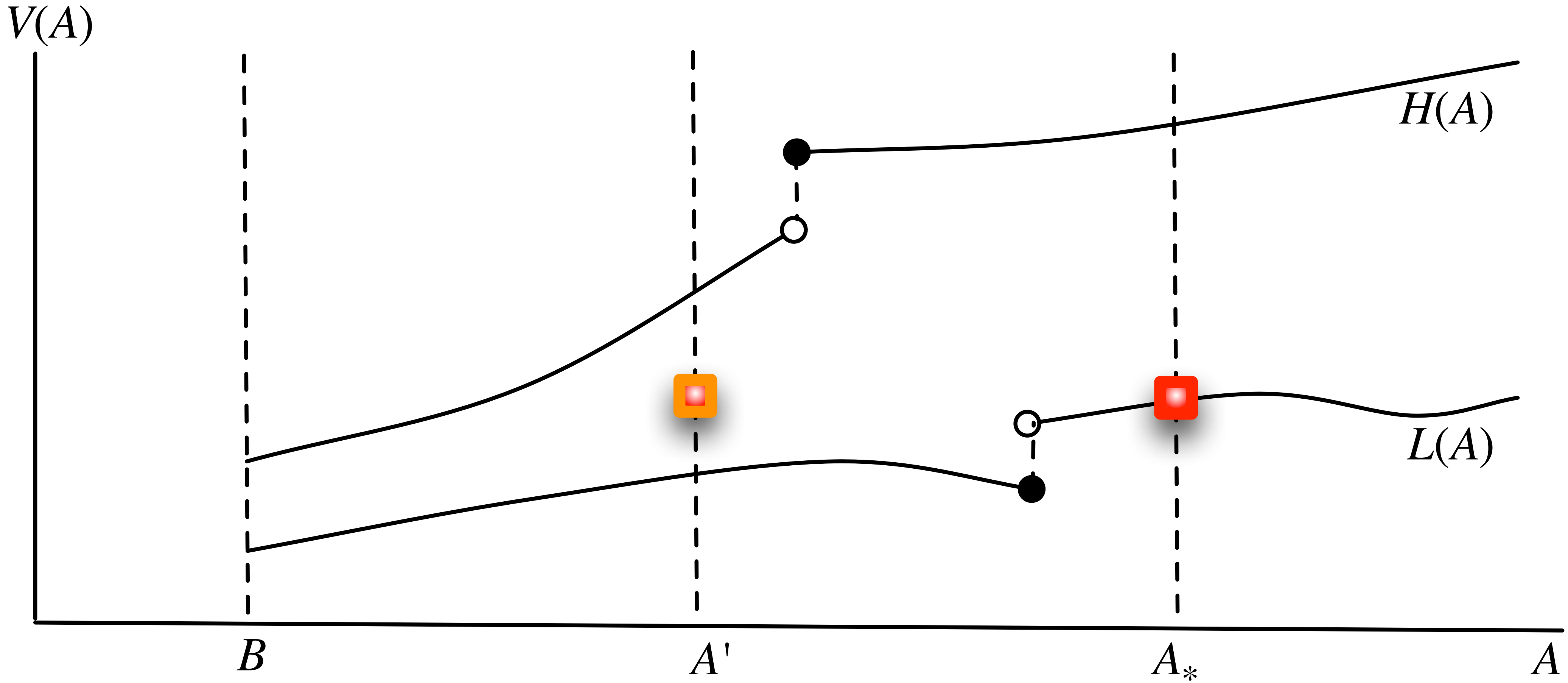

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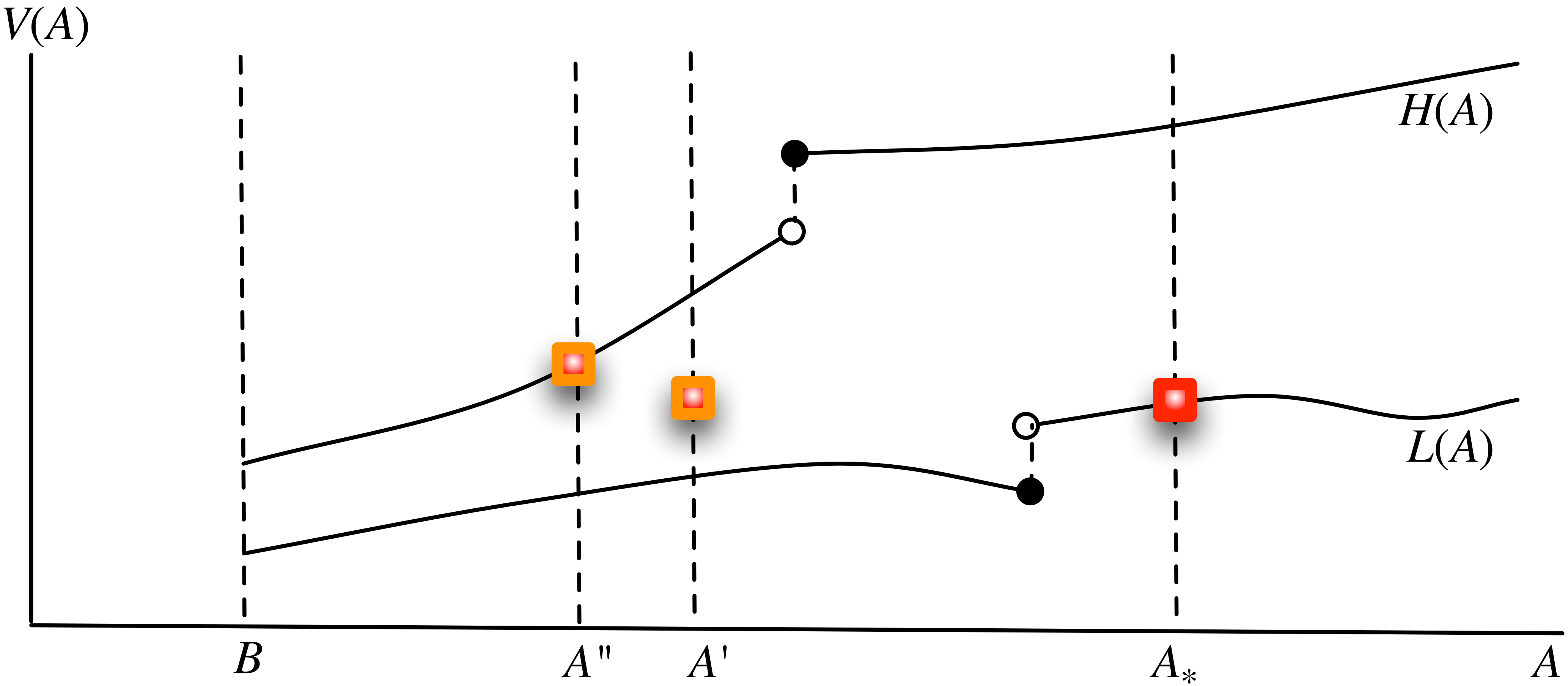

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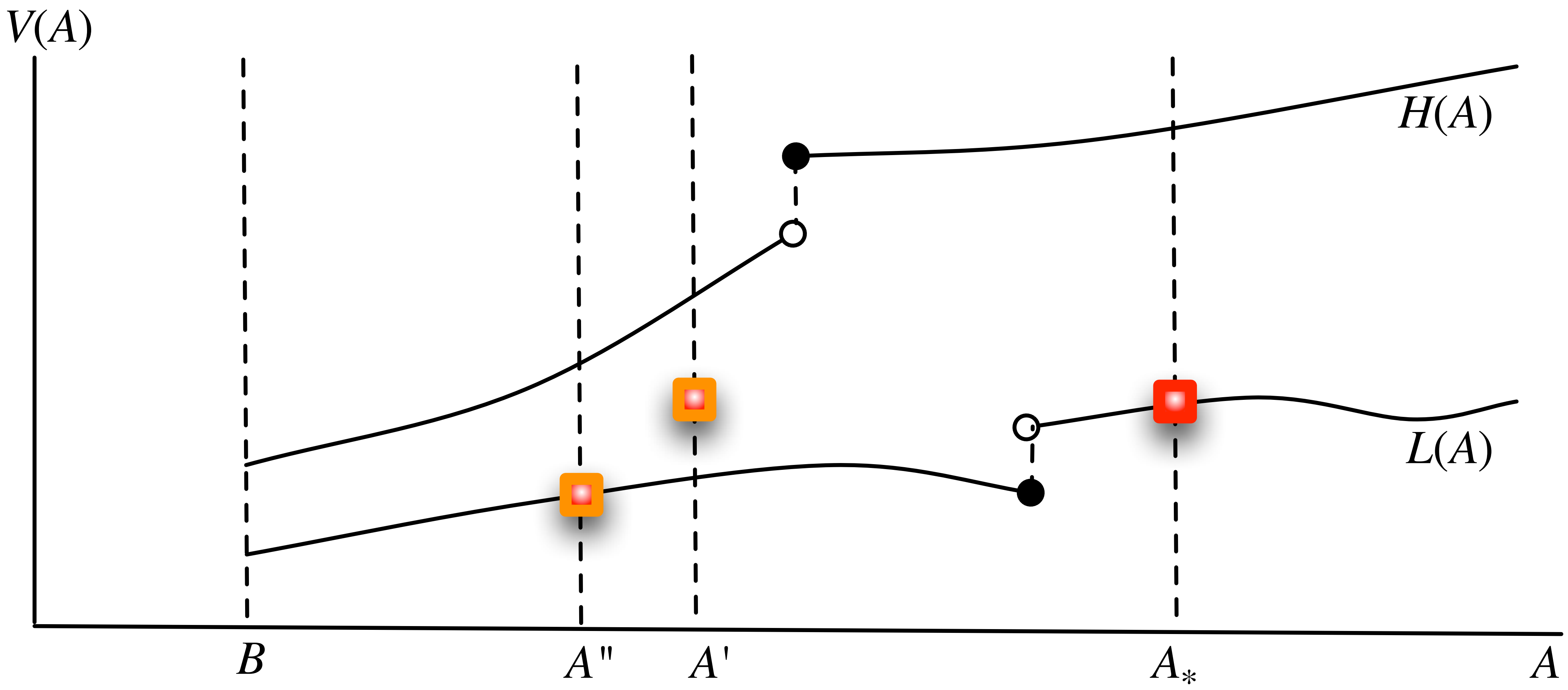

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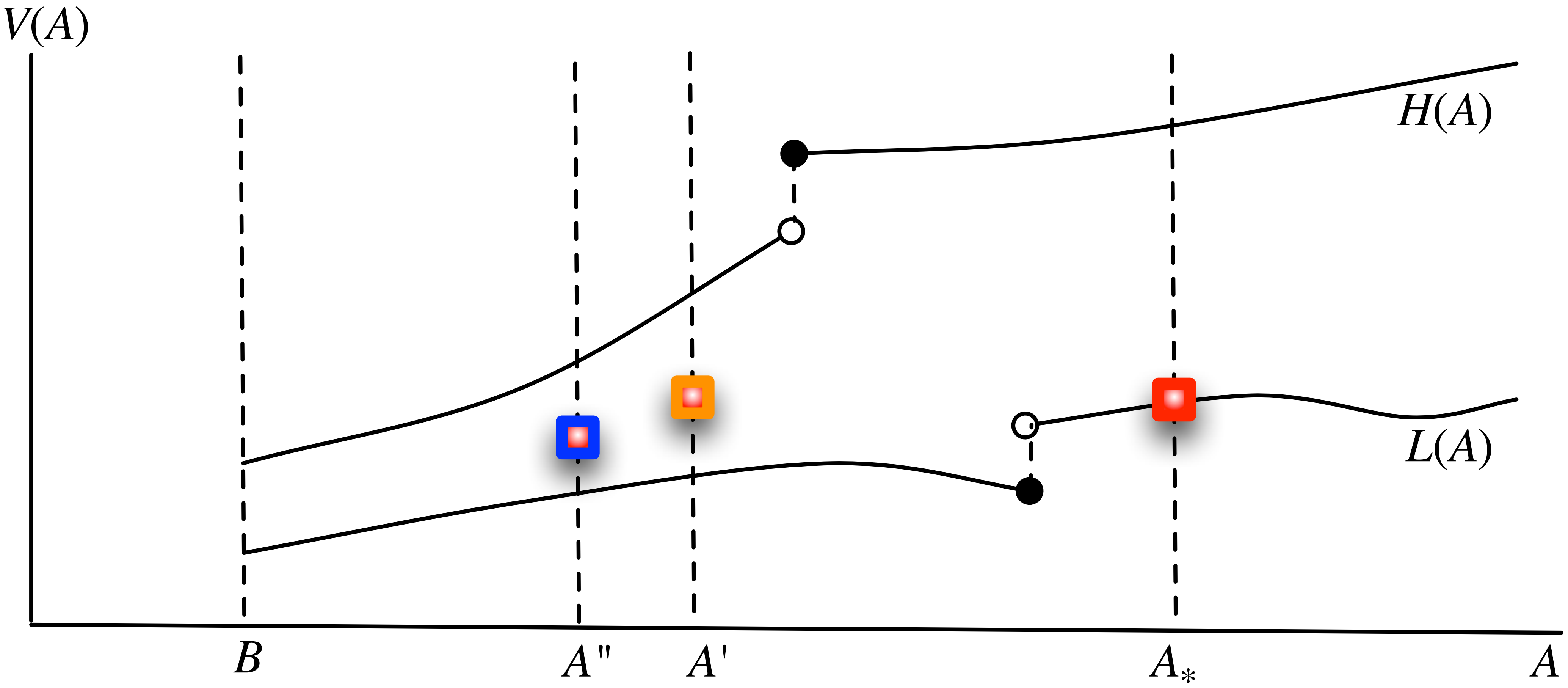

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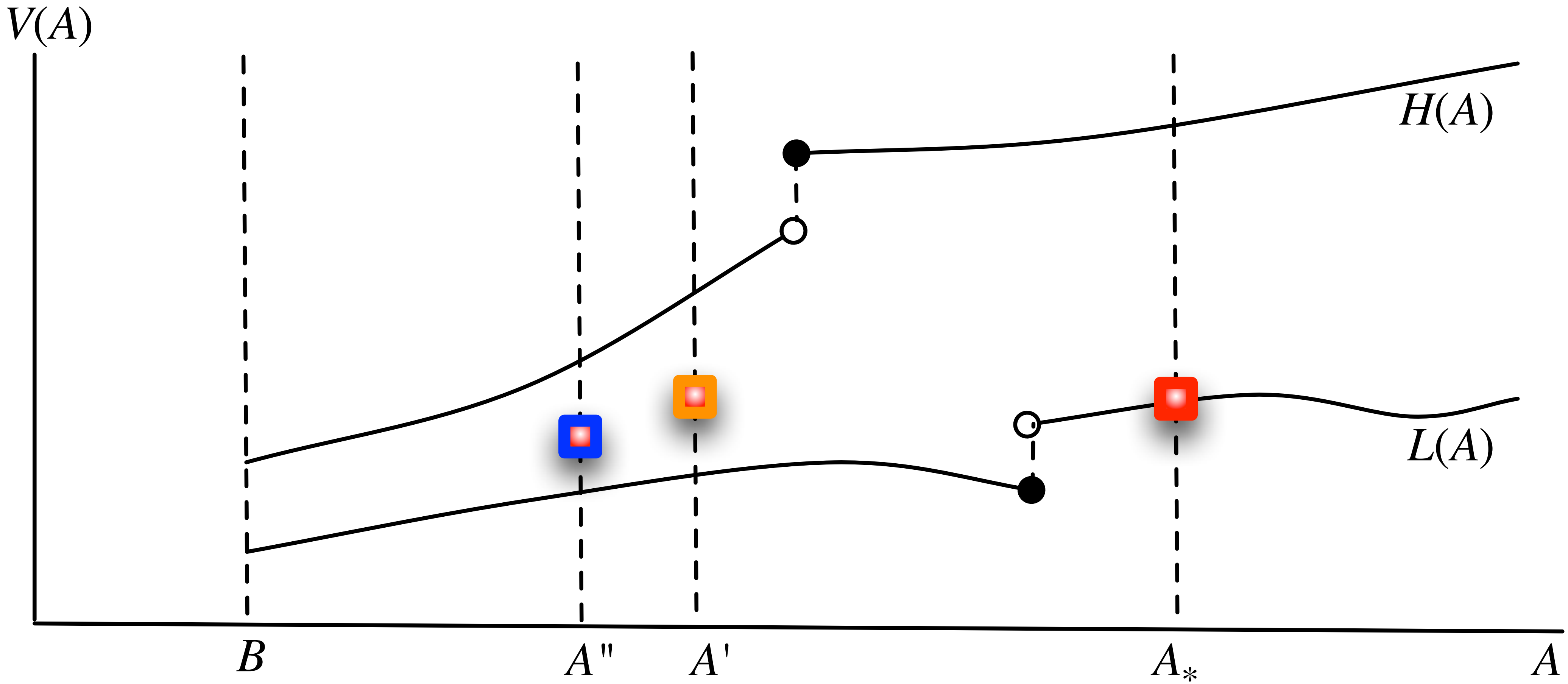


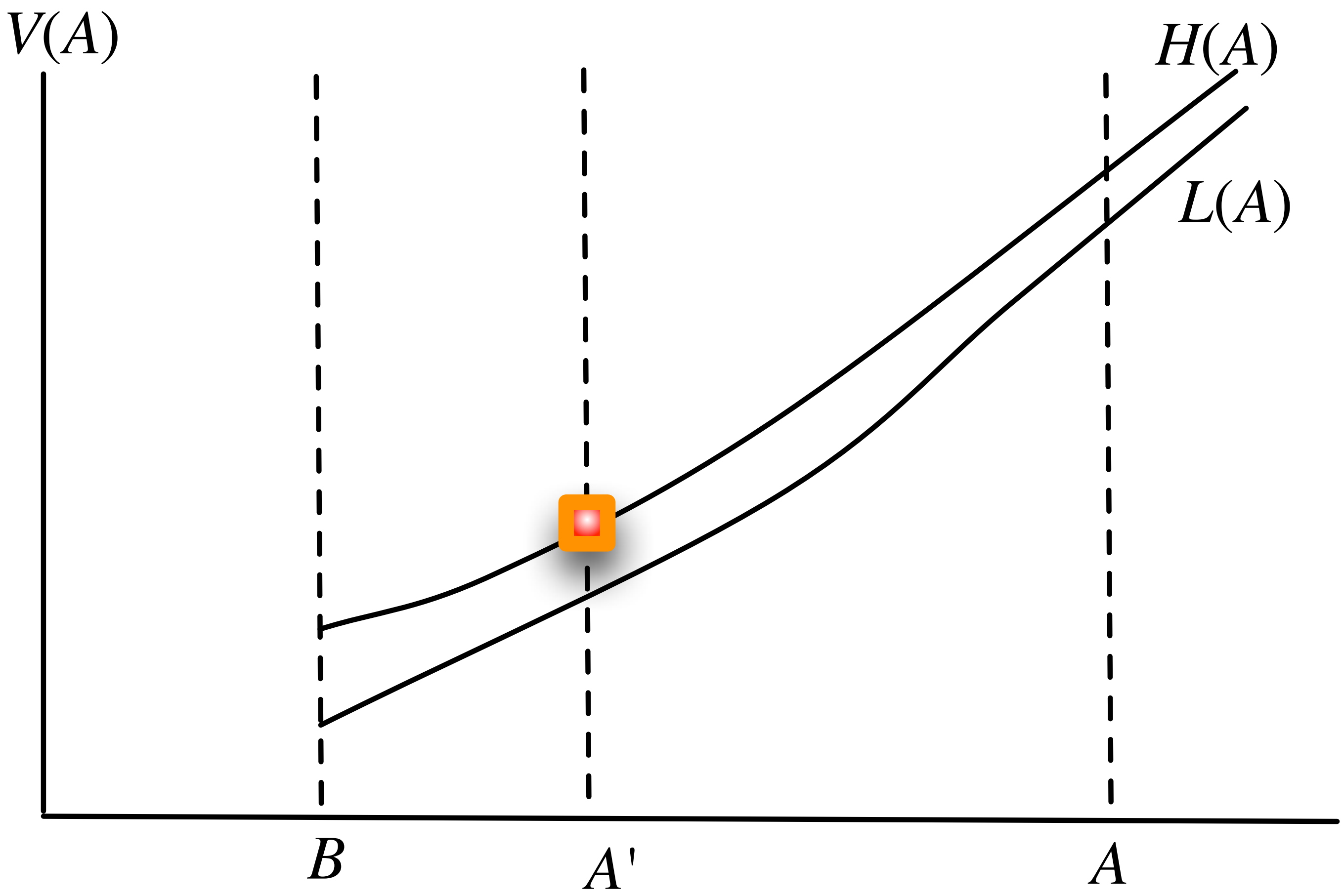
■ Proposition 3. If $A' > B$ is continuation for A_* under lowest value at A_*, then A' is followed by value $H^-(A')$.

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

Lowest Values

- Structure is remarkably simple. Following a deviation:
- One more binge, followed by highest-value program.
- Like Abreu penal codes, but for entirely different reasons.
- But argument also reveals why $L(A)$ jumps up occasionally.

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



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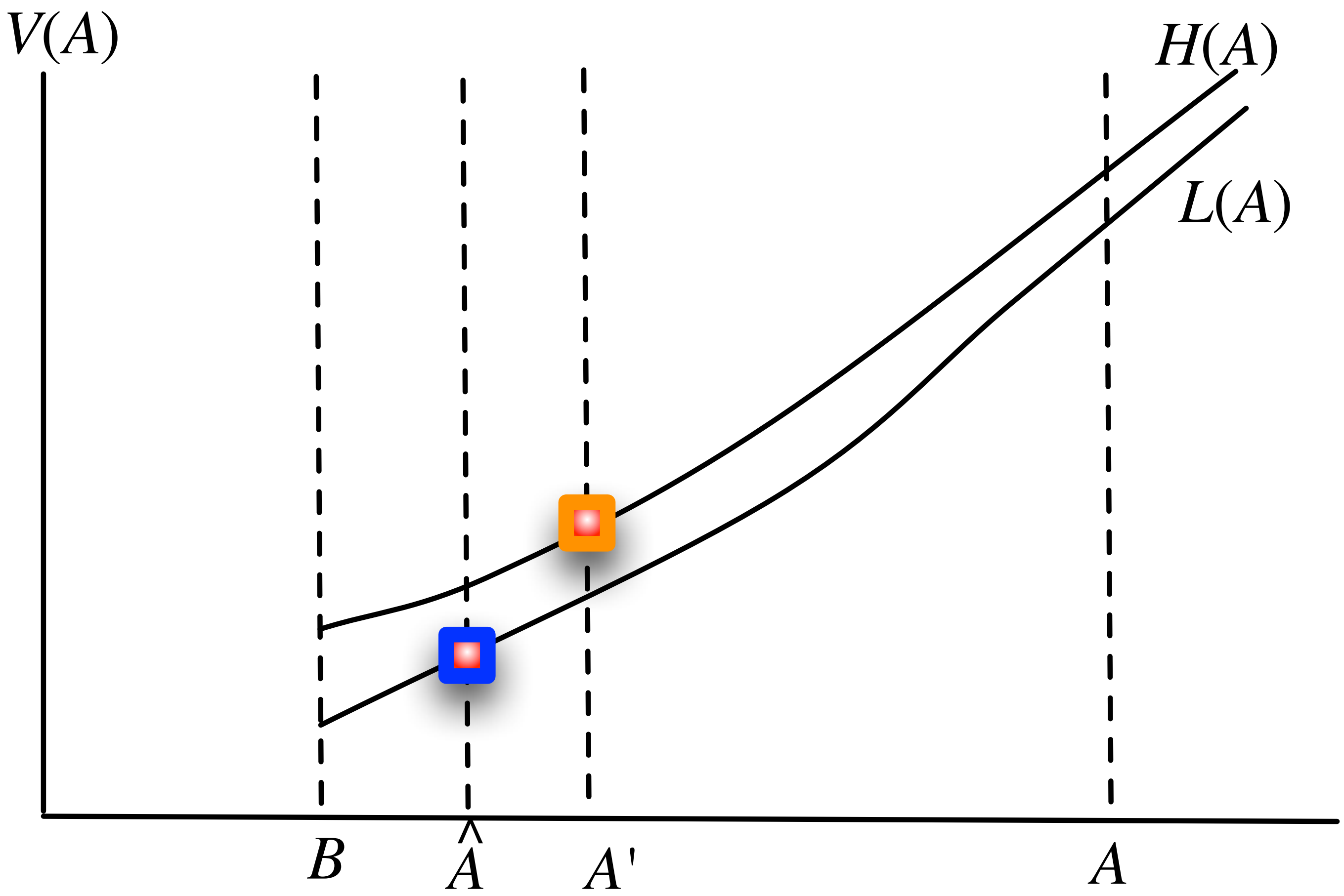

- Not possible; get a contradiction:

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

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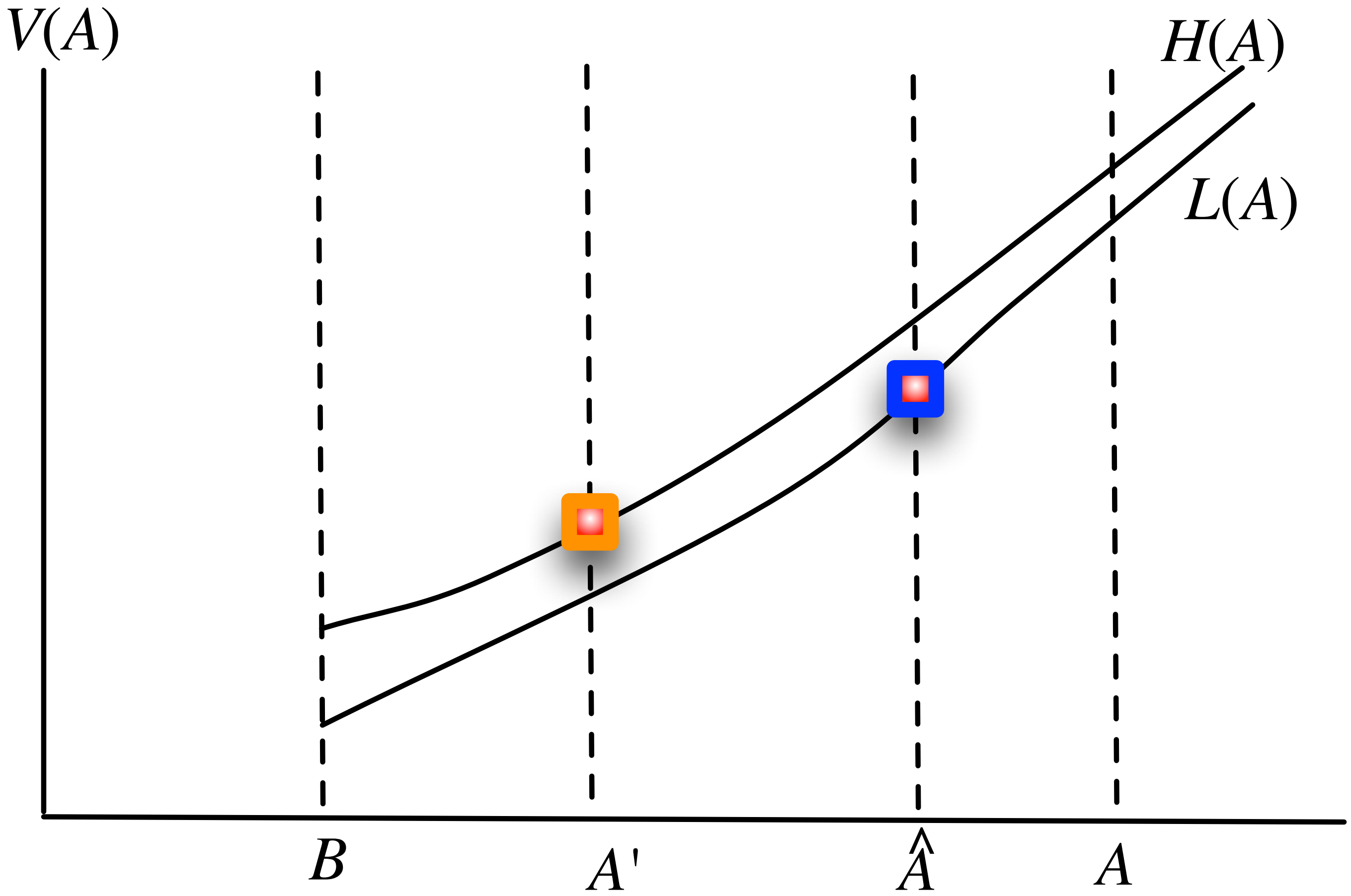

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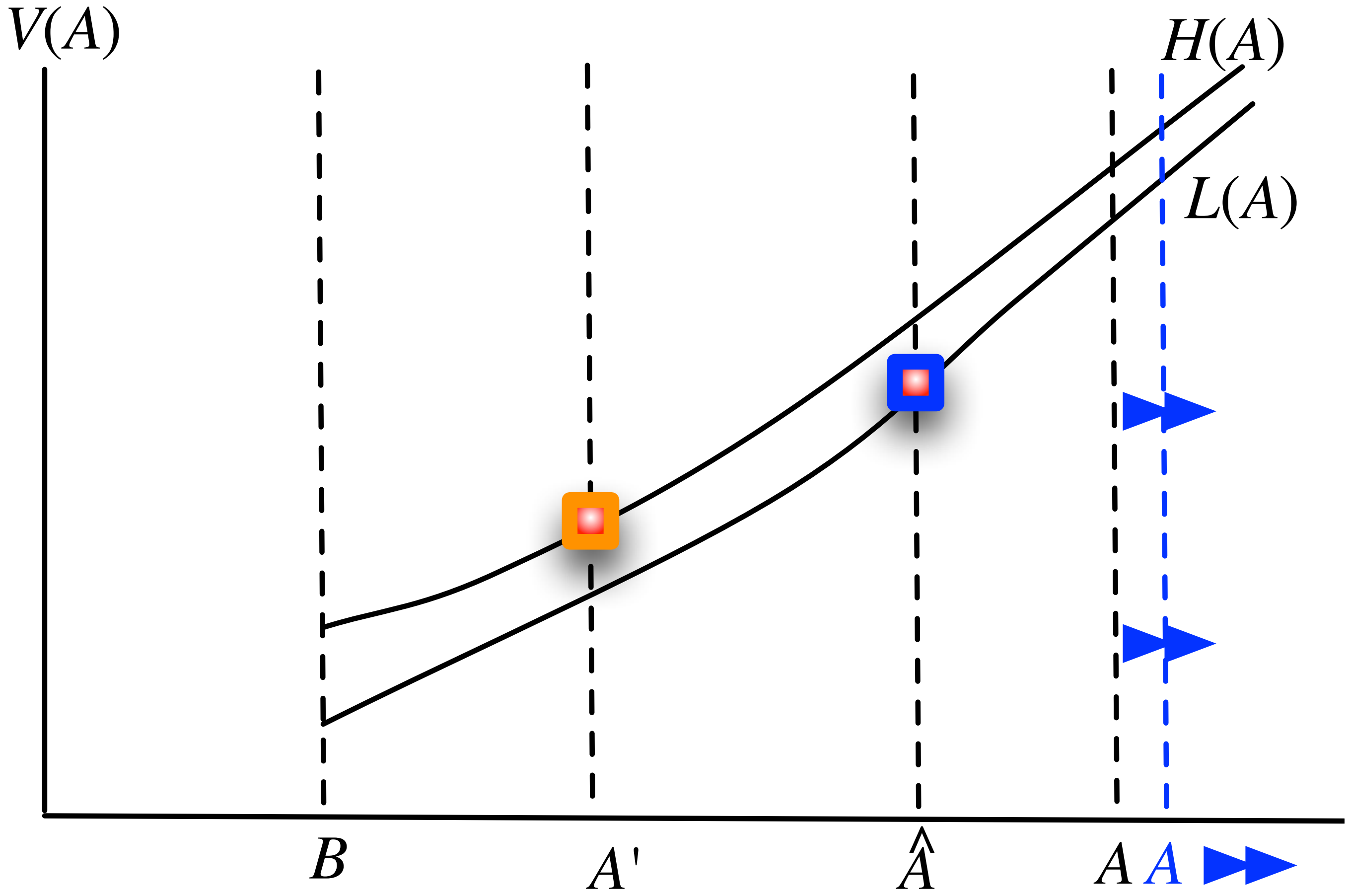

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- By concavity of u, A' may need to jump up, so $L(A)$ jumps too.

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.

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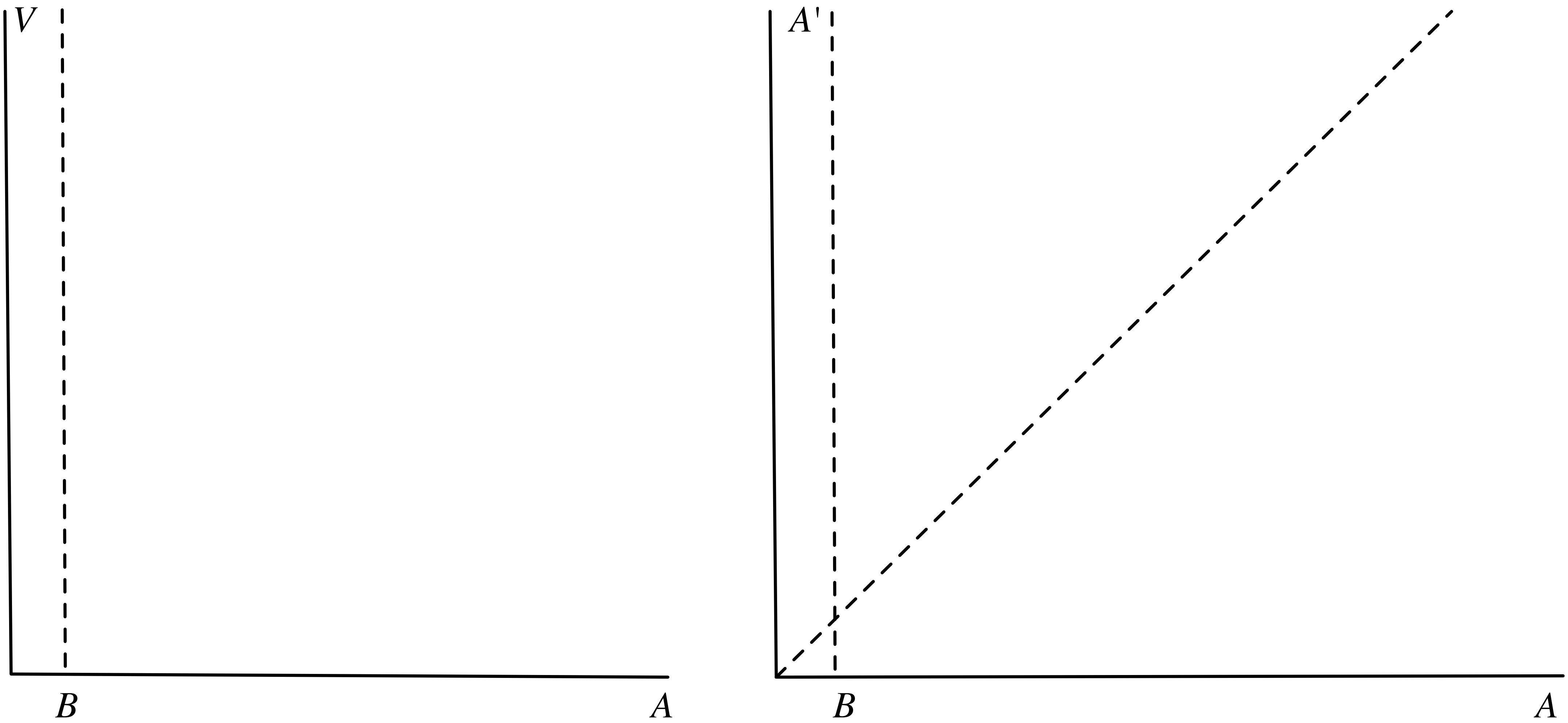
- Simple: what happens after lapse of control is easy to describe.

  - 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



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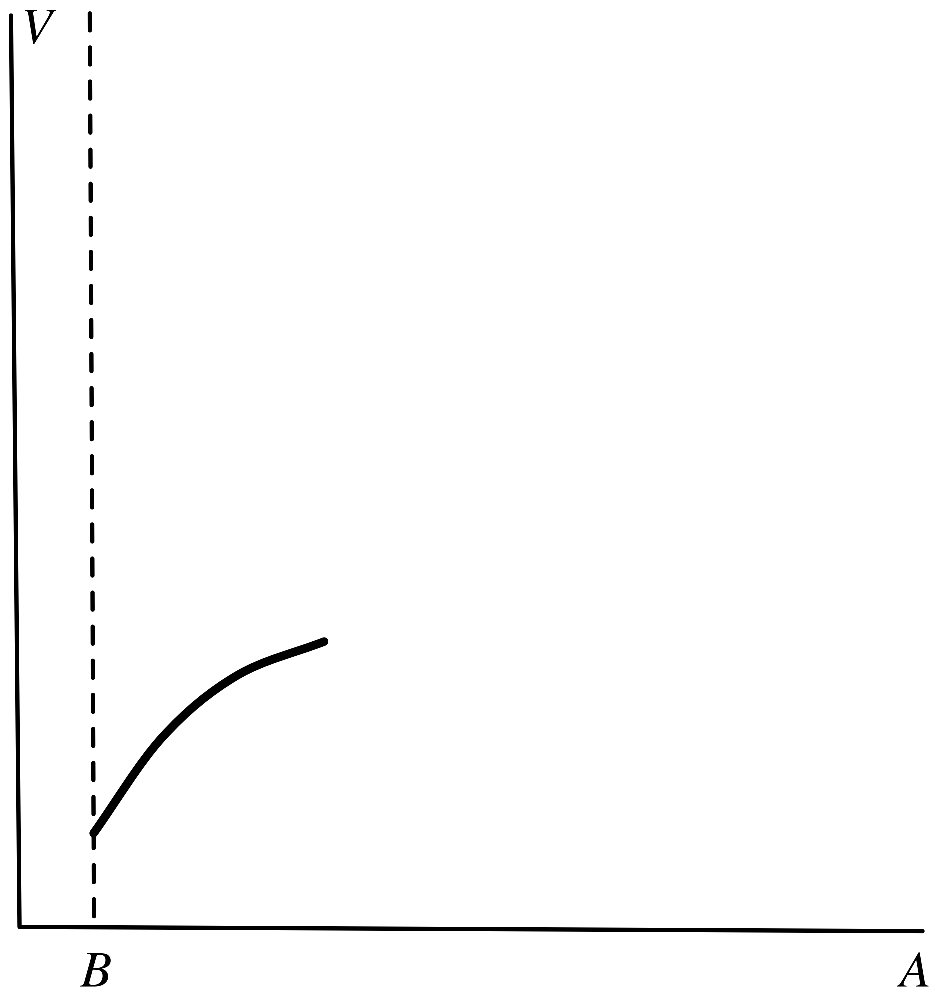

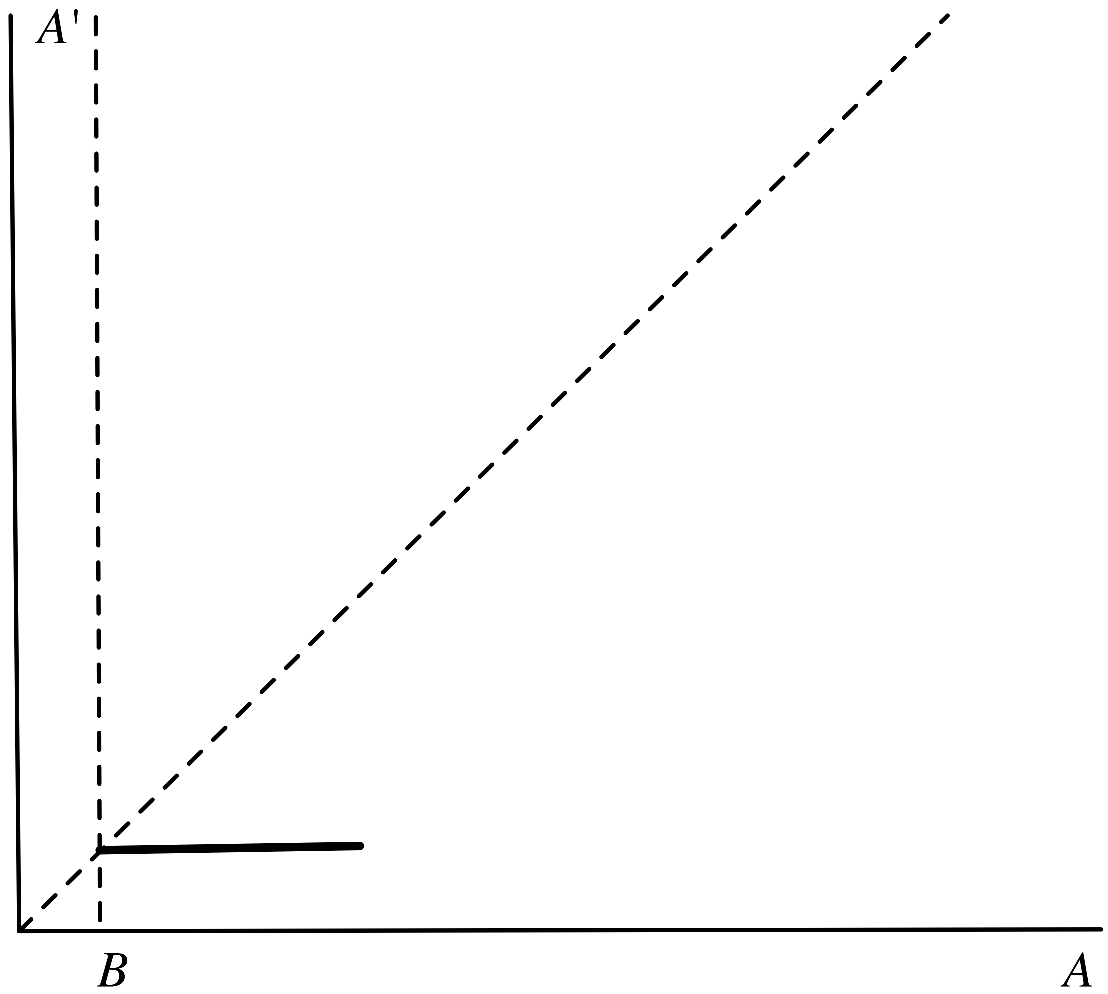

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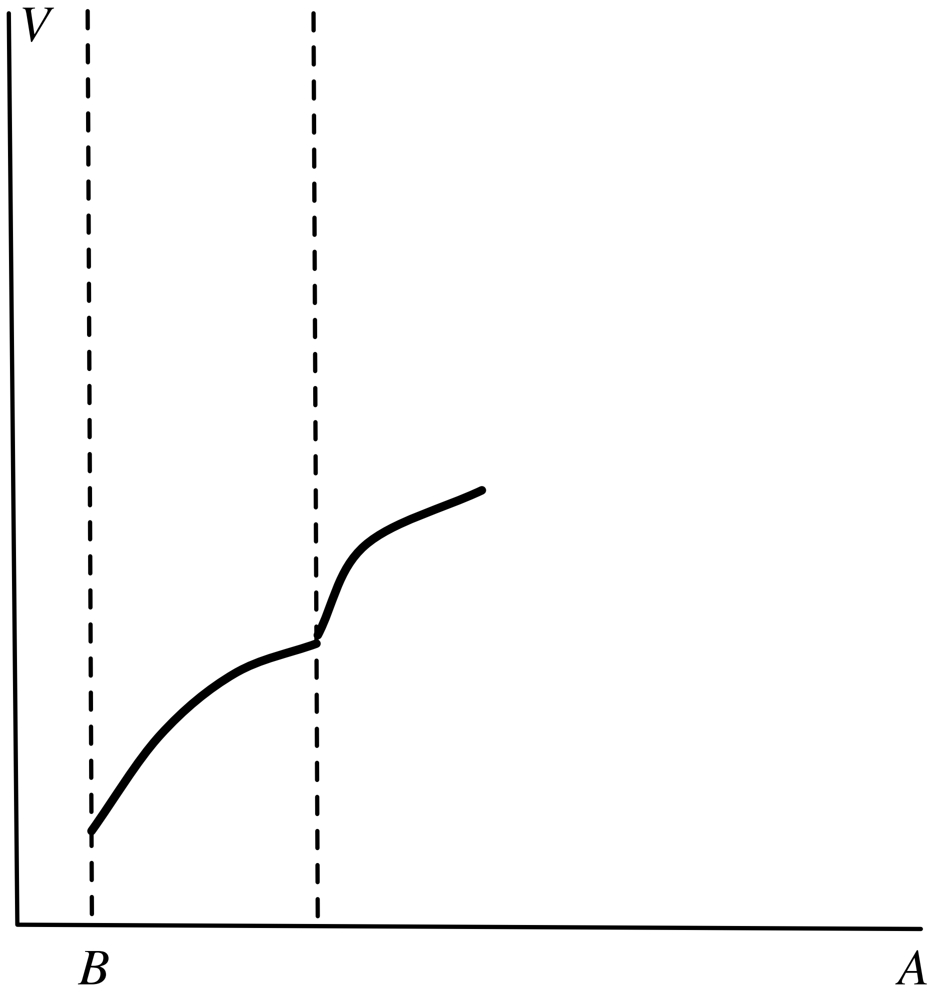

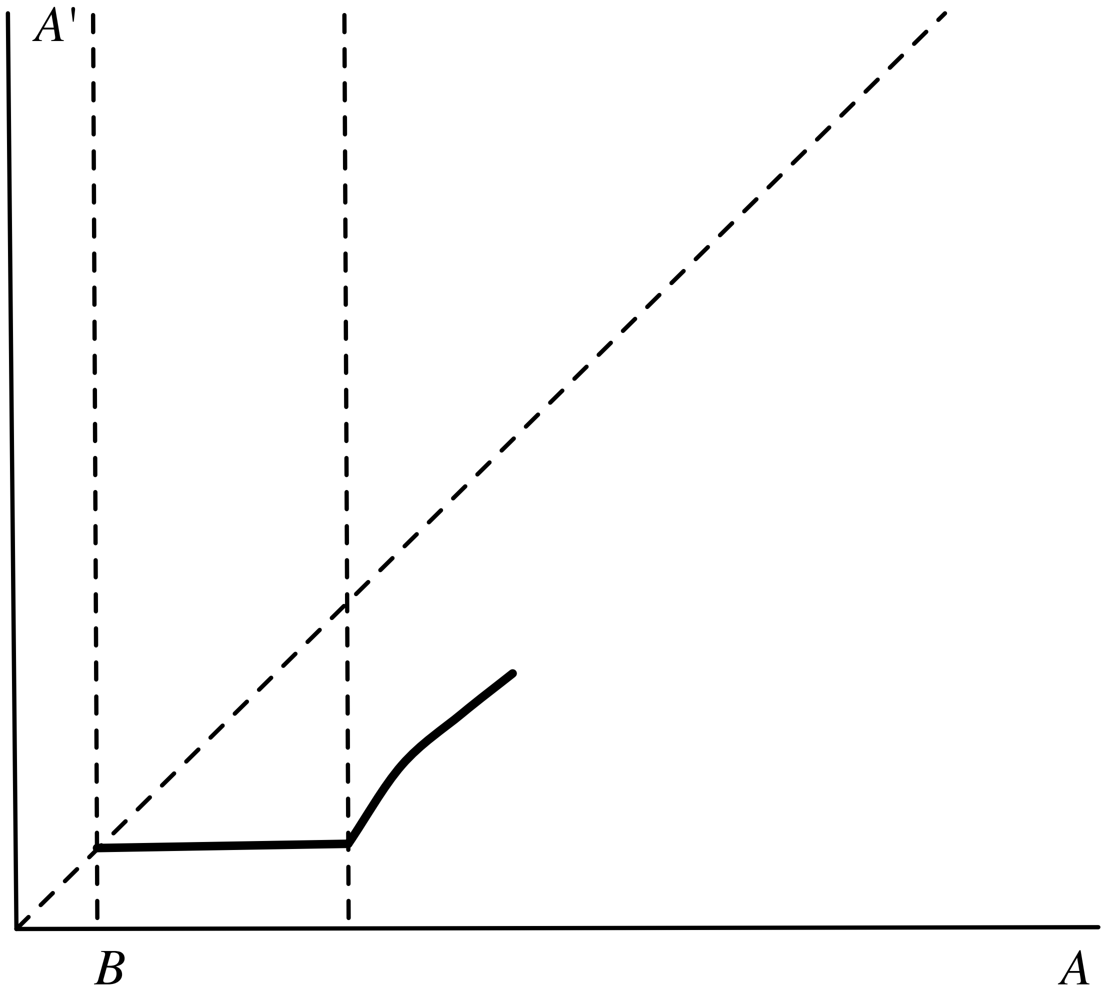

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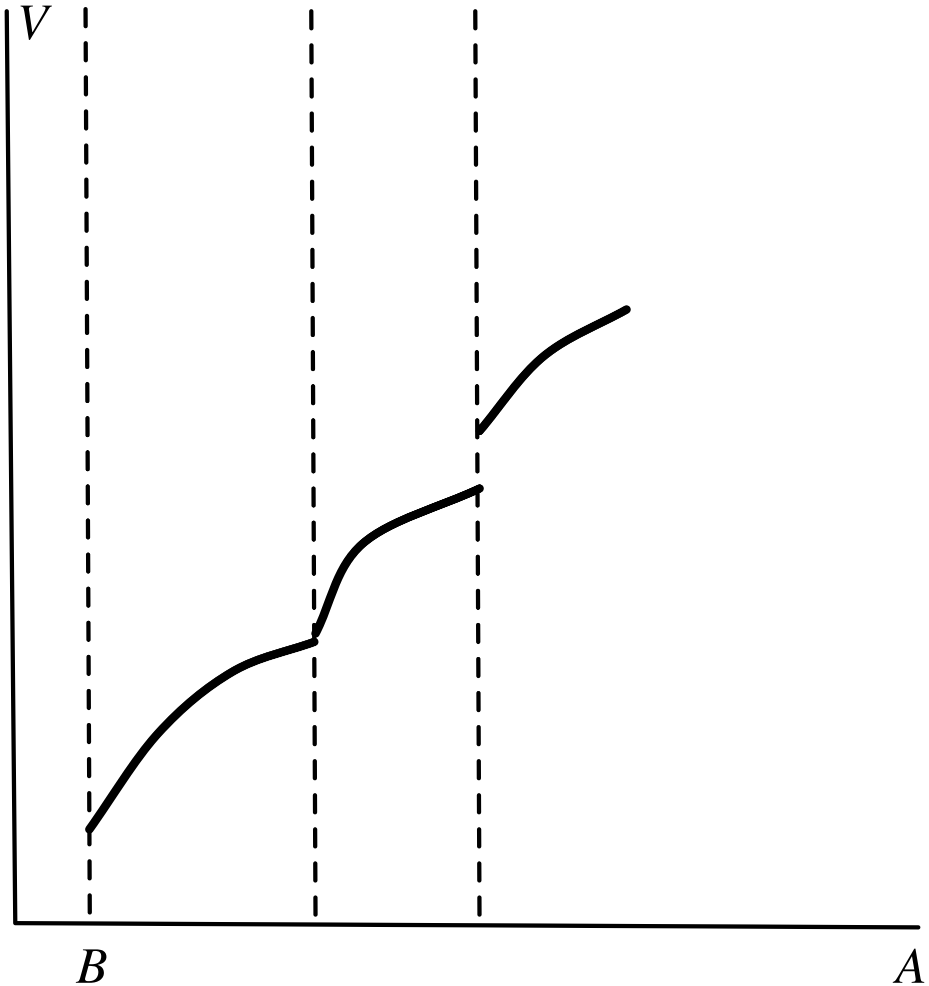
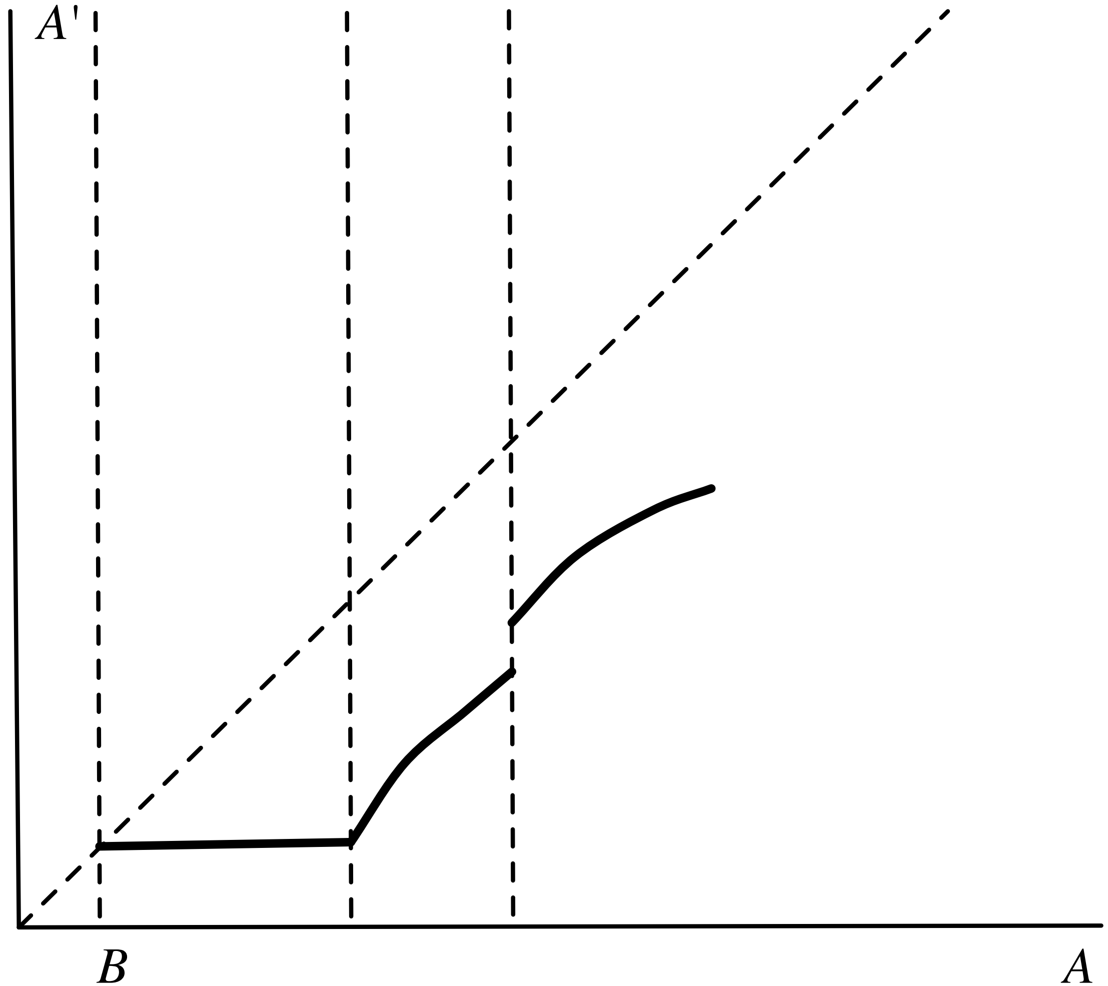
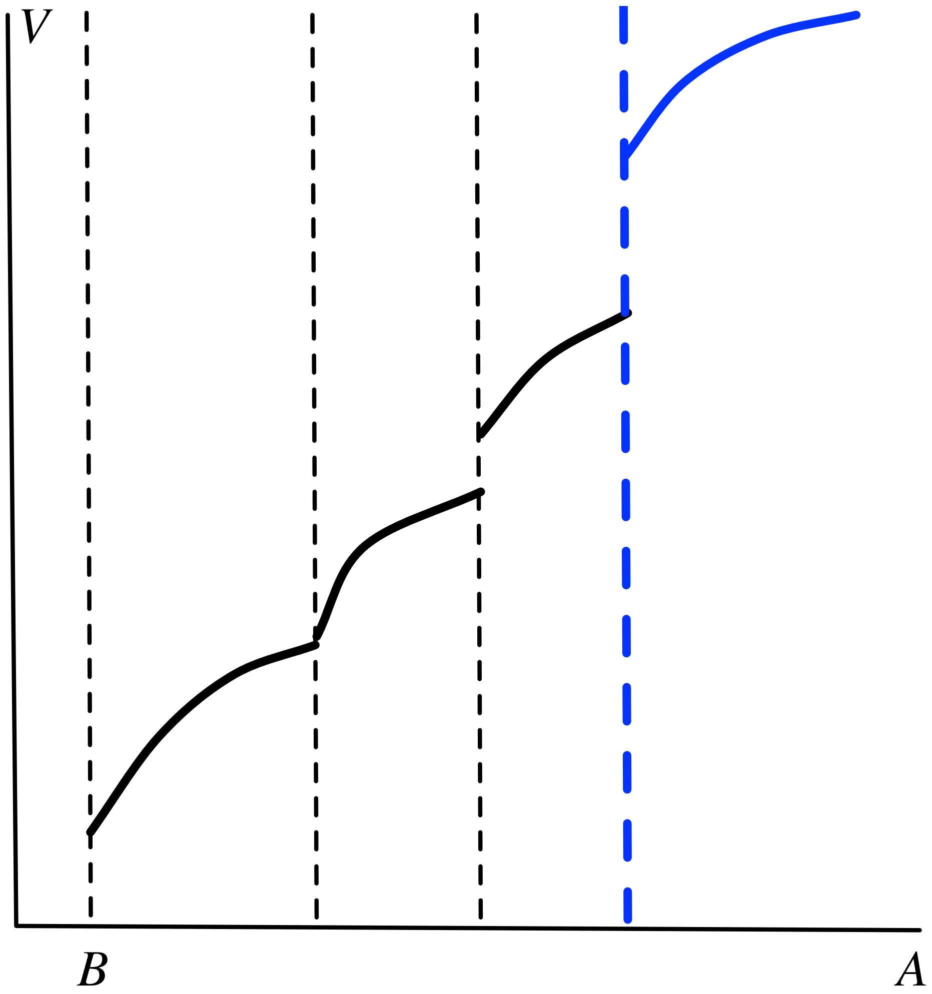
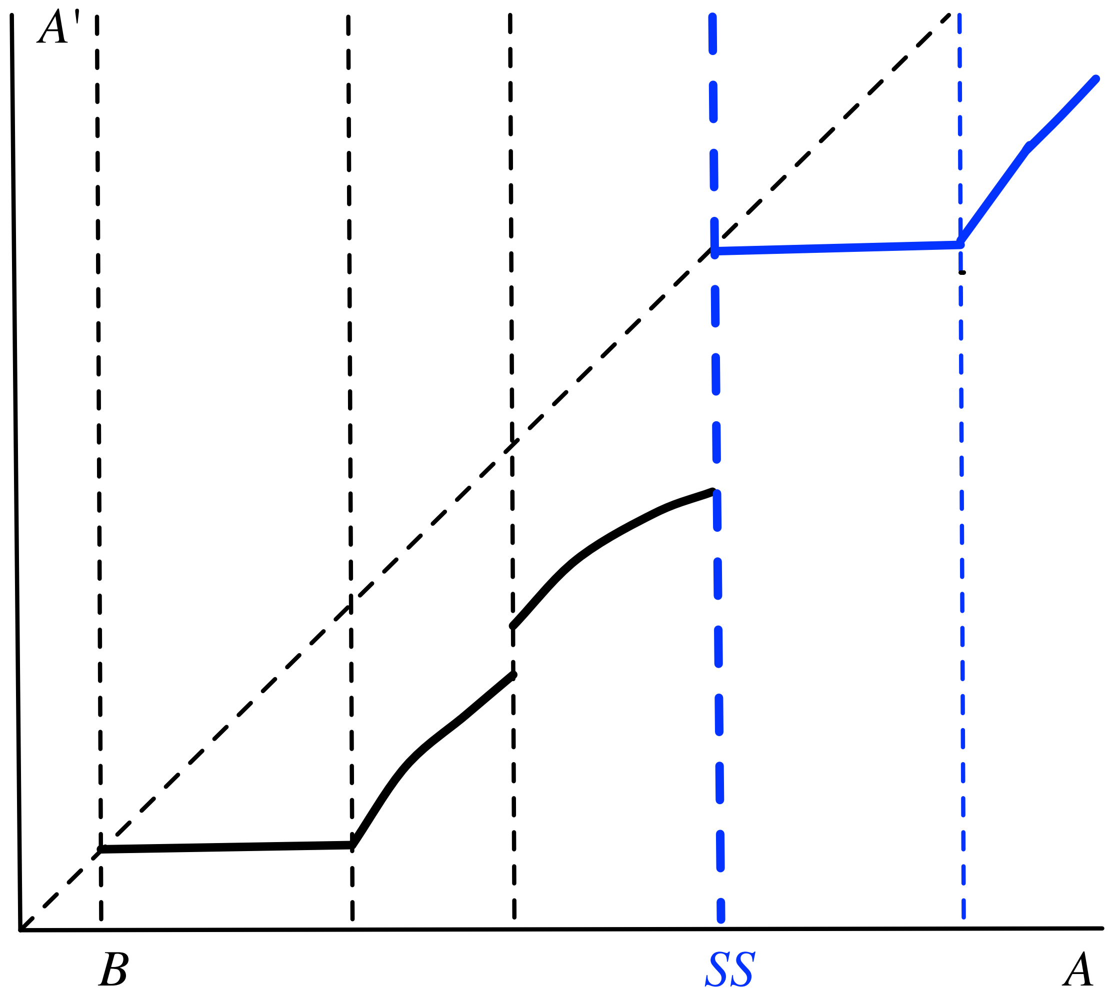
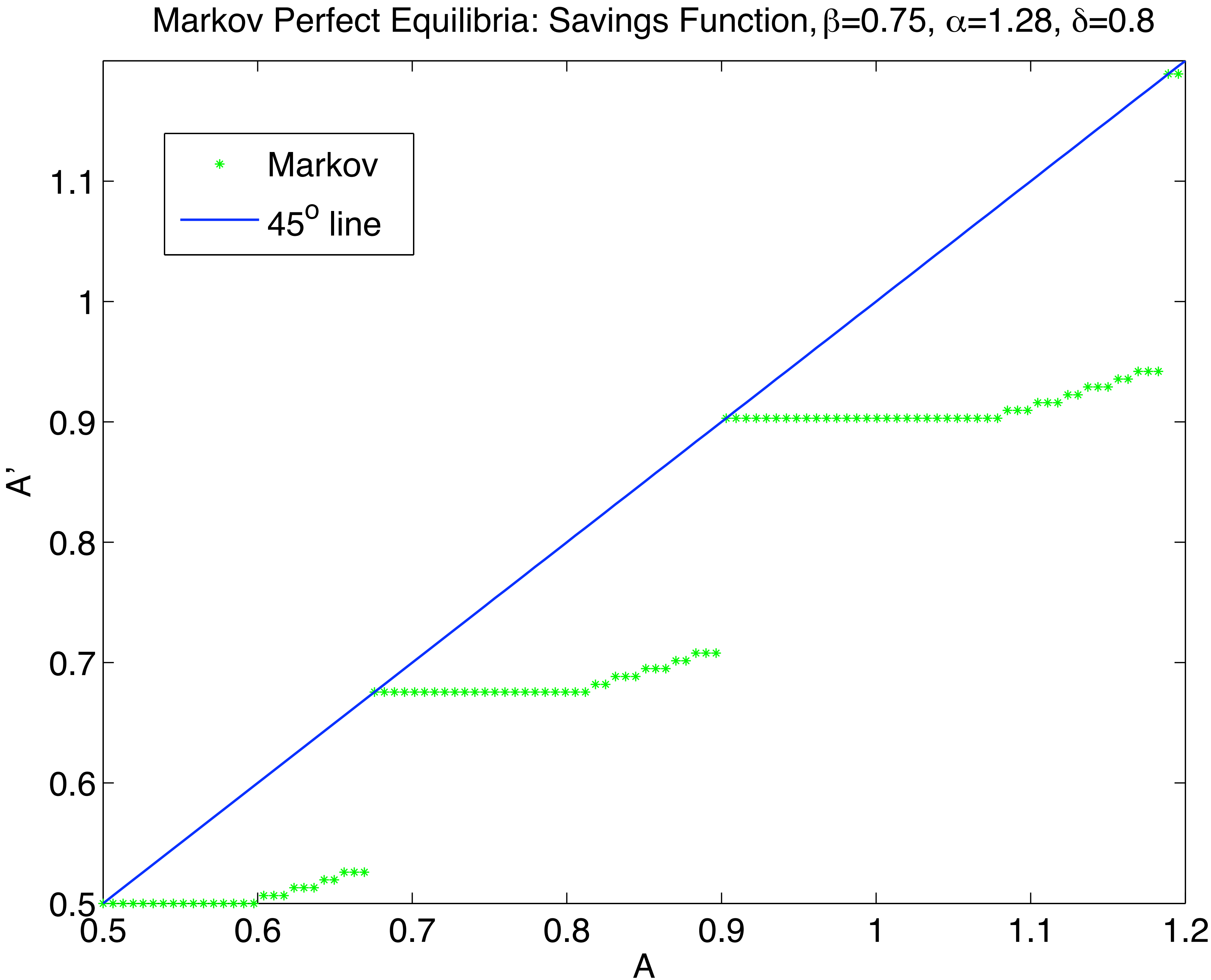




Markov Equilibrium: Values and Continuations

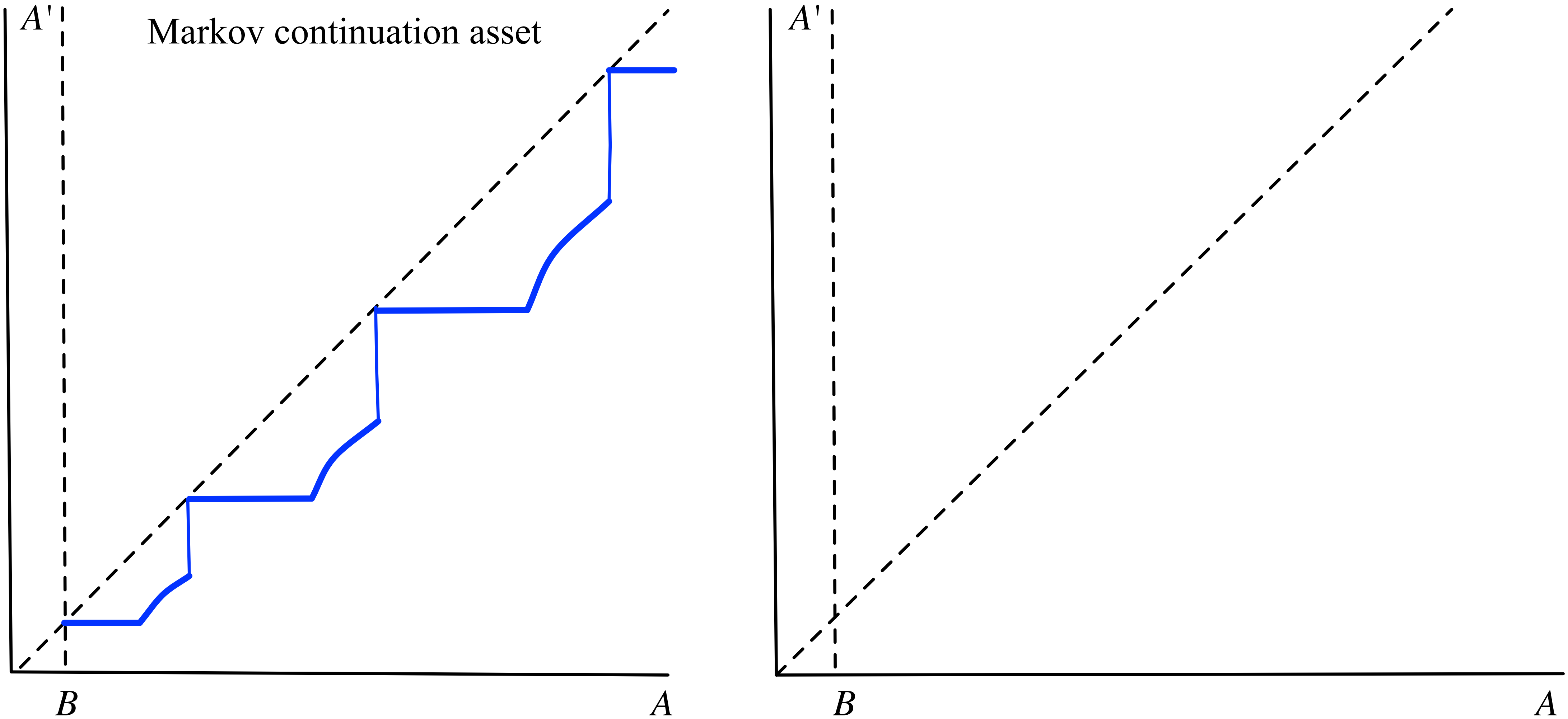






Markov Perfect Equilibria: Savings Function, β=0.75, α=1.28, δ=0.8
Markov
45° line
A'
A
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2

Illustration of the nonuniform case:



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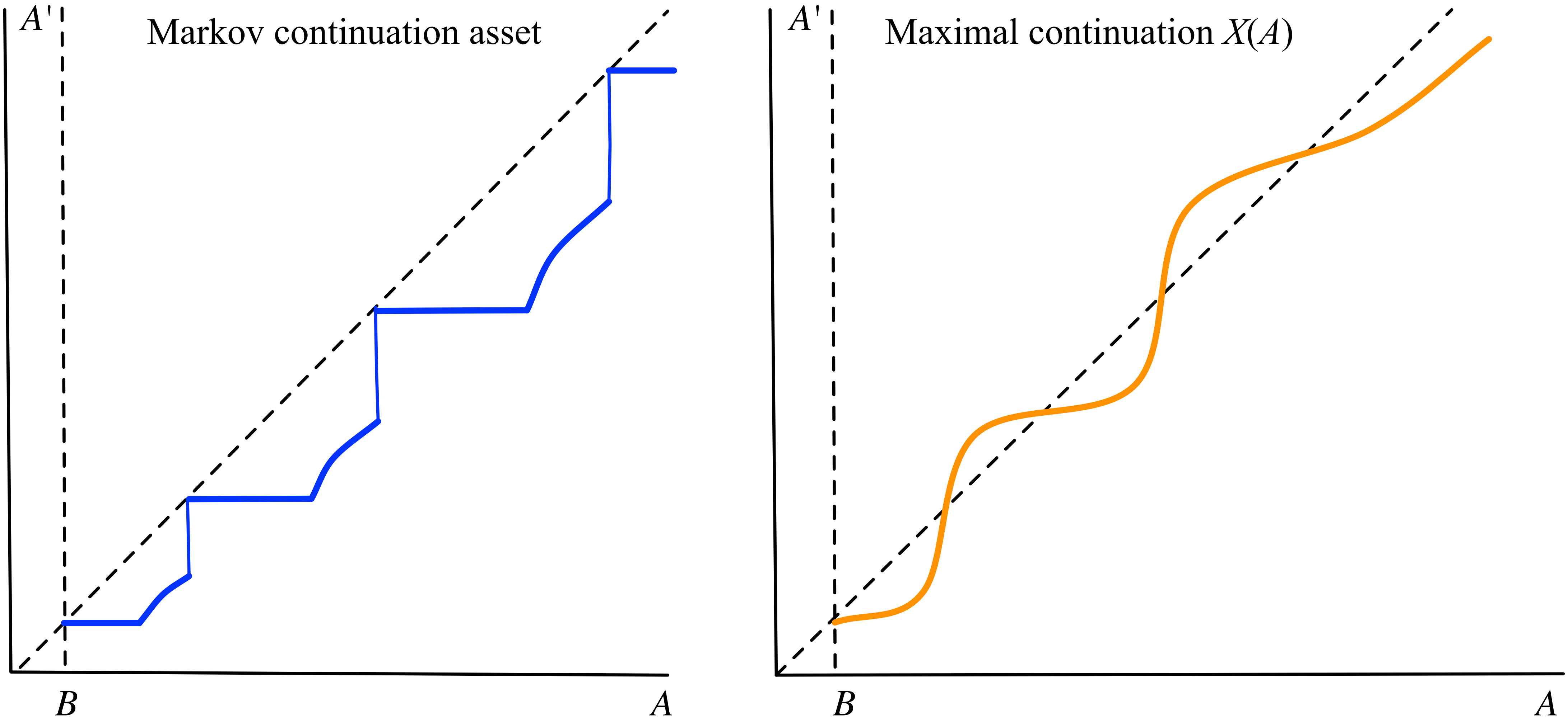

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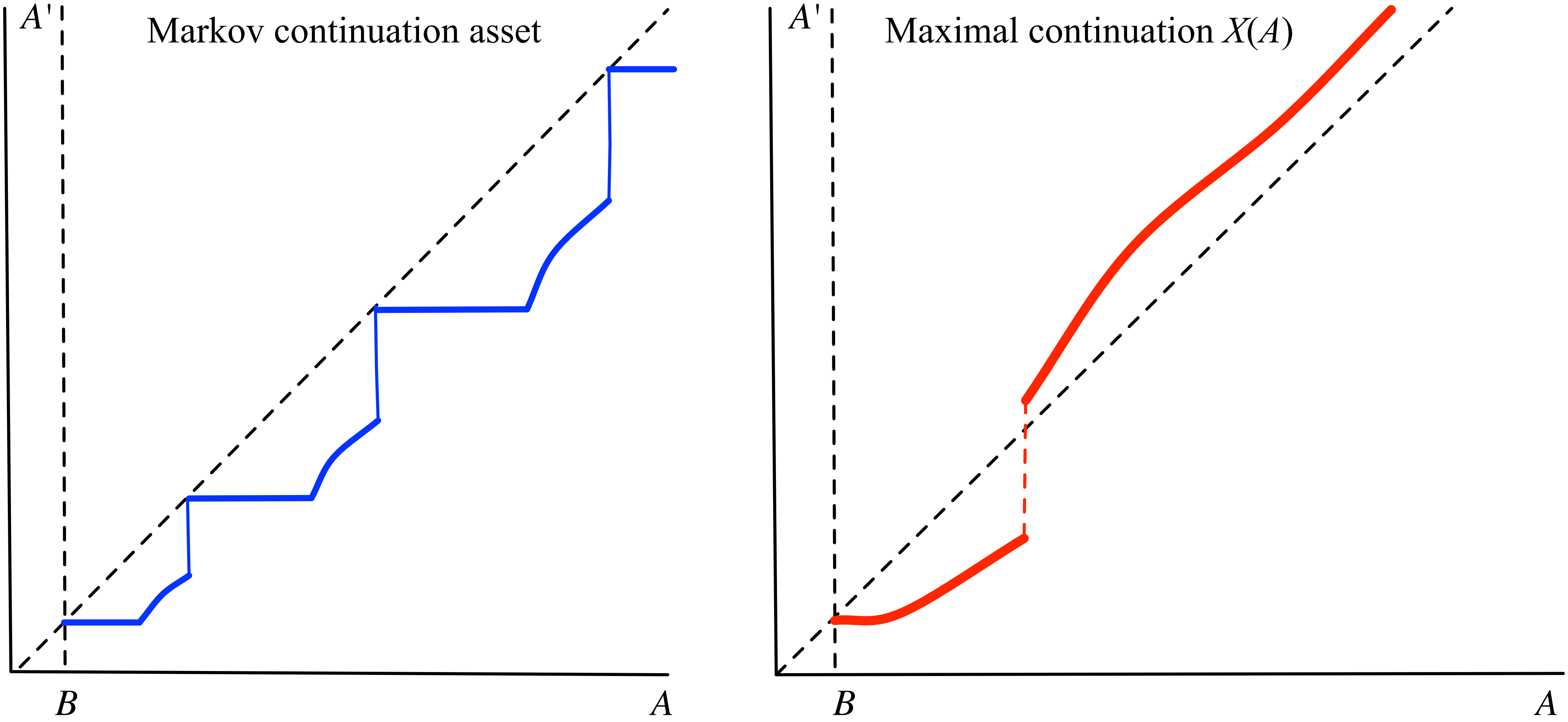

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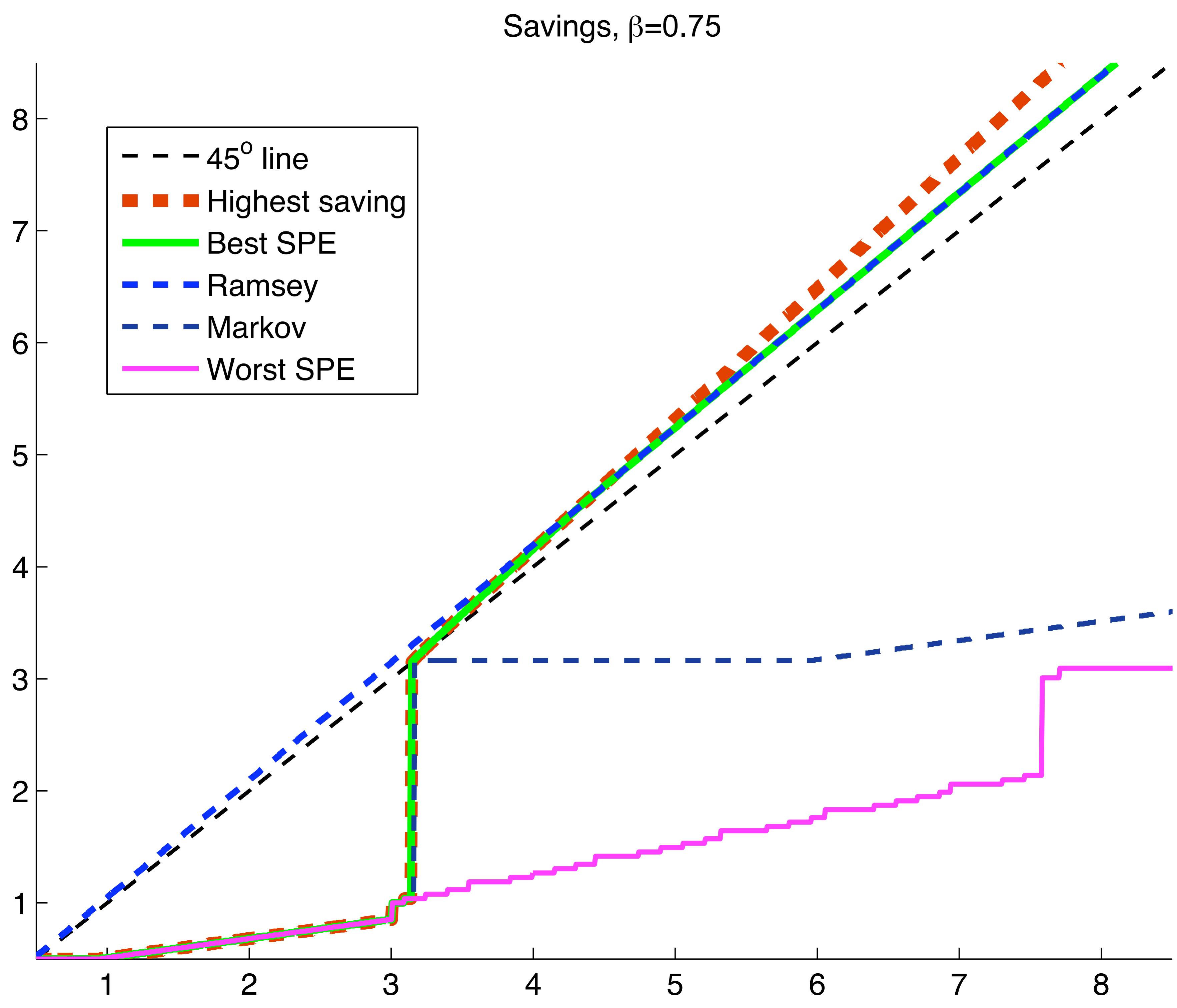
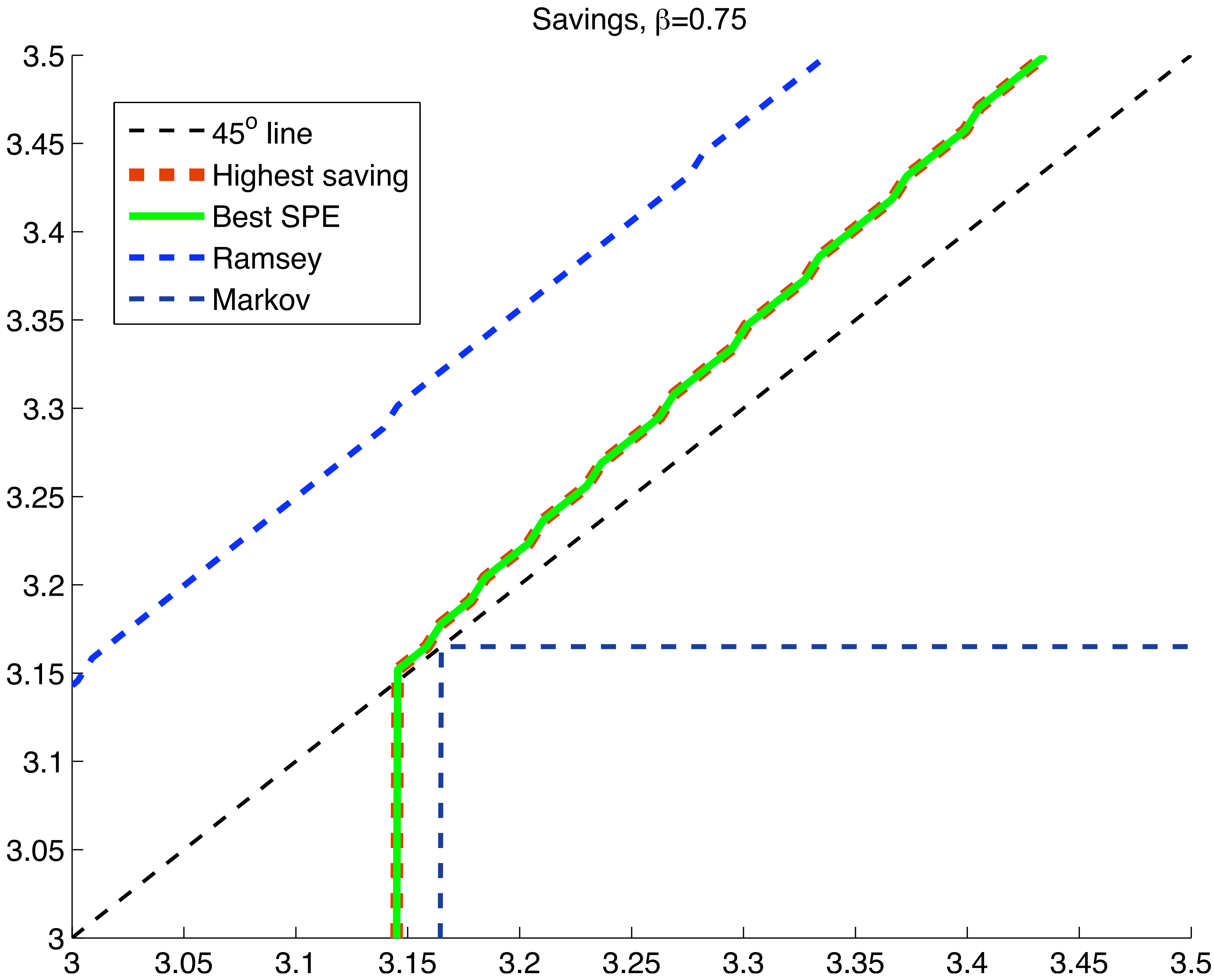
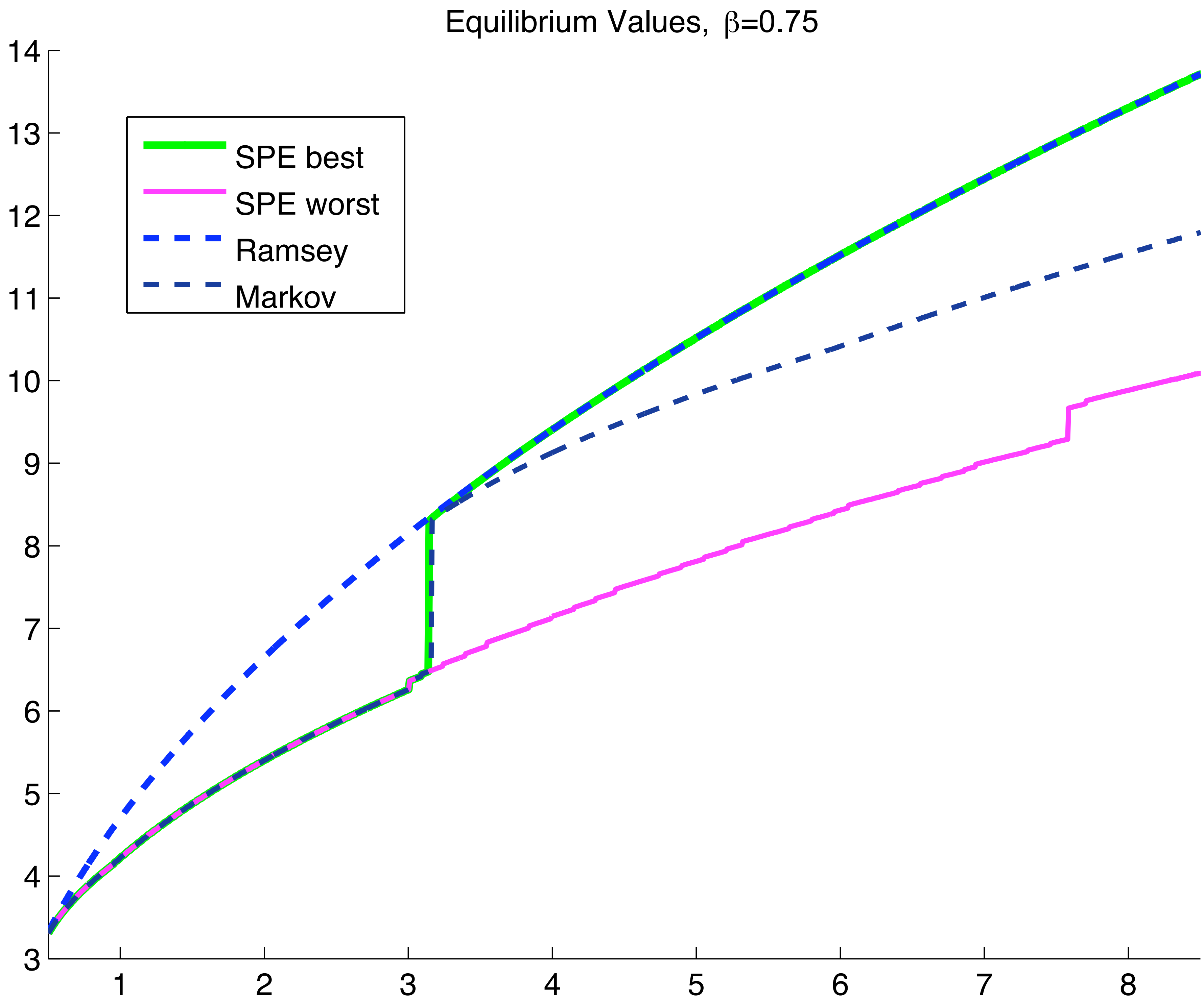


Savings, β=0.75
45° line
Highest saving
Best SPE
Ramsey
Markov
Worst SPE
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8



Savings, β=0.75
45° line
Highest saving
Best SPE
Ramsey
Markov
3.5
3.45
3.4
3.35
3.3
3.25
3.2
3.15
3.1
3.05
3
3
3.05
3.1
3.15
3.2
3.25
3.3
3.35
3.4
3.45
3.5



Equilibrium Values, β=0.75
SPE best
SPE worst
Ramsey
Markov
14
13
12
11
10
9
8
7
6
5
4
3
1
2
3
4
5
6
7
8

- **Proposition 4 [Central Result].** In the non-uniform case,

- There is $A_1 > B$, such that every $A \in [B, A_1)$ has a poverty trap.

- There is $A_2 \geq A_1$ such that all $A \geq A_2$ exhibit strong self-control.

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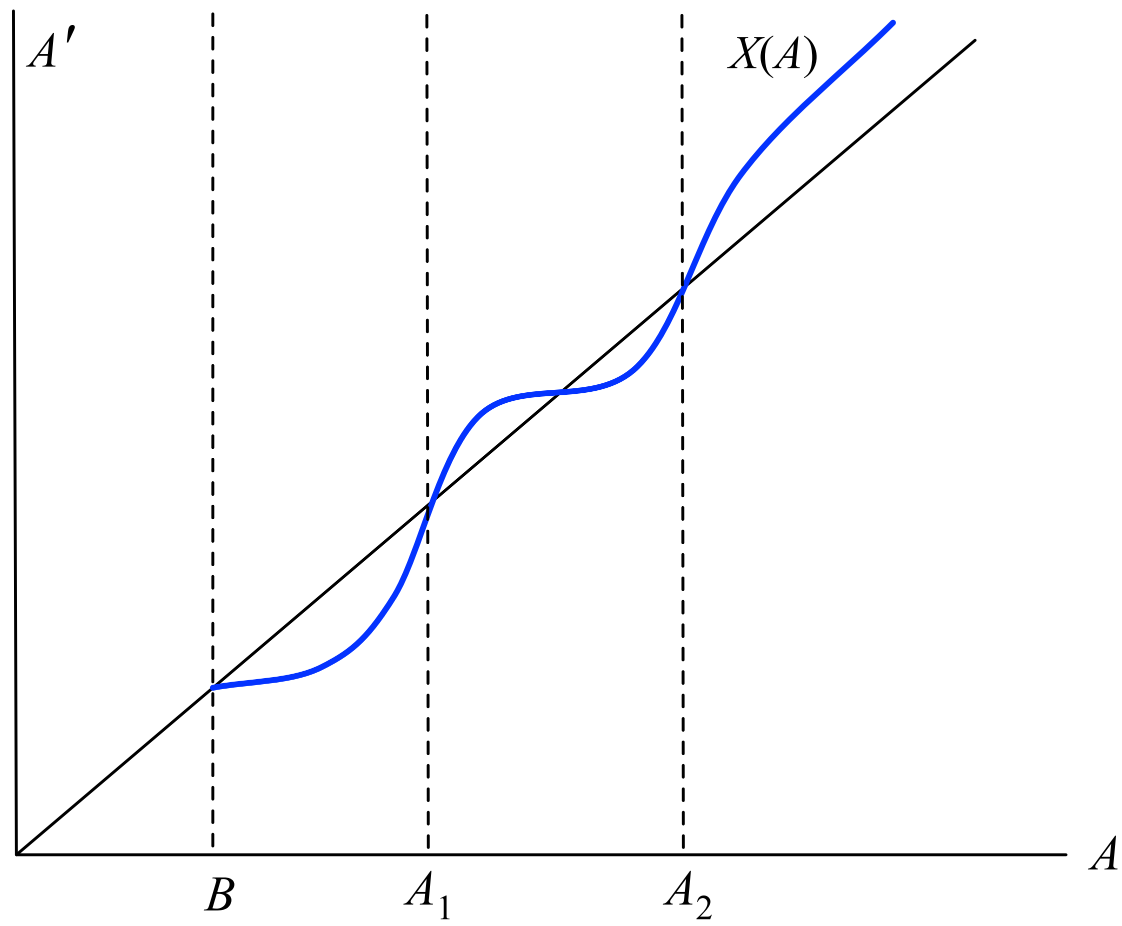

Outline I. The Poverty Trap

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

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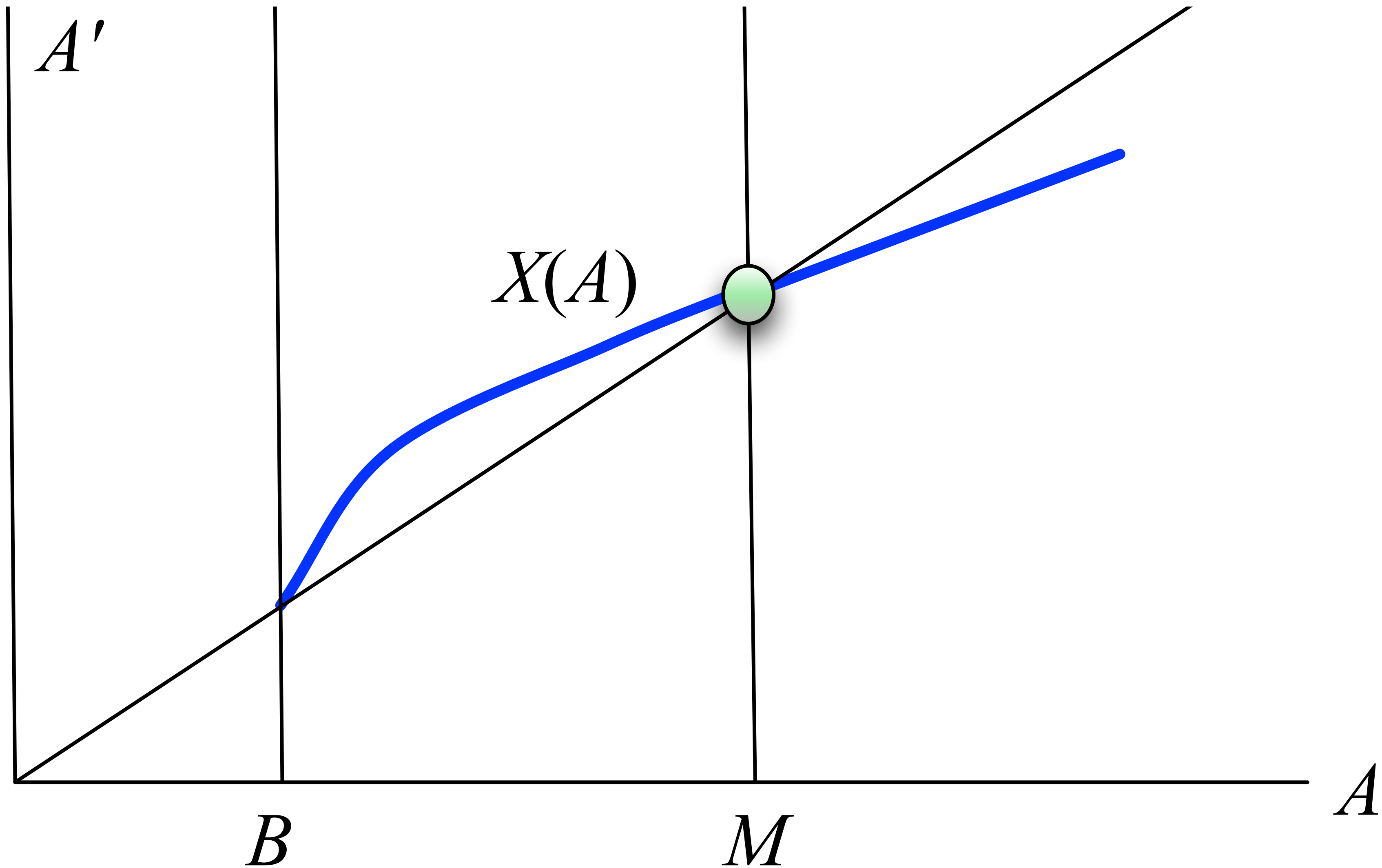

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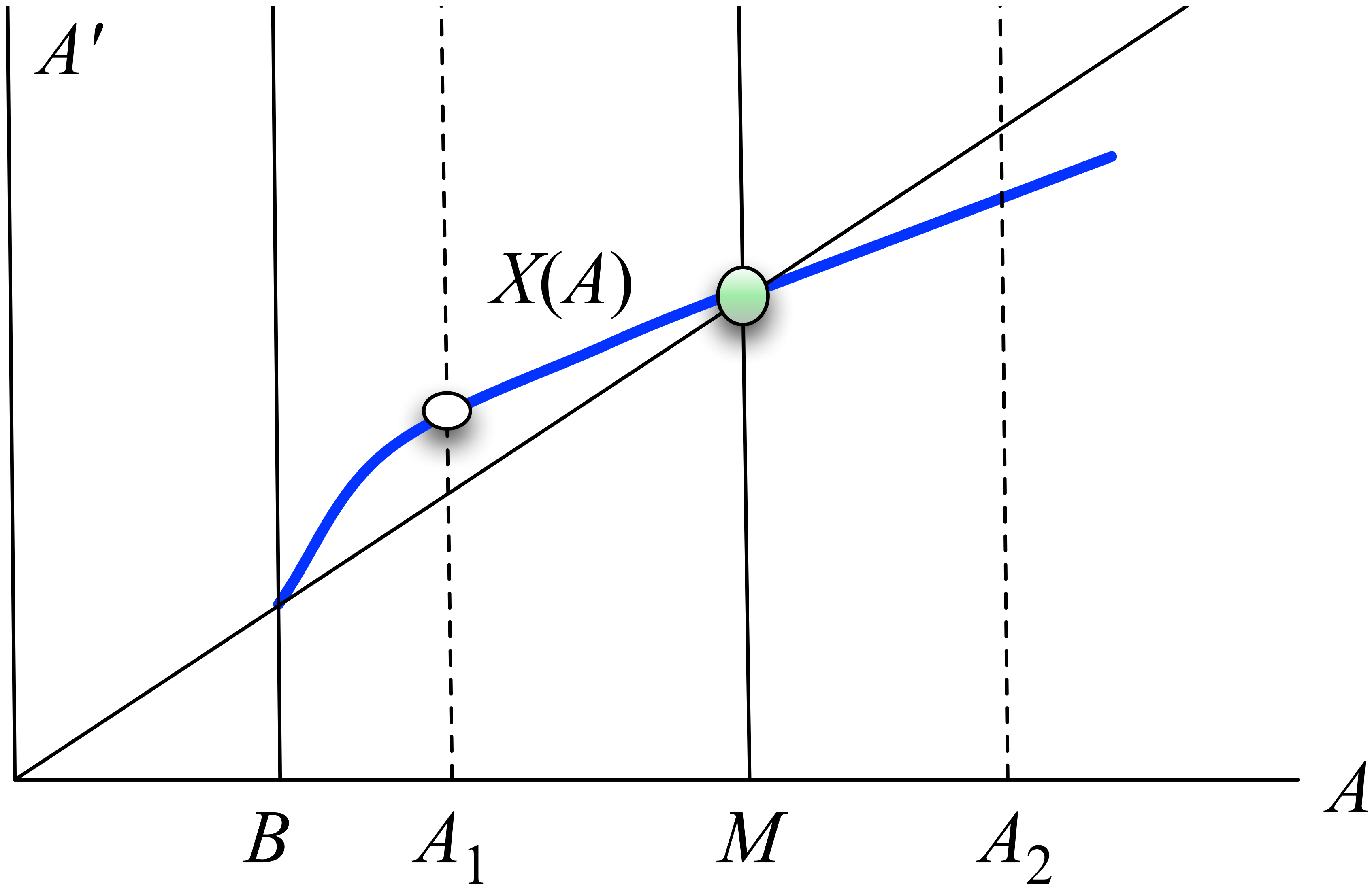

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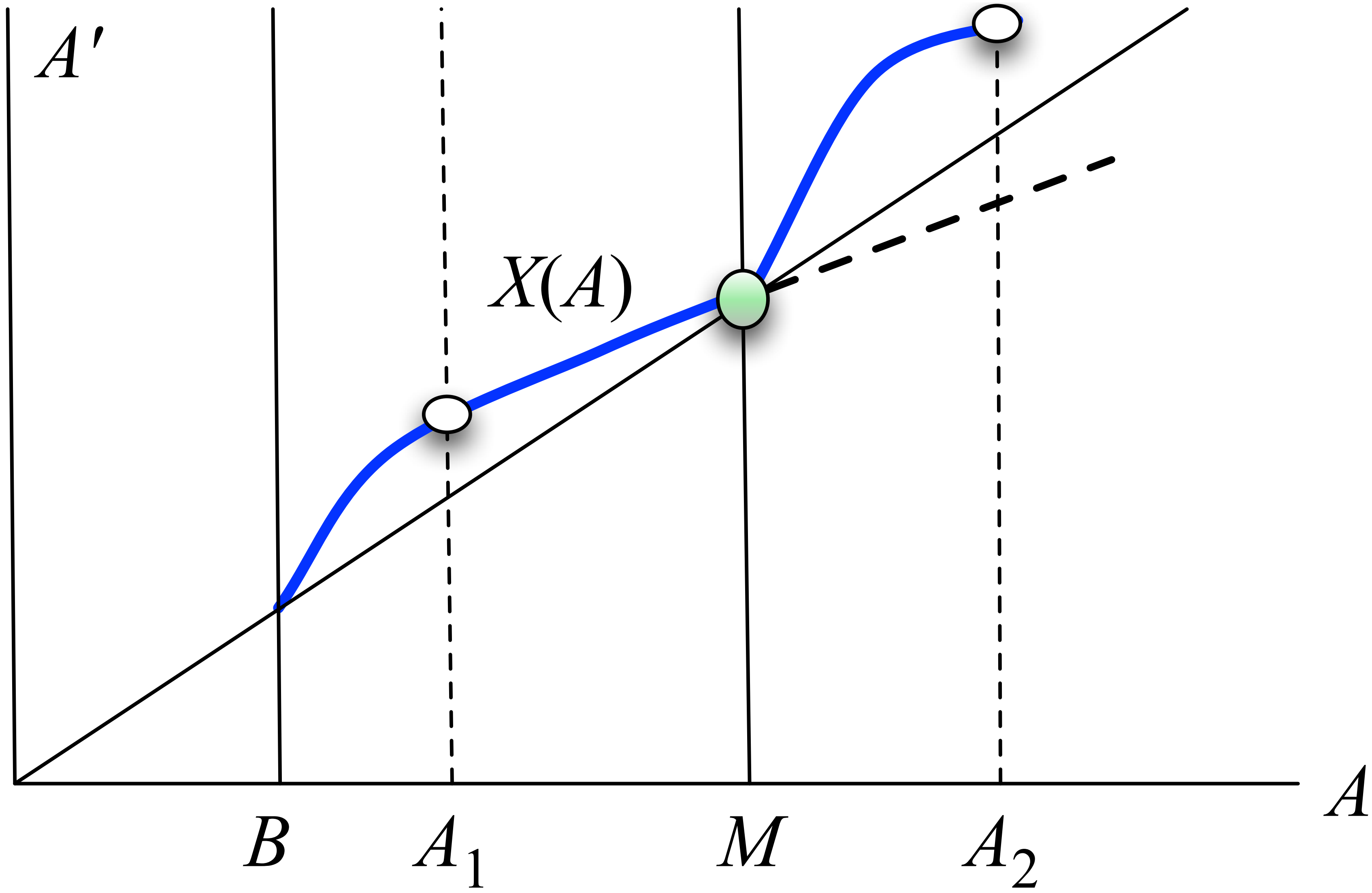

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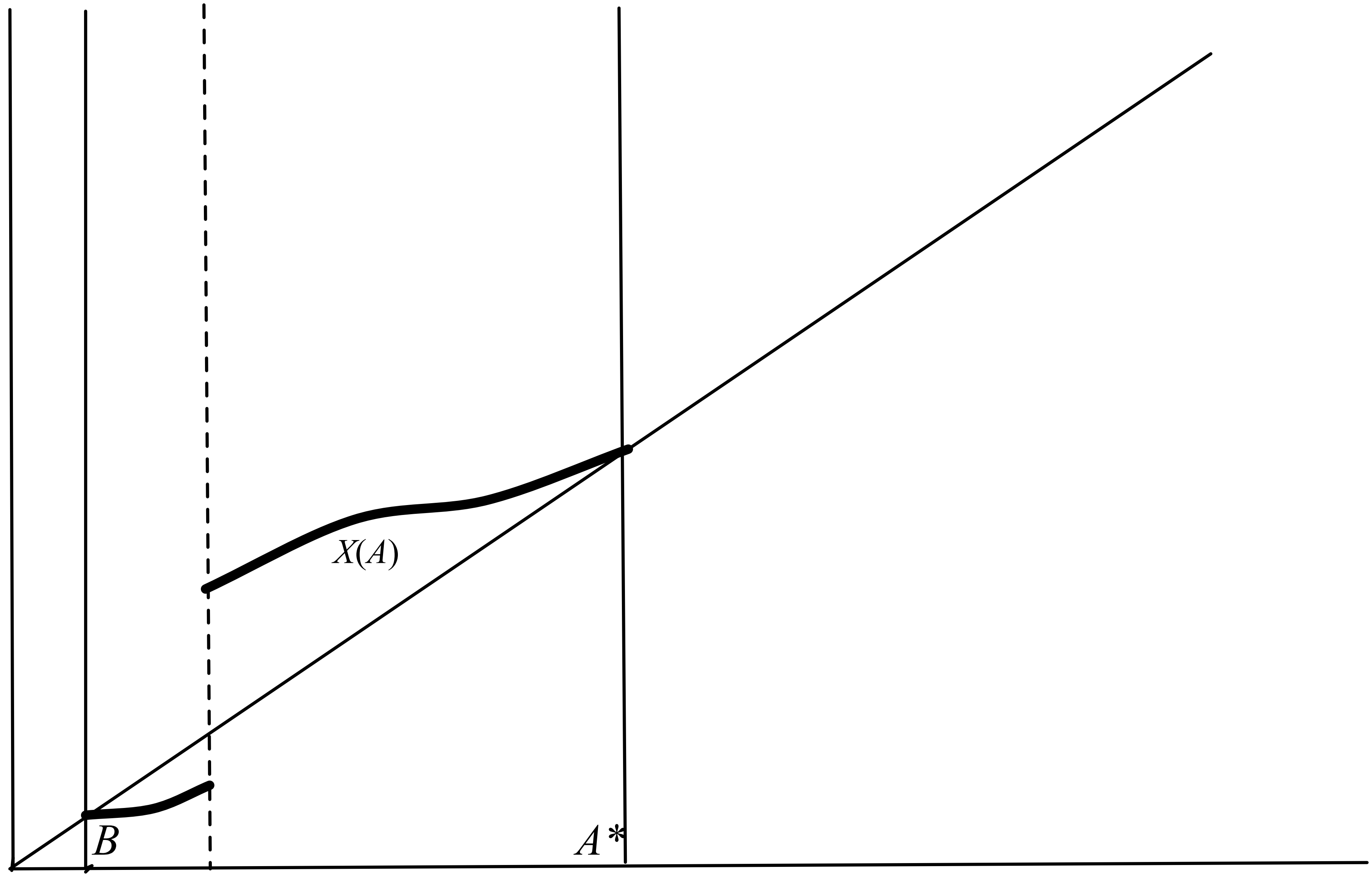

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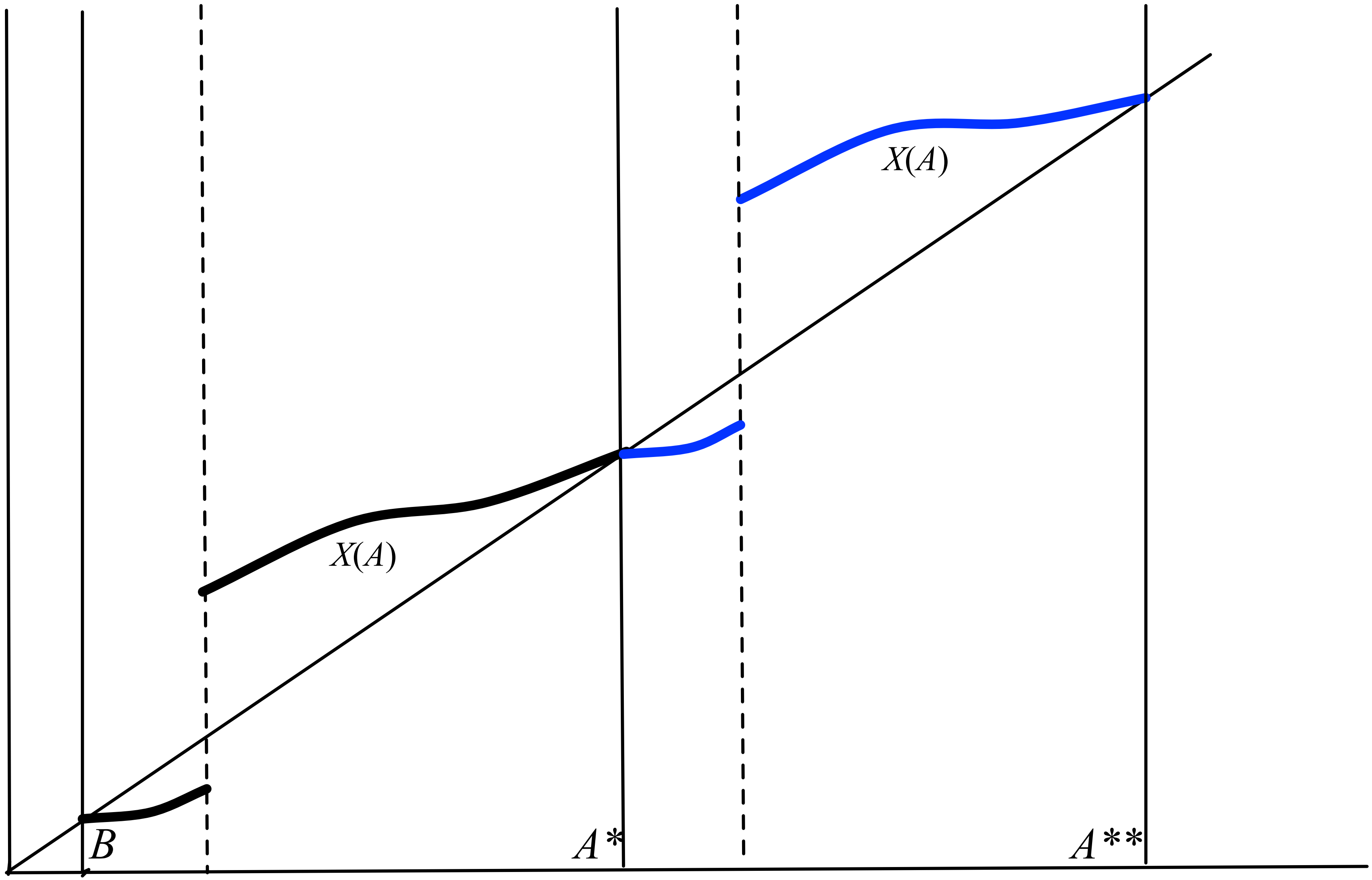

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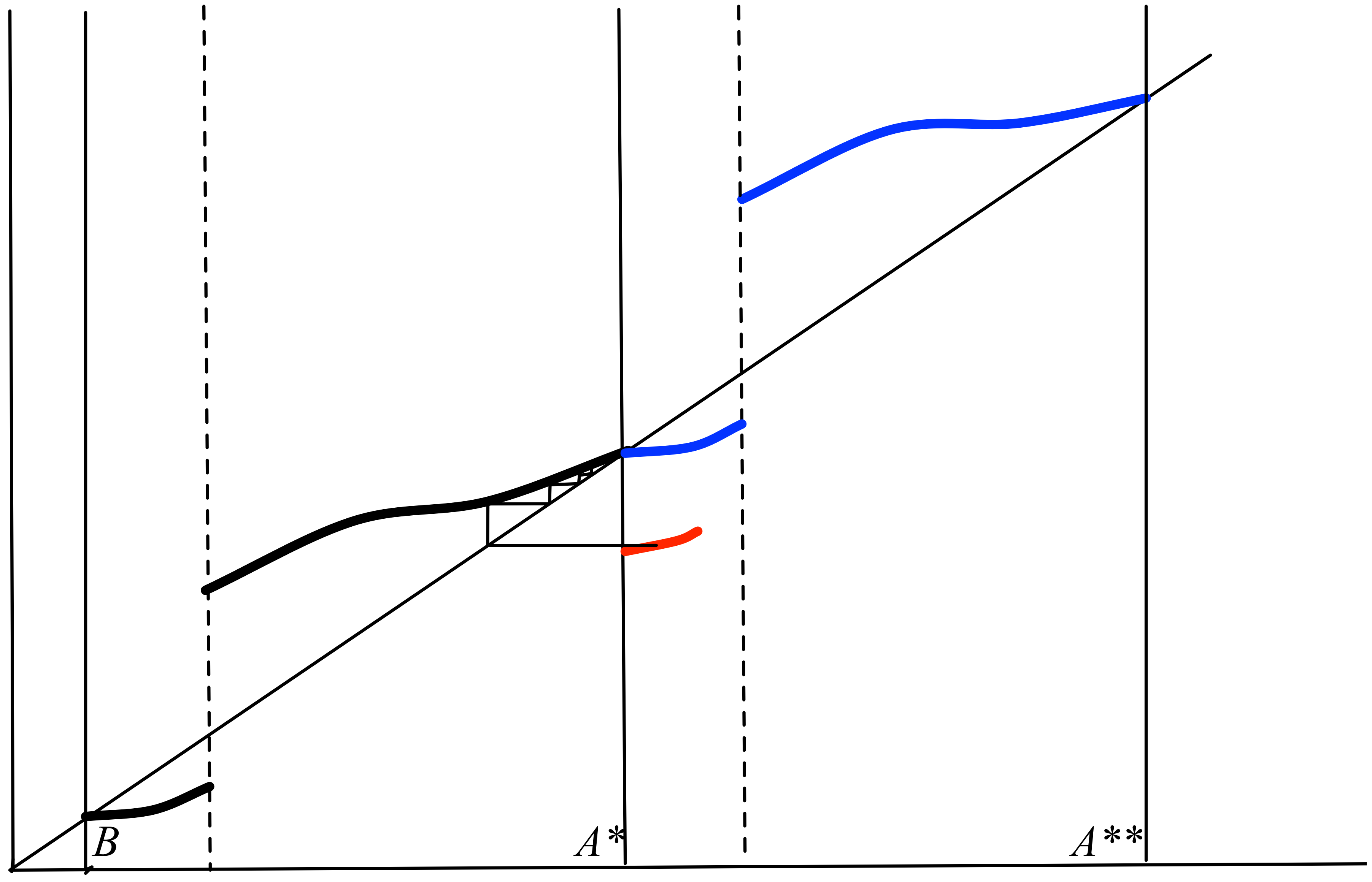

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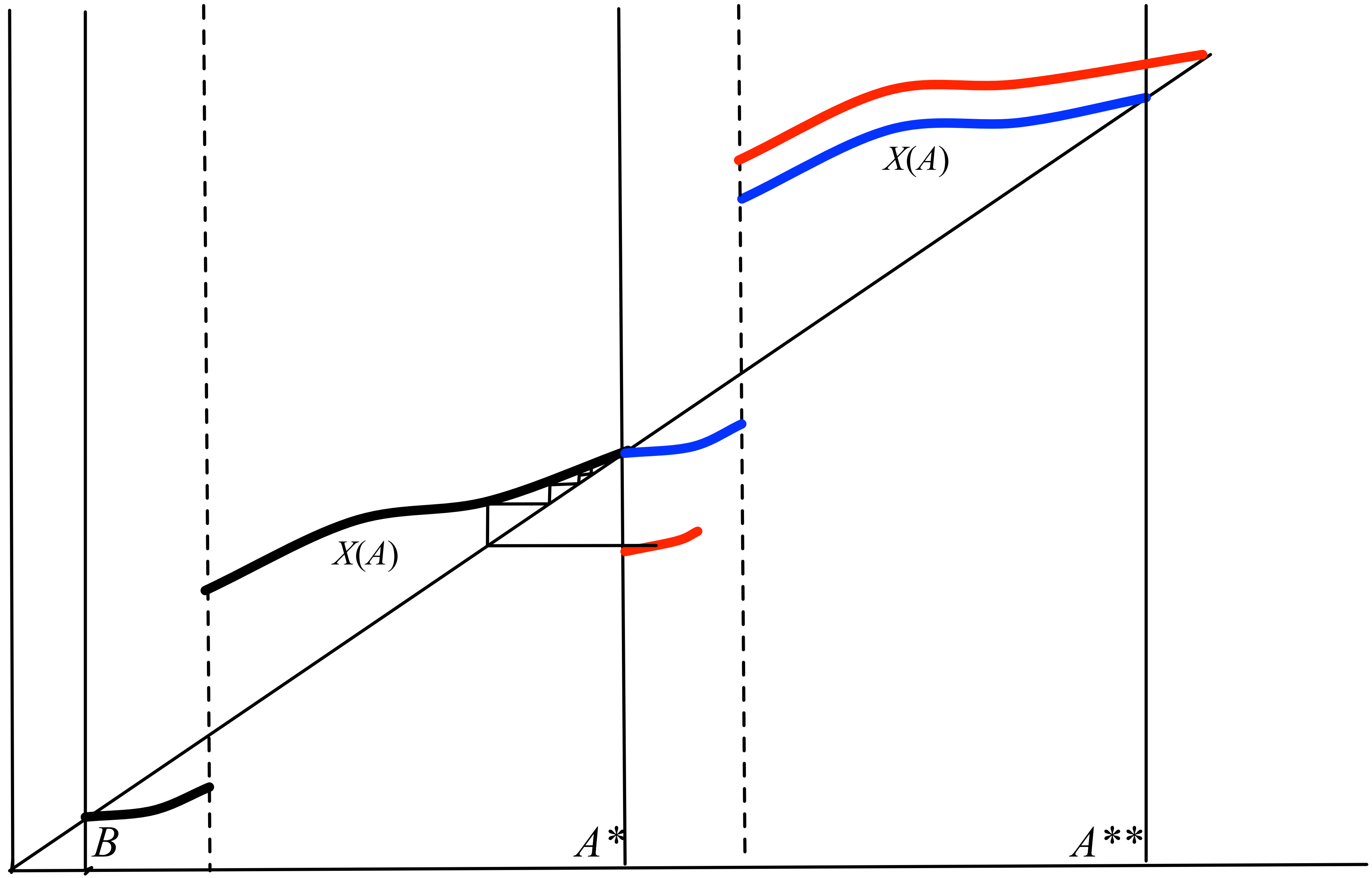

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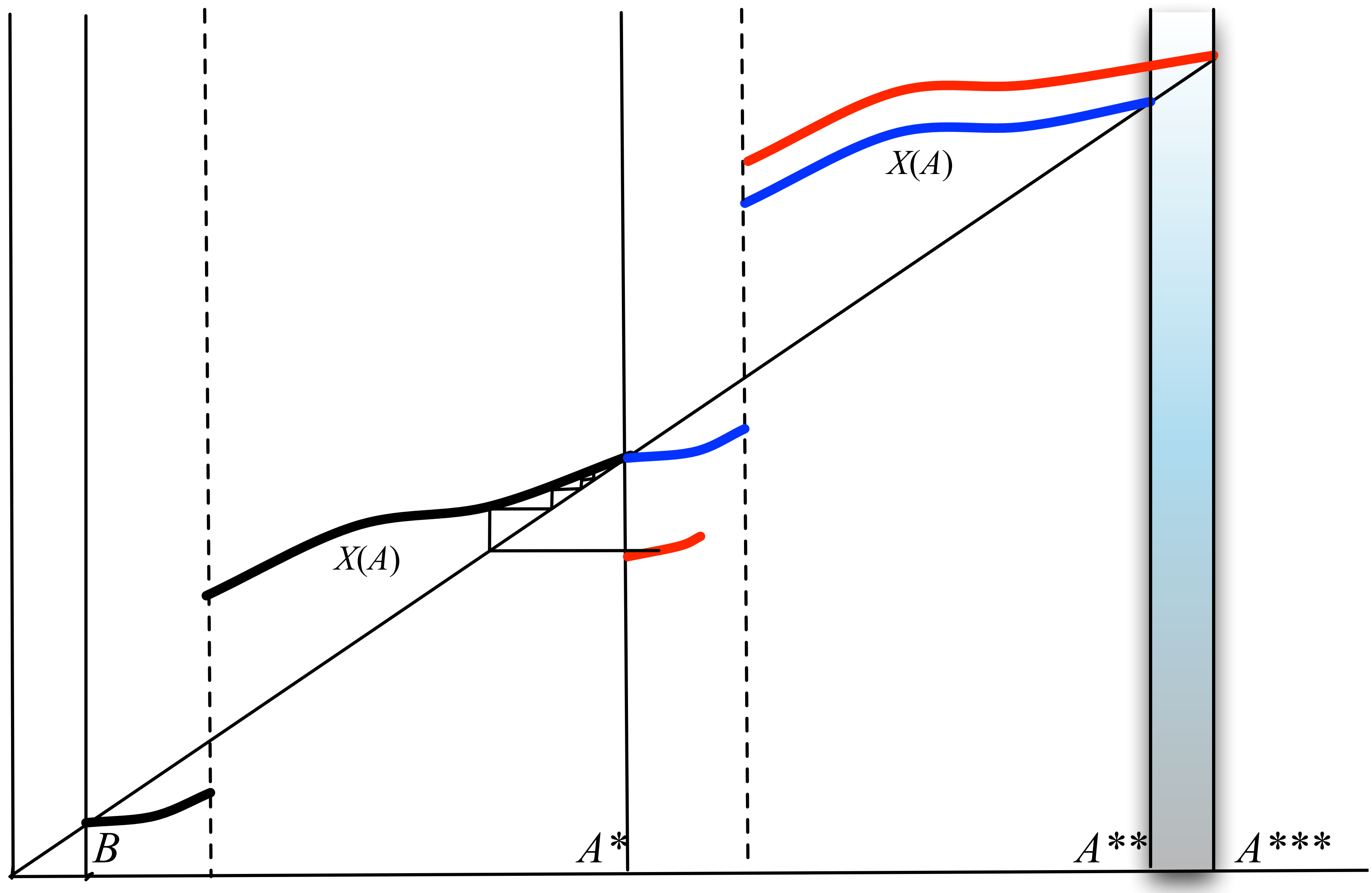
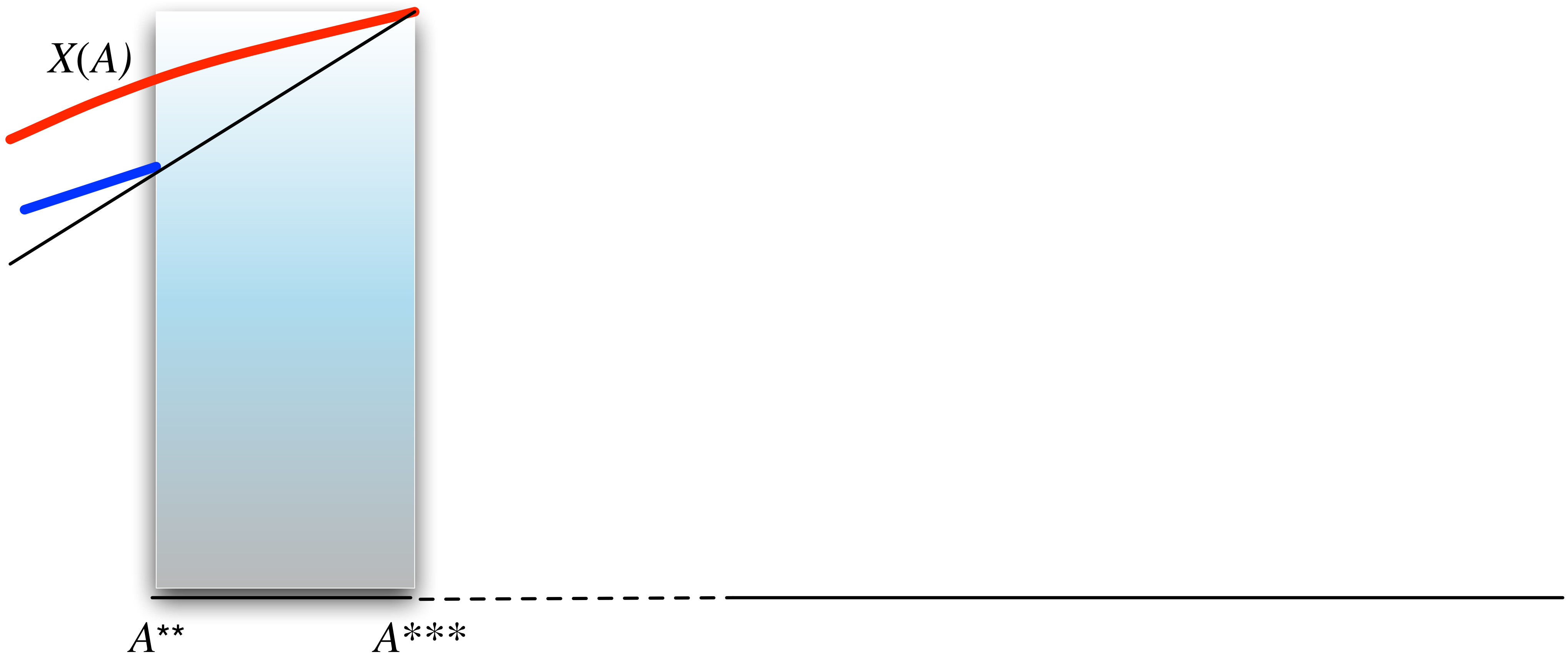
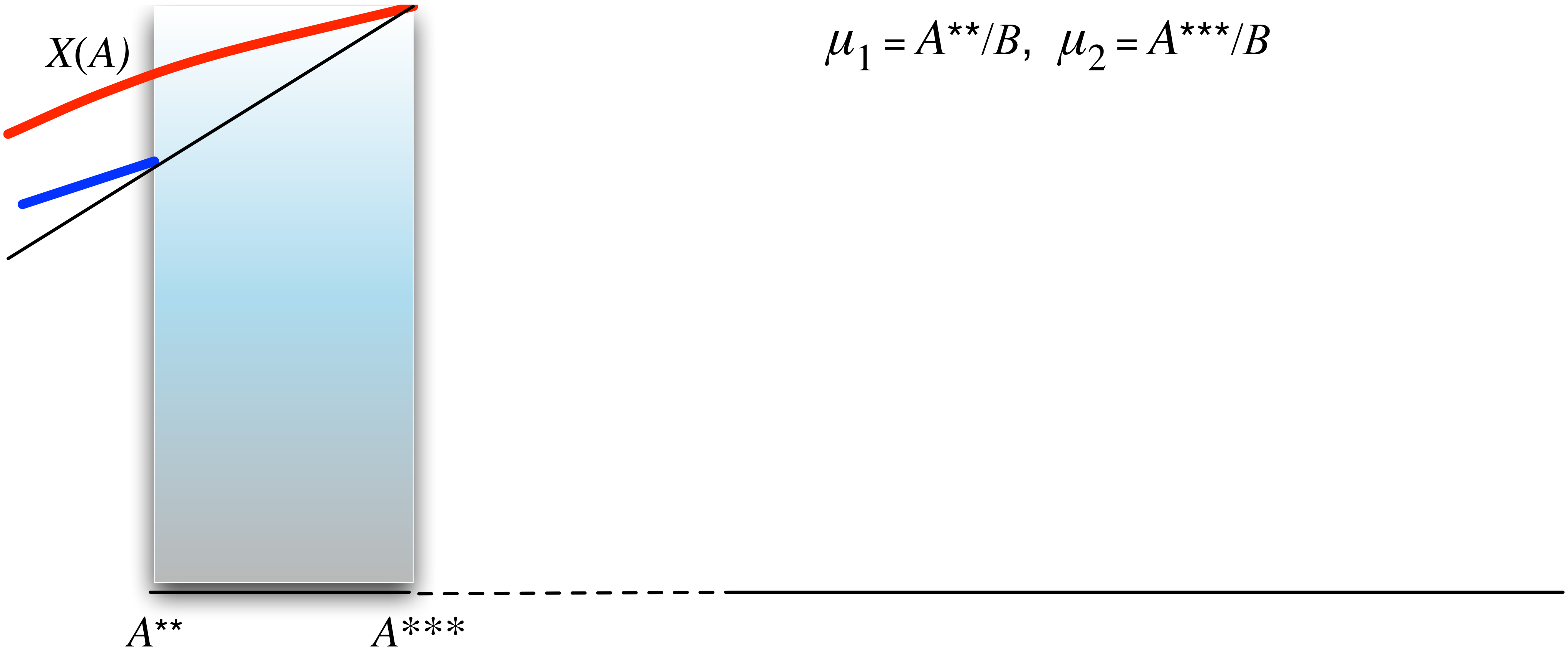


Outline II. Strong Self-Control, contd.



Outline II. Strong Self-Control, contd.



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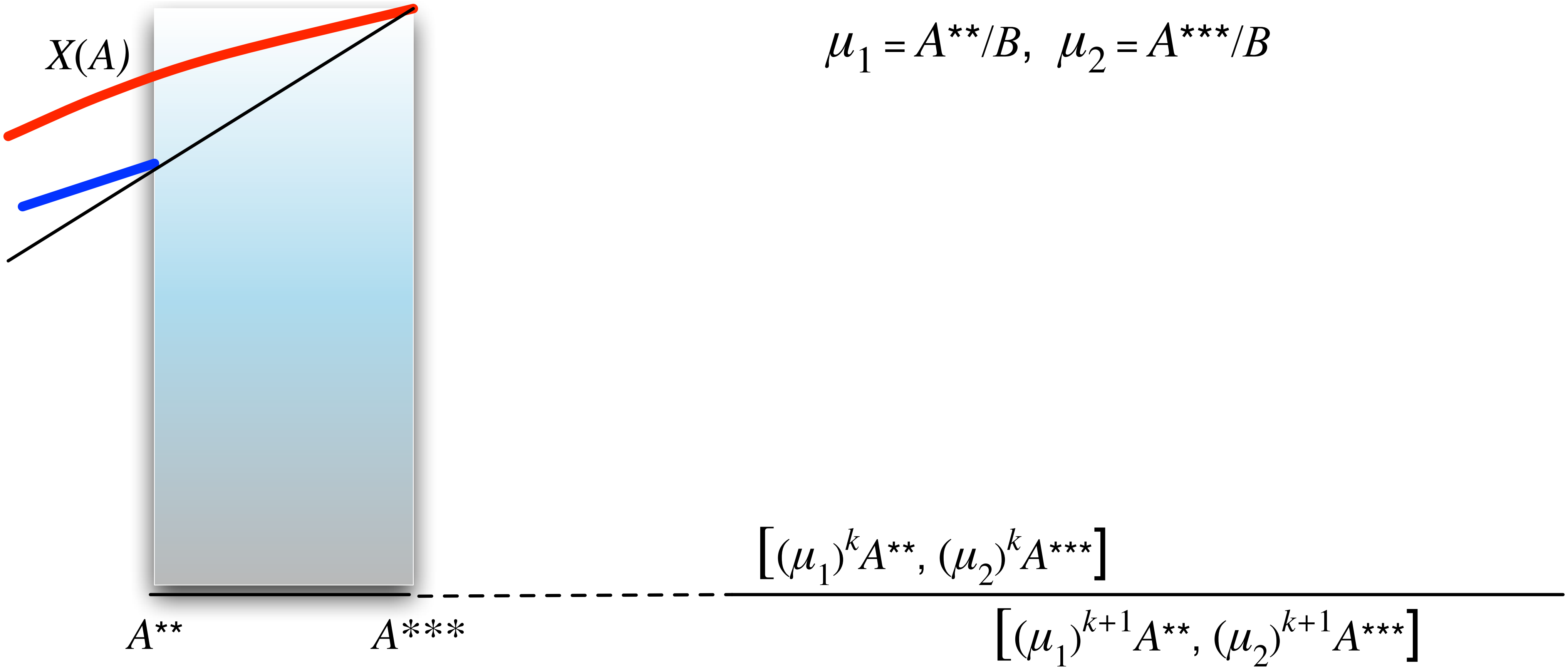

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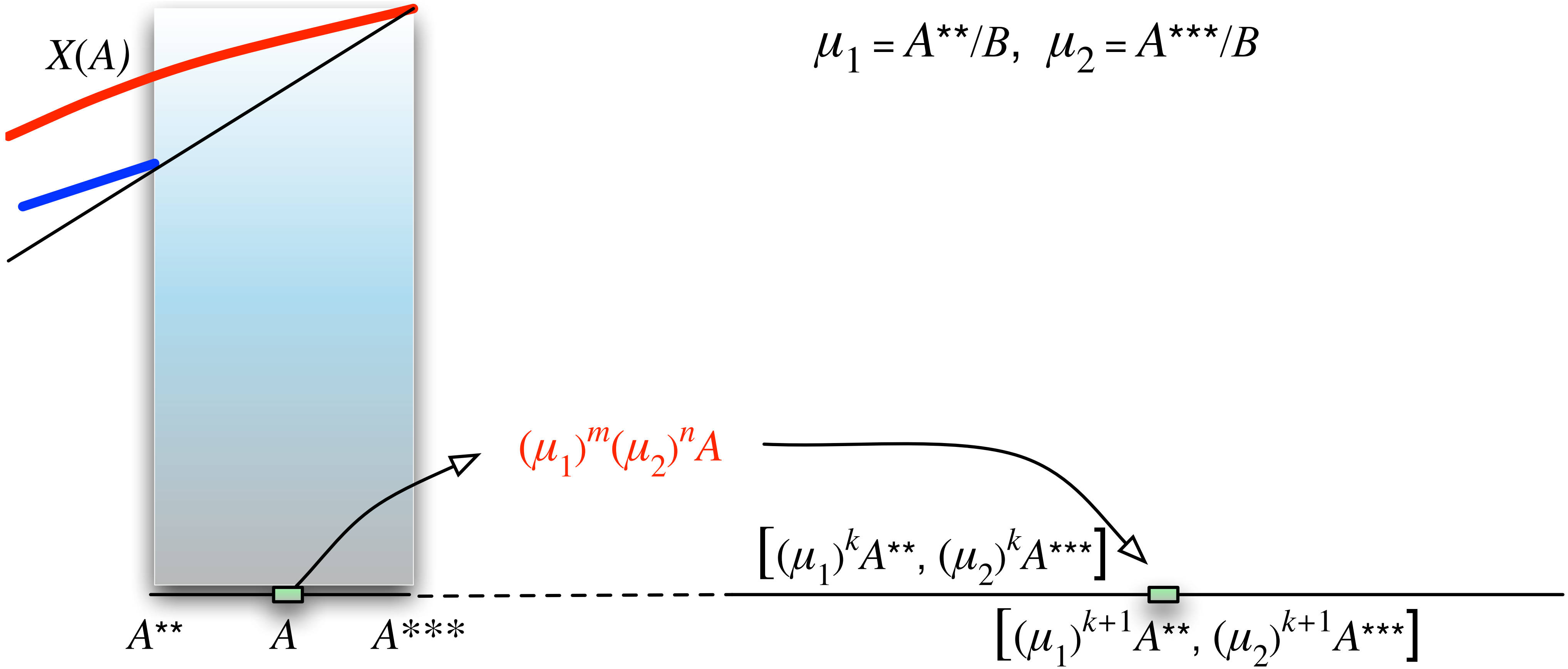

Some Implications of the Model

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- 1. Link Between Credit Limit and Self-Control

- 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 the poverty trap will fall further.

- Summary: ambiguous effects, depending on where you start.

- 2. Asset-Specific MPCs

  Hatsopoulos-Krugman-Poterba (1989), Thaler (1990).

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  - $B/A = B/(W + \text{permanent income})$.

- Jump in financial assets W.

  - Nonuniform case: decumulation to accumulation.

  - So low MPC from financial assets.

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

  - High MPC in non-uniform case.

- At best B unchanged; then identical MPCs.

- 3. The Demand For External Commitment Devices:

- Why isn't all savings done through external commitment?

  - Obvious answer: uncertainty creates the need for flexibility.

- But external commitments undermine internal self-control:

  - E.g., locking up money in inaccessible account increases B.

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- Implication for institutional design:

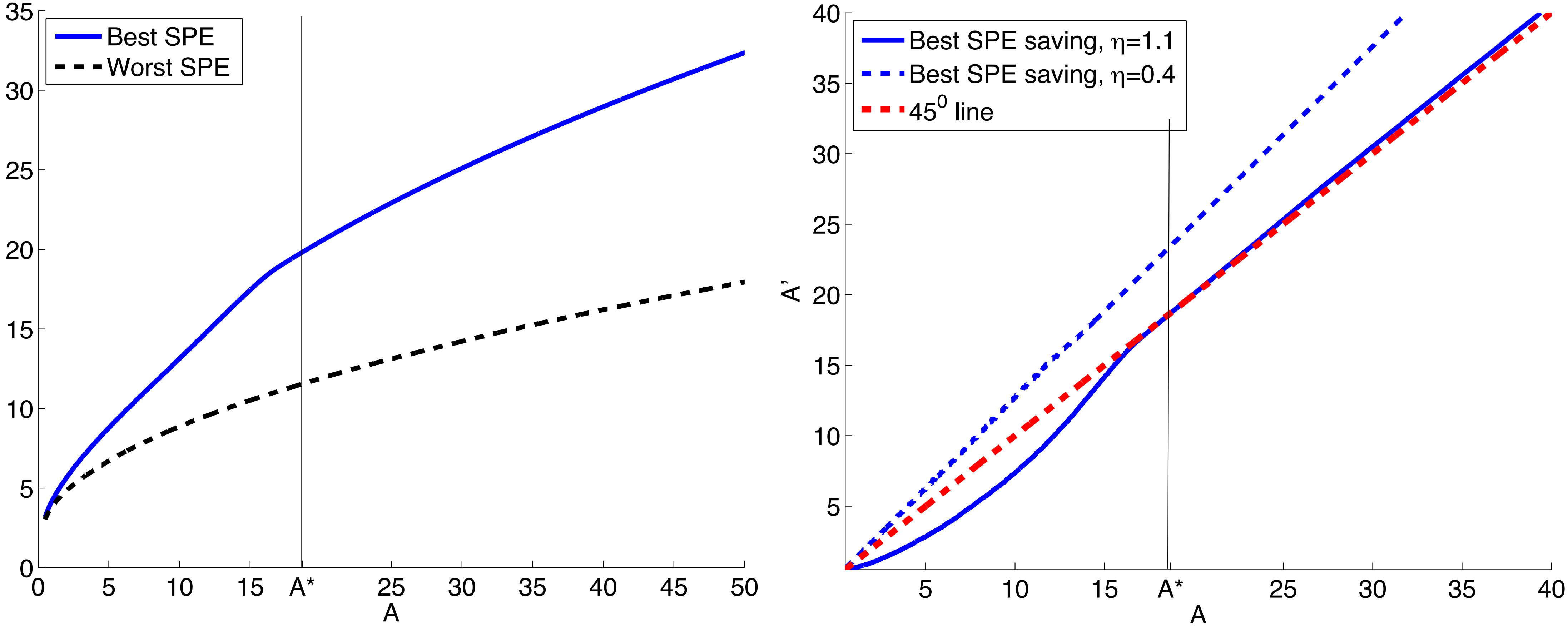
- External commitment needed to escape poverty trap, but . . .

- To keep people saving once out of the poverty trap, we need the commitments removed.

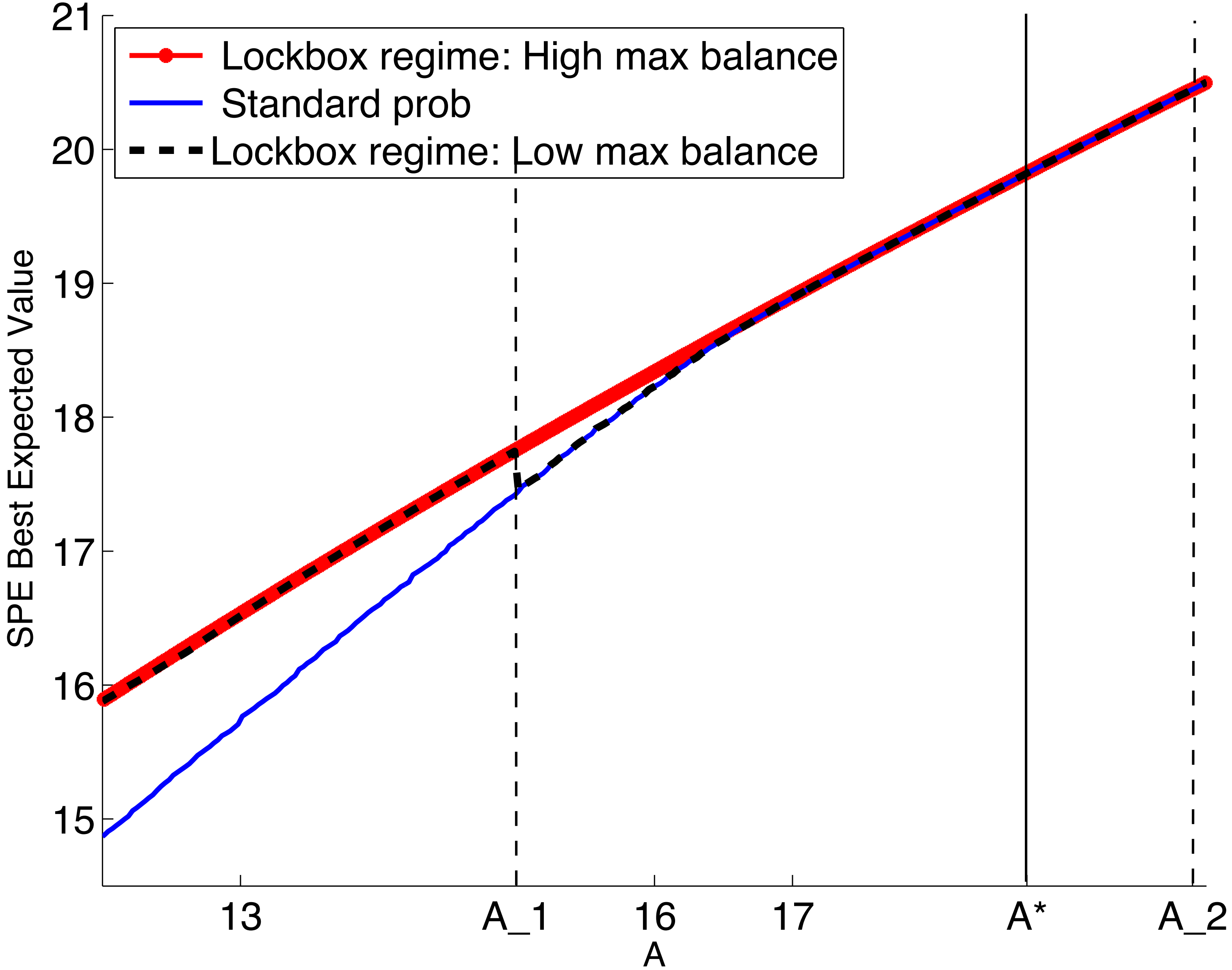
- Offer targeted lockboxes: once target achieved, funds are transferred into a standard account

- 4. Policy Experiments:
- Can compare accounts with different features
  - lock/unlock principal/interest combinations.
- Examples:
  - Standard account
  - Lock-box with threshold balance, unlocked fully afterwards
  - Lock-box with minimum balance, unlocked excess balance
  - Lock-box with principal always locked, interest never locked
- Need extended model with taste shocks to utility in every period.

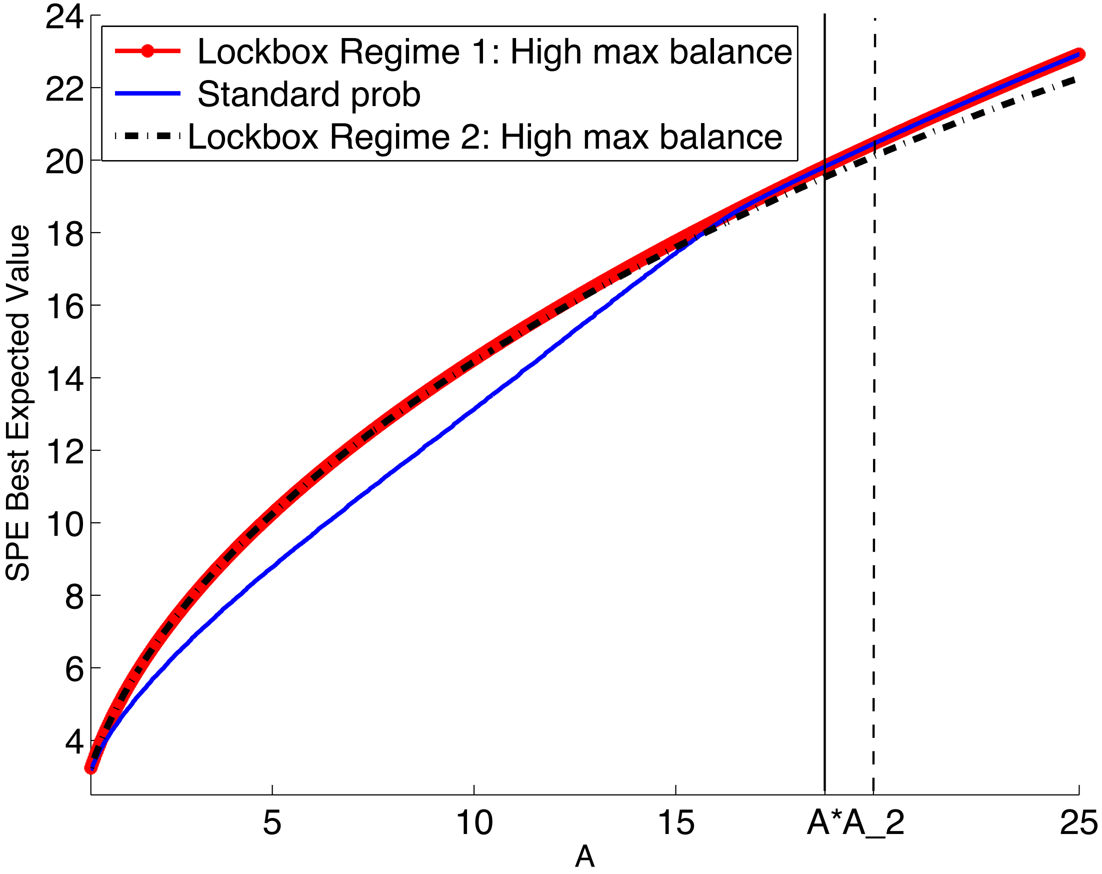
Values and saving in the stochastic model with two taste shocks:

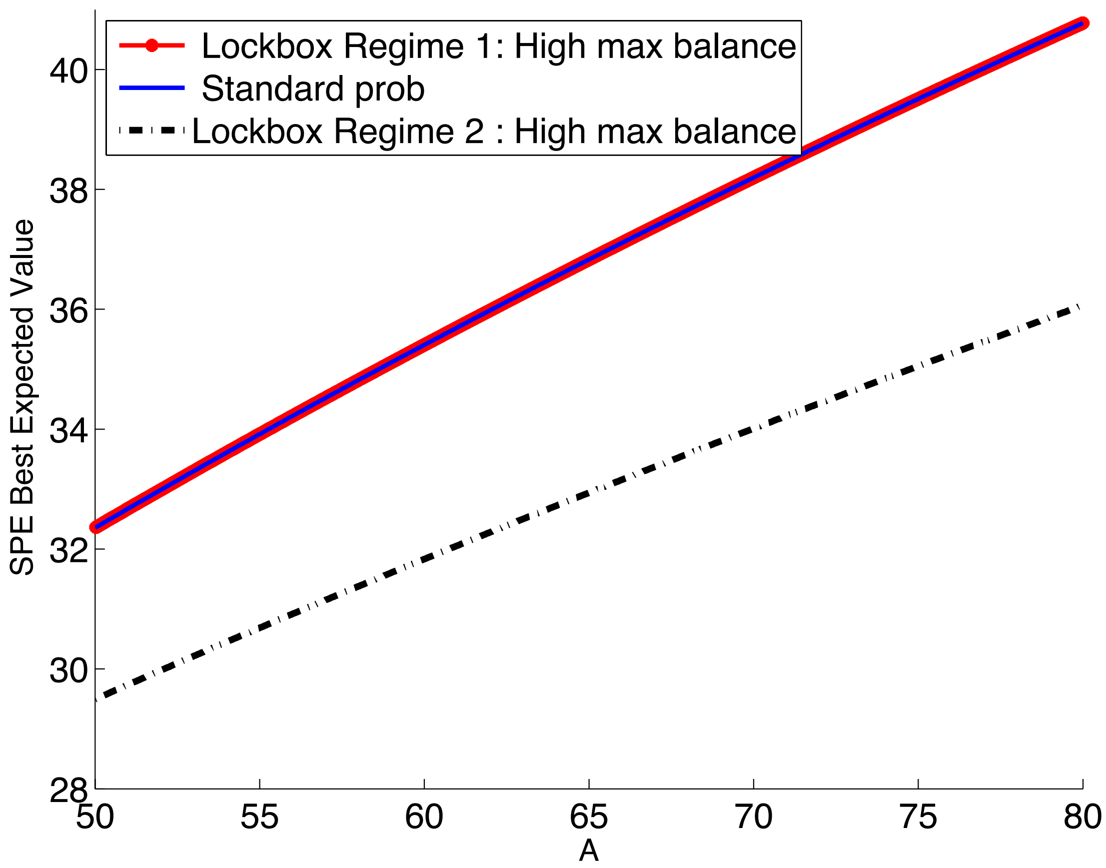


- Value functions, low and high thresholds, with full unlocking:



Value functions for the minimum balance problem:





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  - Ainslee's personal rules as history-dependent equilibria

Summary

- We know that a failure of self-control can lead to poverty.
  - Is the opposite implication true?
- Model constructed for scale-neutrality:
  - The result isn't effectively "assumed", say, by positing that the poor are more prone to temptation.
  - Ainslee's personal rules as history-dependent equilibria
- Structure of optimal personal rules is surprisingly simple:
  - Deviations entail further "falling off" the wagon, followed by "climbing back on".

- The ability to impose self-control rises with wealth.

- The self-control problems that keep people in poverty may be a consequence of poverty.

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  - The self-control problems that keep people in poverty may be a consequence of poverty.

- Novel policy implications, among them, for 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