A Theory of Bank Resolution: Technological Change and Political Economics

PRELIMINARY DRAFT

This draft: April 2011

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I made these slides last night.

- On Thursday the following concepts came up repeatedly:
  - Too complex to resolve (TCTF).
  - Banks will alter their business models and investments to become or remain TCTF.
  - Failed complex banks can cause macro-economic externalities (e.g., knock-on effects).
  - Resolution technology is inadequate to close failed complex banks. (Supervisors **can't** close complex banks.)
  - Announced resolution policies are time inconsistent. (Supervisors **don't** or **won't** close banks.)
  - Removing legal and informational barriers to bank resolution (e.g., orderly liquidation authority, living wills, simpler organizational form, bank-specific bankruptcy law).

I made these slides last night.

- We model failed bank resolution as a repeated game between the banking industry and a resolution authority (RA).
  - ***All of the Thursday concepts are important in our model.***
- These phenomena are often discussed, but not very often treated rigorously in a formal mathematical model.
- Our objective:
  - Provide a formal treatment of the causes and effects of these phenomena.
  - Hope other theorists might build on our simple model.
- Two concepts are central to our model:
  1. Technology constraints (RA can't close the bank).
  2. Political/economic pressure (RA won't close the bank).

1. Resolution technology

- Resolution technology has limits. For example:
  - Difficult and slow asset valuations.
  - Legal limits on resolution powers.

- These limits force a tradeoff on the resolution authority (RA):
  - Bailout bank? ***Avoids illiquidity*** but ***fosters moral hazard.***
  - Close bank? ***May create illiquidity*** but ***imposes discipline***.

- We characterize this tradeoff as the "liquidity price of discipline" in resolution policy.
  - Improved resolution technology (legal, informational, technological) can improve this tradeoff.

2. Pressure on policymakers

- Closing a failed complex bank has **short-run costs** and **long-run benefits**.
  - Short-run potential for illiquidity and economic instability.
  - Long-run reduction in moral hazard incentives.
- Thus, the RA faces a time inconsistency problem.

- Conditions that can exacerbate the RA's short-run emphasis:
  - A macro-economic downturn.
  - A wave of multiple bank failures.

Related theory literature

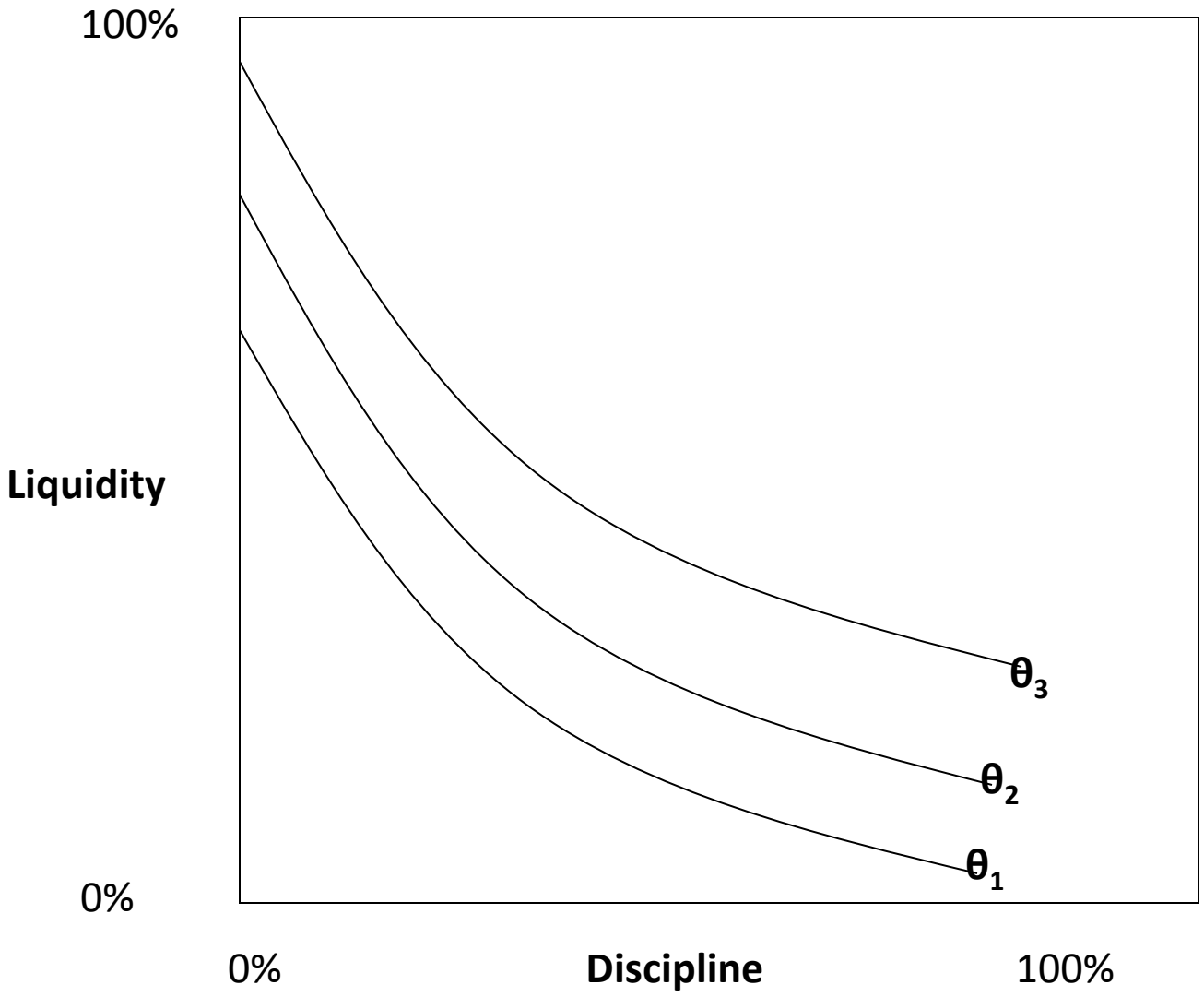
- The tradeoff between preserving liquidity and imposing discipline is central to our model. Other studies also include a liquidity-discipline tradeoff:
  - Freixas (1999); Goodhart and Huang (1999); Cordella and Yeyati (2002).
- In our model, the RA faces a time inconsistency problem. Other studies of TBTF also highlight a time inconsistency problem:
  - Mailath and Mester (1994); Acharya and Yorulmazer (2007).
- We use random strategies. Other studies use random strategies to explicitly model a policy of "constructive ambiguity."
  - Freixas (1999); Goodhart and Huang (1999); Gong, Hwa and Jones (2010).

Related theory literature

- We model insolvency-driven failures and bank resolution policies. Other studies model Illiquidity-driven failures and lender-of-last-resort policies:
  - Diamond and Rajan (2002); Freixas, Parigi and Rochet (2003); Freixas and Parigi (2008).
- We model external "pressure" on the RA to bail out failed banks. Other studies show how external conditions (e.g., herding) can encourage forbearance:
  - Acharya (2001); Acharya and Yorulmazer (2006, 2008); Brown and Dinc (2009).
- We place a technological constraint at the center of our model. We are unaware of other studies that do so.

Model set-up for the RA

- The Resolution Authority (RA) has limited technology:
  - Cannot close highly complex banks.
  - Must accept a tradeoff between:
    - preserving liquidity
    - imposing discipline.
- When a bank fails, RA has two choices:
  - **Close** the bank.
    - Bank leaves the game (***discipline imposed***).
    - Could cause an externality (***macro-illiquidity***).
  - **Bail out** the bank.
    - Bank plays game again (***no discipline imposed***).
    - Avoids potential externality (***no macro-illiquidity***).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Discipline
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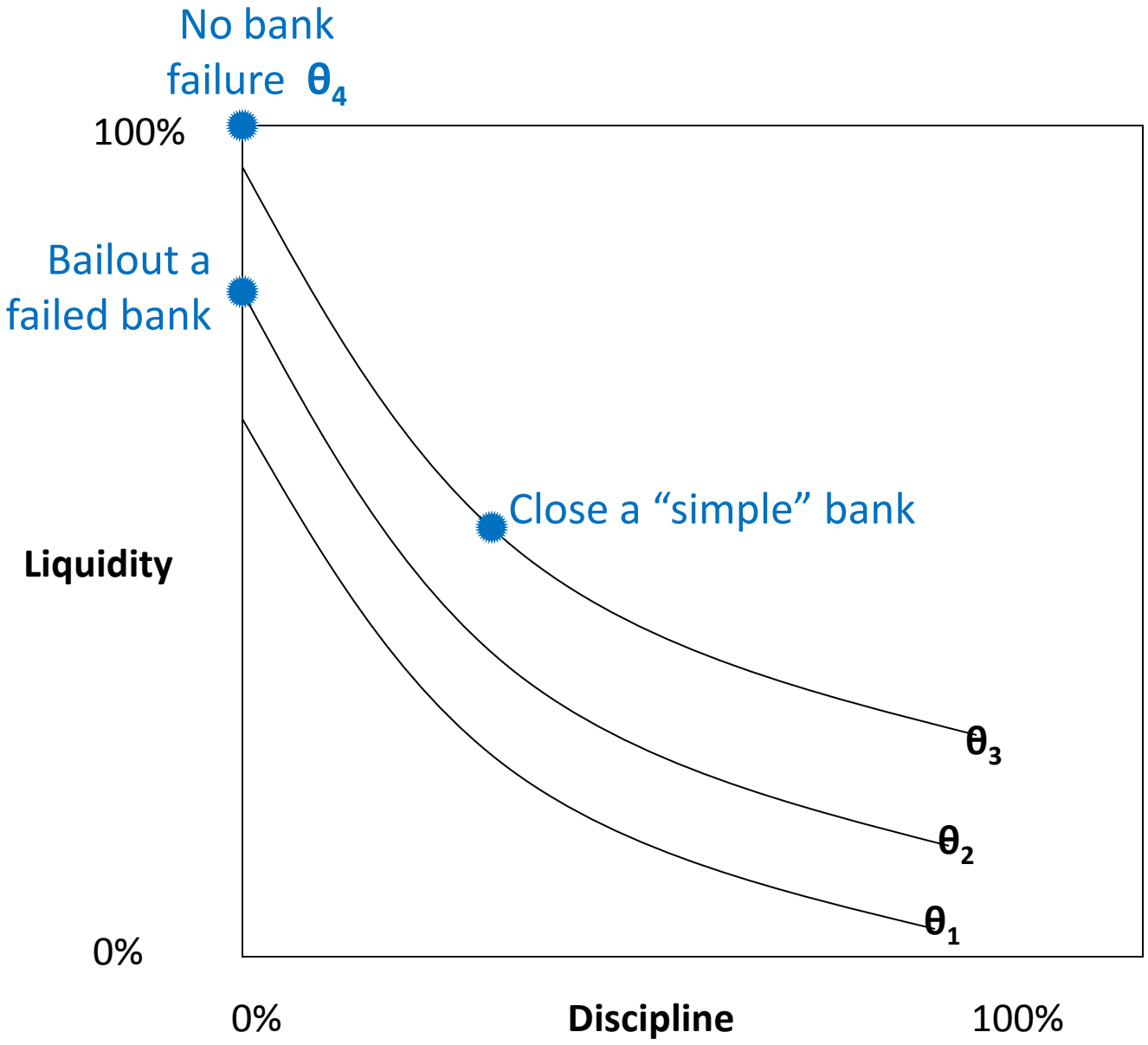
No bank failure θ_4
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Bailout a failed bank
Close a "simple" bank
Liquidity
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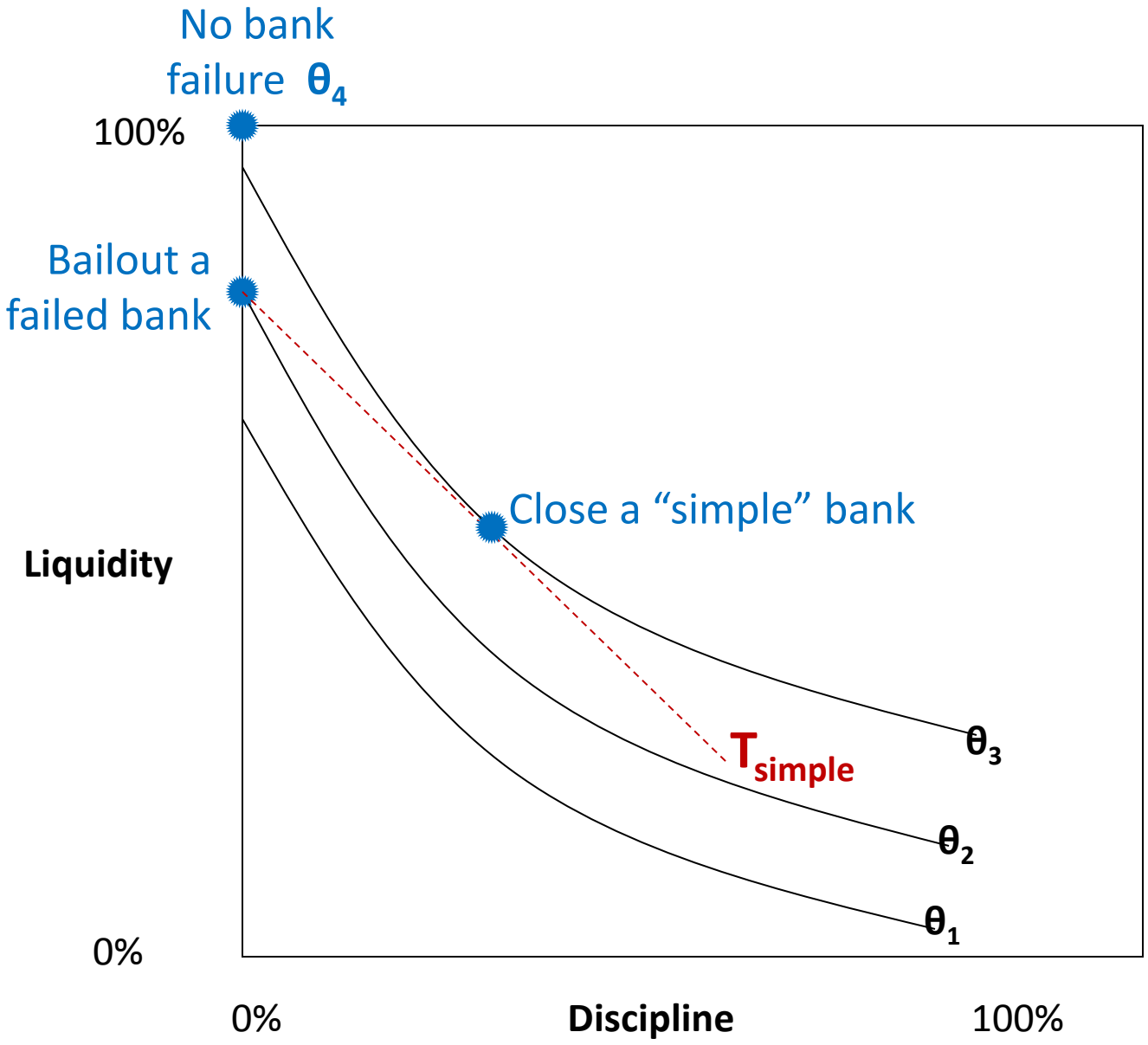
No bank failure θ_4
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Liquidity
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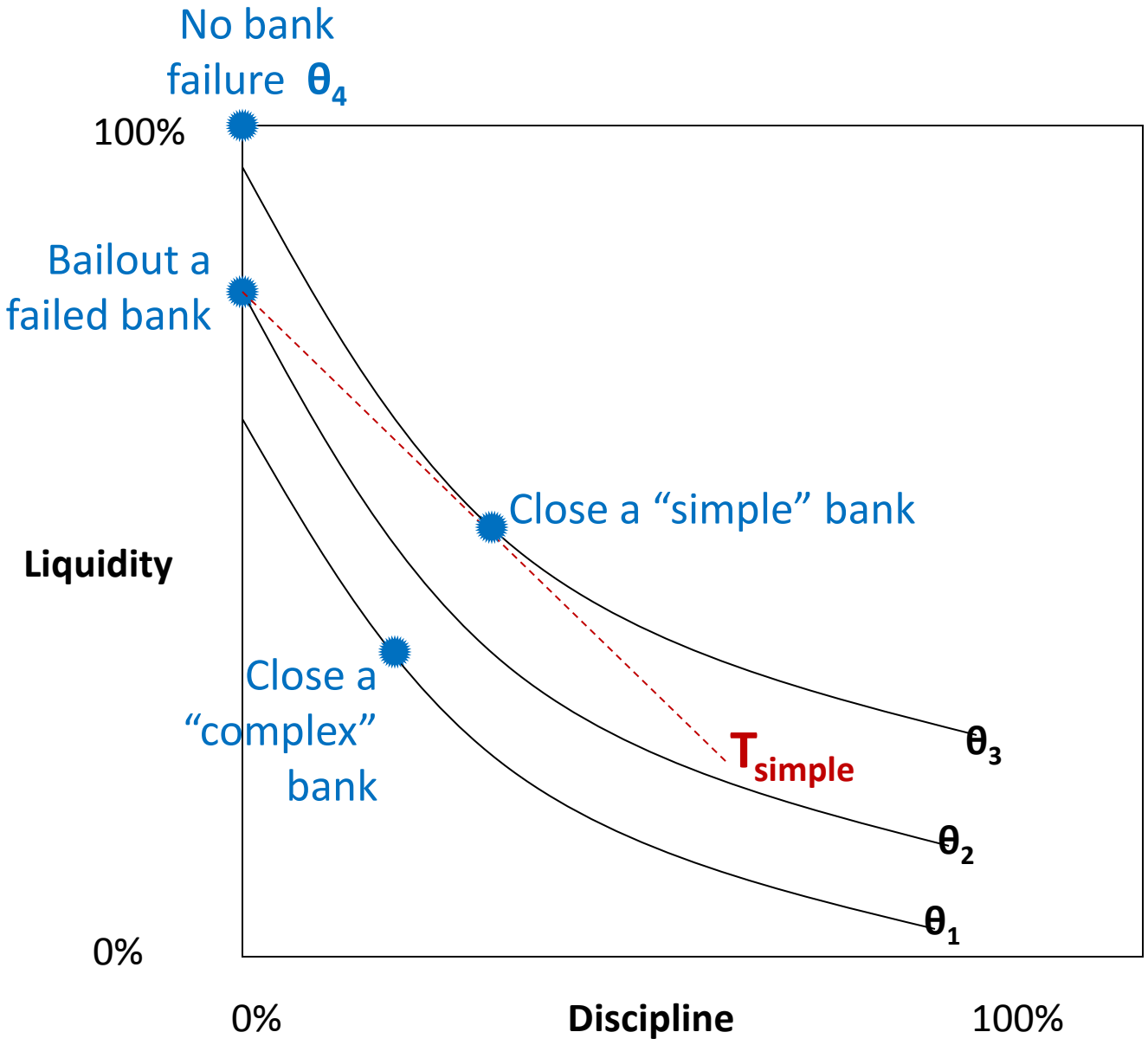
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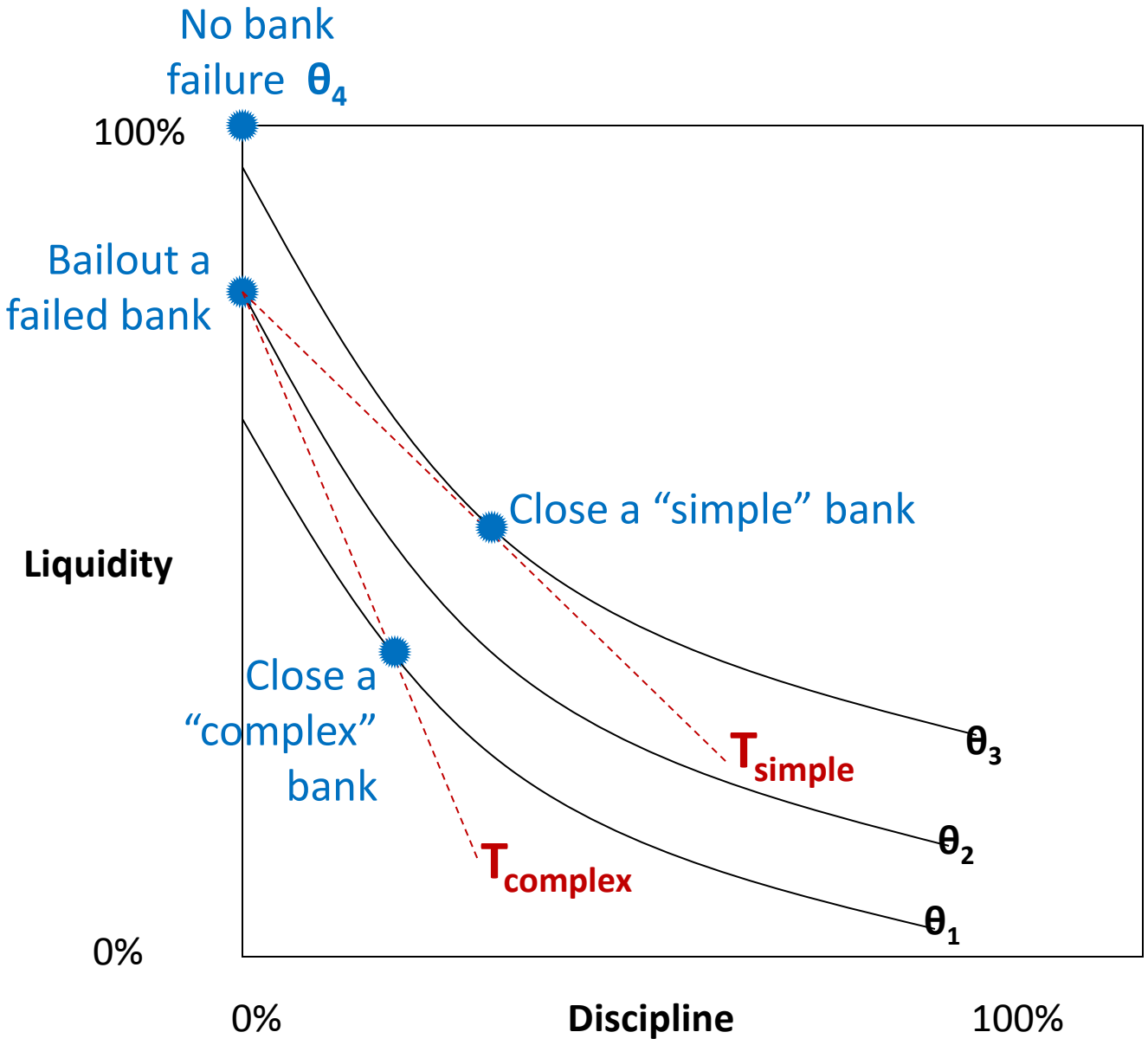
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Model set-up for banks

- Each bank writes a combination of simple and complex loans.
- Simple loans: Transparent, easy to value and unwind.
- Complex loans: Opaque, difficult to value and unwind.
- The two loan production functions (simple and complex) are separable and exhibit diminishing returns.
- Loans default with probability ρ_i ($i = C,S$). Four states of nature:
  1. No loans default. Probability = $(1-\rho_C)(1-\rho_S)$.
  2. Complex loans default. Probability = $\rho_C(1-\rho_S)$.
  3. Simple loans default. Probability = $(1-\rho_C)\rho_S$.
  4. Both types of loans default. Probability = $\rho_C\rho_S$.
- Banks use a VaR capital policy that protects it against states 1, 2 and 3. But bank fails in state 4.

Model set-up for banks

- Banks issue deposits at start of period, invest in risky loans, and use investment proceeds to pay back depositors at period-end.
- In states 1, 2, 3: Investment proceeds > deposits. Profits are distributed and bank plays again next period.
- In state 4: Investment proceeds < deposits, bank fails.
  - The RA either closes or bails out the failed bank.
  - The RA's technology allows failed "mostly simple" banks to be closed quickly.
  - The RA's technology prevents failed "mostly complex" banks from being quickly closed.
  - Thus, closing a mostly complex bank generates external costs (e.g., investor uncertainty, depositor runs).

Model set-up for banks

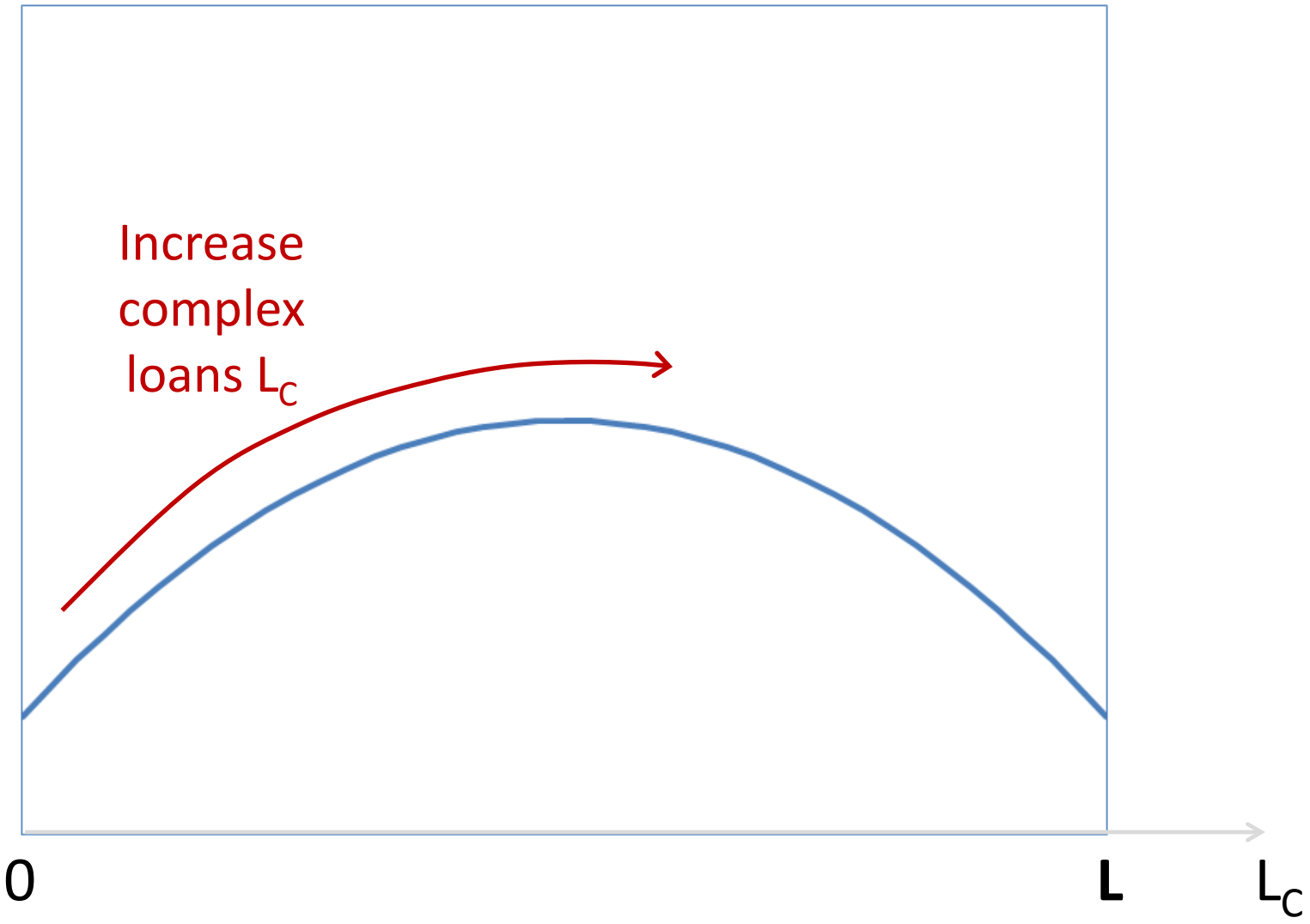
- Banks choose L_C to maximize:

$$\pi = (1-\rho_C)\cdot A_C(L_C)^{\alpha} + (1-\rho_S)\cdot A_S(\boldsymbol{L}-L_C)^{\alpha}$$

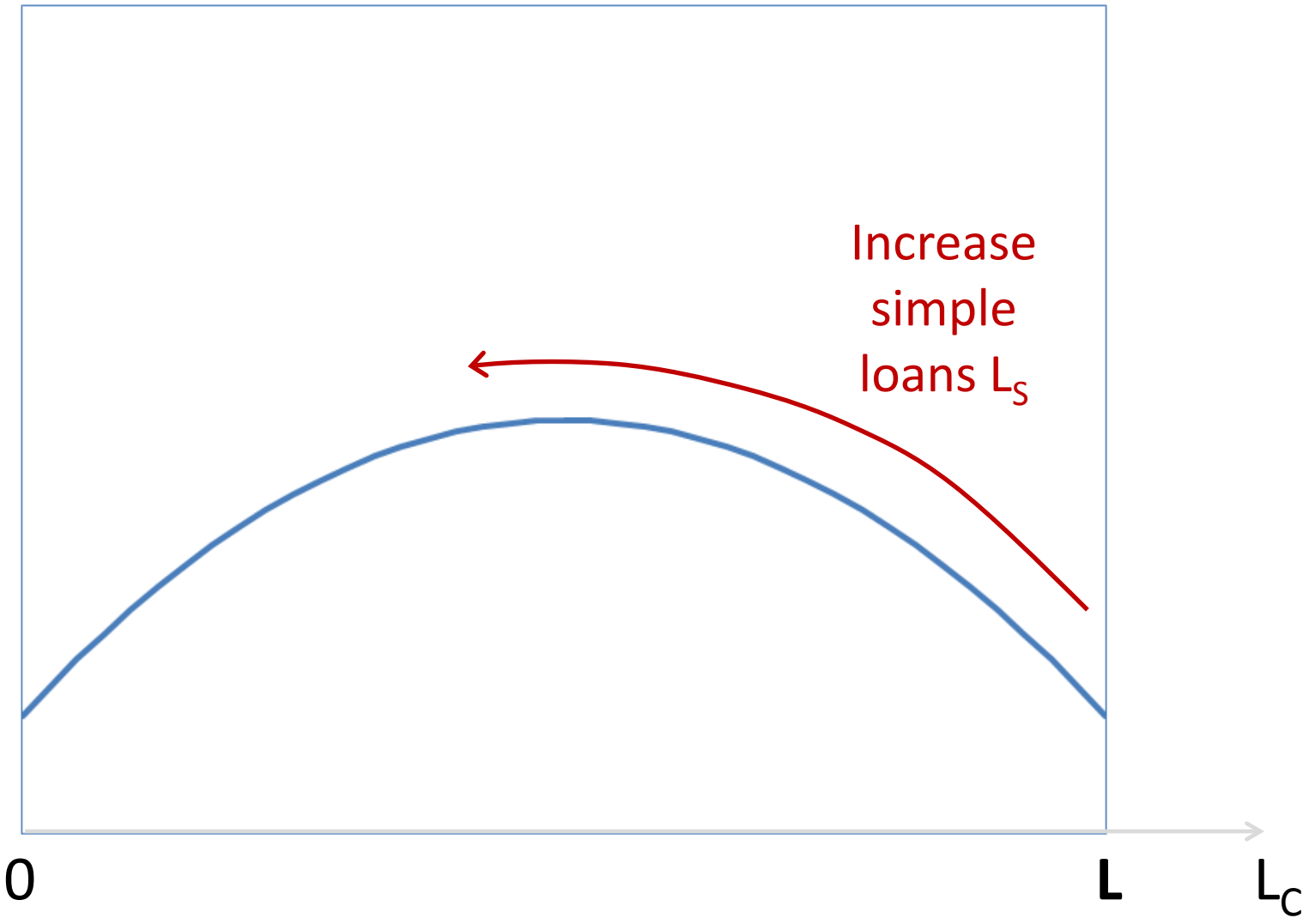
subject to: $\boldsymbol{L} = L_C + L_S$

- The $A_i(L_i)^{\alpha}$ are concave profit functions, $i = (C,S)$.
- $\boldsymbol{L}$ is the exogenous demand for loans.
- The solution L_C^* is an interior solution.

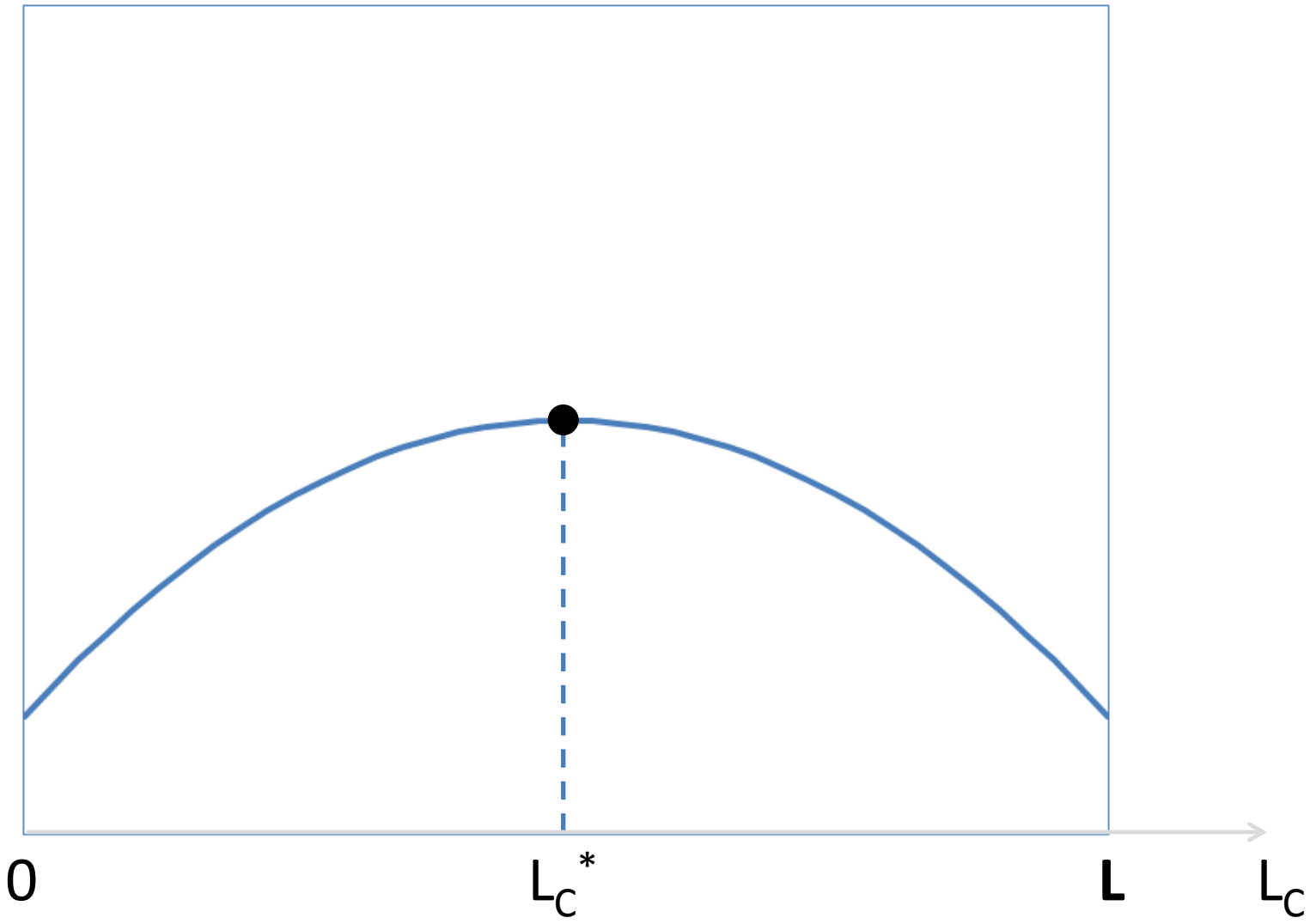
Expected profits from producing Complex Loans and Simple Loans



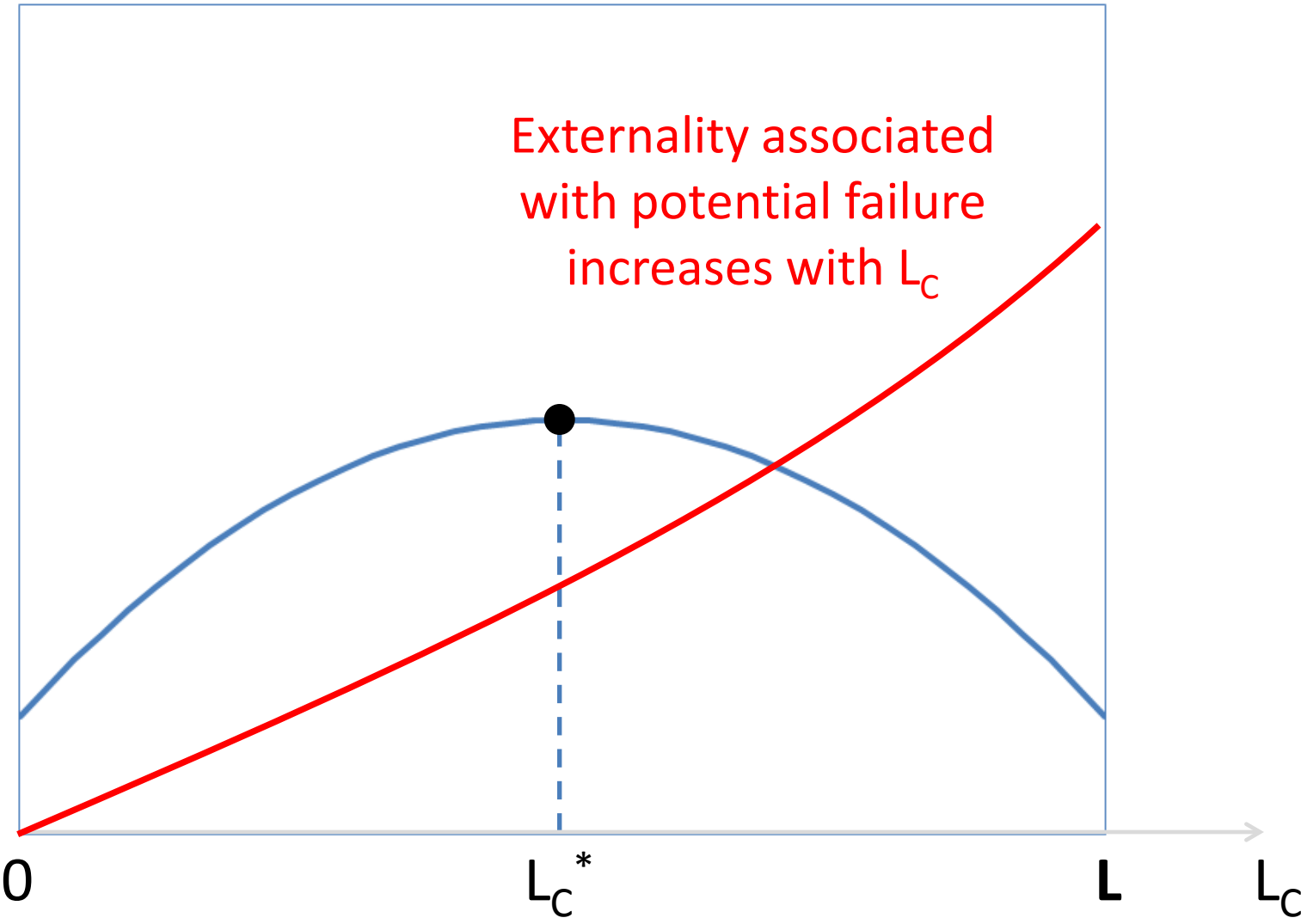
Expected profits from producing Complex Loans and Simple Loans



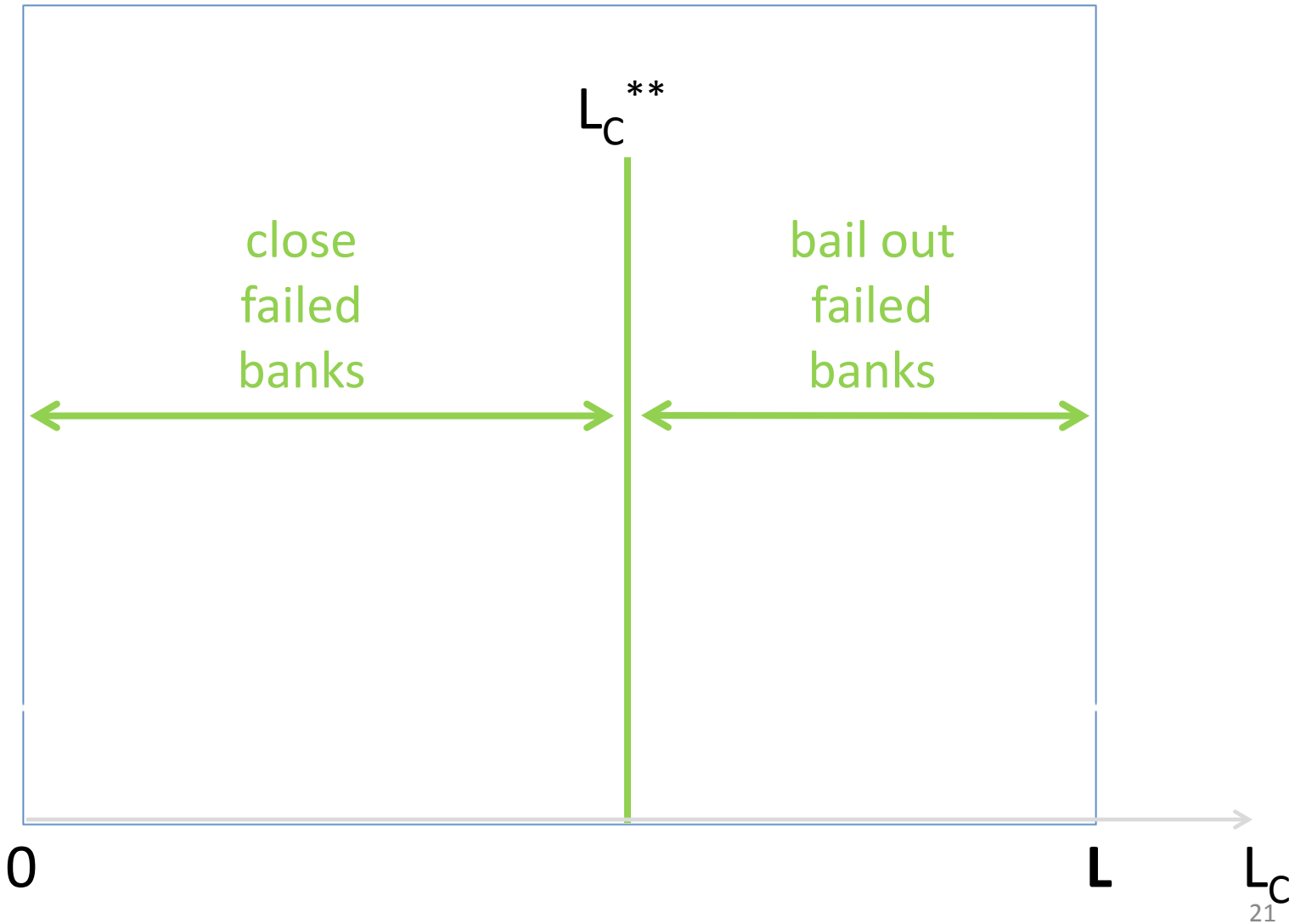
In **<u>one-period game</u>** **<u>without RA</u>**, banks make both complex and simple loans.



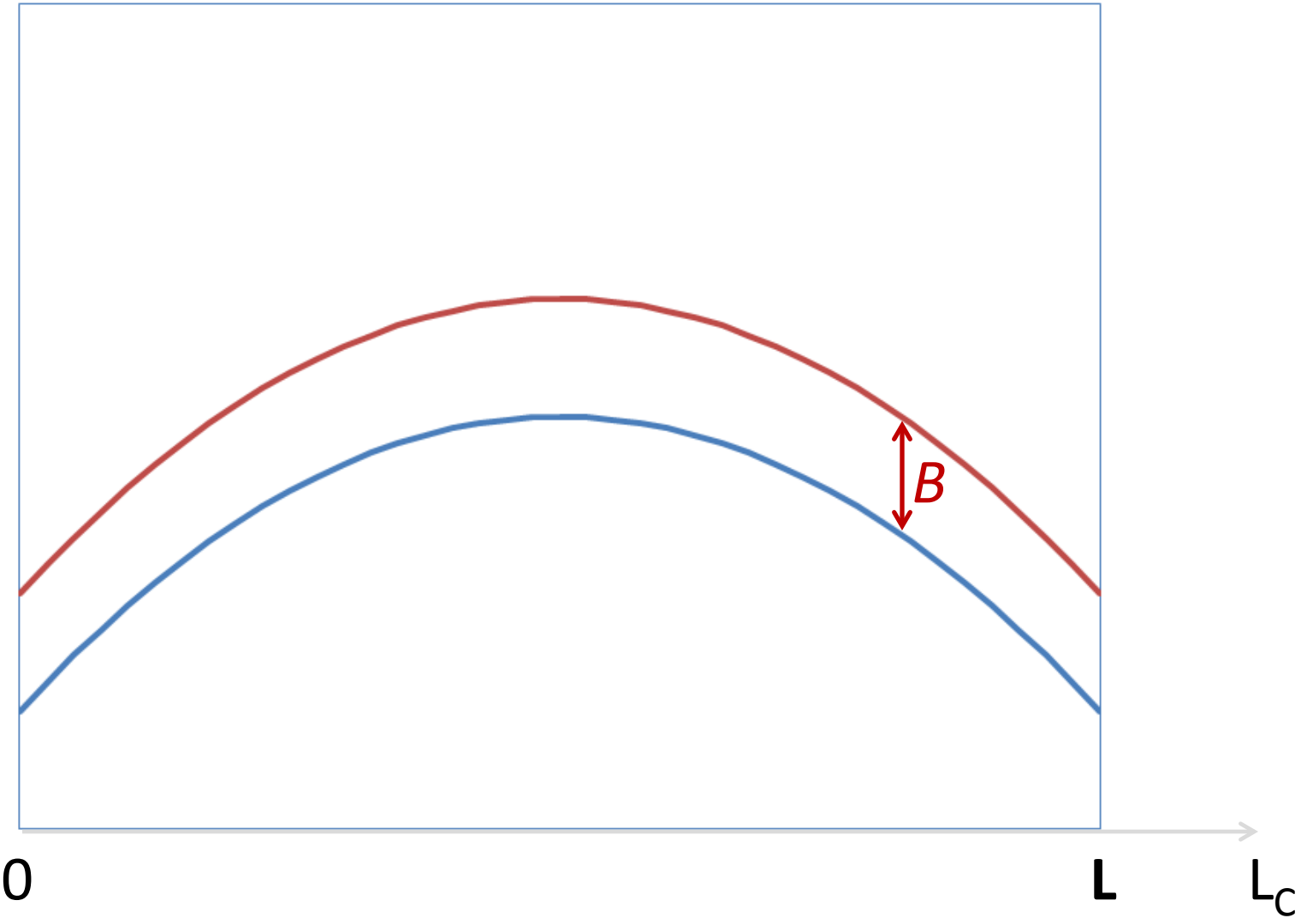
Externality associated with complex loans creates a role for failed bank resolution (the RA).



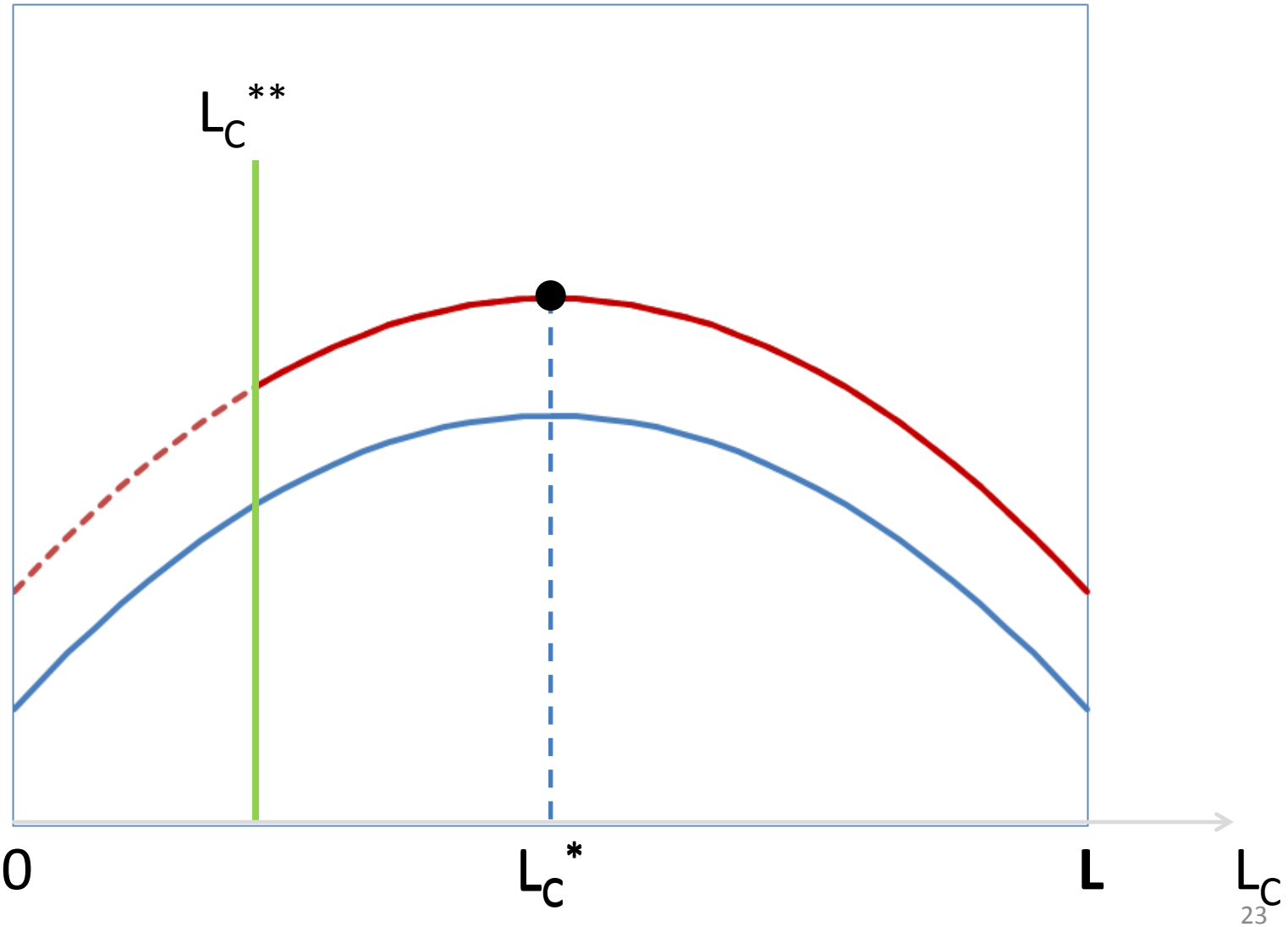
Bank closure technology: RA unable to close failed banks beyond some complexity threshold.



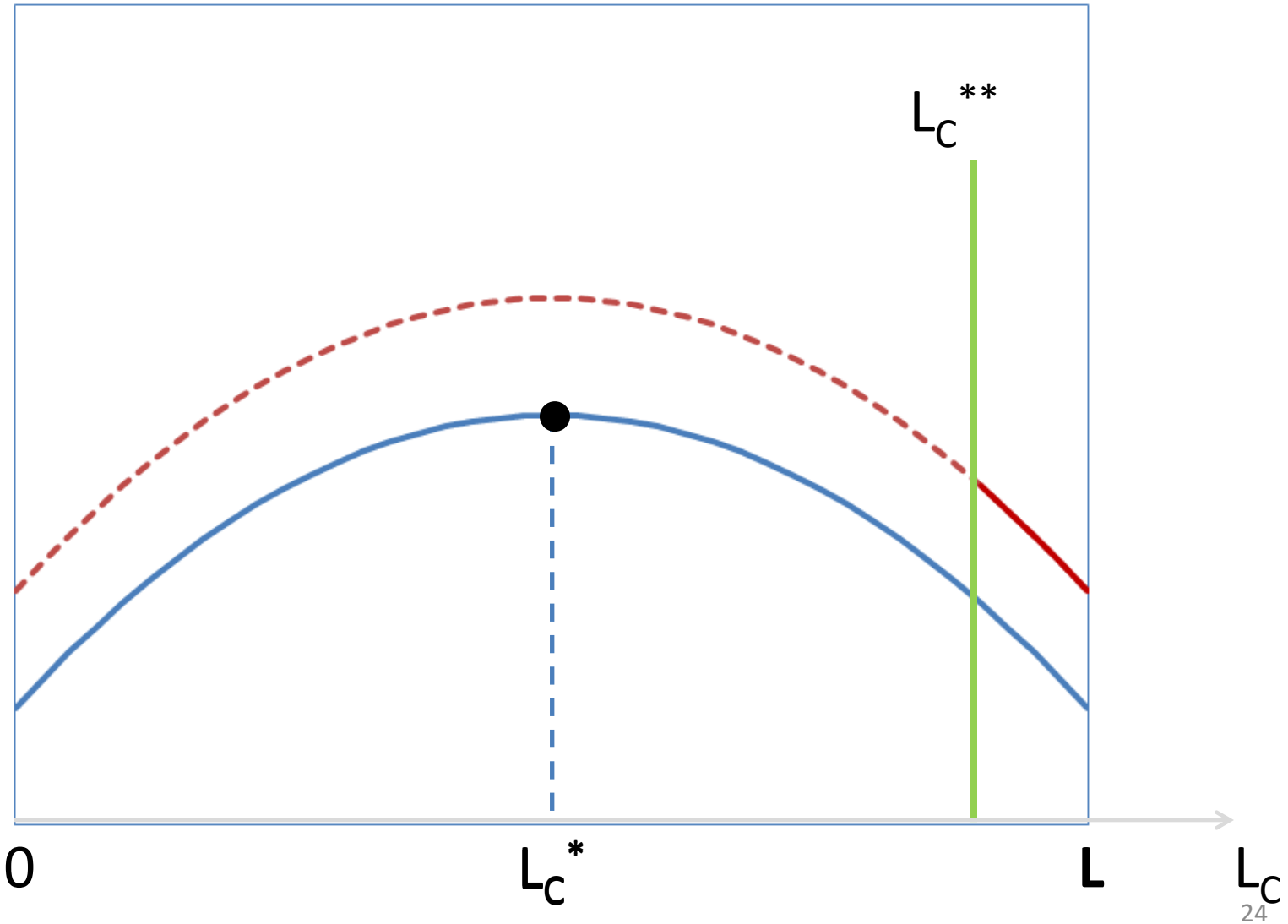
Bailouts: RA pays depositors and recapitalizes the failed bank (*B*). Externality is avoided.



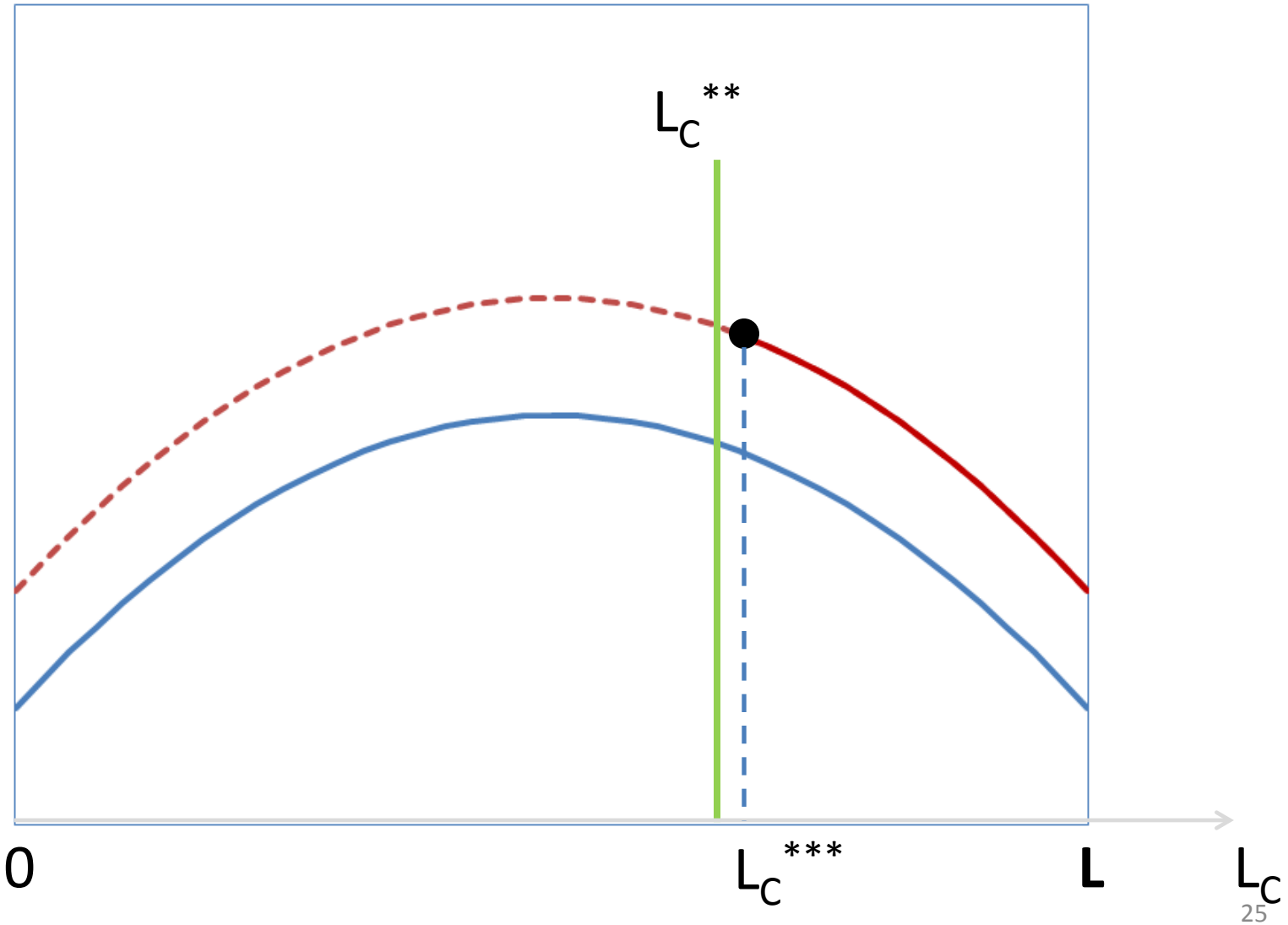
In **one-period game** with **weak technology**: RA has no affect on loan mix. Failed banks bailed out.



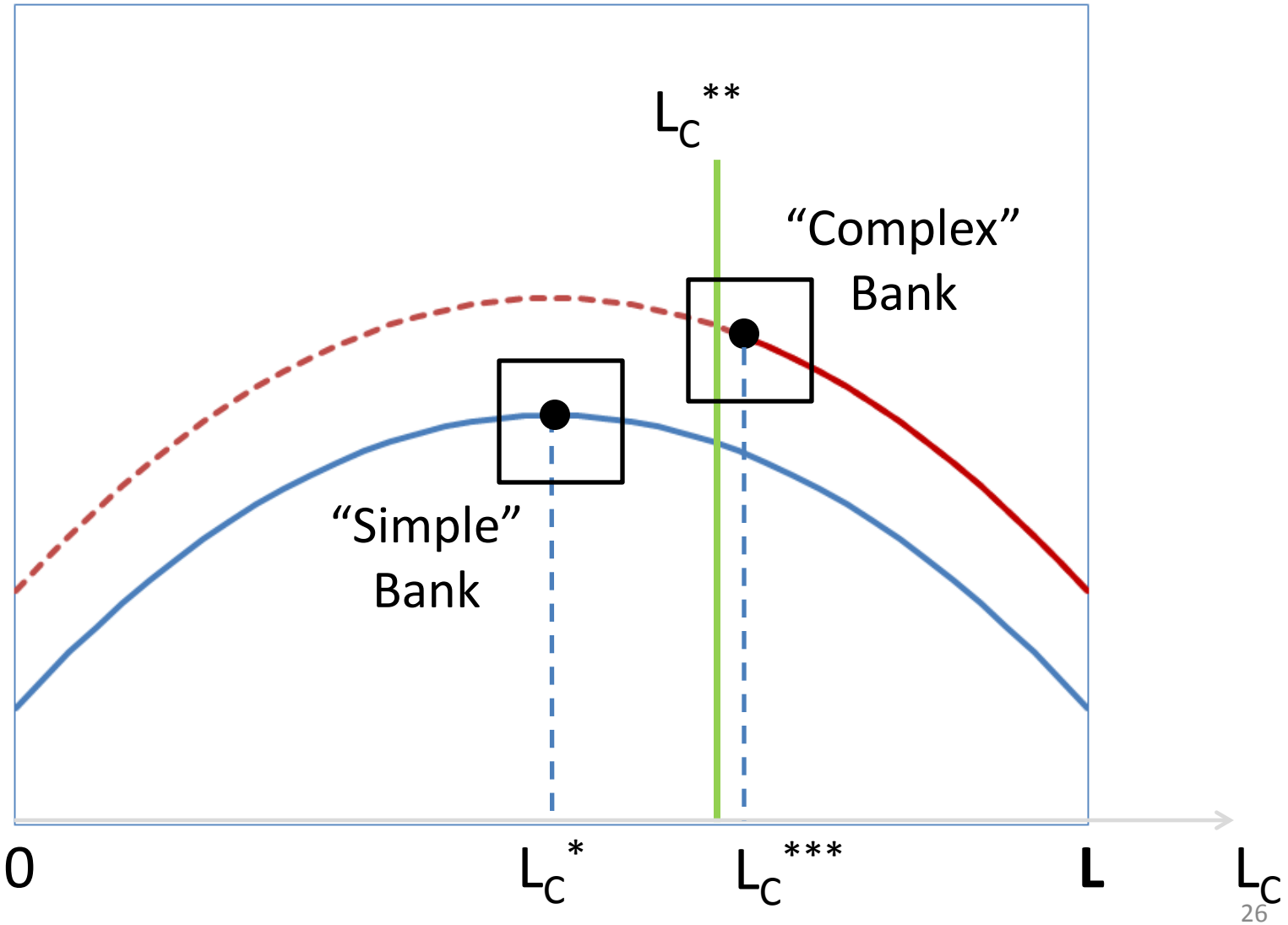
In **one-period game** with **strong technology**: RA has no effect on loan mix. Failed banks closed.



Interesting case: Banks increase complex loans in order to remain TCTF. Failed banks bailed out.



RA can announce "no bailouts" (hopes for L_C^*). But not credible in one-period game. Banks choose L_C^{***}.



Infinite horizon game

- A repeated game between the RA and a bank.
  - Technology is fixed.
  - Bank chooses “simple” or “complex.”
  - If there is a failure, RA chooses close or bailout.
- Bank discount factor is γ.
- RA discount factor is δ.

Infinite horizon game

- **We derive conditions that support an equilibrium in which:**
  a. **banks repeatedly choose simple, and**
  b. **the RA never bails out a failed bank.**

- Use a one-period Markov approach in which the past influences player choices only through state variables (Fudenberg and Tirole 1991; Maskin and Tirole 2001).

- Two possible states of nature in each period t:
  - A bailout occurred at t-1, so s_t=B.
  - No bailout occurred at t-1, so s_t=NB.

- We solve the game in mixed strategies. (Recall that time inconsistency precludes pure strategies.)

Infinite horizon game

- The RA's profile of strategies:
  - If failed bank is simple, close bank with certainty.
  - If failed bank is complex, randomize:
    - Close bank with probability q.
    - Bail out bank with probability 1-q.

- The bank's profile of strategies:
  - If s_t=NB, choose simple with certainty.
  - If s_t=B, randomize:
    - Choose simple with probability p.
    - Choose complex with probability 1-p.

Infinite horizon game

- The optimal values of q* and p* are:

$$q^* = 1 - \frac{\big(1-\gamma(1-\varphi)\big)}{\varphi\big[\gamma\pi_s + \big(1-\gamma(1-\varphi)\big)B\big]}(\pi_S - \pi_C)$$

$$p^* = 1 - \left(\frac{1}{\delta} - 1\right)\frac{\theta_2 - \theta_1}{\varphi(\theta_3 - \theta_2)}$$

- q^* and p^* just high enough to support (simple, NB) equilibrium.

- This "disciplinary equilibrium" obtains only if the RA is credible. This requires the RA's discount factor $\delta > \underline{\delta}$:

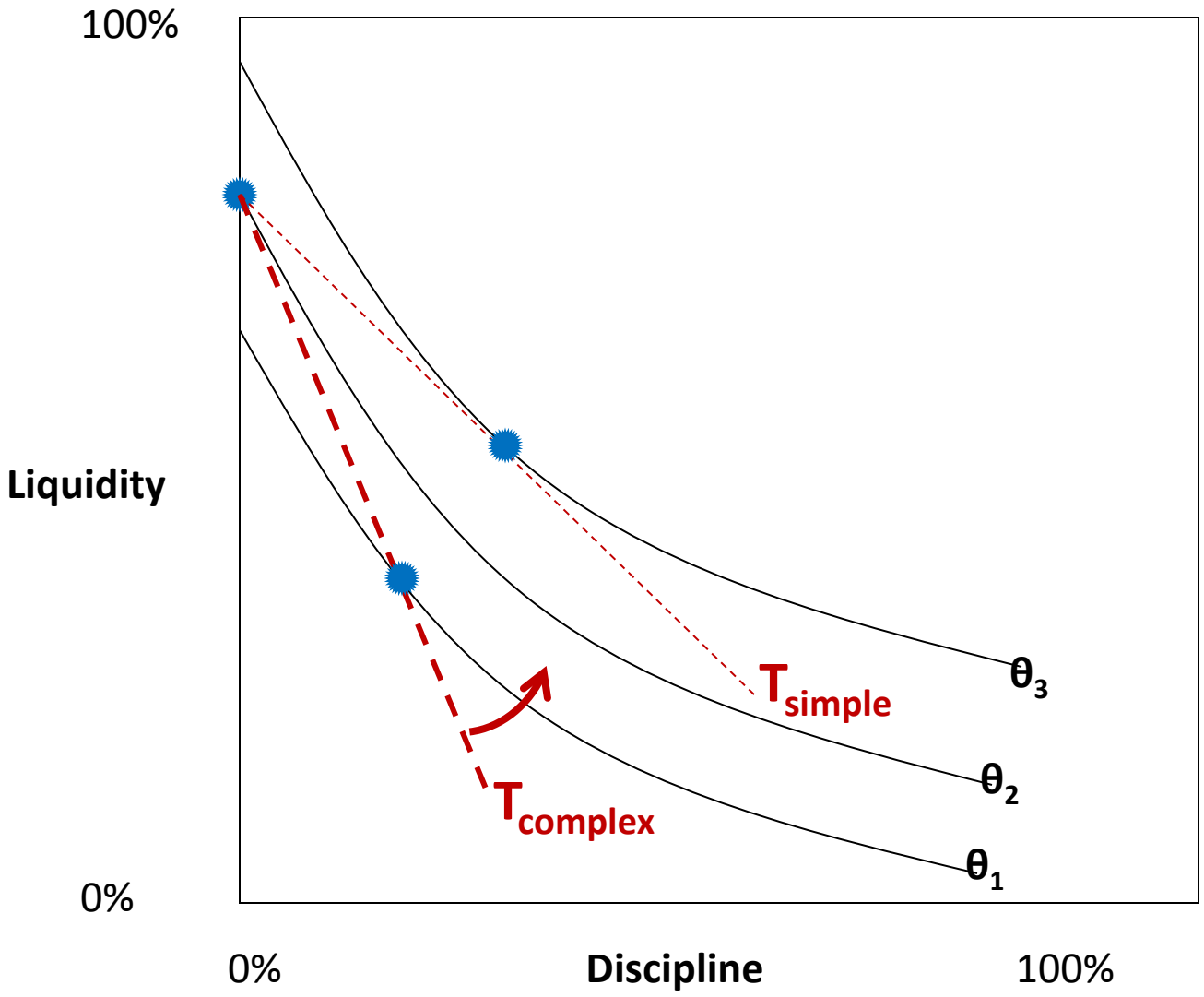
$$\underline{\delta} = \frac{1}{1 + \frac{\varphi(\theta_3 - \theta_2)}{\theta_2 - \theta_1}}$$

- If $\delta < \underline{\delta}$ then the players play random strategies.
- If $\delta = 0$ then we revert to the one-period game.

Infinite horizon game

Two important comparative static results:

1. Technology matters:
   - We can represent a positive technology shock with an increase in the utility θ_1 of closing a failed complex bank.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θ3
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θ1
Tsimple
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Infinite horizon game

Two important comparative static results:

1. Technology matters:
   - We can represent a positive technology shock with an increase in the utility θ_1 of closing a failed complex bank.
   - $\partial \underline{\delta} / \partial \theta_1 < 0$
   - $\partial p^* / \partial \theta_1 > 0$
   - Technological efficiencies support a broader disciplinary equilibrium and reduce the likelihood that banks will choose complex.

Infinite horizon game

Two important comparative static results:

2. Pressure (external circumstances) matters:
   - We can represent an increase in "immediacy" (economic or political pressure) with a decrease in δ.
   - $\partial p^*/\partial \delta > 0$
   - RA "immediacy" increases the likelihood that banks will choose complex.

Conclusions and Implications

- We extend the theory literature on failed bank resolution.
  - Solve a time inconsistency game in mixed strategies.
  - Highlight the important roles of resolution technology and economic/political pressure.
- Implications:
  - Improved technology supports greater RA discipline.
  - Note: Failed bank resolution policy during the crisis increased the size and complexity of large complex banks. This makes the technological hurdle even higher!
  - The Dodd-Frank Act (orderly liquidation authority, living wills) may be a technology improvment.
  - Note: In next crisis, will external pressures for "immediacy" hinder the application of these improvements?

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