Capital Regulation and Tail Risk

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Lessons from the Crisis: Bank Capital

- **Calls for more bank capital in response to crisis**
  - Basel III
    - doubles the minimal capital ratio
    - conservation and countercyclical buffers

- **Arguments in favor of higher capital**
  - Ex-post: capital as a buffer
    (absorbs losses and reduces the risk of insolvency)
  - Ex-ante: more capital reduces risk-shifting incentives
    ("skin in the game" effect)

Capital and Tail Risk

- **Higher bank capital: Necessary…but not sufficient**
  - Compensating the cost of capital (Hellmann et al., 2000)
  - Correlation risks (Acharya, 2009)
  - Funding risks (Perotti and Suarez, 2010)
- **Tail risk: negatively skewed gambles**
  - Carry trades reliant on ST wholesale funding (Gorton, 2010)
  - Contingent liabilities on systemic risk (Acharya and Richardson, 2009)
  - Undiversified housing exposure (Shin, 2009)
- **Tail risk was low in traditional loan-oriented banking**
  - "Skin in the game" effect dominated, hence higher capital → lower risk-taking

This Paper

- Reviews the effectiveness of capital regulation, and in particular of excess capital buffers, in dealing with tail risk events

- **Under tail risk**

  - **Buffer and incentives effects of capital diminish**
    - Higher capital does not absorb extreme tail losses
    - Losses go deep in debt value

  - **Capital may enable risk-taking**

    Excess buffers →
    A bank can afford to lose *some* capital (low cost of losing capital) →
    Putting capital to risk

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The Model

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Set-up

- Main ingredients
  - Bank is managed by an owner-manager (the banker) with limited liability
  - Prudential framework based on minimal capital ratio
    - Rising capital is costly (asymmetric information, agency problem)
  - Bank has access to a tail risk project
- There are 3 dates (0, ½, 1), no discounting, and everyone is risk-neutral

Projects

- **A bank**, capital and deposits, $C + D = 1$
- **Projects**, investment at 0, returns at 1
  - **Safe**: $R_S > 1$
  - **Risky**:
    - $\boldsymbol{R_H} > R_S$ w.p. p
    - $0 < \boldsymbol{R_L} < 1$ w.p. $1-p-\mu$
    - $\boldsymbol{R_0} = 0$ w.p. μ; captures tail risk
- **Risk-shifting**
  - **Safe** has higher NPV: $R_S > pR_H + (1-p-\mu)R_L$
  - A bank with low capital prefers **Risky**: $R_S - 1 < p(R_H - 1)$

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Capital Regulation

- At date 0: initial capital $c > c_{min}$ (by assumption)
- At date ½
  - Final outcome of the project becomes known
  - Bank's capital ratio: $c_i = (R_i\text{-}D)/R_i$, with $i = \{S, H, L, 0\}$
- If $c_i < c_{min}$ (undercapitalized bank) → Corrective action
  - Raise new equity (cost T), or
  - Close down (lose positive capital, if any)
- Safe: $c_S > c_{min}$
- Risky: $c_H > c_{min}$

  $c_0 < 0 < c_{min}$

  c_L, depending on R_L and c (negative, positive but insufficient, sufficient)

$$\boldsymbol{c_L}: \quad ? < 0 < ? < c_{min} < ?$$

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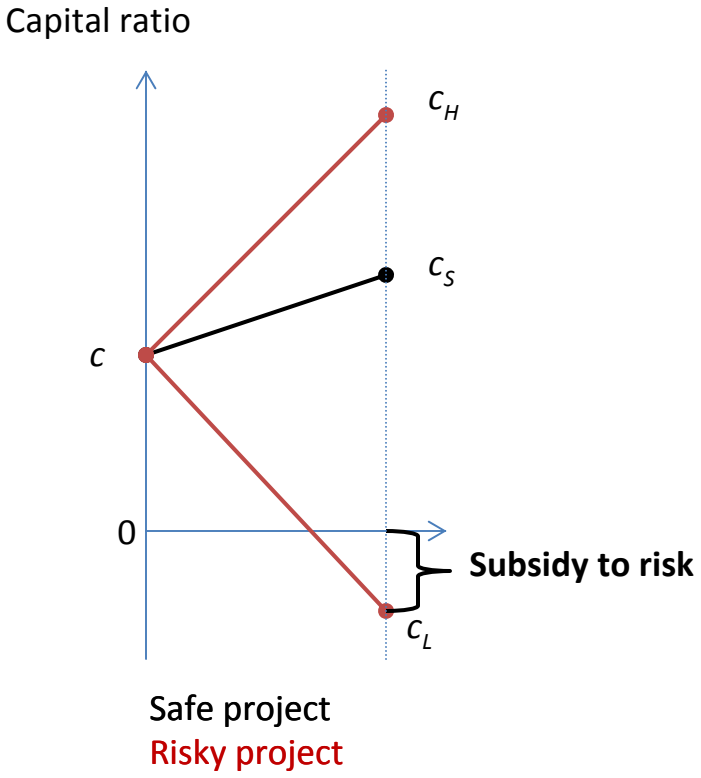
Intuition

Capital and Risk-taking: Traditional

No tail risk, no capital adjustment cost ($\mu=0$, $T=0$)



Capital ratio: (assets–debt)/assets

- Banks do not internalize losses when **negative** capital
- Too much risk-taking

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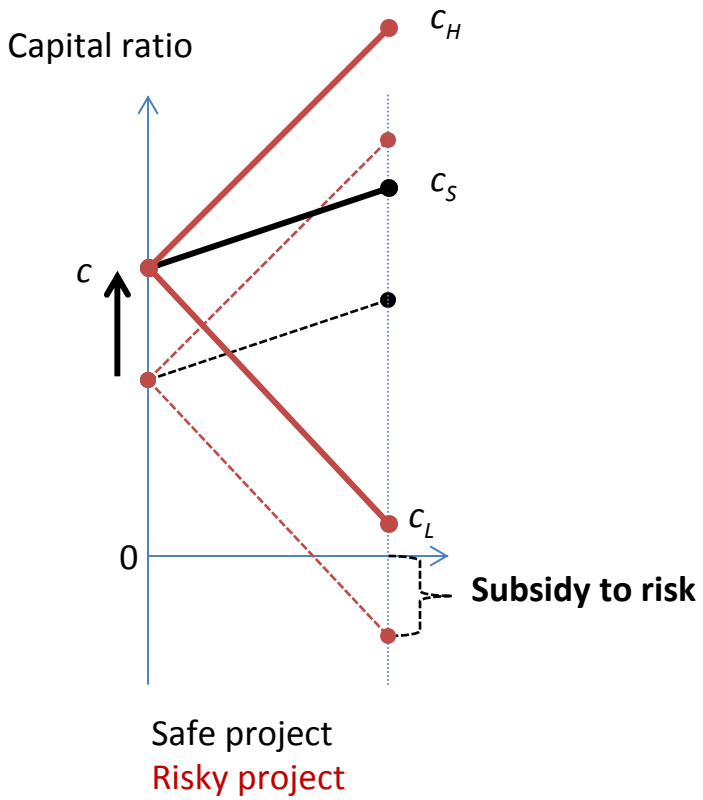
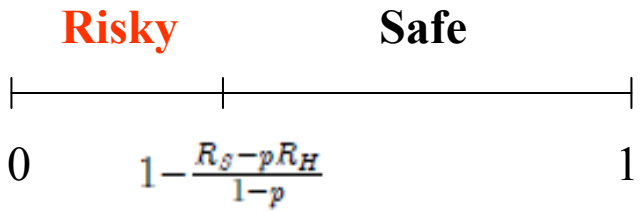
Capital and Risk-taking: Traditional (cont'd)

No tail risk, no capital adjustment cost ($\mu=0$, $T=0$)



Less incentives for risk-taking (less chance of $c_L<0$)



More capital → Lower risk

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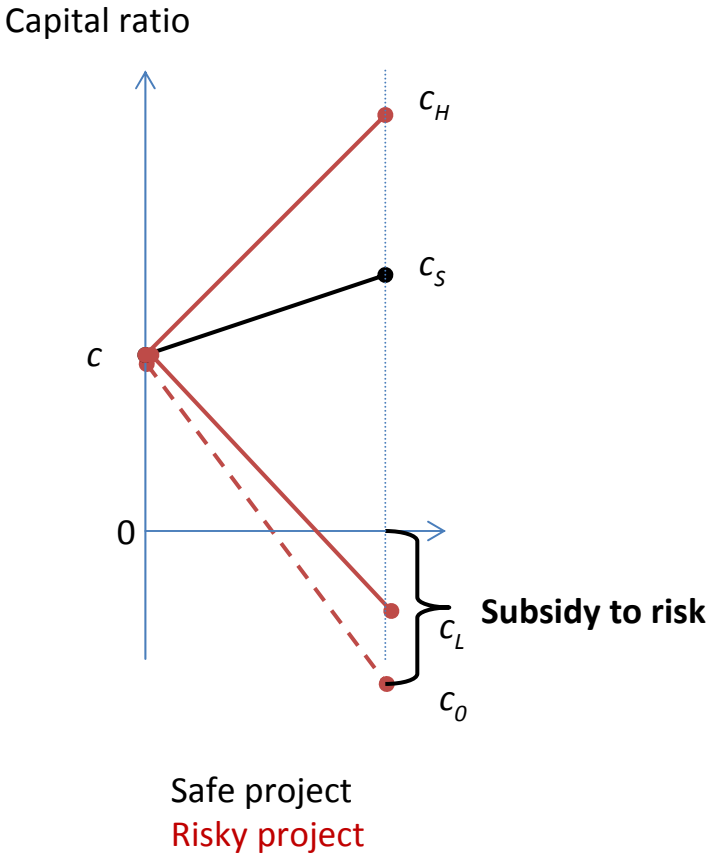
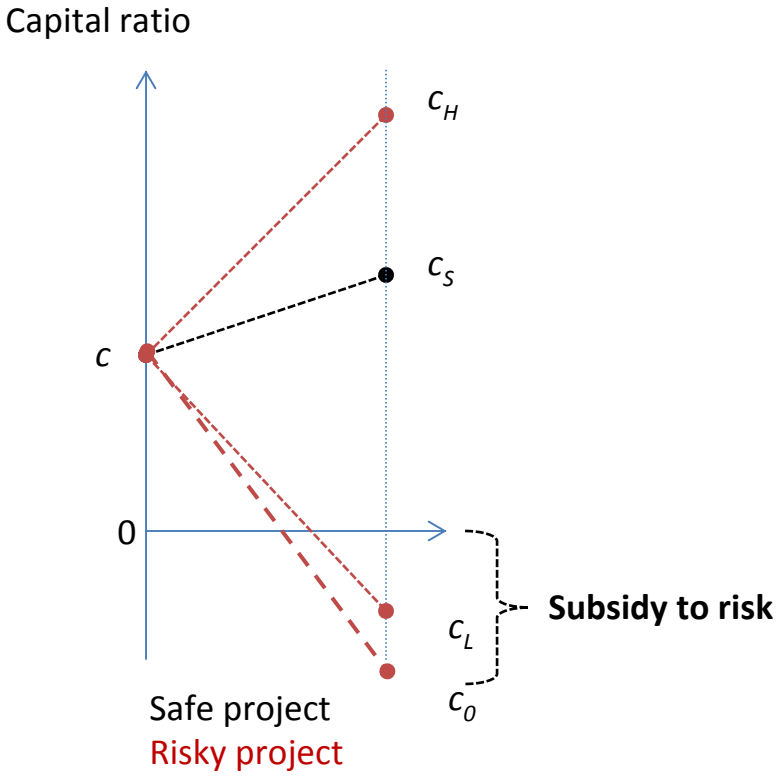
“Skin in the game” and Tail Risk

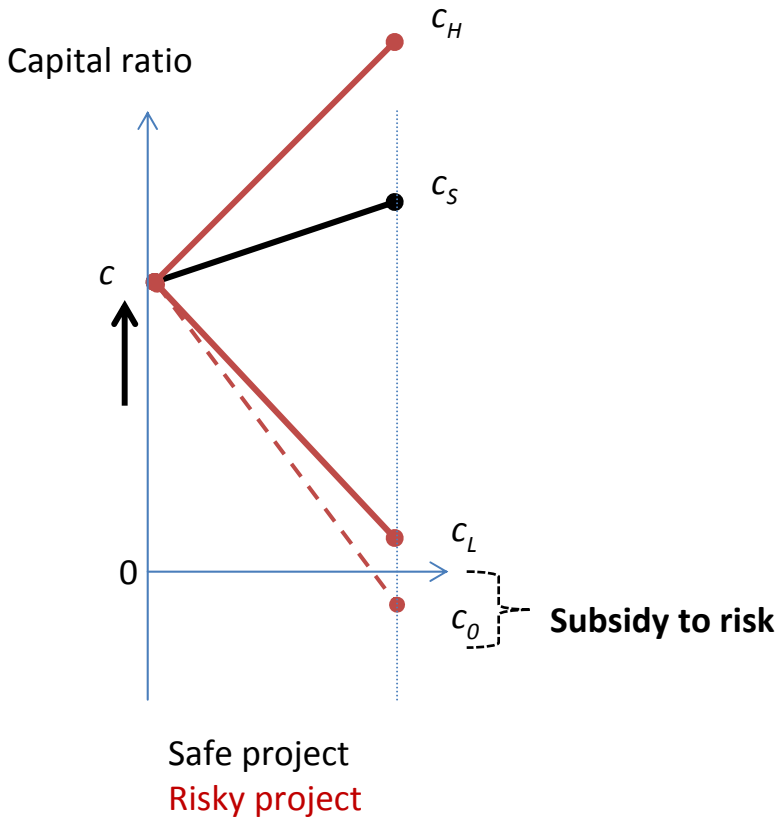
Tail risk, no capital adjustment cost ($\mu>0,\ T=0$)



"Skin in the game" and Tail Risk (cont'd)

Tail risk, no capital adjustment cost ($\mu>0,\ T=0$)





More capital → Reduces but does not eliminate risk incentives

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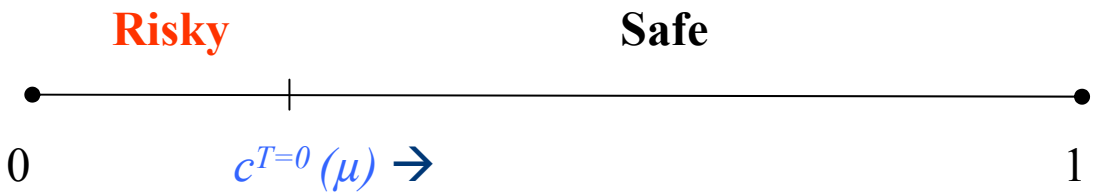
“Skin in the game” and Tail Risk (cont’d)



• Higher μ → more initial capital is required to maintain incentives to select the safe project

• Tail risk limits the effectiveness of required capital for controlling bank risk-taking

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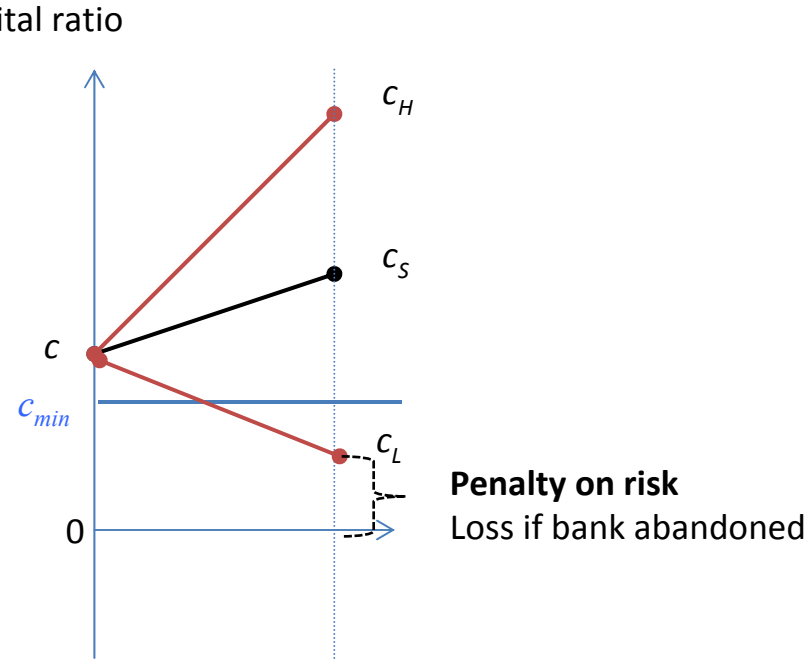
Capital and Risk-taking: Enabling effect

No tail risk, capital adjustment cost ($\mu = 0$, $c_{min} > 0$)



c_{min}: Minimal capital requirement

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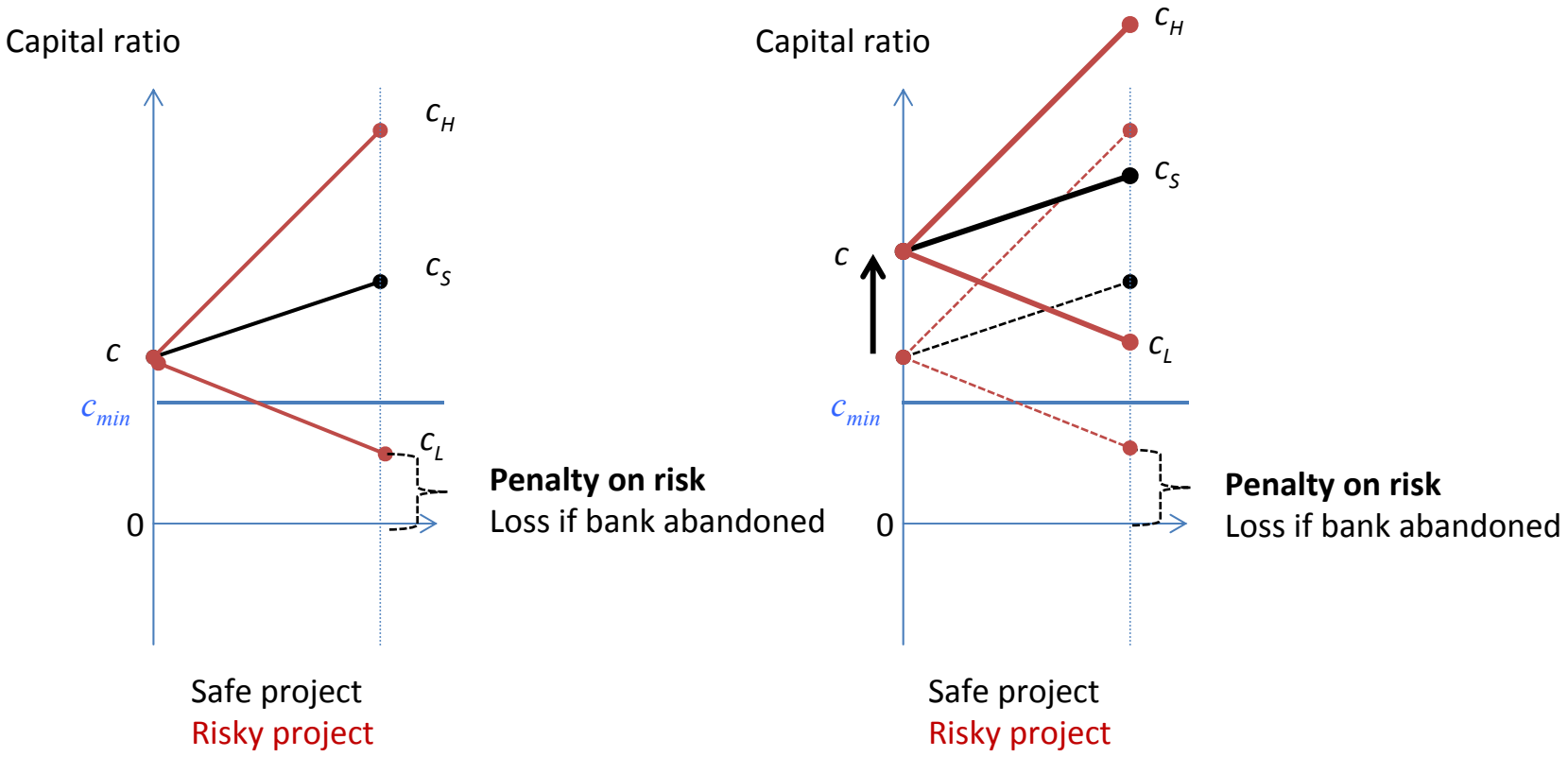
Capital and Risk-taking: Enabling effect (cont'd)

No tail risk, capital adjustment cost ($\mu = 0$, $c_{min} > 0$)

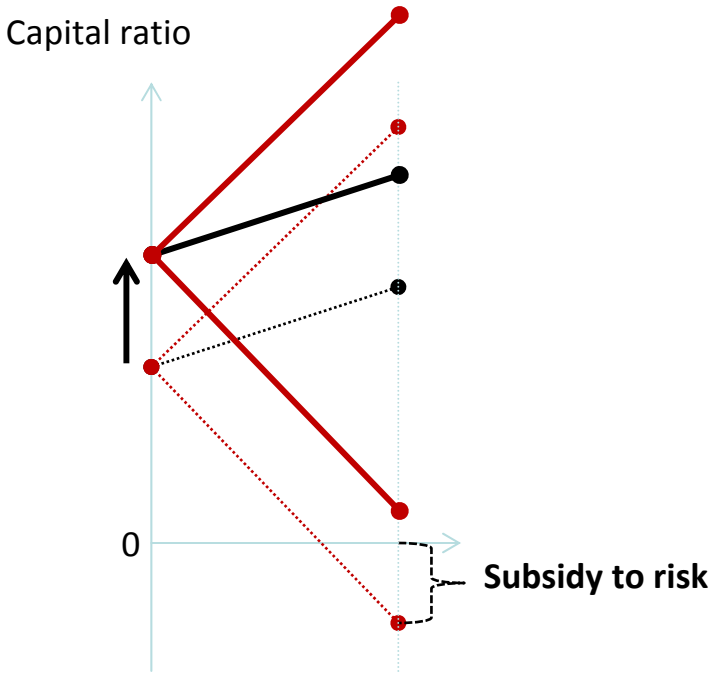


c_{min}: Minimal capital requirement

More capital → <u>More</u> incentives for risk (less chance $c_L < c_{min}$)

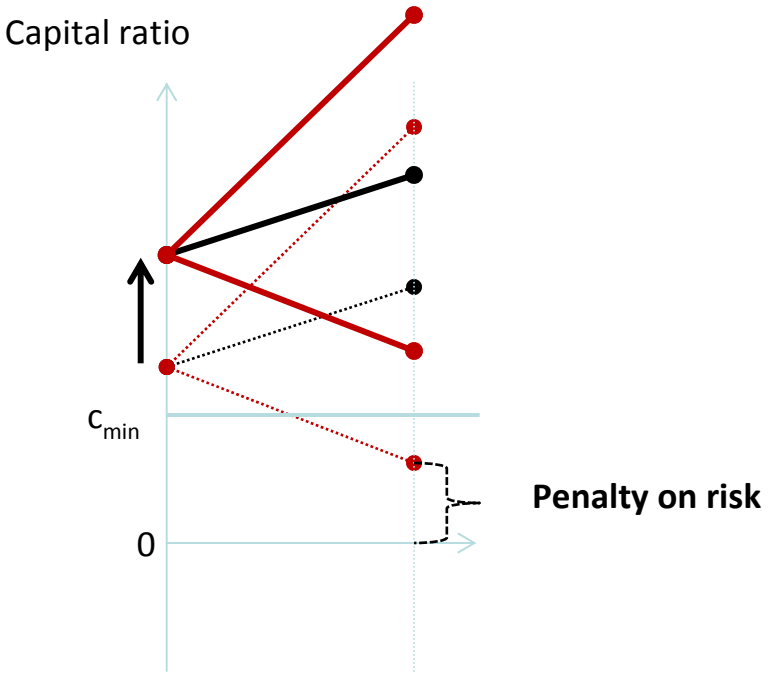
The two opposite effects of higher capital

Limited liability effect



Safe project
Risky project

Capital adjustment cost effect



Safe project
Risky project

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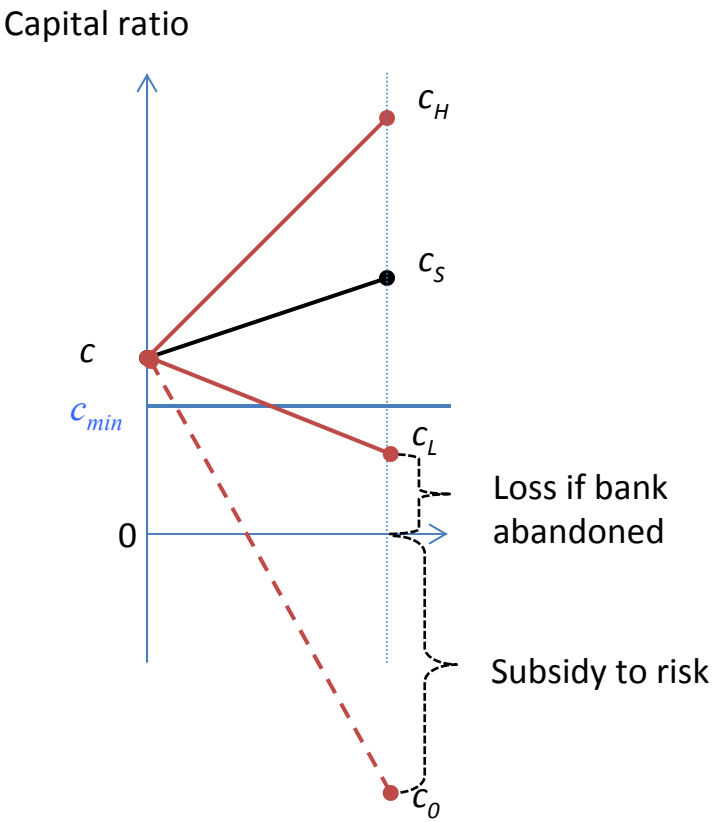
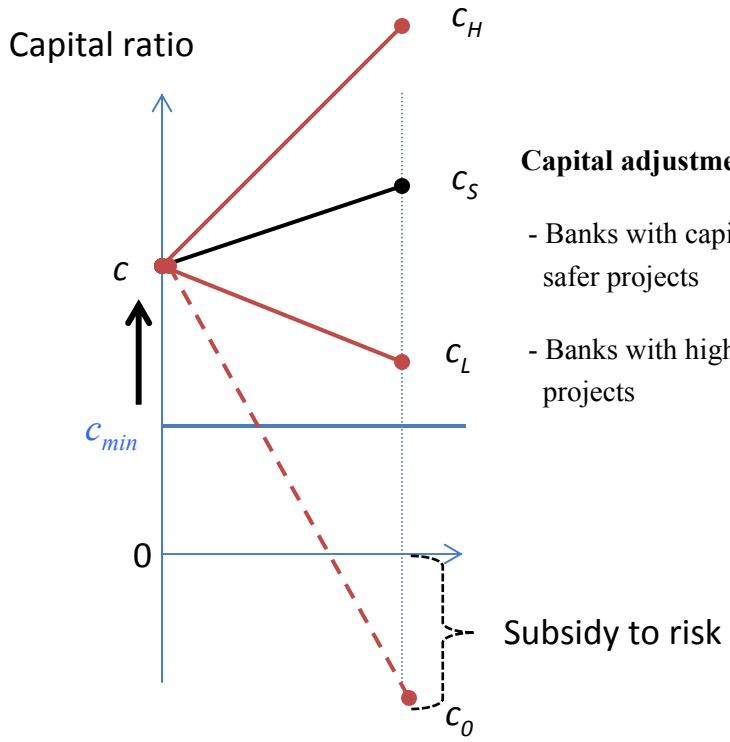
Putting together: Tail risk

When is risk bad ?

- **in the presence of left tail projects:** $\mu > 0$





Capital adjustment cost effect dominates:

- Banks with capital closer to minimal choose safer projects
- Banks with higher capital choose riskier projects

Higher capital → Higher excess risk

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Solving the model

Recapitalization Decision

- No recapitalization;
- Bank is abandoned;
- Banker gets zero payoff.

- The bank is recapitalized at cost T;
- Banker gets a positive payoff $R_L - (1-c) - T$

- Capital is sufficient;
- Banker gets positive payoff $R_L - (1-c)$

$$c^{Recapitalize} = 1 + T - R_L.$$

$$c^{Sufficient} = 1 - (1 - c_{\min})R_L.$$

With $c^{Recapitalize} < c^{Sufficient}$ for $T < c_{\min} R_L.$

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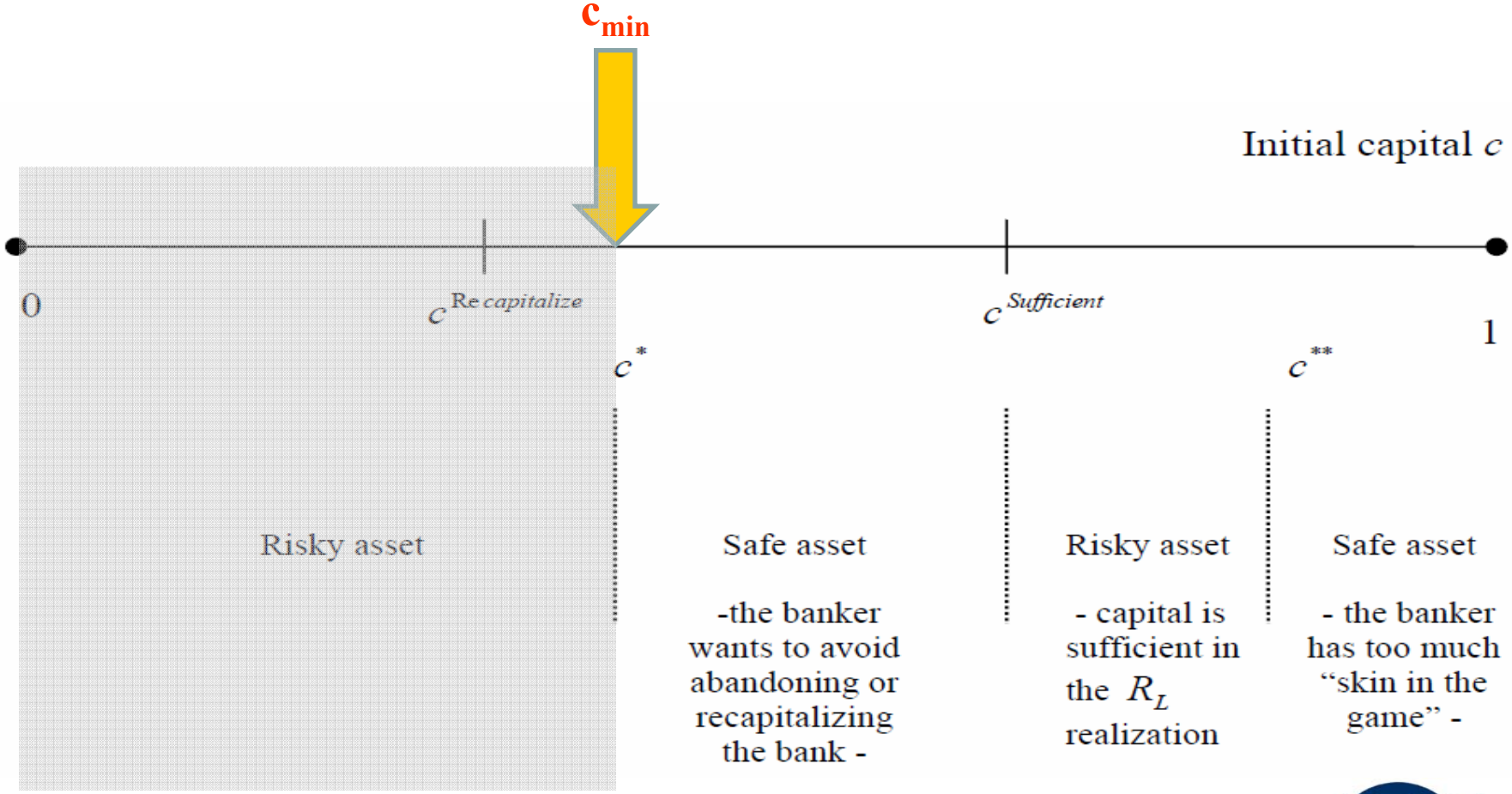
Project Choice

There are parameter values such that:



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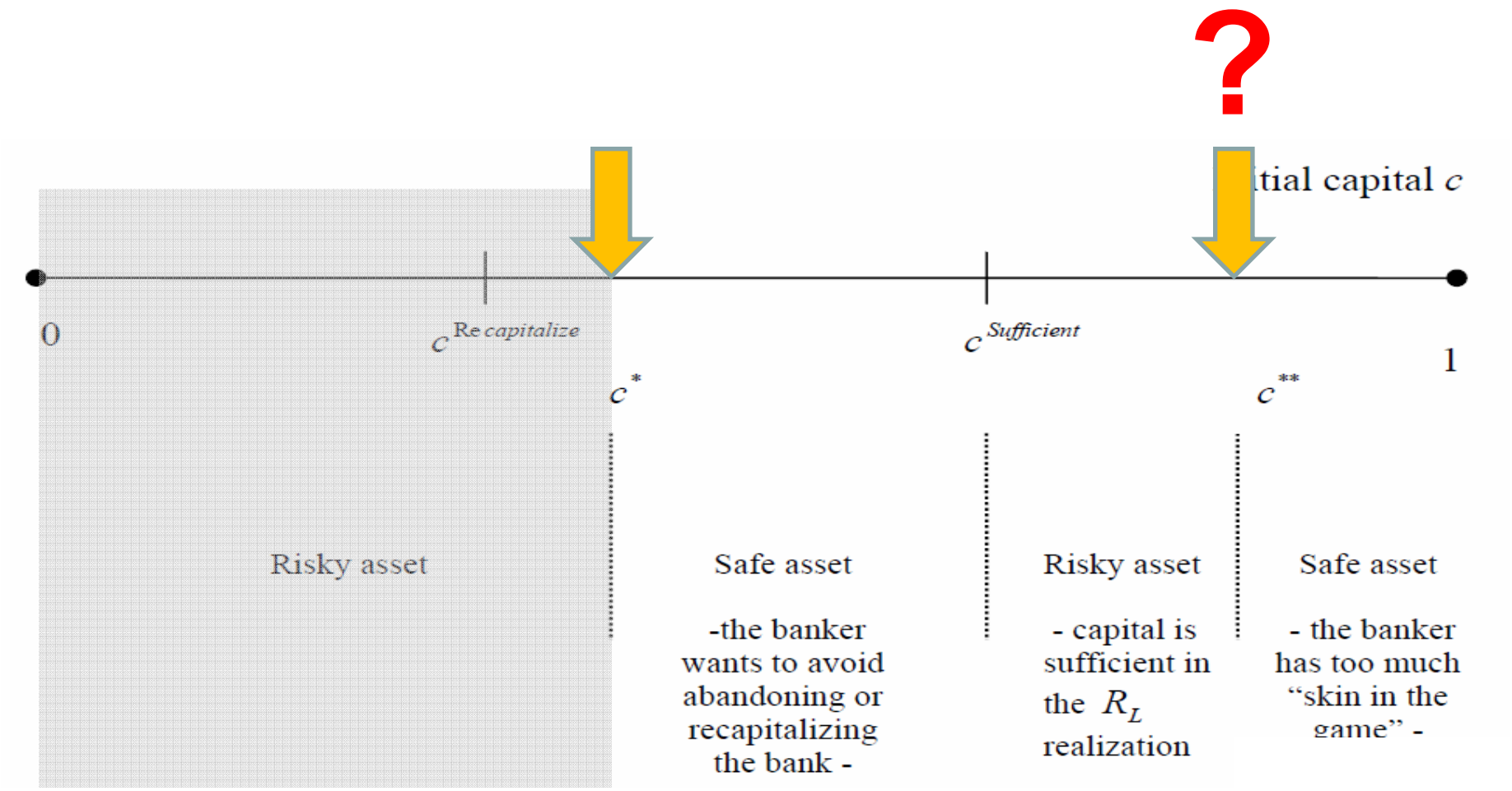
Minimal capital

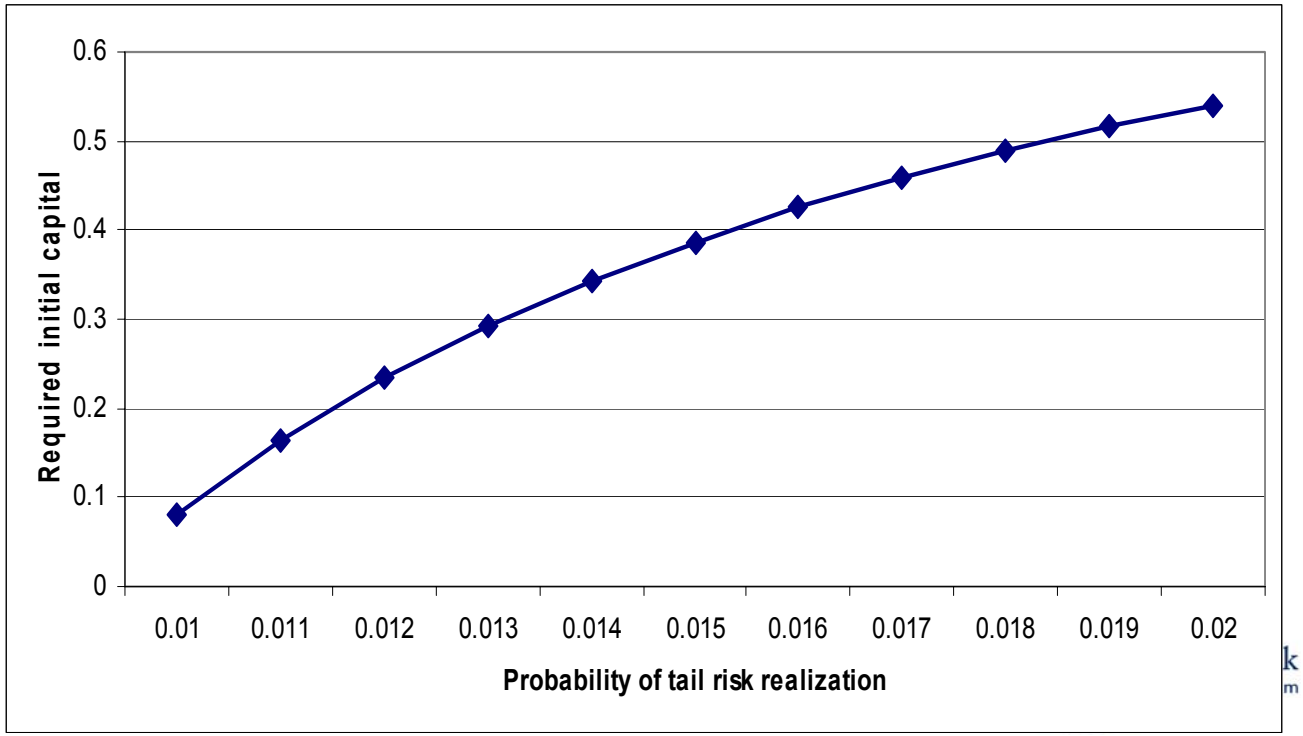


Capital req'ts not effective for tail risk

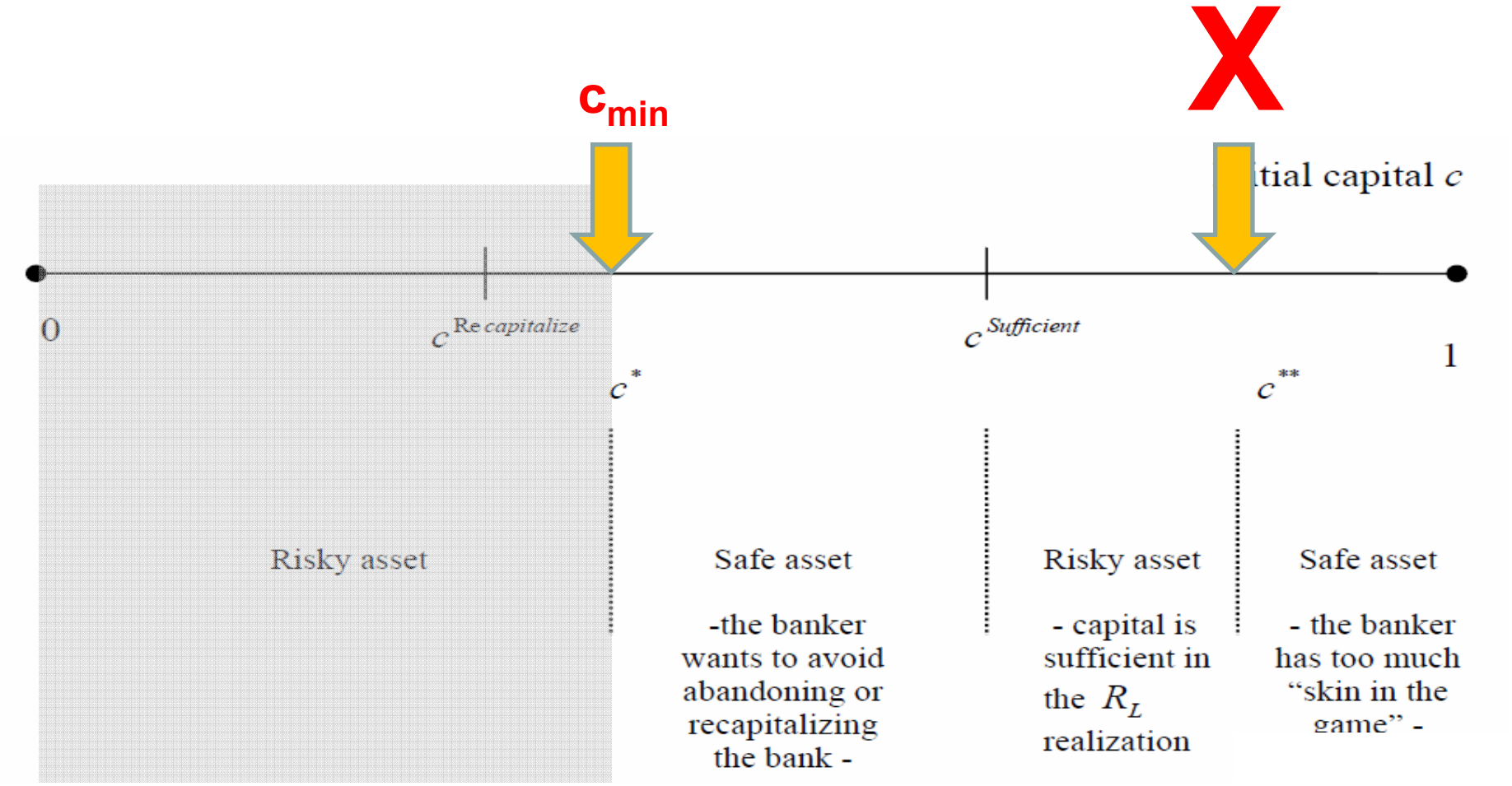
Exercise: Capital necessary to prevent risk-shifting

- $R_S = 1.03$
- $R_H = 1.14$; $R_L = 0.92$; $R_0 = 0$; $p = .5$; $\mu = .01$ // **E(R)** = 1.021
- **c** = 8%**

- **Increase μ holding E(R) fixed**
- **Impact on c****



Capital req'ts not effective for tail risk



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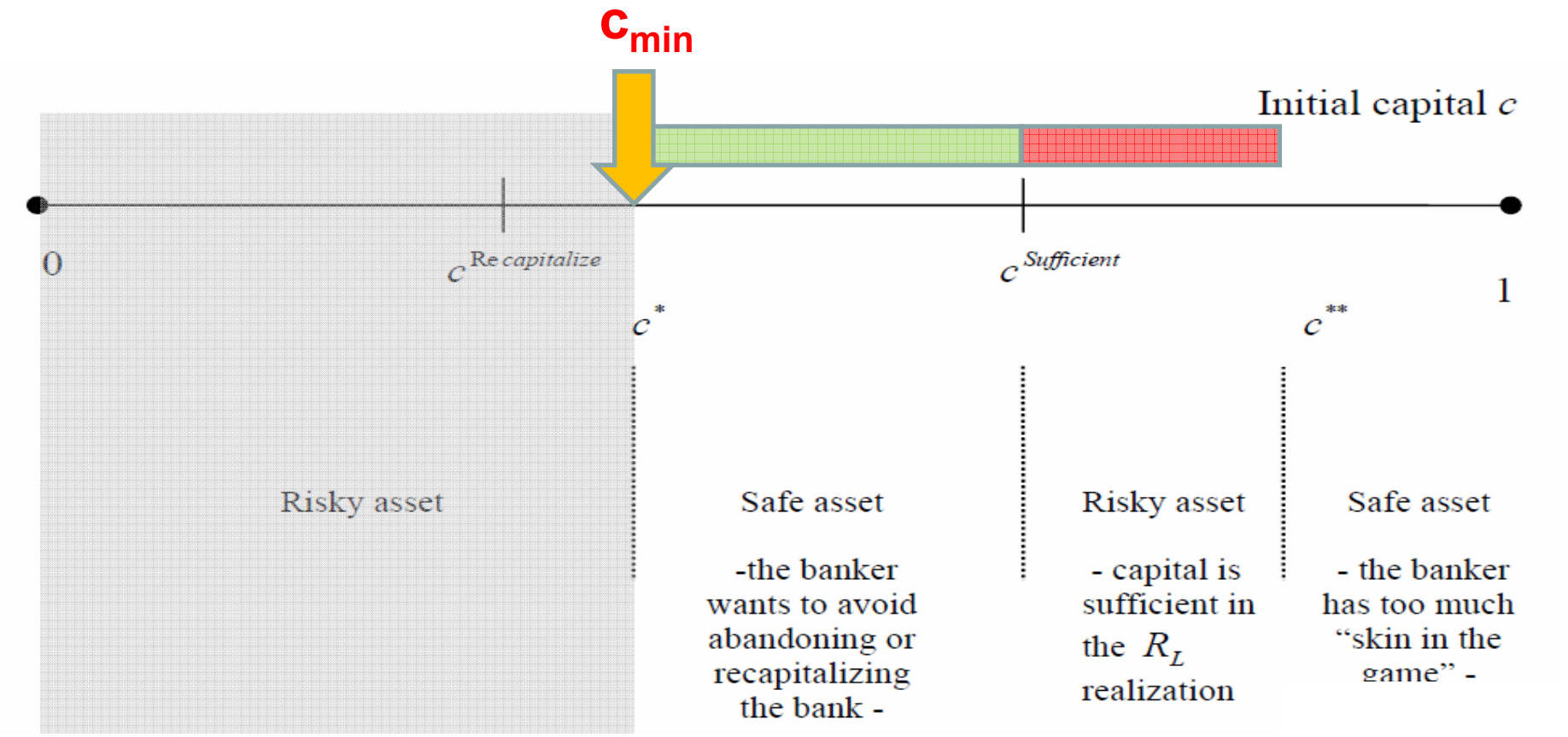
Focus on Excess capital



Deal with skewed returns directly

- How to deal with skewed returns ?
  - Not by capital ratios alone
    (similar with liquidity, exposure, correlations)
  - Prohibit extreme bets or increase their ex-ante cost
    (Acharya et al., 2010; Perotti and Suarez, 2009)
  - Enhanced supervision to capture tail risk
    (particularly for well-capitalized banks)

Conclusions

- Capital is useful

  … but it is ineffective in dealing with tail risk

  ... impossible to control all risk-taking using a single instrument

- Capital may enable risk-taking

- Need a distinct approach (direct + regulatory focus)

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