Markets, Banks and Shadow Banks

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Motivation

"While **higher capital and liquidity requirements** on banks will no doubt help to insulate banks from the consequences of large shocks, the danger is that they **will also drive a larger share of intermediation into the shadow banking realm**."

Hanson, Kashyap, and Stein (2011)

Introduction

- Main issues to be addressed

  → What is the difference between banks and shadow banks?

  → How regulation affects funding through these channels?

  → How shadow banks affect effectiveness of regulation?

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  - → What is the difference between banks and shadow banks?
  - → How regulation affects funding through these channels?
  - → How shadow banks affect effectiveness of regulation?
- Goal is to construct a model to shed light on
  - → Effect of regulation on structure & risk of financial system
  - → Regulatory tradeoffs

What are shadow banks?

- Broad definition (Financial Stability Board)

  "Credit intermediation involving entities and activities outside of the regular banking system."

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  "Credit intermediation involving entities and activities outside of the regular banking system."

- Narrower definition (Javier Suarez)

  "**Banking-like activities** developed outside of the perimeter of traditional bank regulation."

What are banking-like activities?

- Maturity transformation

  → Especially if funding with debt with very short maturities

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- Risk transformation

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- Risk transformation

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- **Credit origination**

  → Especially if relationship-based or **monitoring-intensive**

Our approach

- Focus on two dimensions: **monitoring** and **regulation**

  → Whether lenders monitor (or screen) borrowers

  → Whether lenders comply with capital regulation

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- Focus on two dimensions: **monitoring** and **regulation**
  - → Whether lenders monitor (or screen) borrowers
  - → Whether lenders comply with capital regulation
- Three funding modes
  - → When borrowers are not monitored: **market finance**
  - → When borrowers are monitored
    - + Lenders comply with regulation: **regulated banks**
    - + Lenders not comply with regulation: **shadow banks**

Key assumptions on bank capital

- Bank capital is costly but provides “skin in the game”

  → Commitment device for monitoring borrowers

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- Complying with regulation implies certification

  → Novel role for banking supervision

- Not complying with regulation requires private certification

  → Additional cost of equity capital

The emergence of shadow banks

- Trade-off between costs and benefits of public certification

  → If bank capital regulation is very tough

  → (Shadow) banks may prefer not to comply with regulation

  → And resort to more expensive private certification

The emergence of shadow banks

- Trade-off between costs and benefits of public certification
  - → If bank capital regulation is very tough
  - → (Shadow) banks may prefer not to comply with regulation
  - → And resort to more expensive private certification
- What if capital could be (privately) certified at zero cost?
  - → Alternative setup: regulated banks have insured deposits
  - → Similar qualitative results
  - → In the paper: not for today

Overview

- Model setup
- Equilibrium
  - → Model with no capital requirements
  - → Flat capital requirements (Basel I)
  - → Value-at-Risk capital requirements (Basel II & III)
- Optimal capital requirements
- Concluding remarks

Part 1

Model setup

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- Two dates ($t = 0, 1$)
- Agents: → Set of potential **entrepreneurs**
  → Set of risk-neutral **banks**
  → Set of risk-neutral **investors**

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- Entrepreneurs have projects that require outside finance
- Banks raise funds by issuing uninsured debt and equity capital
  → **No deposit insurance**

Entrepreneurs

- Continuum of entrepreneurs of observable types $p \in [0,1]$

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- Continuum of entrepreneurs of observable types $p \in [0,1]$
- Each entrepreneur of type p has risky project

$$\text{Unit investment} \;\rightarrow\; \text{Return} = \begin{cases} A_p, & \text{with prob. } 1-p+m_p \\ 0, & \text{with prob. } p-m_p \end{cases}$$

$\rightarrow m_p \in [0,p]$ is the monitoring intensity of lending bank

Bank monitoring

- Monitoring is not observed by debtholders

  → Moral hazard problem

- Monitoring entails cost

$$c(m_j) = \frac{\gamma}{2} m_j^2, \text{ with } \gamma > 0$$

Investors

- Two types of risk-neutral investors
  - → Debtholders: require expected return normalized to 0
  - → Shareholders: require expected return $\delta > 0$ (cost of capital)

Assumptions

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  → Each bank only lends to a single type p of entrepreneurs

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- Loan market is contestable (limit pricing)

  → Equilibrium loan rate is lowest feasible rate

Bank capital certification

- Bank capital has to be certified

  → Otherwise shareholders could lever up

- Certification cost $\eta > 0$

Part 2

Equilibrium

Part 2a

Model with no capital requirements

Banks' decisions

- Bank lending to entrepreneurs of type p sets

  (1) Capital k_p per unit of loans

  (2) Borrowing rate B_p offered to debtholders

  (3) Lending rate R_p offered to entrepreneurs

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- Bank lending to entrepreneurs of type p sets

  (1) Capital k_p per unit of loans

  (2) Borrowing rate B_p offered to debtholders

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  → Such contract determines monitoring m_p

Equilibrium

- An equilibrium is array $(k_p^*, B_p^*, R_p^*, m_p^*)$ that solves

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→ and shareholders' participation constraint

$$\pi_p^* \geq (1+\delta+\eta)k_p^*$$

Proposition 1

- There is a marginal type

$$\hat{p} = 1 - \sqrt{\frac{1+\delta+\eta}{c''(0)(\delta+\eta)}}$$

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→ Safer types $p \leq \hat{p}$ choose market finance: $m_p^* = k_p^* = 0$

Proposition 1

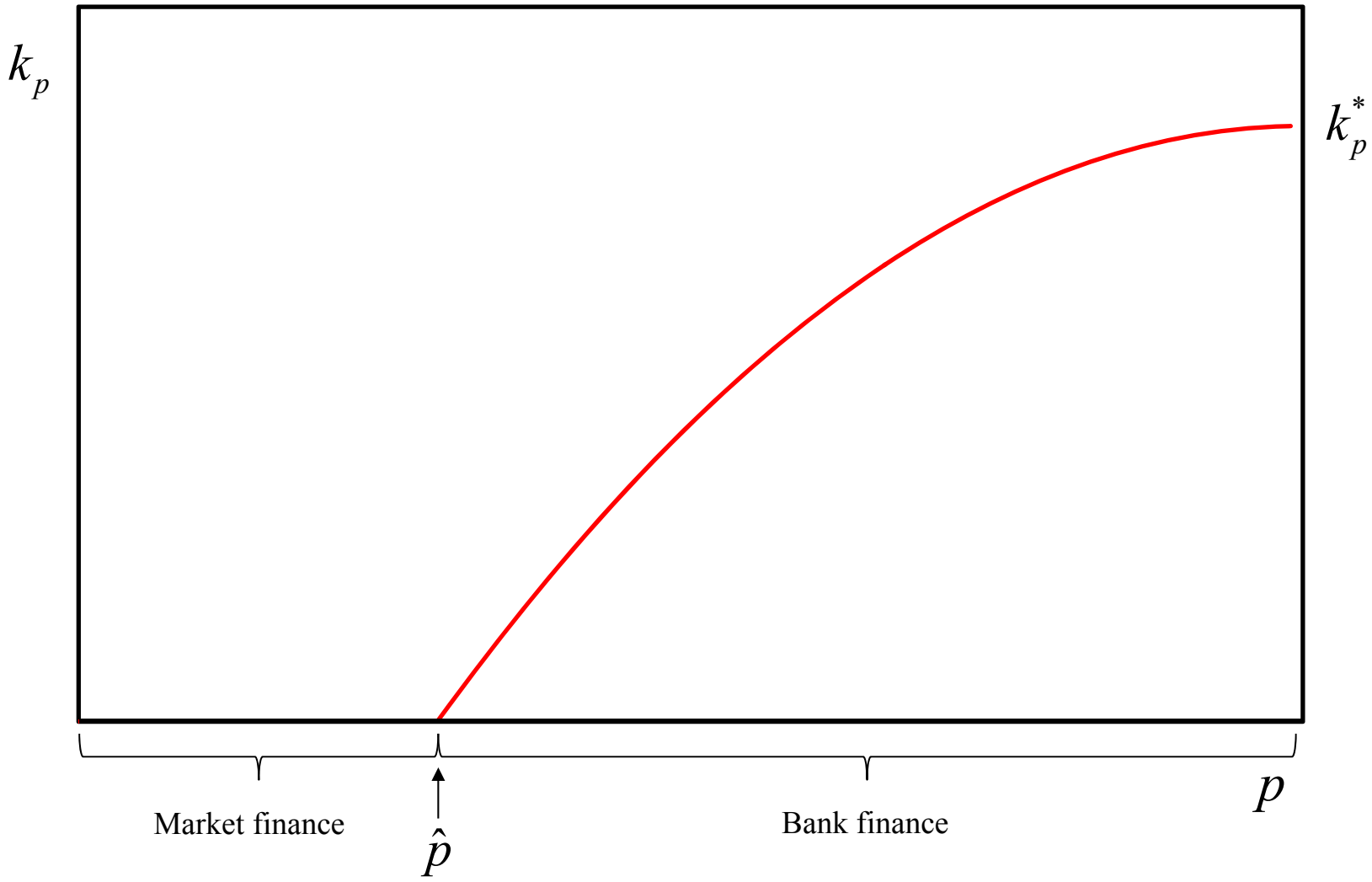
- There is a marginal type

$$\hat{p} = 1 - \sqrt{\frac{1+\delta+\eta}{c''(0)(\delta+\eta)}}$$

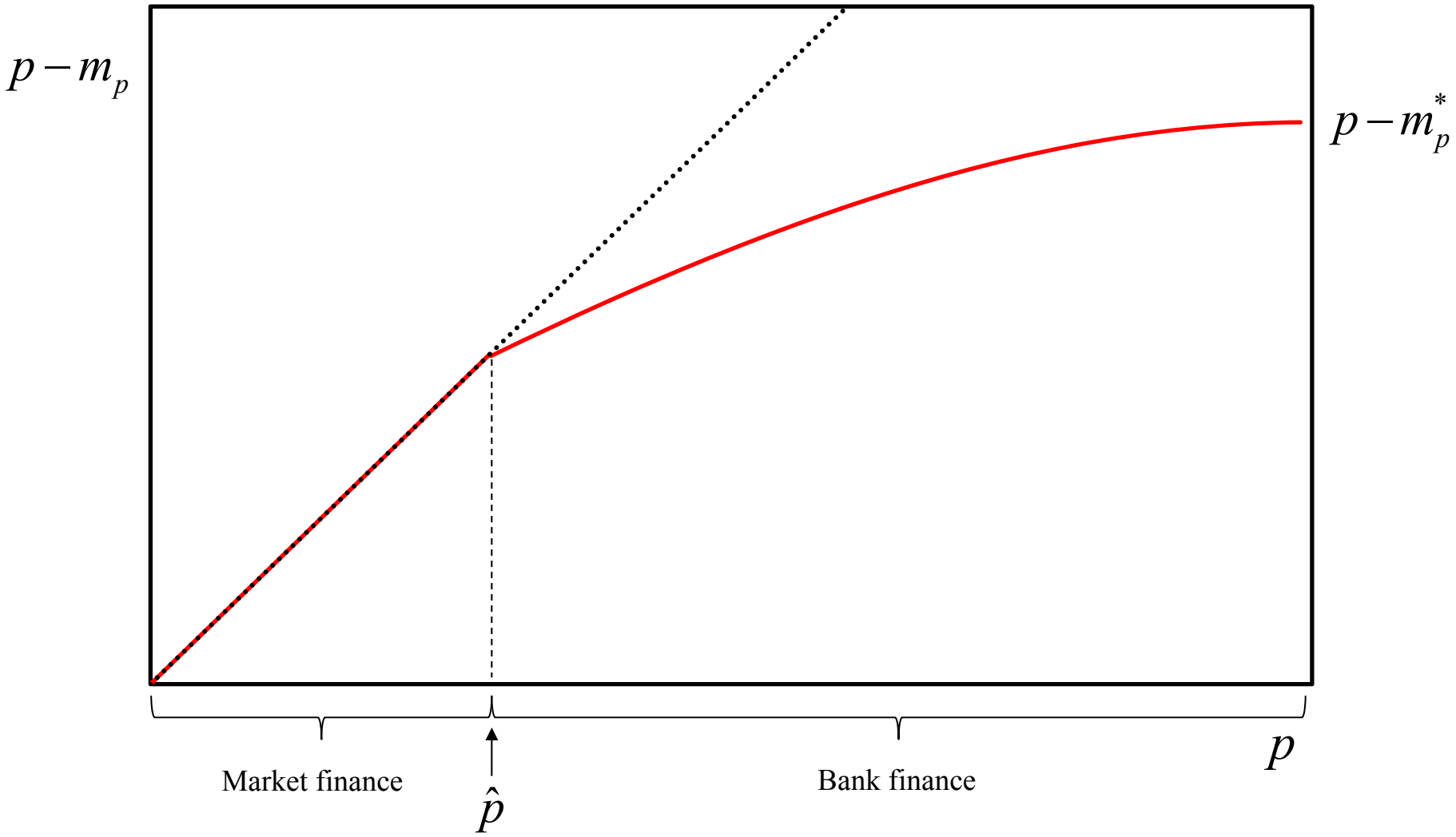
→ Safer types $p \leq \hat{p}$ choose market finance: $m_p^* = k_p^* = 0$

→ Riskier types $p > \hat{p}$ choose bank finance: $m_p^* > 0$ and $k_p^* > 0$

Bank capital



Probability of default



Comparative statics on certification cost

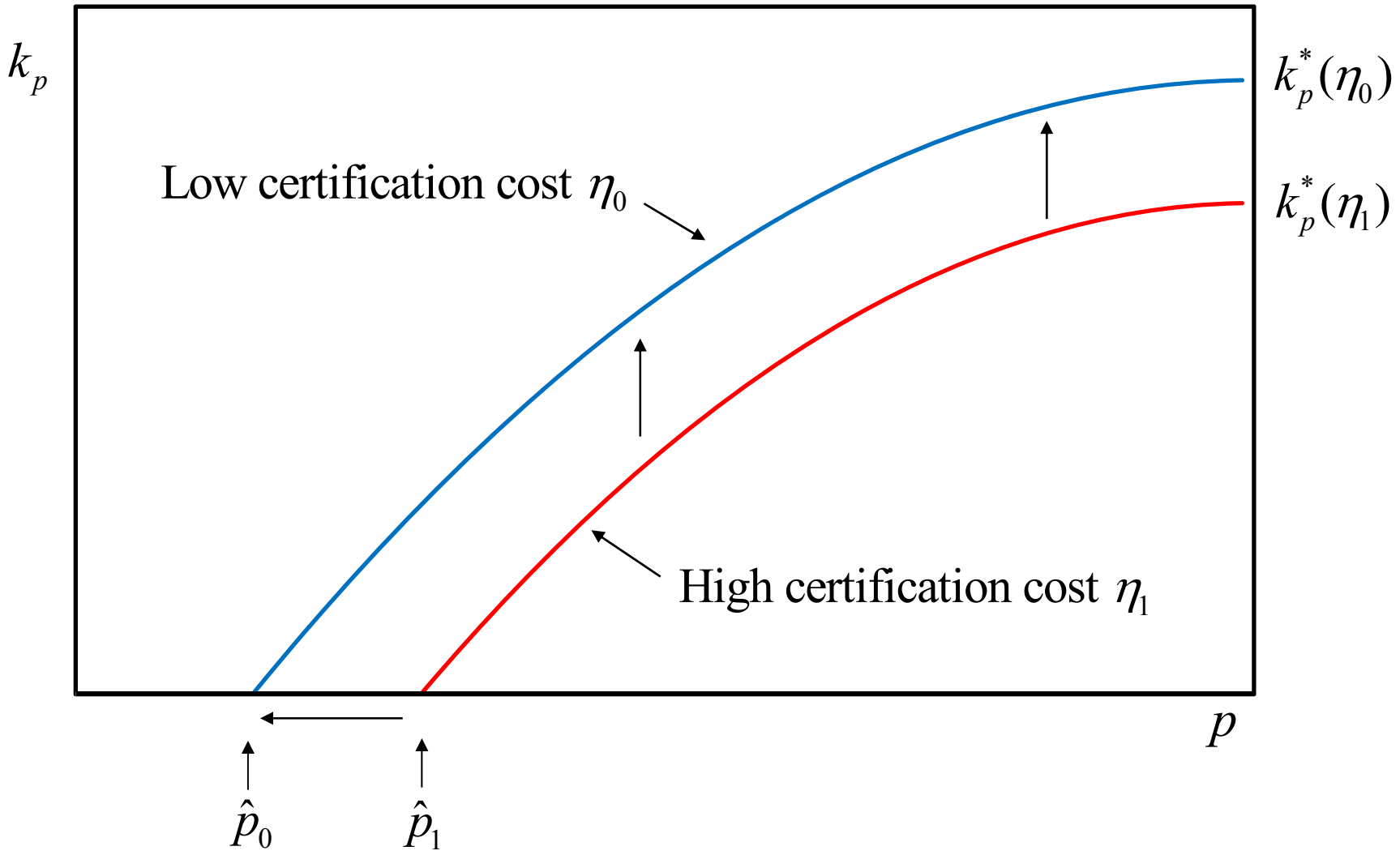
- Effect of a reduction in certification cost η (from η_1 to η_0)

  → Expands region where bank finance is optimal

  → Increases banks' capital and monitoring

  → Reduces entrepreneurs' probability of default

Bank capital



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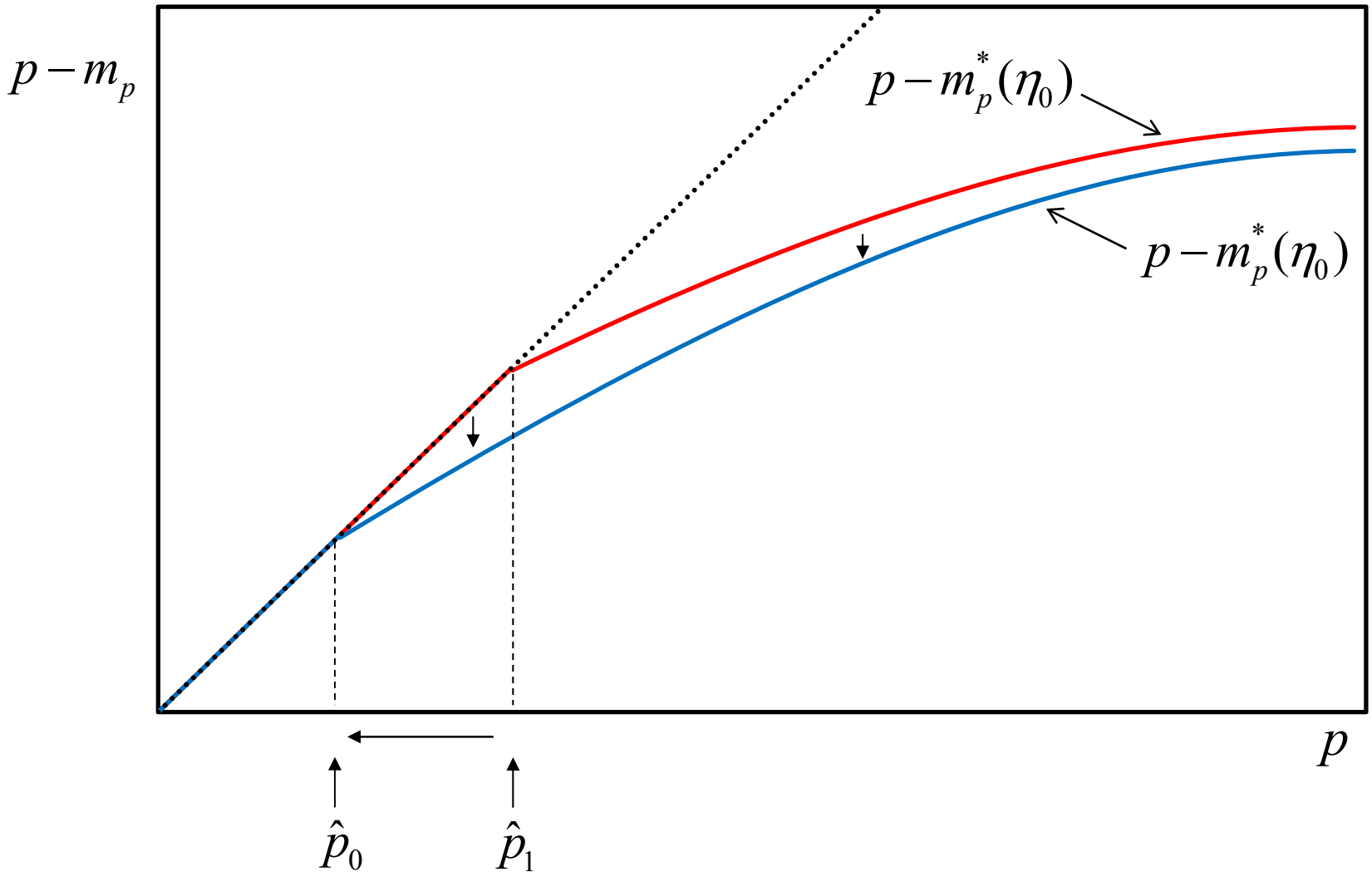

Private vs public certification

- Introduce two possible certification agencies
  - → Public agency (bank supervisor) with cost η_0
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  - → Supervisor may have access to richer information

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- Why is private certification costlier than public certification?
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- What is flip side of public certification?
  - → Banks have to comply with regulation

What's next?

- Two types of capital requirements
  - → Risk-insensitive (flat) capital requirements
  - → Risk-sensitive (Value-at-Risk) capital requirements

Part 2b

Flat capital requirements

Flat capital requirements

- Flat requirement (Basel I) or leverage ratio (Basel III)

$$k_p \geq \bar{k}$$

Flat capital requirements

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- Complying with regulation implies certification (with $\eta_0 = 0$)

  → Role of banking supervision

Shadow banks

- Not complying with regulation implies no public certification

  → Shadow banks resort to private certification

  → Certification cost $\eta_1 > 0$

  → Higher cost of capital for shadow banks

Two cases: low and high flat requirements

- With low flat requirements

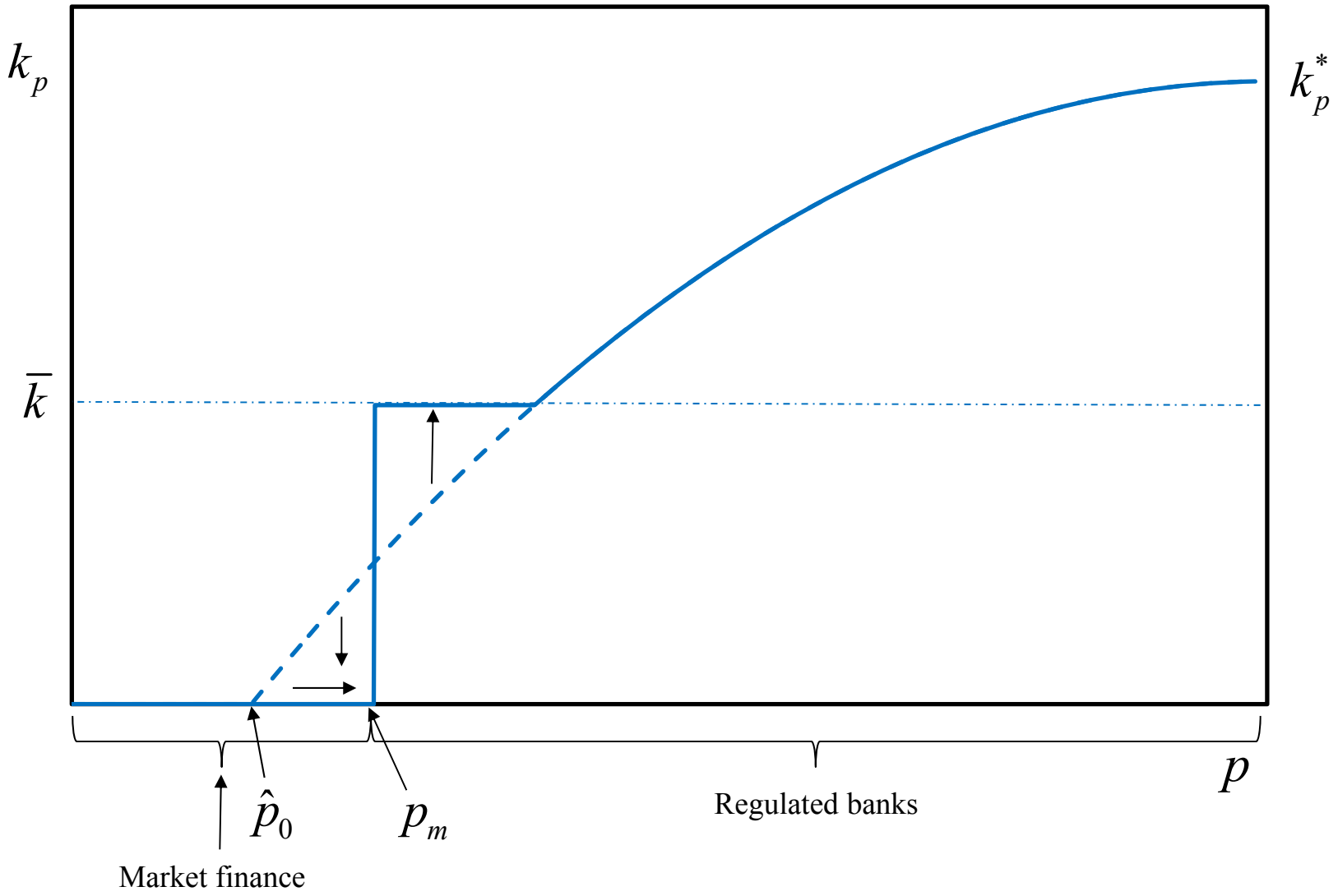
  → Only direct market finance and regulated banks

  → No role for shadow banks

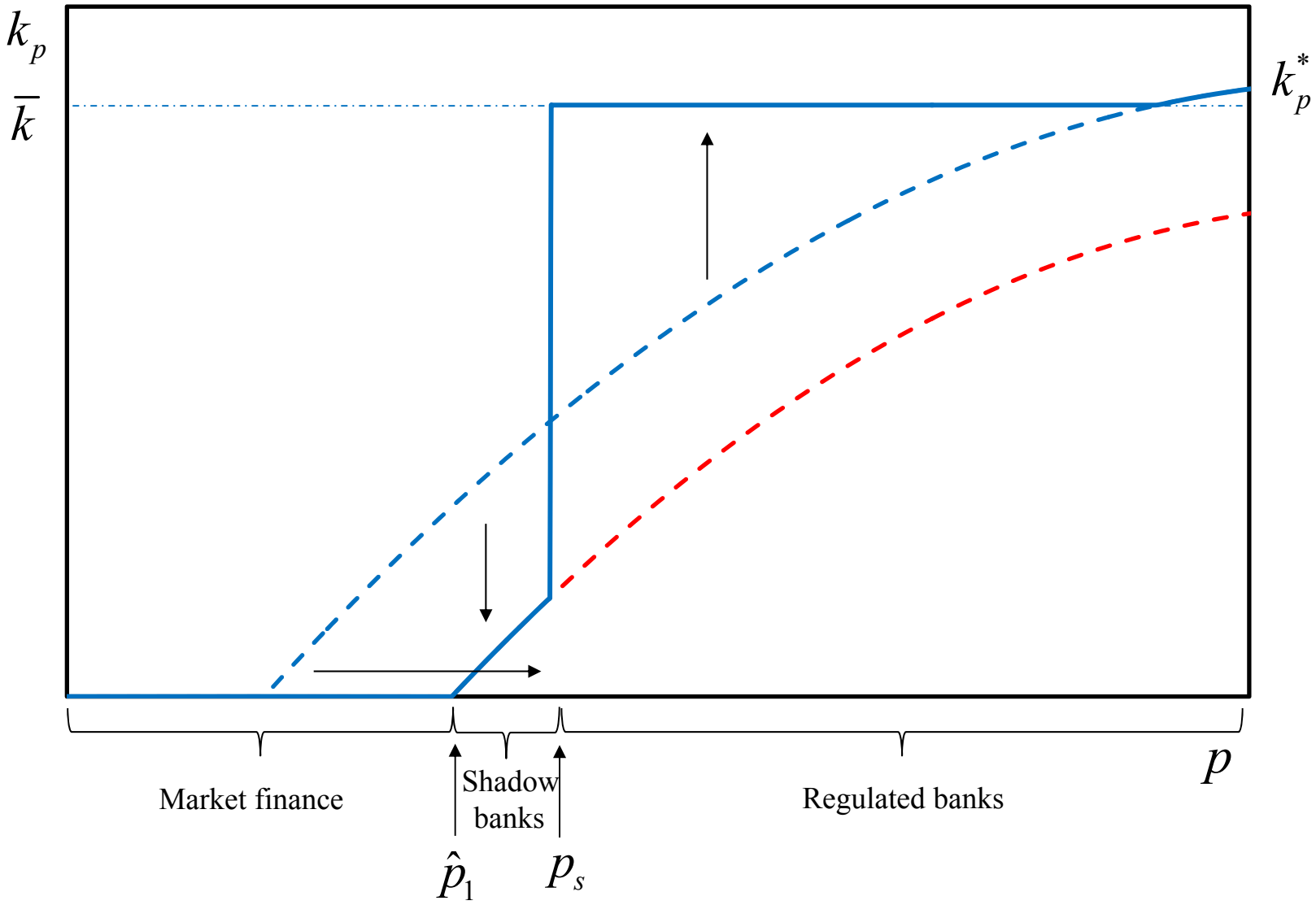
Two cases: low and high flat requirements

- With low flat requirements
  - → Only direct market finance and regulated banks
  - → No role for shadow banks
- With high flat requirements
  - → Shadow banks can profitably enter the market
  - → To fund medium-risk projects
  - → Taking over part of the regulated banks' market

Capital with low flat requirements



Capital with high flat requirements



Effect of tightening flat capital requirements

- Drives safer borrowers away from regulated banks

  → Lower monitoring and higher risk

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- No effect on high-risk regulated banks

  → Capital requirement is not binding

  → These banks maintain capital buffers

Part 2c

Value-at-Risk based capital requirements

VaR capital requirements (i)

- Introducing a VaR-based capital requirement (à la Basel II)

  → In Basel II

$$\Pr(\text{loan losses} > \bar{k}_p) = \alpha$$

  where $1 - \alpha$ is confidence level (e.g. 99.9%)

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  → In Basel II

$$\Pr(\text{loan losses} > \bar{k}_p) = \alpha$$

  where $1 - \alpha$ is confidence level (e.g. 99.9%)

  → We postulate

$$\Pr(\text{loan default} \mid \bar{k}_p) = \alpha$$

VaR capital requirements (ii)

- To ensure

$$\Pr(\text{loan default} \mid \bar{k}_p) = \alpha$$

$\rightarrow$ we require $\bar{k}_p$ to be such that $p - m_p = \alpha$

VaR capital requirements (ii)

- To ensure

$$\Pr(\text{loan default} \mid \bar{k}_p) = \alpha$$

→ we require $\bar{k}_p$ to be such that $p - m_p = \alpha$

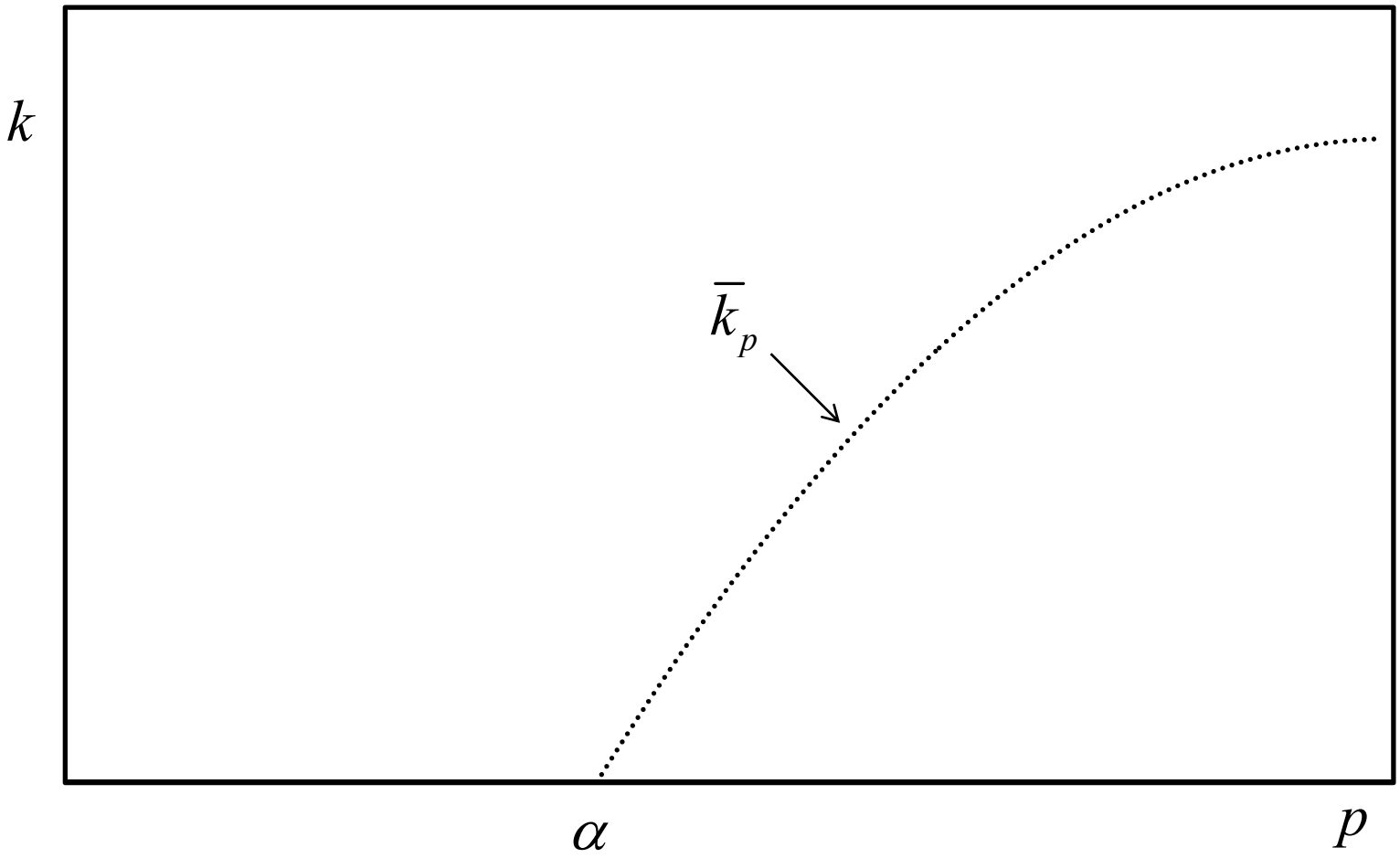
- Model then gives closed-form capital requirements formula

$$\bar{k}_p = f(p, \alpha)$$

→ Increasing in risk p

→ Increasing in confidence level $1 - \alpha$

VaR capital requirements



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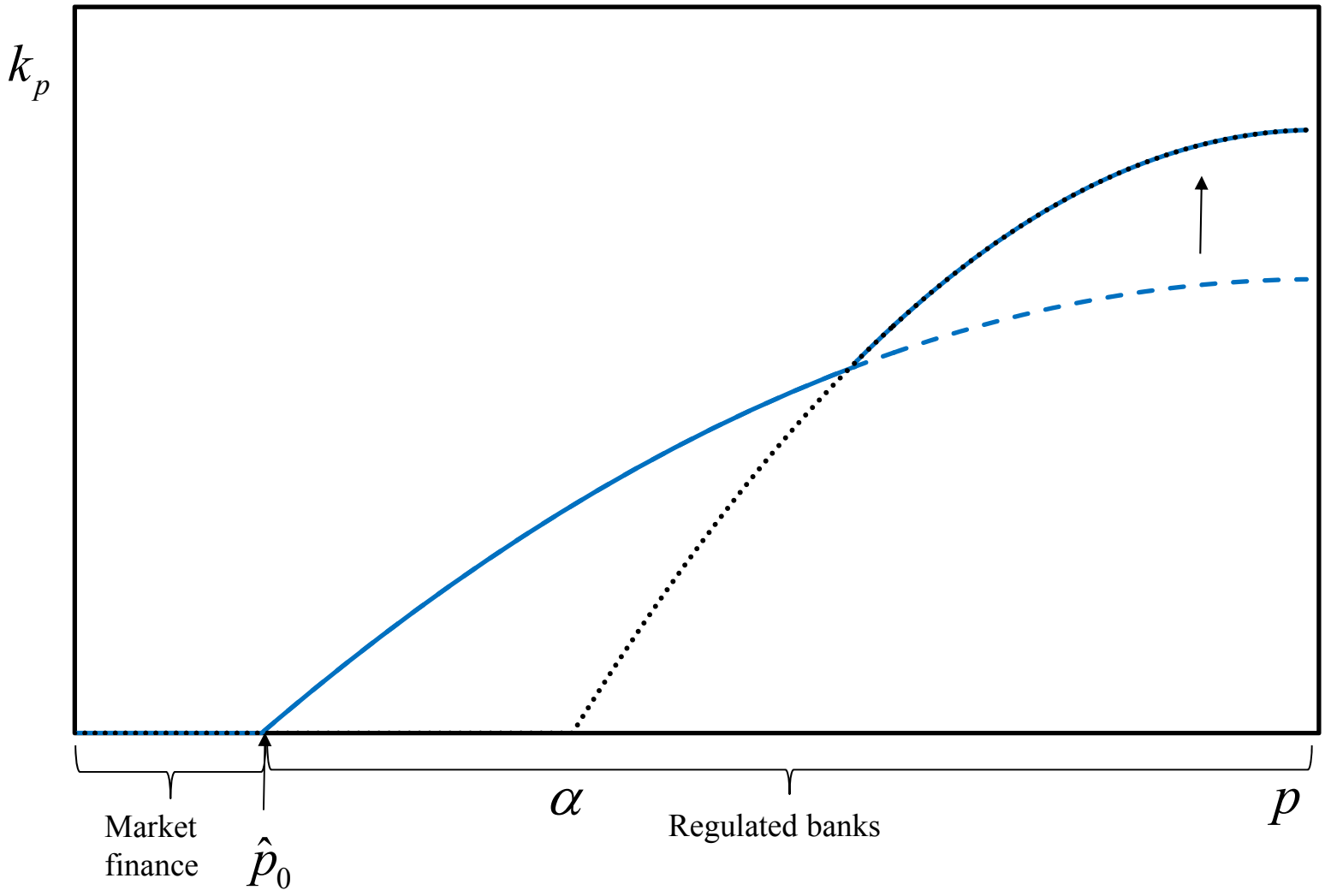
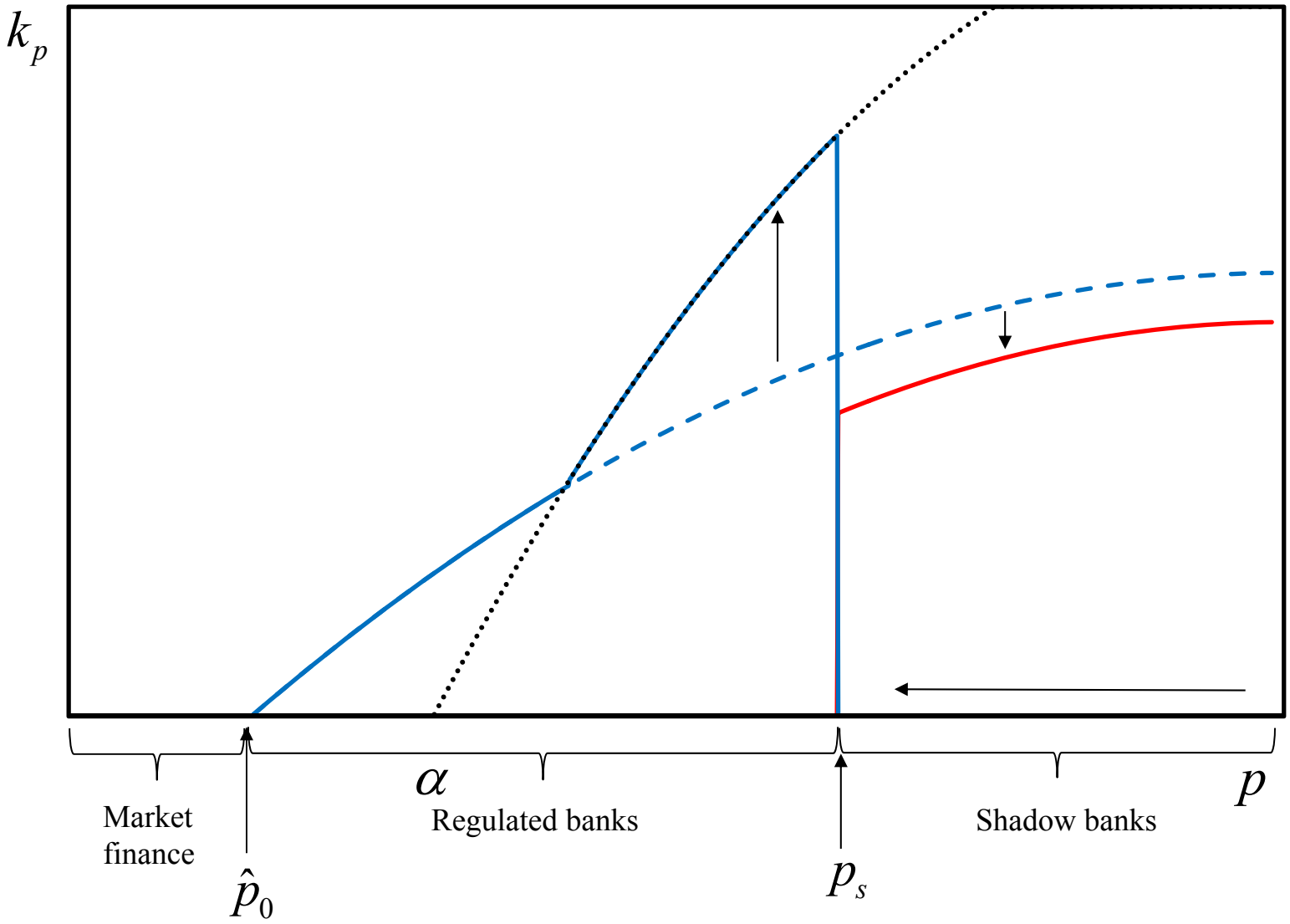


Capital with high VaR requirements



Effect of tightening VaR requirements

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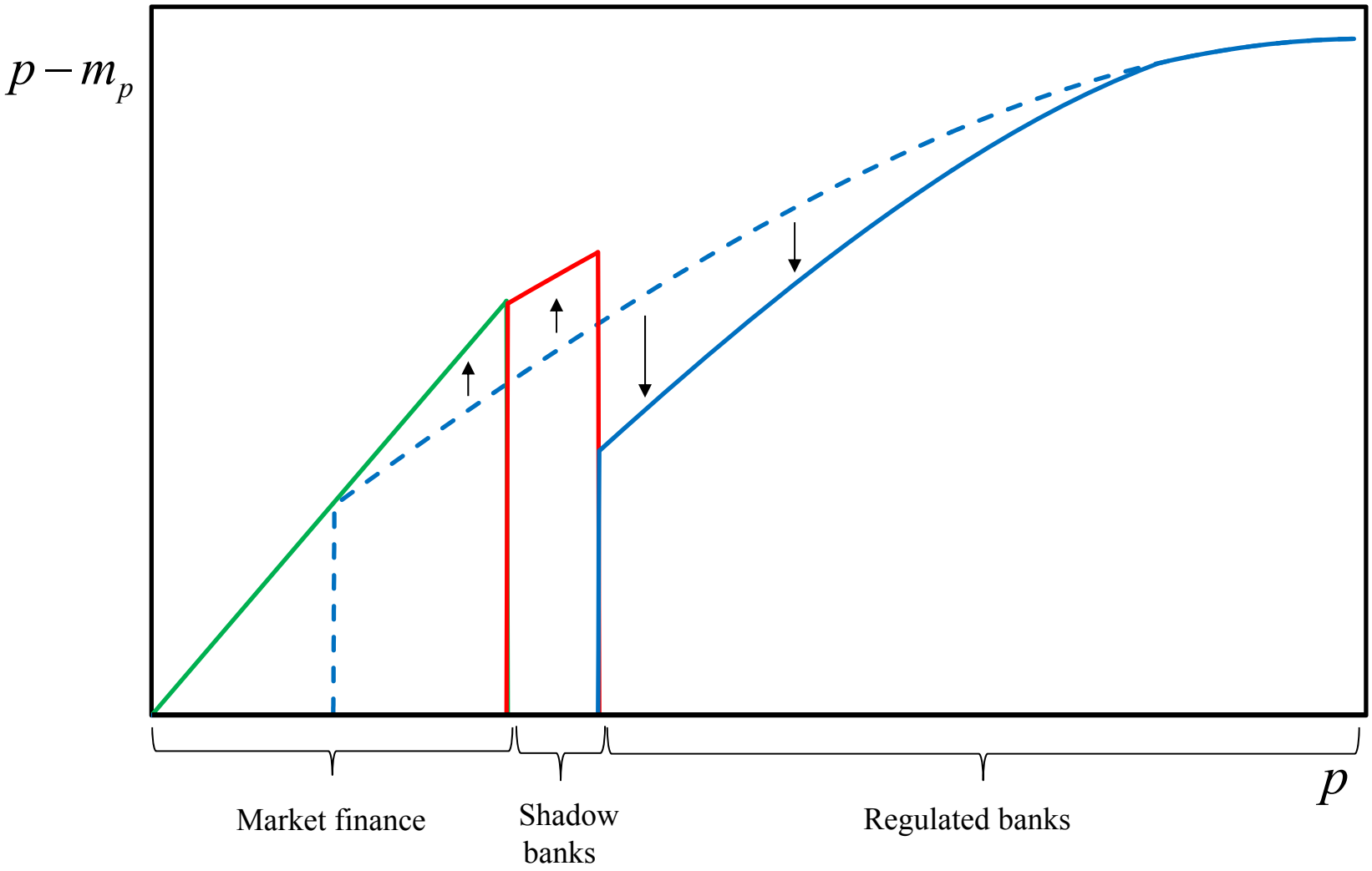
- Very different from the effect of tightening flat requirements

PD with high flat requirements



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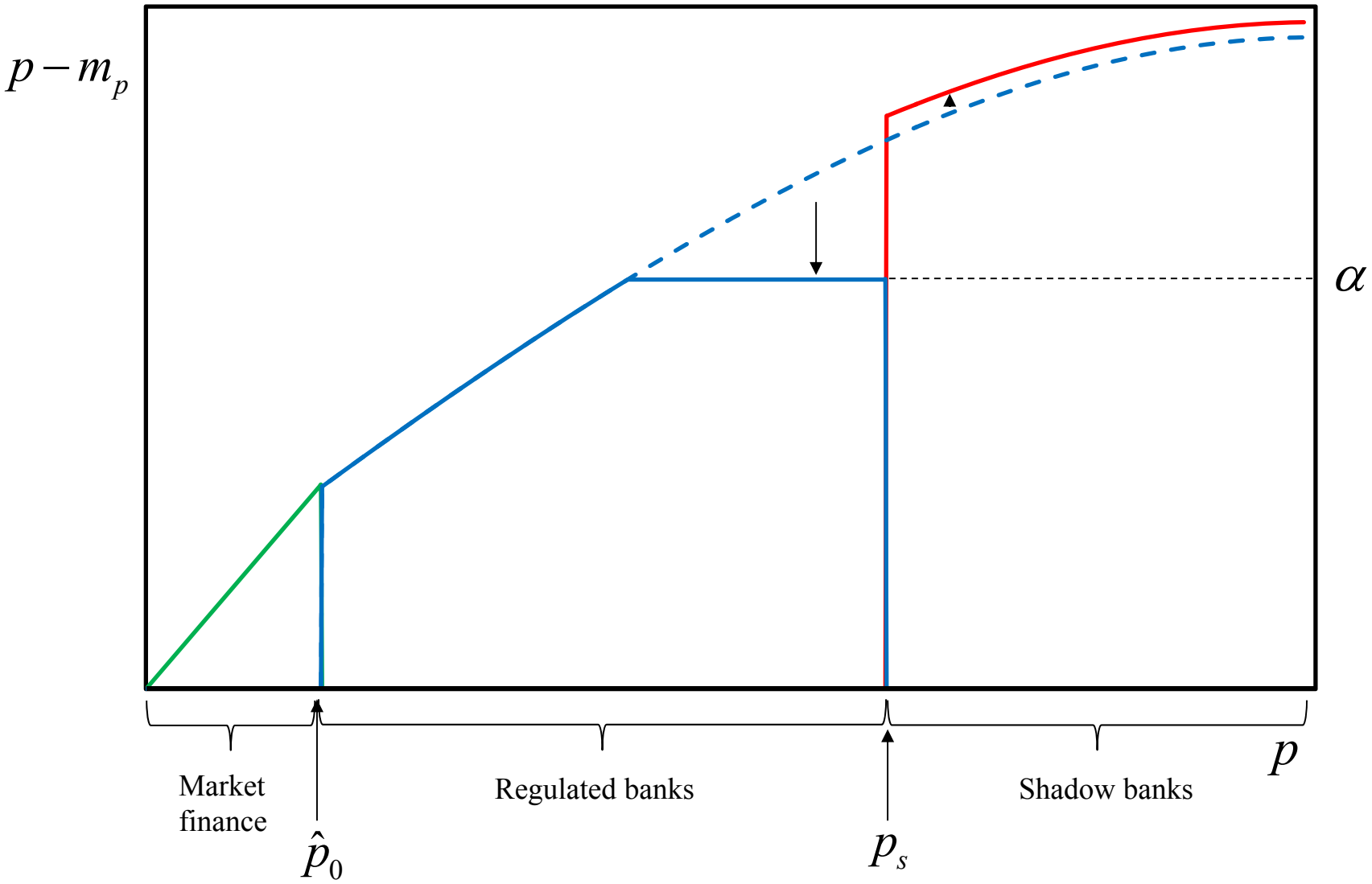

Part 3

Optimal capital requirements

Assumptions (i)

- Representative consumer

  → Utility function over goods produced by entrepreneurs

  → Unit investment produces unit output, if successful

  → Success return A_p is unit price of goods produced by type p

Assumptions (ii)

- Utility function of representative consumer

$$U(q,x) = q + \frac{\sigma}{\sigma - 1}\int_0^1 (x_p)^{\frac{\sigma-1}{\sigma}}\, dp$$

→ q is consumption of composite good

→ x_p is output of entrepreneurs of type p

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- Budget constraint

$$q + \int_0^1 A_p x_p \; dp = I$$

→ I is consumer's income

Assumptions (iii)

- Maximizing the utility subject to the budget constraint gives

$$A_p = (x_p)^{-1/\sigma}$$

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- Maximizing the utility subject to the budget constraint gives

$$A_p = (x_p)^{-1/\sigma}$$

→ Success return A_p is decreasing function of output x_p

- How is output = investment = x_p determined?

→ Free entry of entrepreneurs: investment x_p adjusts

→ Until success return A_p equals equilibrium loan rate R_p

Social welfare function

- Investors receive opportunity cost of their funds

  → Participation constraints are satisfied with equality

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Social welfare function

- Investors receive opportunity cost of their funds

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- Entrepreneurs borrow at rates that leaves them no surplus

  → By assumption of free entry

- Social welfare comes from output produced by entrepreneurs

  → Social welfare function

$$W(x) = I + \frac{1}{\sigma - 1}\int_0^1 (1 - p + m_p)(x_p)^{\frac{\sigma-1}{\sigma}}\, dp$$

Optimal capital requirements

- Optimal capital requirements defined by

$$k^* = \arg\max_k W(x(k))$$

Optimal capital requirements

- Optimal capital requirements defined by

$$k^* = \arg\max_k W(x(k))$$

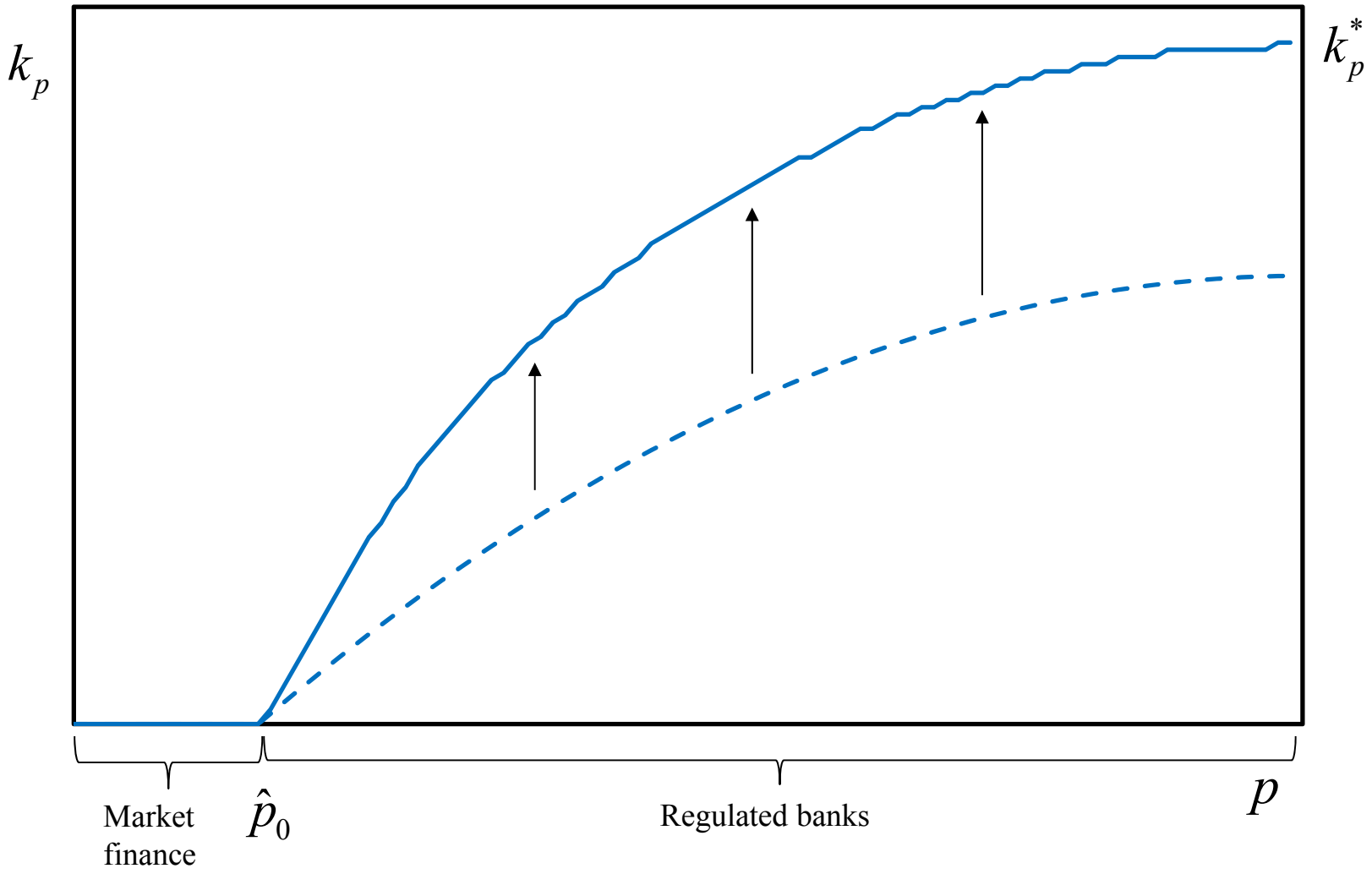
- Optimal capital requirements are risk-sensitive

  → But do not satisfy VaR condition

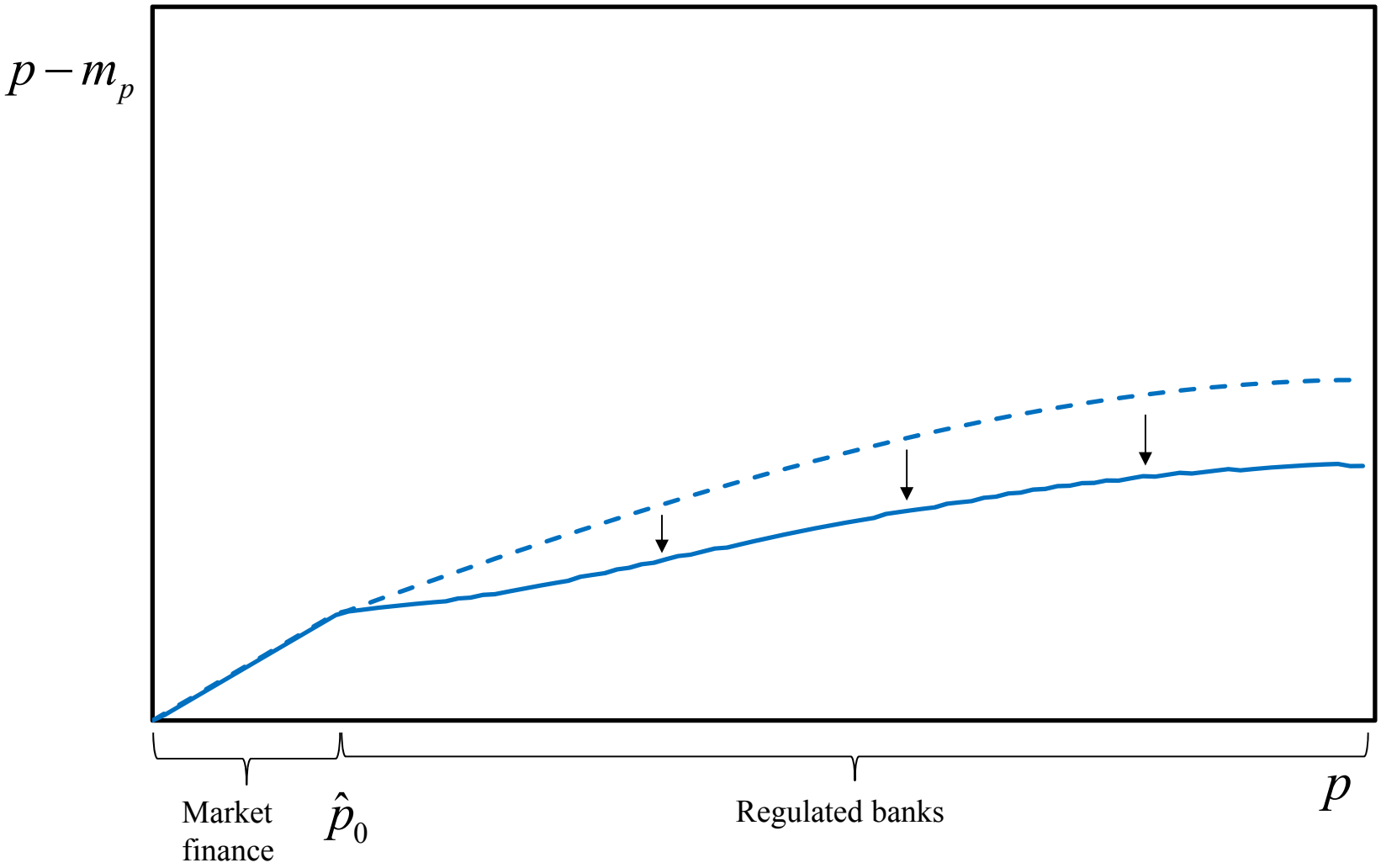
  → Lower confidence level for higher risks

  → To avoid emergence of shadow banks for riskier firms

Optimal capital requirements



PD with optimal requirements



Concluding remarks

Summing up

- Model of the effects of bank capital regulation on

  → Structure and risk of the financial system

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  → Based on certification of capital by supervisor

  → Alternative: deposit insurance subsidy for regulated banks

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- Model of the effects of bank capital regulation on

  → Structure and risk of the financial system

- Key element: distinction between regulated and shadow banks

  → Based on certification of capital by supervisor

  → Alternative: deposit insurance subsidy for regulated banks

- Framework for thinking about regulatory trade-offs

  → Also as a building block of more elaborate models

Optimal capital requirements

- Higher capital requirements

  → Ameliorate risk-taking incentives: bright side

  → Drive some borrowers to shadow banks: dark side

  → Flat (VaR) creates medium (high) risk shadow banks

Optimal capital requirements

- Higher capital requirements
  - → Ameliorate risk-taking incentives: bright side
  - → Drive some borrowers to shadow banks: dark side
  - → Flat (VaR) creates medium (high) risk shadow banks
- Optimal requirements will not be VaR-based
  - → Need to bring economics into banking regulation
  - → Think in terms of welfare trade-offs

References

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Appendix

Model with deposit insurance

Model with deposit insurance

- So far regulated banks have no deposit insurance

  → Advantage (wrt shadow banks): lower certification cost

Model with deposit insurance

- So far regulated banks have no deposit insurance

  → Advantage (wrt shadow banks): lower certification cost

- Alternative setup

  → Capital is certified at zero cost ($\eta_0 = \eta_1 = 0$)

  → Advantage of regulated banks: underpriced insurance

Results with deposit insurance

- With high flat capital requirements

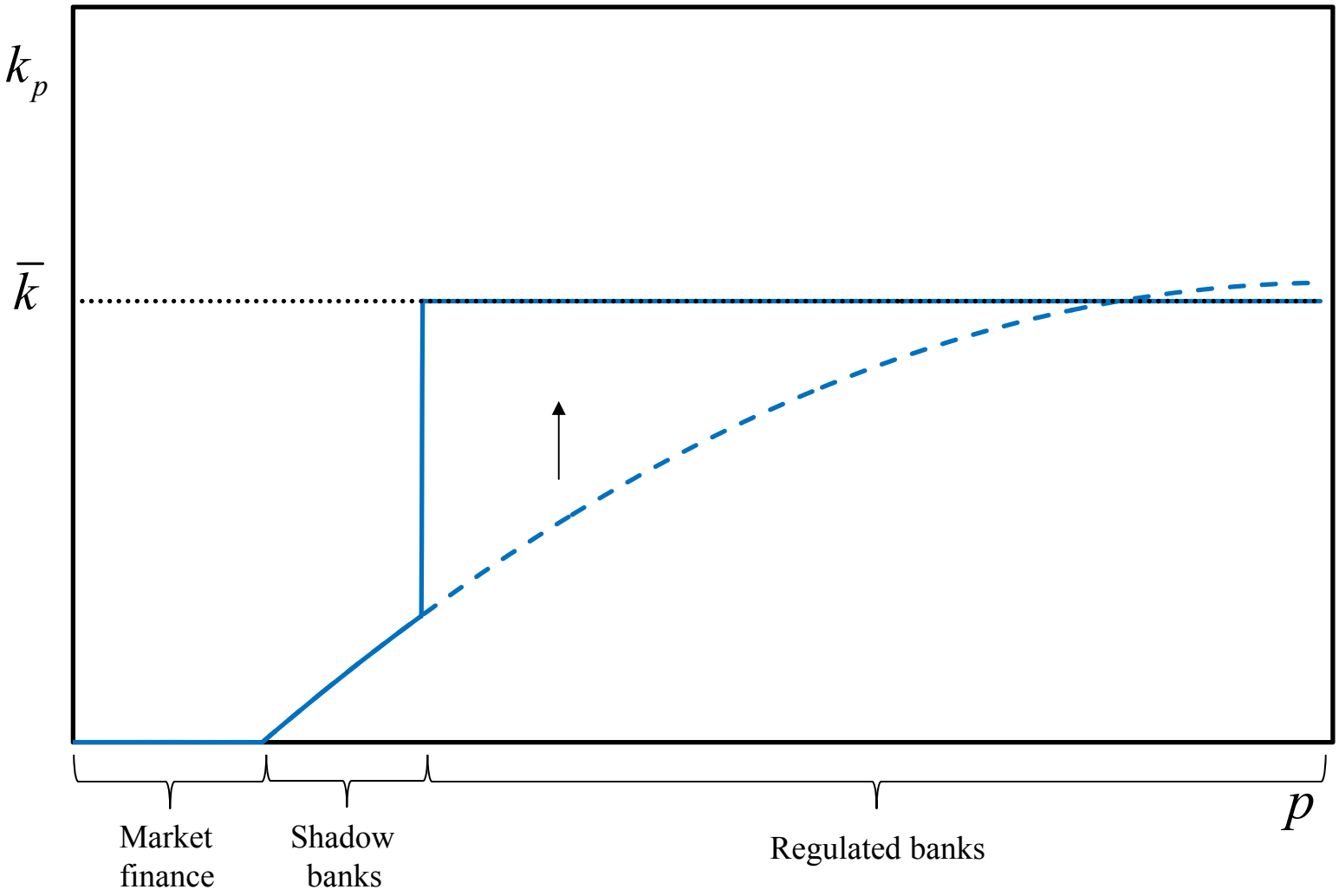
  → Shadow banks can profitably enter the market

  → To fund medium-risk projects

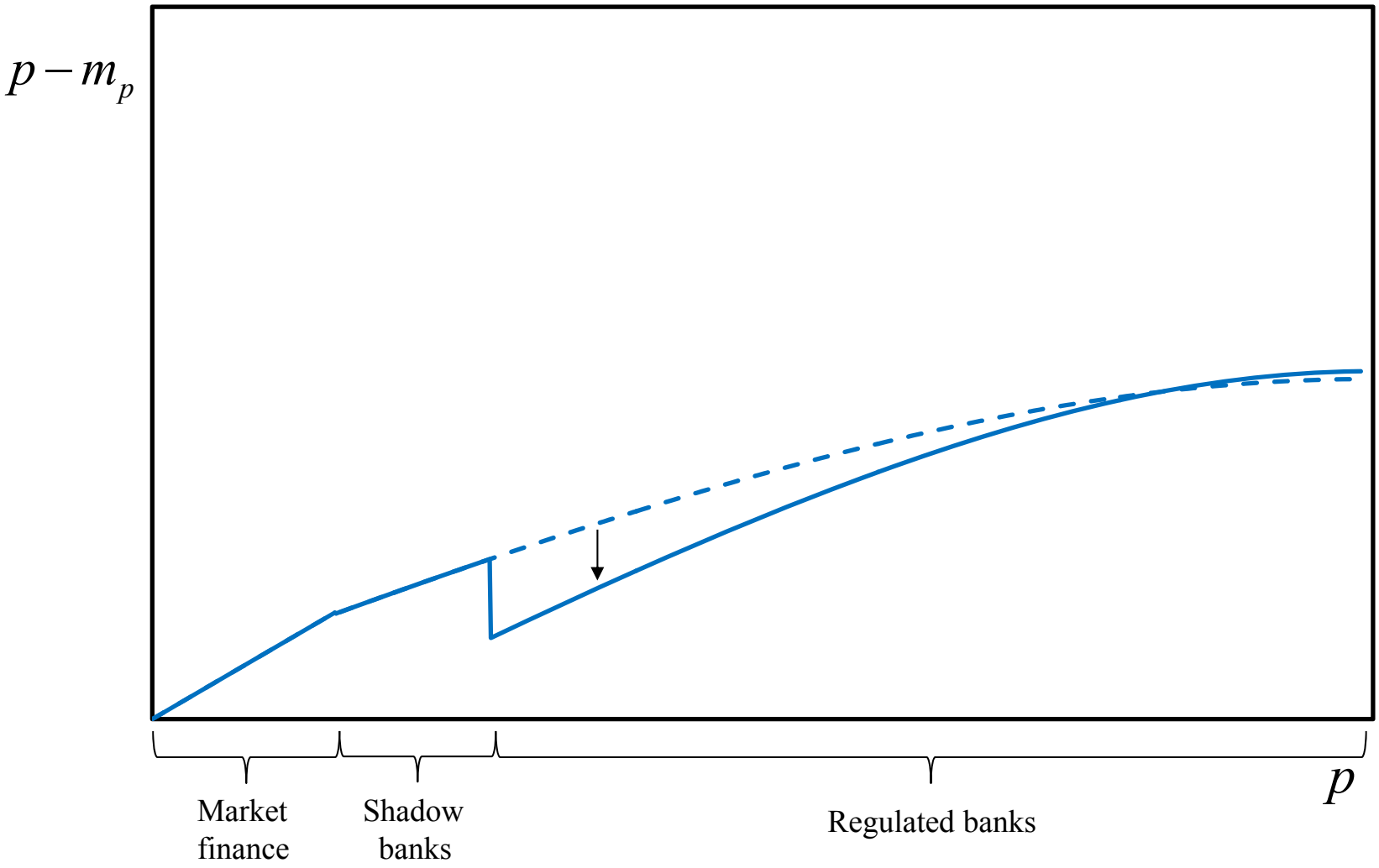
Results with deposit insurance

- With high flat capital requirements
  - → Shadow banks can profitably enter the market
  - → To fund medium-risk projects
- With high VaR-based capital requirements
  - → Shadow banks can profitably enter the market
  - → To fund high-risk projects

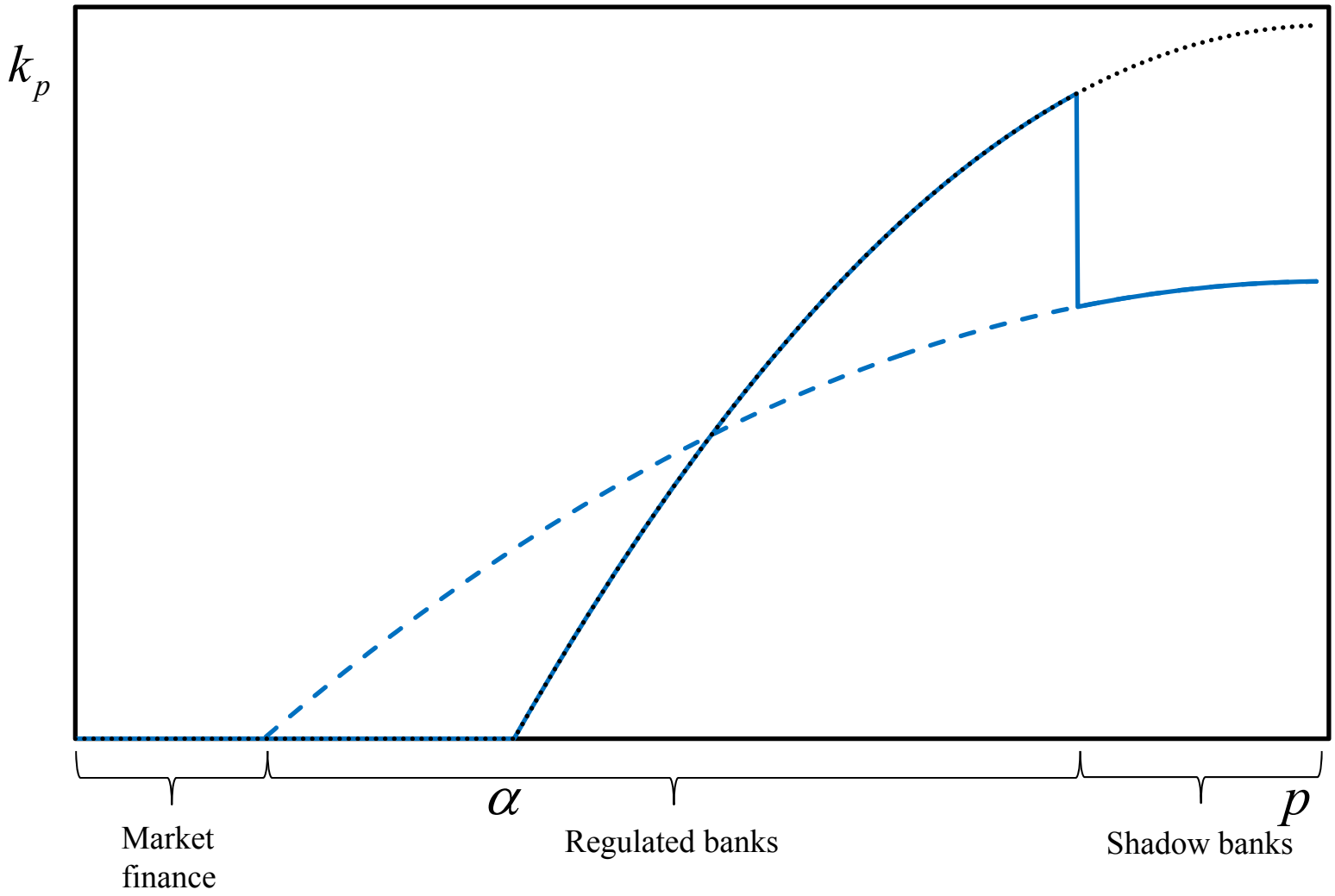
Flat capital requirements



PD with flat requirements



Capital with VaR requirements



PD with VaR requirements