

Optimal Bank Capital Regulation

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“We must lay the foundation for reform to help to ensure that a global crisis, such as this one, does not happen again.”

G20 Washington Summit, November 2008

Introduction

- Major overhaul of financial regulation is under way
 - Many areas will be reviewed
 - Credit derivative markets
 - Credit rating agencies
 - Accounting standards
 - Compensation practices
- Key role of bank regulation
 - Focus of presentation

Introduction

- Theoretical framework
 - Optimal regulation under asymmetric information
 - Focus on moral hazard (hidden actions)
 - Inefficient choice of risk (risk-shifting)
 - Use bank capital to ameliorate risk-shifting incentives

What is bank capital?

- (Equity) capital is a liability: Funds provided by shareholders
- Simplified balance sheet

assets	liabilities
loans $\rightarrow l$	$d \leftarrow$ deposits
	$k \leftarrow$ capital

- Sources of capital: equity issues + retained earnings

Overview

- A simple moral hazard model of bank's choice of risk
- First-best and second-best regulatory policies
 - Optimal bank capital regulation
- Implications
 - Regulation of systemic banks
 - Counter-cyclical regulation
 - “Search for yield” story
- Concluding remarks

Model setup

- At date 0
 - Bank raises $1 - k$ deposits and k capital
 - Bank invests in risky asset + chooses risk parameter p
- At date 1
 - Return from investment (Allen and Gale , 2000)

$$R = \begin{cases} 1 + s(p) & \text{with probability } 1 - p \\ 0 & \text{with probability } p \end{cases}$$

→ $s(p)$ is risk-shifting function, increasing and concave

→ higher risk of failure implies higher success return

Model setup

- Assumptions
 - Bank is managed by risk-neutral shareholders
 - Limited liability
 - Deposit insurance
 - Cost of deposits = 0 (normalization)
 - Cost of capital $\delta > 0$
 - Minimum capital requirement γ

Model setup

- Why deposit insurance?
 - It simplifies analysis (but similar results without it)
 - It is pretty realistic

“There are two kinds of countries: those that have deposit insurance, and others that don’t know yet that they have it.”

Hellmann, Murdock, and Stiglitz (AER, 2000)

Model setup

- Moral hazard
 - Risk is chosen after deposits are raised
 - Deposit rate is not contingent on risk (or capital)

Bank's maximization problem

- Bank's objective function

$$\max_{(k,p)} V(k, p) = \left[(1-p)[1+s(p)-(1-k)] - k(1+\delta) \right]$$

subject to $k \geq \gamma$

- Choice of capital k

$$\frac{\partial V(k, p)}{\partial k} = -(p + \delta) < 0 \rightarrow \text{corner solution } \hat{k} = \gamma$$

Bank's maximization problem

- Choice of risk p

$$\frac{\partial V(k, p)}{\partial p} = (1-p)s'(p) - s(p) - \gamma = 0 \rightarrow \hat{p} = p(\gamma)$$

→ First-order condition

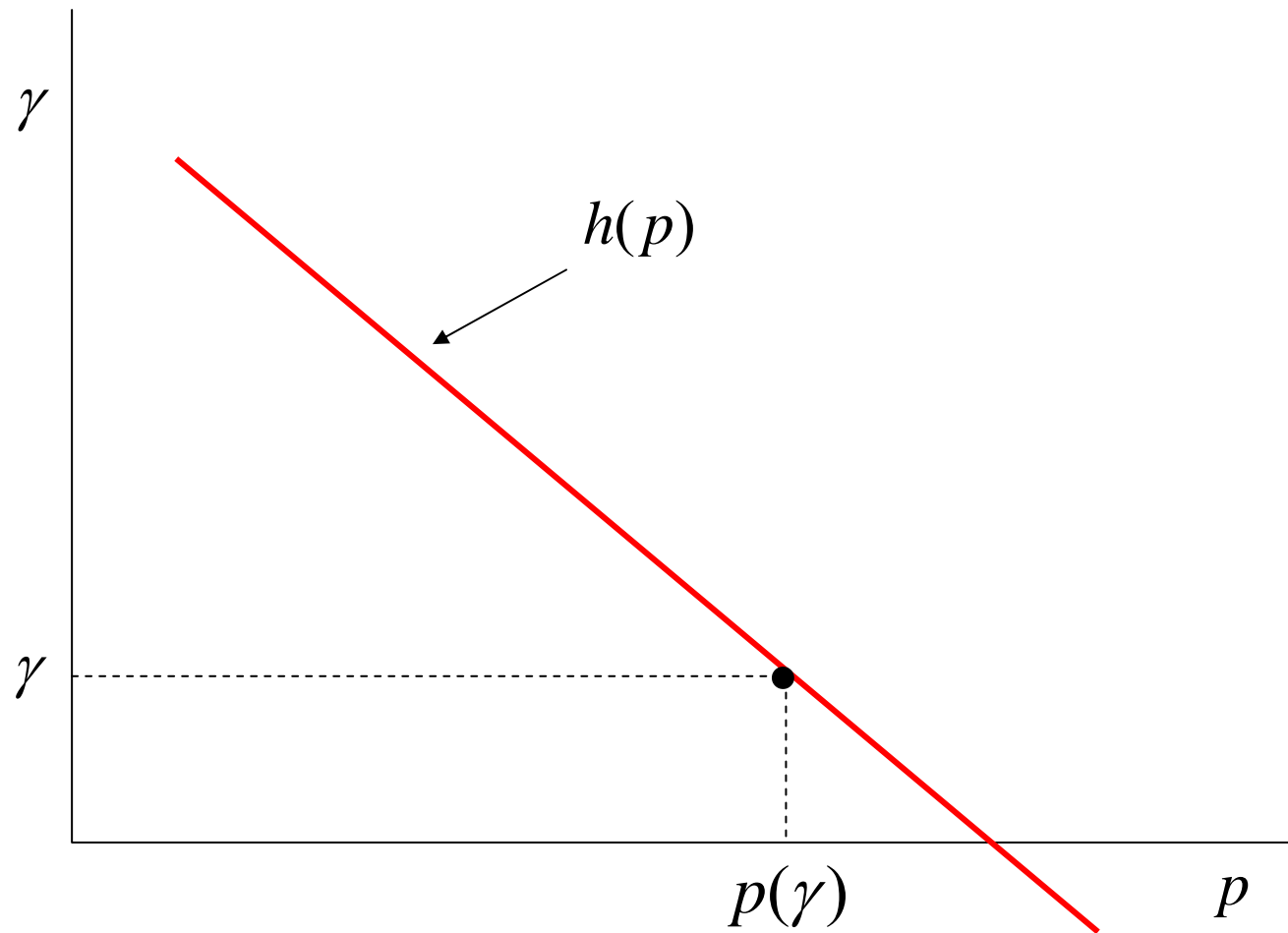
$$h(p) = (1-p)s'(p) - s(p) = \gamma$$

→ Effect of changes in capital requirement γ

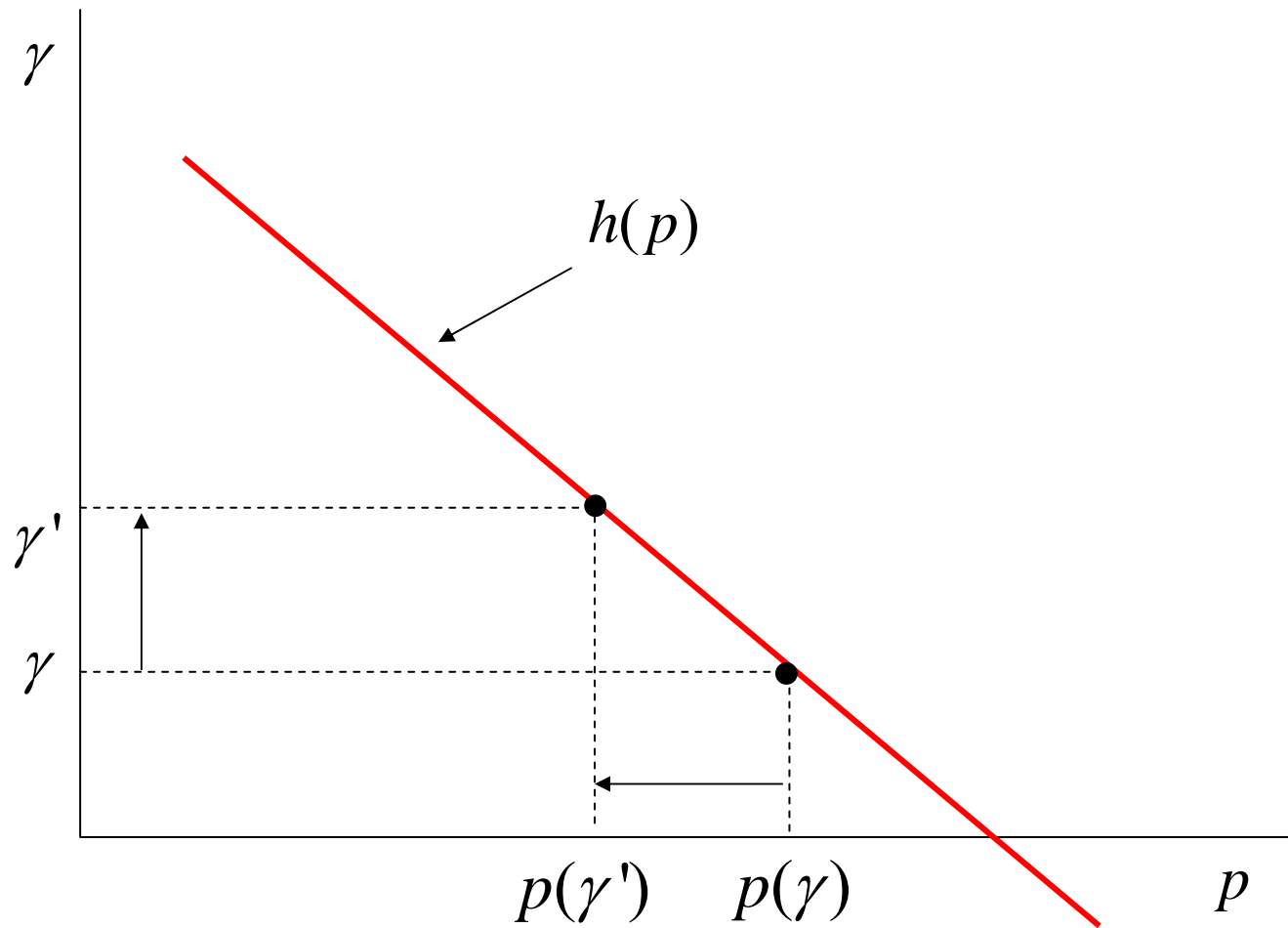
$$p'(\gamma) = \frac{1}{h'(p)} < 0$$

→ Higher capital implies lower risk

Bank's maximization problem



Bank's maximization problem



First-best policy

- Social welfare function

$$W(k, p) = (1 - p)[1 + s(p)] - (1 + k\delta) - pc$$

- Three terms

→ Expected return of investment: $(1 - p)[1 + s(p)]$

→ Cost of funding: $(1 - k) + k(1 + \delta) = 1 + k\delta$

→ Social cost of bank failure: pc

First-best policy

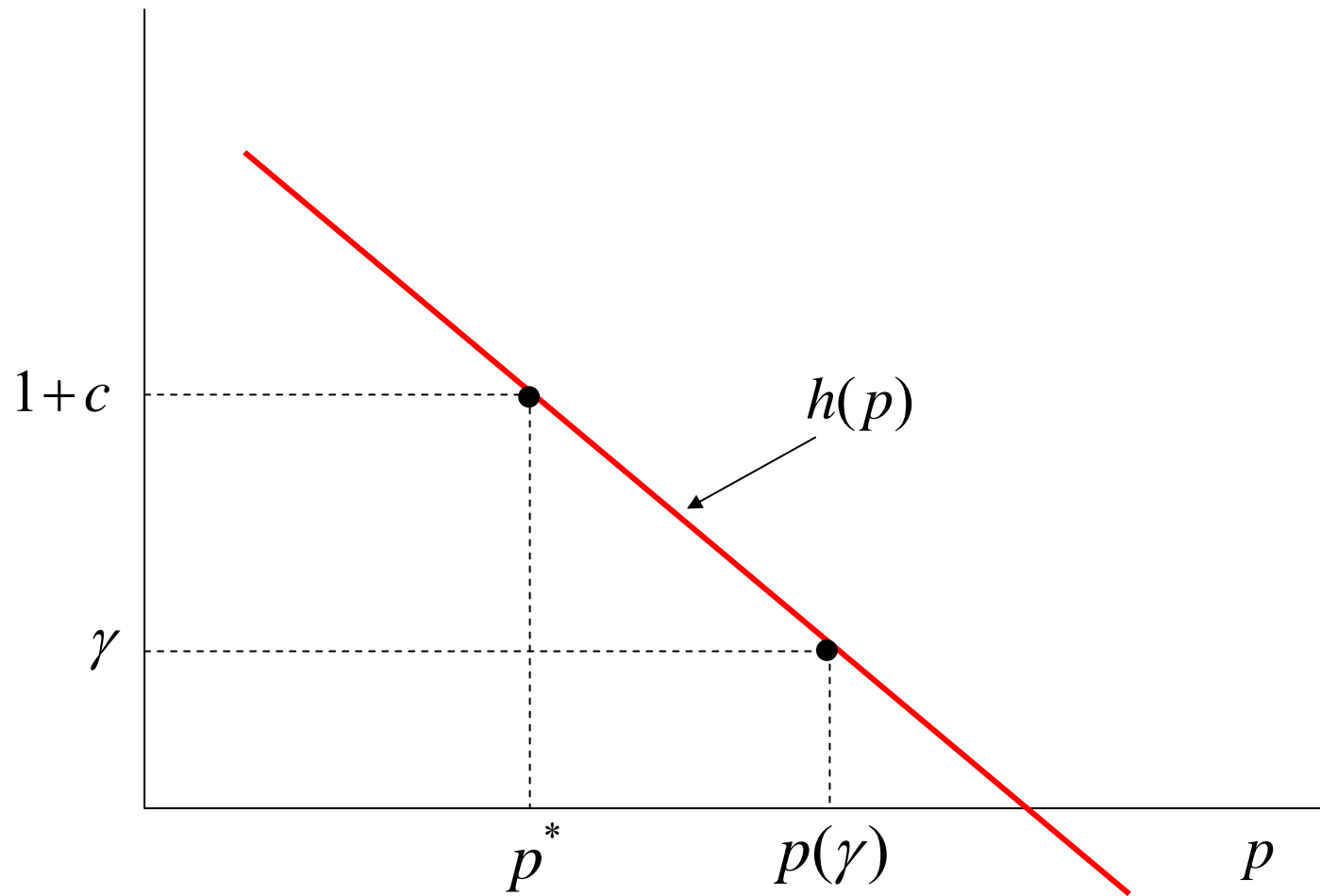
- Optimal choice of capital k

$$\frac{\partial W(k, p)}{\partial k} = -\delta < 0 \rightarrow \text{corner solution } k^* = 0$$

- Optimal choice of risk p

$$\frac{\partial W(k, p)}{\partial p} = h(p) - (1 + c) = 0 \rightarrow p^*$$

First-best policy



First-best policy

- Intuition: when risk p can be directly controlled
 - It is inefficient to use costly capital
- What if the regulator cannot directly control bank's risk-taking?
 - Use minimum capital regulation
 - Second-best policy

Second-best policy

- Optimal capital requirement

$$\frac{\partial W(\gamma, p(\gamma))}{\partial \gamma} + \frac{\partial W(\gamma, p(\gamma))}{\partial p} p'(\gamma) = 0 \rightarrow \gamma^*$$

- Two effects of capital requirement γ
 - Direct effect: decreases welfare
 - Makes funding more expensive
 - Indirect effect: increases welfare
 - Reduces risk chosen by the bank (since $p'(\gamma) < 0$)

Second-best policy

- Since

$$\frac{\partial W(\gamma, p(\gamma))}{\partial \gamma} = -\delta$$

$$\frac{\partial W(\gamma, p(\gamma))}{\partial p} = h(p(\gamma)) - (1 + c)$$

$$h(p(\gamma)) = \gamma \quad (\text{by FOC of bank's maximization problem})$$

- Condition reduces to

$$\gamma = 1 + c - \frac{\delta}{p'(\gamma)}$$

A simple parameterization

- Risk-shifting function

$$s(p) = \alpha + \beta p$$

- Bank's choice of risk

$$p(\gamma) = \frac{\beta - \alpha - \gamma}{2\beta}$$

→ Decreasing in capital requirement γ

→ Decreasing in safe return α

Optimal capital requirement

- Since $p'(\gamma) = 1/2\beta$

→ Optimal capital requirement

$$\gamma^* = 1 + c - 2\beta\delta$$

→ Increasing in social cost of bank failure c

→ Decreasing in cost of capital δ

→ Independent of safe return α

Implications

- Regulation of systemic banks
- Countercyclical regulation
- “Search for yield” story

Regulation of systemic banks

- Social cost of bank failure may be larger for systemic banks
 - Size of bank normalized to 1
 - Parameter c may be larger for systemic banks
- Optimal capital requirement γ^* is increasing in c
 - Higher capital requirements for systemic banks

Regulation of systemic banks

“We request our Finance Ministers to formulate additional recommendations in the following specific areas (...)

Defining the scope of systemically important institutions and determining their appropriate regulation or oversight.”

G20 Washington Summit, November 2008

Counter-cyclical regulation

- Optimal requirement γ^* is decreasing in cost of capital δ
- Rationale for countercyclical capital regulation
 - Requirements should be low when cost of capital is high
 - Requirements should be reduced in recessions
 - Similar result in Kashyap and Stein (2004)

Counter-cyclical regulation

“We request our Finance Ministers to formulate additional recommendations in the following specific areas (...)

Mitigating against pro-cyclicality in regulatory policy.”

G20 Washington Summit, November 2008

Search for yield

- Common explanation for financial crisis
 - Global imbalances → Low interest rates
 - Search for yield → Higher risk-taking
- In our model
 - Bank's choice of risk p is decreasing in safe return α
 - This is second-best efficient
 - Optimal capital requirement γ^* is independent of α

Search for yield

- Capital requirements should have been tightened
 - Not because of the low interest rates
 - But because of contemporaneous low cost of capital

Concluding remarks

- Rationale for bank capital regulation
 - In terms of moral hazard model of bank's choice of risk
- Model is simple but provides a number of interesting insights
- Model (and results) deserve further examination
- Model illustrates power of contract theory in
 - Understanding real world phenomena
 - Providing a framework to discuss policy issues