Interest Rates, Market Power, and Financial Stability

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Introduction (i)

- Question: **How do interest rates affect financial stability?**

  → Focus on risk-taking by financial intermediaries (banks)

  → Using simple theoretical model

  → Based on our "Search for Yield" paper

- In a competitive setting (like in "Search for Yield")

  → Conventional prediction obtains

  → Lower safe rates lead to higher risk-taking

  → **What happens when we introduce market power**?

Introduction (ii)

- Why do safe rates affect banks' risk-taking?

  → Safe rates affect banks' funding costs

  → Impact on loan rates and intermediation margins

- When monitoring incentives depend on intermediation margins

  → Impact on loans' probability of default

- Why is competition relevant?

  → It affects **pass-trough** of funding costs to loan rates

  → It affects margins and monitoring incentives

Introduction (iii)

- Model is silent about what drives changes in safe rates
  - → Real factors (savings glut)
  - → Monetary policy
- Analyze effect of exogenous changes in (real) safe rates

Model setup

- Banks compete à la Cournot in loan market

  → Competition measured by number of banks n

- Banks raise funds from uninsured risk-neutral investors

  → Investors require a given return R_0 (the safe rate)

  → Safe (real) rate linked to stance of monetary policy

- Banks monitor borrowers

  → Monitoring reduces probability of default of loans

  → Monitoring is not observed by investors: moral hazard

Main result

- Lower safe rates lead to

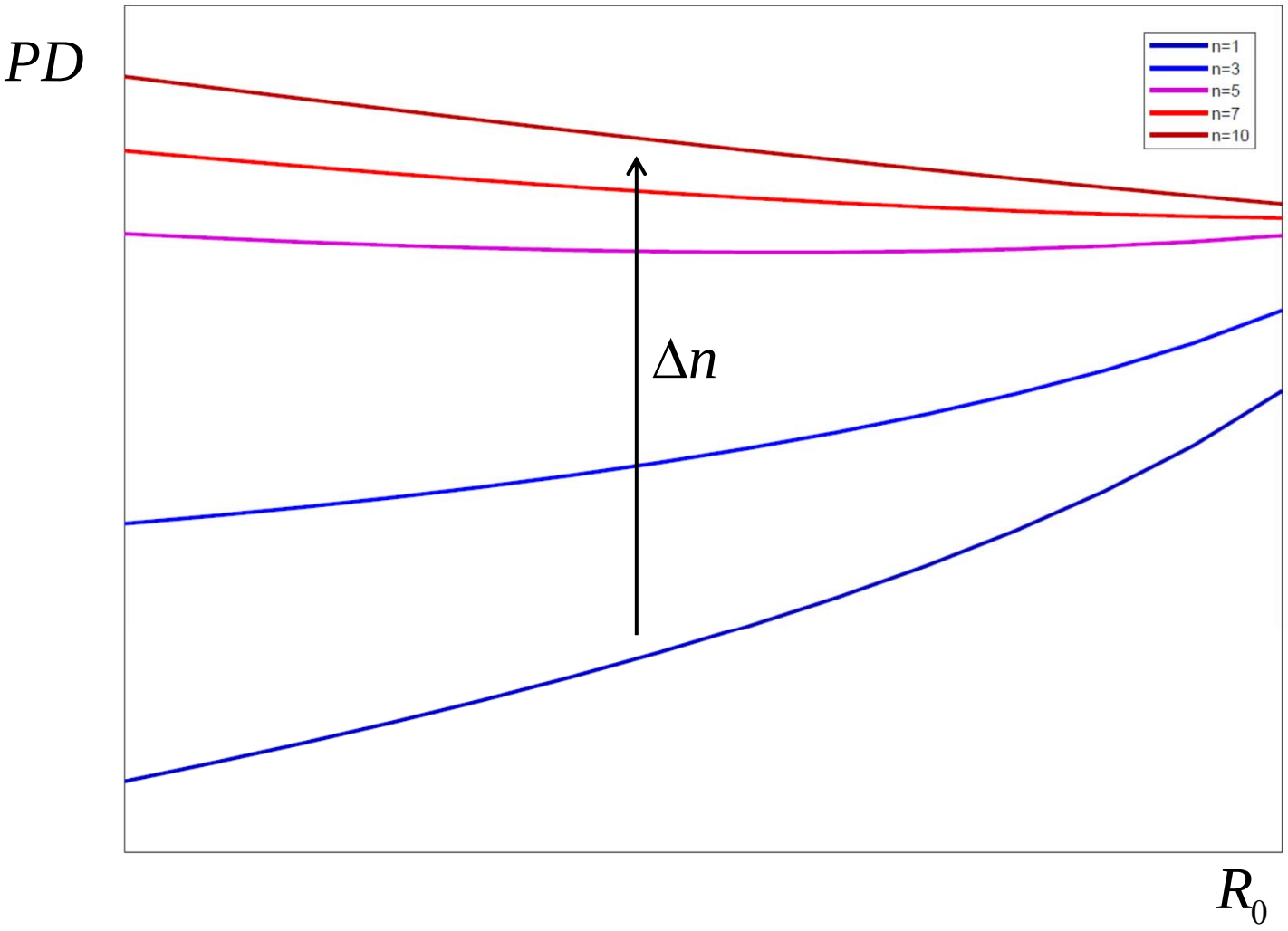
  → Higher risk-taking in competitive environments (high n)

  → Lower risk-taking in monopolistic environments (low n)

- Risk-taking channel of monetary policy reverses sign

  → When banks have significant market power

Main result



Literature

- Large literature on risk-taking channel of monetary policy

  → Jimenez, Ongena, Peydro, and Saurina (ECTA 2014)

- Larger literature on bank competition and risk-taking

  → Hellmann, Murdock, and Stiglitz (AER 2000)

- Not many papers on intersection of the two

  → Dell'Ariccia, Laeven, and Marquez (JET 2014)

- Main reference

  → Martinez-Miera and Repullo (ECTA 2017)

Overview

- Cournot model of bank competition and risk-taking
- Alternative competition scenarios
  - → Direct market finance
  - → Heterogeneous monitoring costs
  - → Bank entry
- Alternative funding scenarios
  - → Insured deposits
  - → Endogenous deposit rates
  - → Endogenous leverage

Part 1

Cournot model of bank competition

Model setup

- Two dates ($t = 0, 1$)
- Three types of risk-neutral agents
  - → **Entrepreneurs** have projects that require bank finance
  - → **Banks** have to raise funds from (uninsured) investors
  - → **Investors** require expected return R_0 (the safe rate)

Entrepreneurs (i)

- Continuum of penniless entrepreneurs have risky projects

$$\text{Unit investment} \quad \rightarrow \quad \text{Return} = \begin{cases} R, & \text{with prob. } 1 - p + m \\ 0, & \text{with prob. } p - m \end{cases}$$

$\rightarrow p$ is probability of failure without monitoring

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

$\rightarrow$ **Monitoring reduces probability of failure**

Entrepreneurs (ii)

- **Assumption 1**: Decreasing returns to aggregate investment L

$$R(L) = a - bL$$

- **Assumption 2**: Single aggregate risk factor

  → Perfectly correlated project returns (for any given m)

- **Assumption 3**: Free entry of entrepreneurs

  → Enter the loan market until $R(L) = R$ (loan rate)

  → $R(L)$ is the inverse loan demand function

Banks (i)

- There are *n* identical banks that compete à la Cournot

  → Strategic variable of bank *j* is its lending l_j to entrepreneurs

  → Total amount of lending is

$$L = \Sigma_{j=1}^{n} \; l_j$$

Banks (ii)

- **Assumption 1**: Banks have no (inside) capital

  → Entirely funded with uninsured deposits (outside capital)

- **Assumption 2**: Bank monitoring is not contractible

  → Moral hazard problem

- **Assumption 3**: Bank monitoring is costly

  → Cost of monitoring

$$c(m_j) = \frac{\gamma}{2} m_j^2$$

Structure of the game

- Three stages

  1. Each bank j sets supply of loans $l_j \rightarrow L = \Sigma_{j=1}^{n} l_j$

     → This determines the loan rate $R = R(L)$

  2. Banks offer interest rate $B(L)$ to investors

  3. Banks (privately) choose monitoring $m(L)$

- Game solved backwards

  → Stages 2 and 3 first, and then stage 1

Characterization of equilibrium (i)

- Banks' choice of monitoring (given L)

$$m(L) = \arg\max_m \left[(1 - p + m)[R(L) - B(L)] - c(m)\right]$$

- Investors' participation constraint

$$[1 - p + m(L)]B(L) = R_0$$

- Two equations with two unknowns

  → Solution gives $B(L)$ and $m(L)$

Characterization of equilibrium (ii)

- Banks' choice of monitoring requires solving

$$\max_m \left[(1-p+m)[R(L)-B(L)]-c(m)\right]$$

→ First-order condition

$$\underbrace{R(L)-B(L)}_{\text{Intermediation margin}} = c'(m) = \gamma m$$

→ **Monitoring intensity is proportional to margin**

Characterization of equilibrium (iii)

- Banks' profits per unit of loans

$$\pi(L) = [1 - p + m(L)][R(L) - B(L)] - c(m(L))$$

- Symmetric Cournot equilibrium condition

$$l^* = \arg\max_{l_j} \left[\pi(l_j + (n-1)l^*) l_j \right]$$

Preliminary result

- Effect of changes in number of banks n on banks' risk-taking

$$\frac{dm^*}{dn} < 0$$

→ where $m^* = m^*(L^*)$

- Negative effect of competition on financial stability

→ Standard "charter value" result

- What's the intuition?

→ Higher n reduces intermediation margin and monitoring

Main result

- Effect of changes in safe interest rate R_0 on banks' risk-taking

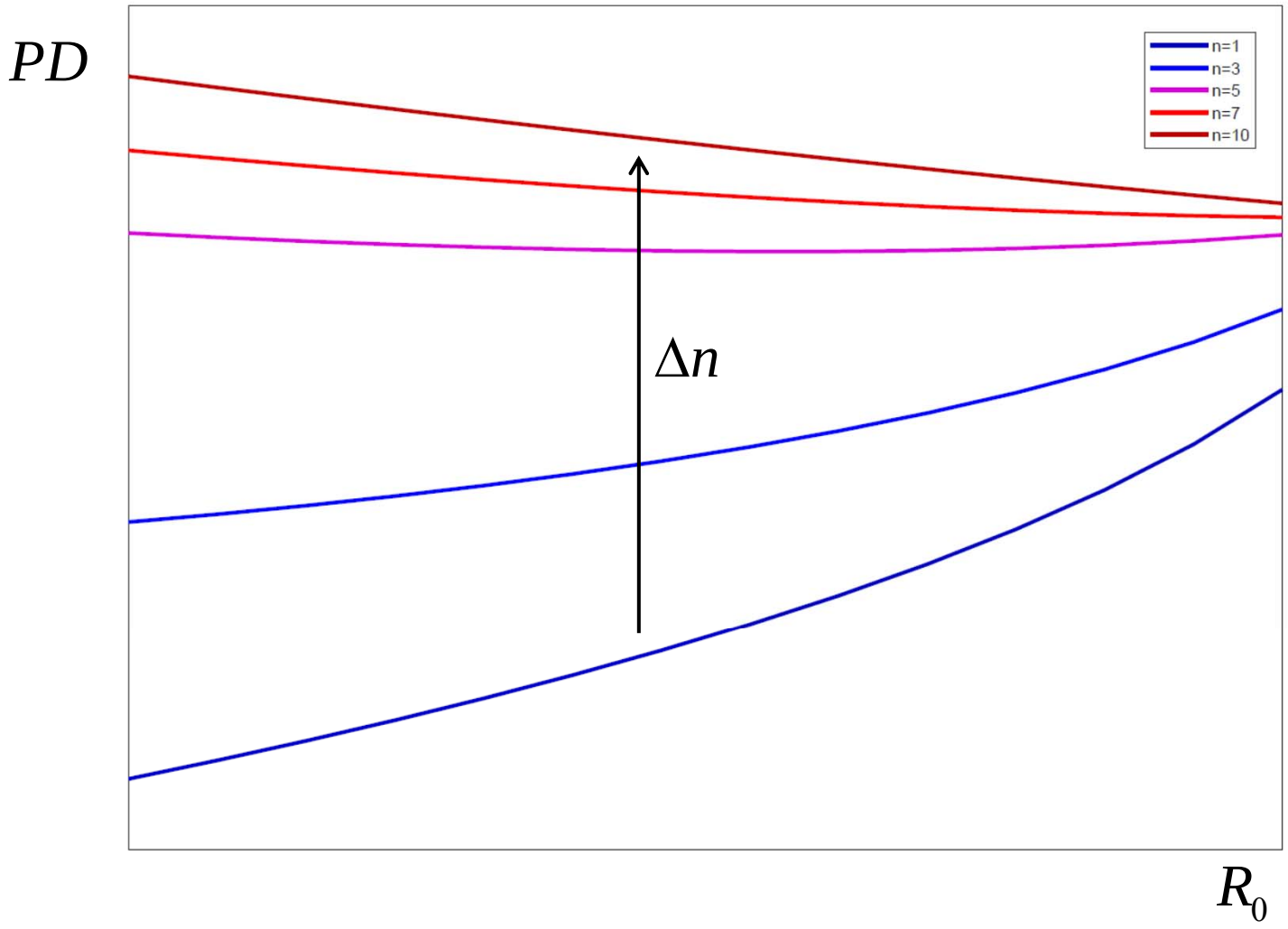
  → Depending on the extent of competition in loan market

  → Measured by number of banks n

- Probability of default is $PD = p - m^*$

- Compute effects of R_0 and n on PD

Effect of safe rate and competition on risk



Summing up

- Competition increases banks' risk-taking

  → Standard "charter value" result

- With high competition lower rates **increase** banks' risk-taking

  → "Search for Yield" result

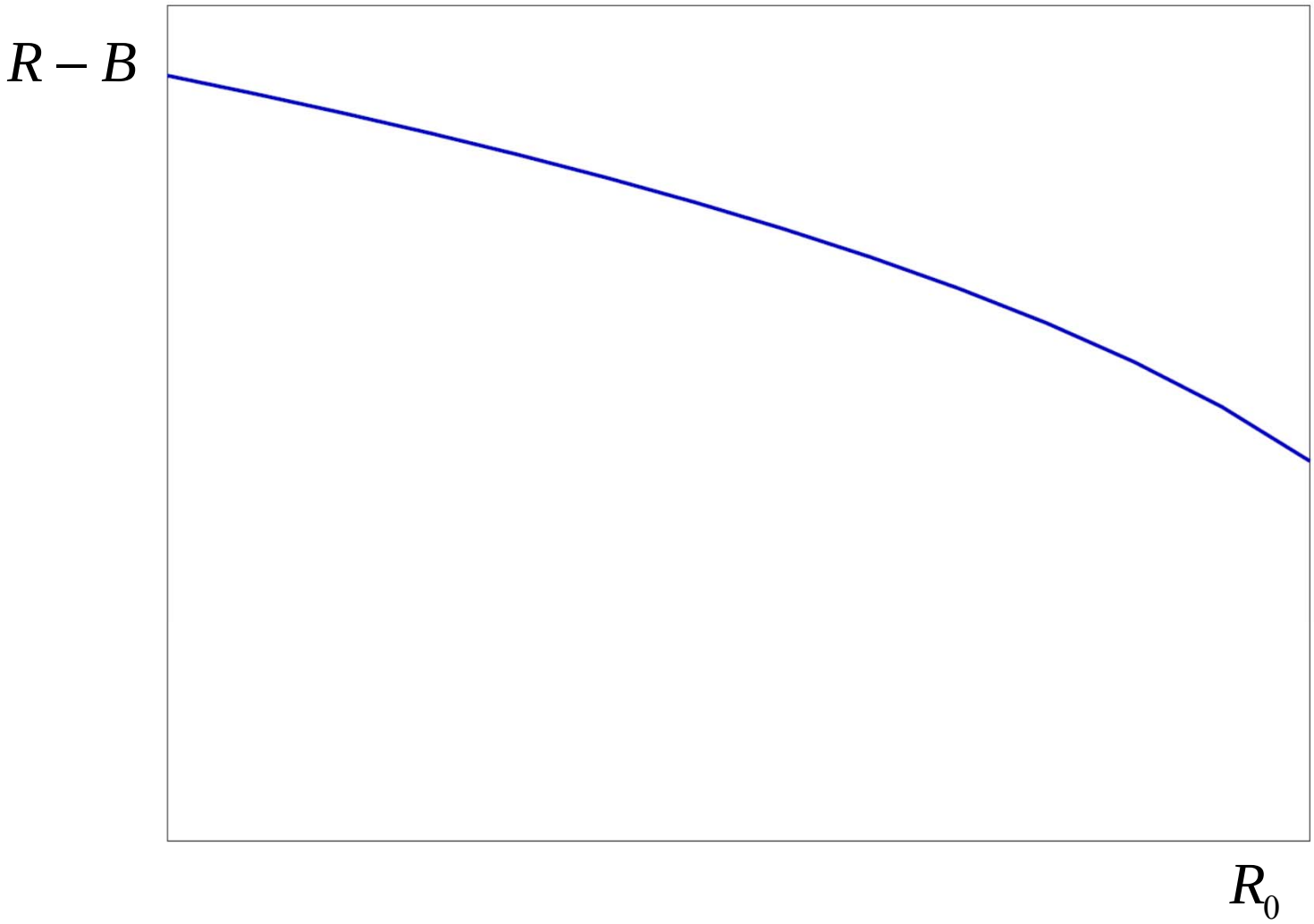
- With low competition lower rates **decrease** banks' risk-taking

  → Novel result

What's the intuition?

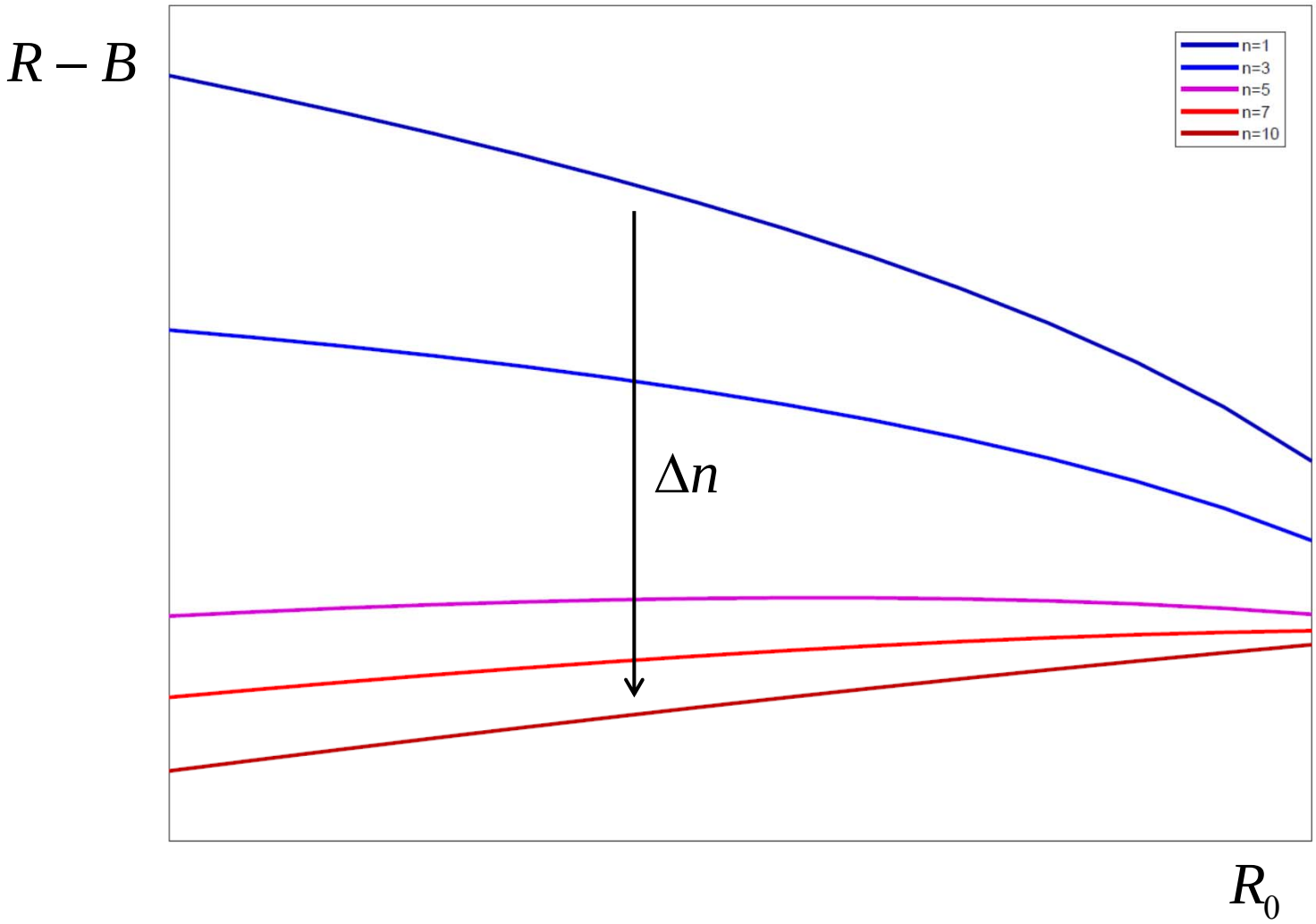
- Refer to literature on **pass-through** in Cournot oligopoly
- With high competition lower costs have little impact on margins
  - → In our case margins (and monitoring) go down
  - → As loan rates react a lot to changes in safe rate
  - → Riskier banks
- With low competition lower costs have large impact on margins
  - → In our case margins (and monitoring) go up
  - → As loan rates do not react much to changes in safe rate
  - → Safer banks

Effect of safe rate on margin under monopoly



Effect of safe rate on margin under competition

Effect of safe rate and competition on margin



Part 2

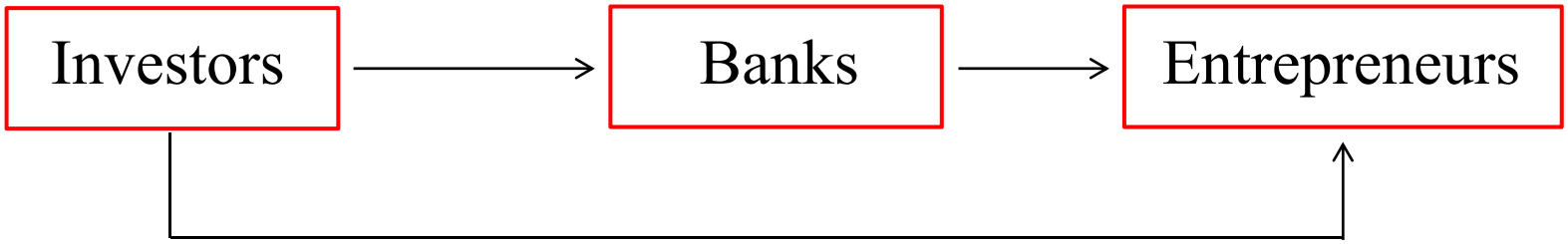
Alternative competition scenarios

Part 2a

Direct market finance

Introducing market finance

Intermediated finance



Direct market finance

Introducing market finance

- Suppose that entrepreneurs can also borrow from the market

  → Bond financing (directly provided by investors)

- Assume that market finance entails no monitoring

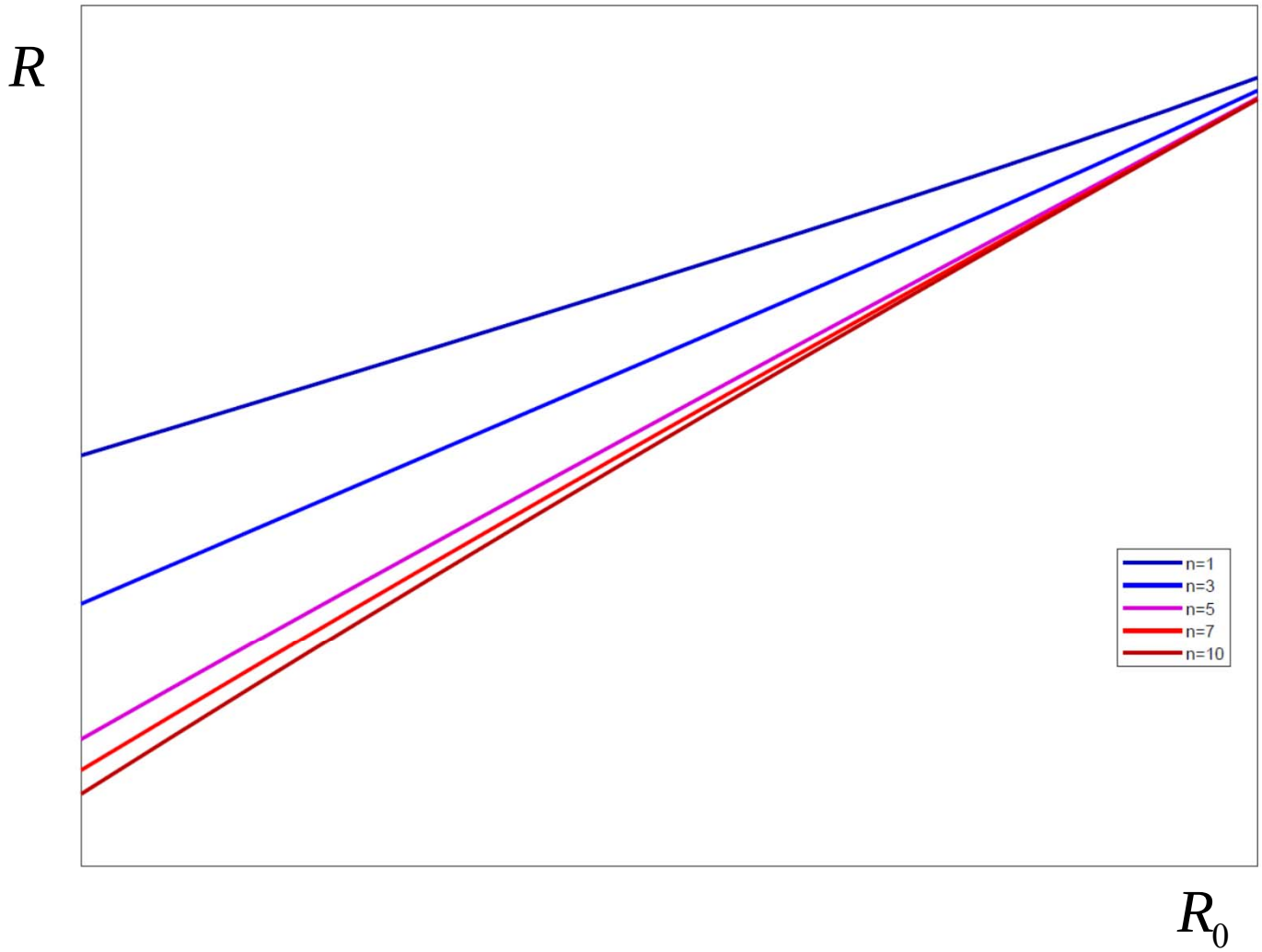
  → Market interest rate R_M satisfies

$$(1-p)R_M = R_0 \quad \rightarrow \quad R_M = \frac{R_0}{1-p}$$

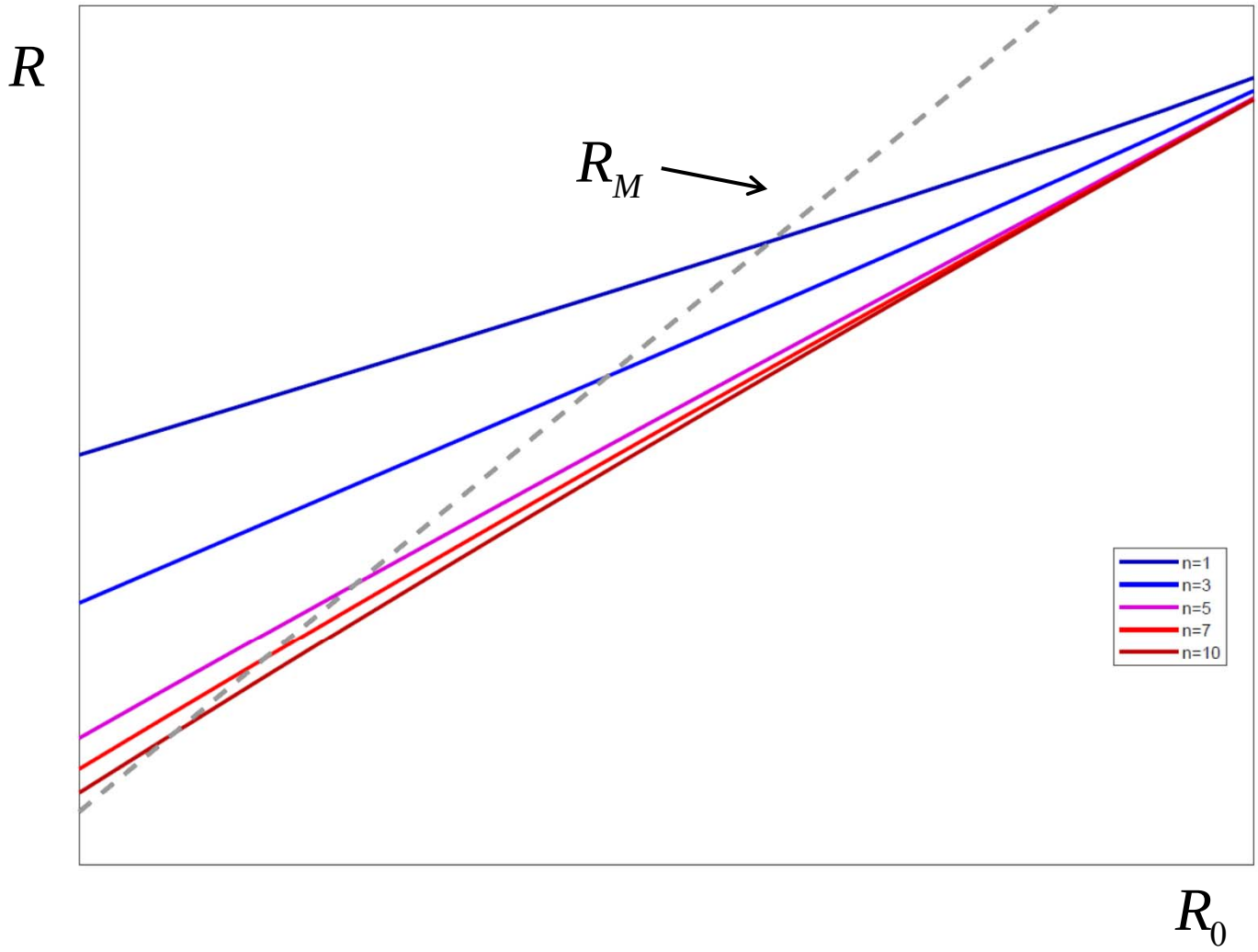
  → Upper bound on the rate that banks can charge

  → When will the bound be binding?

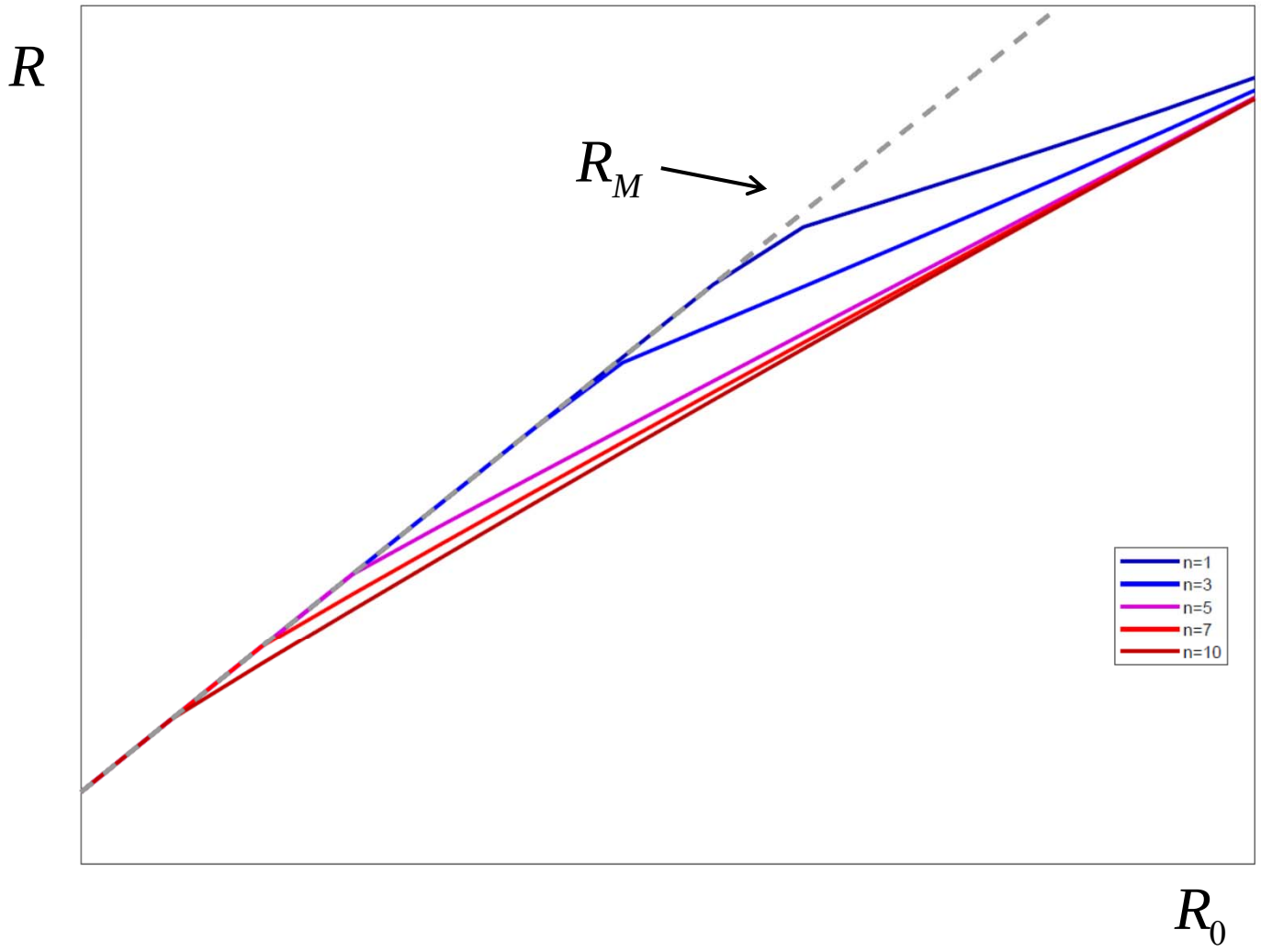
Effect of market finance on loan rates



Effect of market finance on loan rates



Effect of market finance on loan rates



Characterization of equilibrium (i)

- When the bound is binding banks will choose L_M such that

$$R_M = R(L_M)$$

- Equilibrium characterized by

→ Banks' choice of monitoring

$$m(B) = \arg\max_m \left[(1 - p + m)(R_M - B) - c(m)\right]$$

→ Investors' participation constraint

$$[1 - p + m(B)]B = R_0$$

Characterization of equilibrium (ii)

- Banks' first order condition

$$R_M - B = \gamma m$$

→ Substituting into this expression

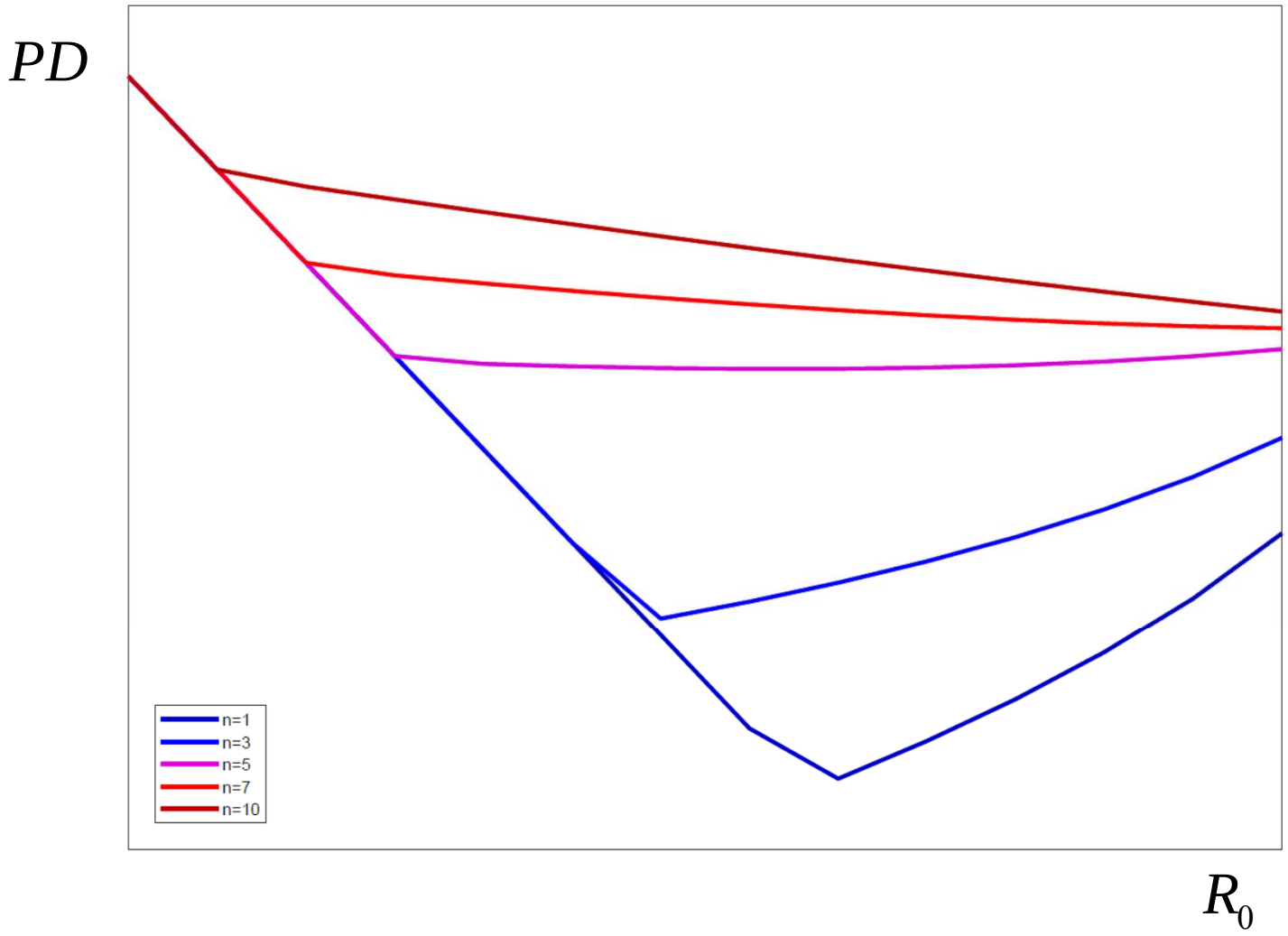
$$R_M = \frac{R_0}{1-p} \quad \text{and} \quad B = \frac{R_0}{1-p+m}$$

→ Equilibrium monitoring

$$m^* = \frac{R_0}{\gamma(1-p)} - (1-p)$$

→ Increasing in the safe rate R_0

Effect of safe rate and competition on risk



Summing up (i)

- Competition with outside sources of finance
  - → Limits bank's market power
  - → Reduces equilibrium loan rates and intermediation margins
  - → Reduces monitoring and increases banks' risk-taking
- Constraint is binding when interest rates are low
  - → In such case **lower rates increase banks' risk-taking**
  - → Regardless of the degree of competition in loan market

Summing up (ii)

- In monopolistic markets

  → U-shaped relationship between safe rates and risk-taking

  → Decreasing for low rates (when constraint is binding)

  → Increasing for high rates (when constraint is not binding)

Part 2b

Heterogeneous monitoring costs

Heterogeneous monitoring costs

- Two types of banks: high and low monitoring costs
- Main results: effects of an increase in the safe rate
  - → Low cost banks are safer
  - → High cost banks are riskier
  - → Market share of low cost banks increases
  - → Average probability of default goes down
- Results closer to model with low market power

Part 2c

Bank entry

Bank entry

- What happens when we allow for entry (and exit) into market?

  → Effect of rates “too low for too long”

- Main results

  → Lower safe rates induce entry

  → New “competition effect” which increases risk-taking

- When initially banks have high market power

  → Lower safe rates could result in safer banks in short run

  → But riskier banks in the long run

Part 3

Alternative funding scenarios

Part 3a

Insured deposits

Insured deposits

- With insured deposits banks are funded at safe rate: $B(L) = R_0$

  → Simpler model

- Main results

  → Increases in safe rate always lead to lower margins

  → Increase probability of default

- Results similar to model with high market power

Part 3b

Endogenous deposit rates

Cournot competition in deposit market

- Introduce linear inverse supply function of deposits
- Cournot competition for deposits and loans

  → Balance sheet constraint $l_j = d_j$
- Similar results as those of the original model

  → With high competition lower rates increase risk-taking

  → With low competition lower rates decrease risk-taking

Part 3c

Endogenous leverage

Endogenous leverage

- What happens when banks can adjust their leverage?

  → In response to changes in safe rate

  → Dell'Ariccia et al. (2014)

- Two models

  → Fixed aggregate supply of bank capital

  → Infinitely elastic supply of bank capital at the rate $R_0 + \delta$

- In both models bank equity is inside equity

  → Funds provided by agents taking monitoring decisions

Characterization of equilibrium

- Let k denote bank's capital per unit of loans
- Banks' choice of monitoring (given L and k)

$$m(L) = \arg\max_m \left[(1-p+m)[R(L)-(1-k)B(L)]-c(m)\right]$$

→ First-order condition

$$\underbrace{R(L)-(1-k)B(L)}_{\text{Intermediation margin}} = c'(m) = \gamma m$$

→ Monitoring is increasing in k

→ **Bank capital ameliorates risk-taking incentives**

Fixed supply of capital

- Increase in safe rate leads to a reduction in leverage

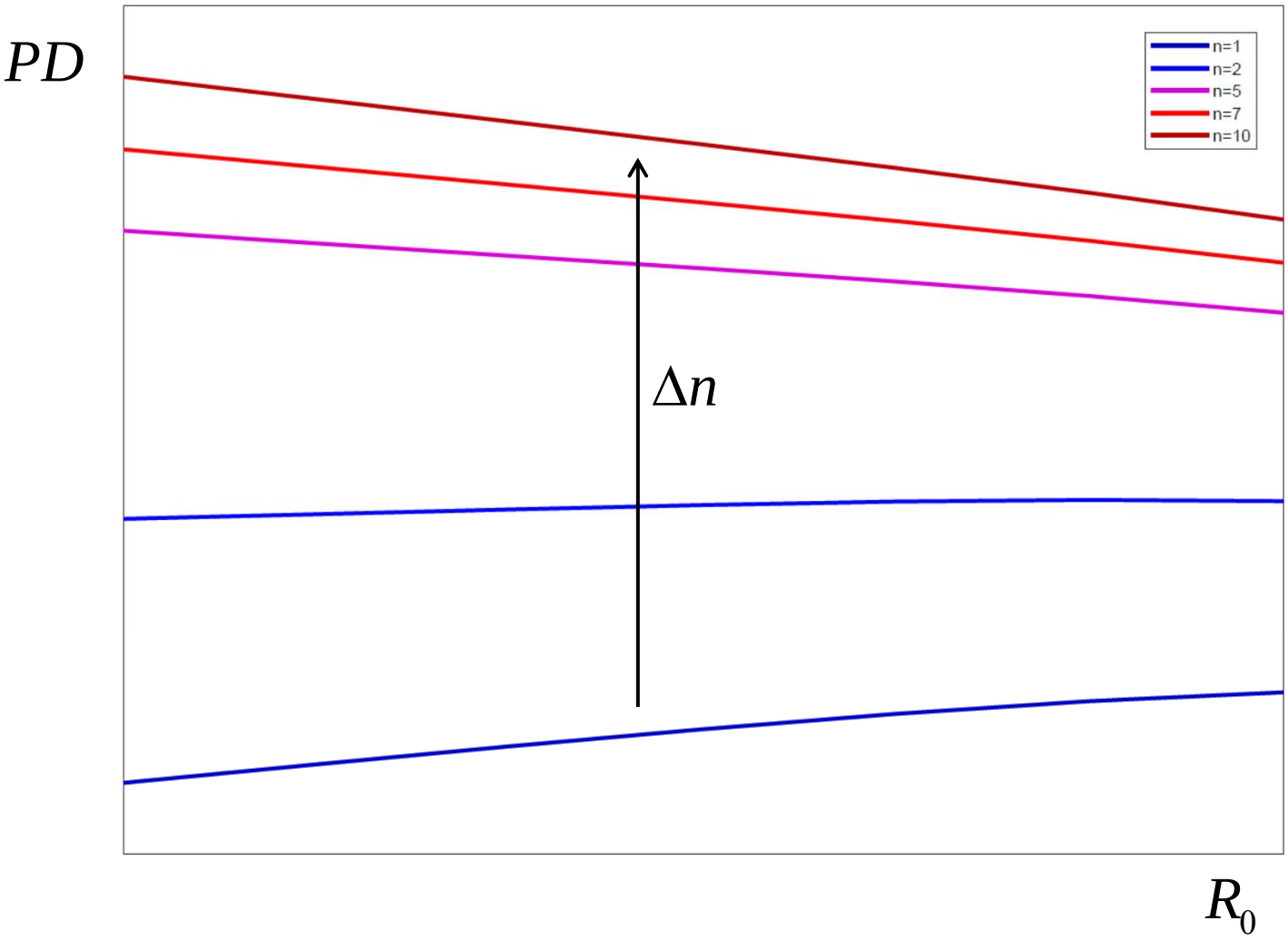
  → Due to the lower equilibrium supply of loans

- Leverage effect tends to increase monitoring

  → But do not fully reverse original results

  → With low competition higher rates still increase risk-taking

Fixed supply of capital



Infinitely elastic supply of capital

- Increase in safe rate leads to a reduction in leverage

  → Due to reduction in relative cost of capital

- Leverage effect tends to increase monitoring

  → Fully reversing original results

  → Low safe rates are always detrimental to financial stability

  → Same result as in Dell'Ariccia et al. (2014)

Concluding remarks

Concluding remarks (i)

- Market structure shapes effect of safe rates on financial stability

  → With high competition: lower rates imply riskier banks

  → With low competition: lower rates imply safer banks

- Results are consistent with “charter value” hypothesis

  → Competition always increases banks’ risk-taking

  → In line with current view of bank supervisors

Concluding remarks (ii)

- Results show that you can have higher credit and lower risk
- When banks have significant market power
  - → Lower rates increase lending and decrease risk-taking
  - → No trade-off between credit and financial stability

Testable implications (i)

- Model yields key testable implication

$$Risk = \alpha + \underbrace{\beta_0}_{-} R_0 + \underbrace{\beta_1}_{-} HHI + \underbrace{\beta_2}_{+} R_0 * HHI + \text{ Controls}$$

→ where HHI = Herfindahl index = $1/n$

Testable implications (ii)

- Other testable implications

  → Nonlinear effect of direct market finance

  → Effect of proportion *D* of insured deposits

  → Effect of stock market trading (access to equity market)

$$Risk = \alpha + \underbrace{\beta_0}_{-} R_0 + \underbrace{\beta_1}_{-} HHI + \underbrace{\beta_2}_{-} R_0{*}HHI + \underbrace{\beta_3}_{+} R_0^2{*}HHI$$

$$+ \underbrace{\beta_4}_{+} R_0{*}D + \underbrace{\beta_5}_{-} R_0{*}S + \text{ Controls}$$

Some references

• Dell'Ariccia, L. Laeven, and R. Marquez (2014), "Real Interest Rates, Leverage, and Bank Risk-Taking," *Journal of Economic Theory*.

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