Search for Yield

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Motivation (i)

"Over the past decade a combination of diverse forces has created a significant increase in the global supply of saving, a **global saving glut**, which helps to explain both the increase in the U.S. current account deficit and the **relatively low level of long-term real interest rates** in the world today."

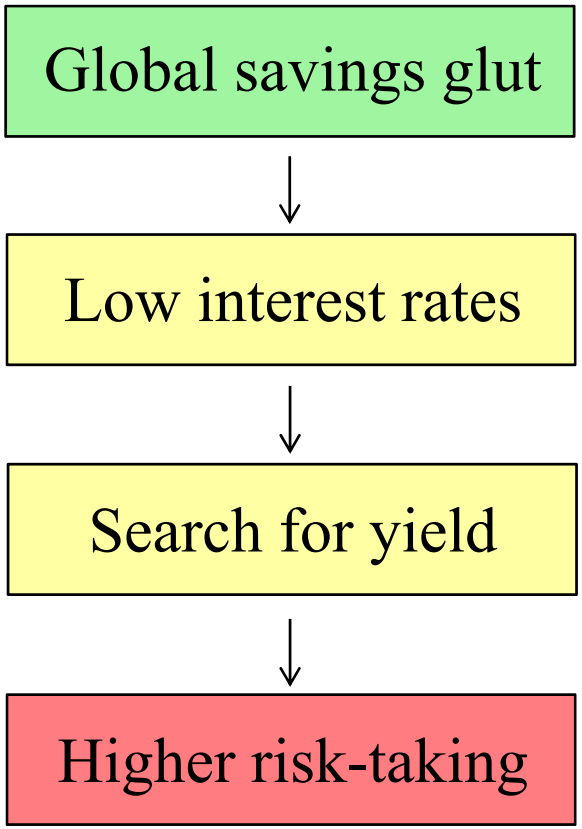
Ben Bernanke (2005)

Motivation (ii)

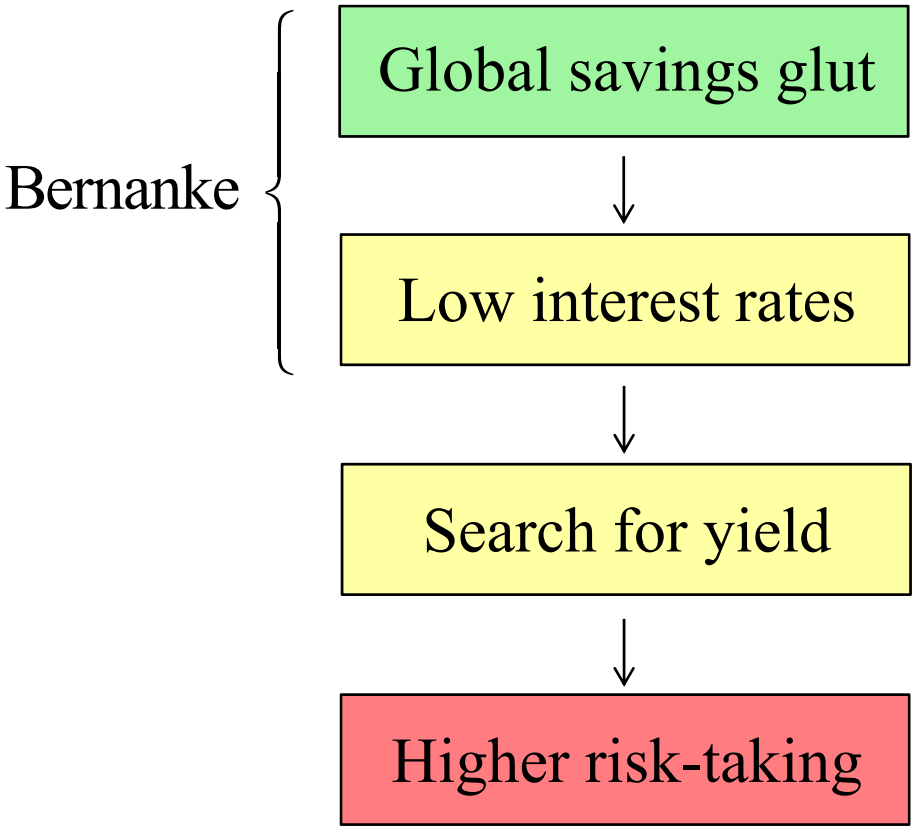
"An **environment of low interest rates** following a period of high rates is particularly problematic, for not only does the **incentive of some participants to 'search for yield' go up**, but also asset prices are given the initial impetus, which can lead to an upward spiral, **creating the conditions for a sharp and messy realignment**."

Raghu Rajan (2005)

Summing up


Global savings glut
Low interest rates
Search for yield
Higher risk-taking

Summing up


Bernanke
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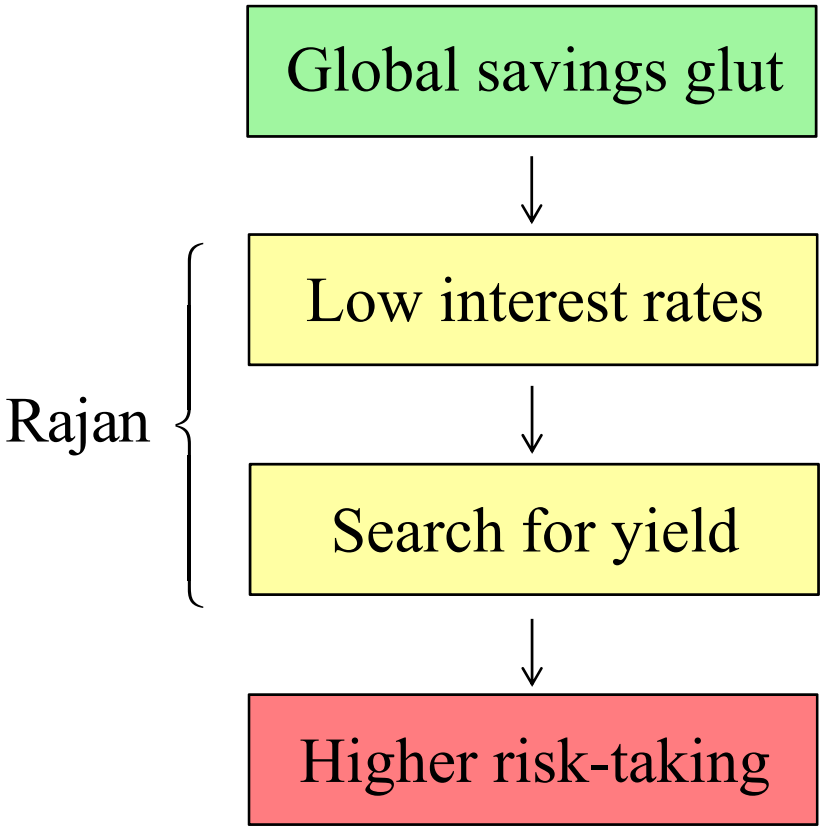
Summing up


Global savings glut
Low interest rates
Rajan
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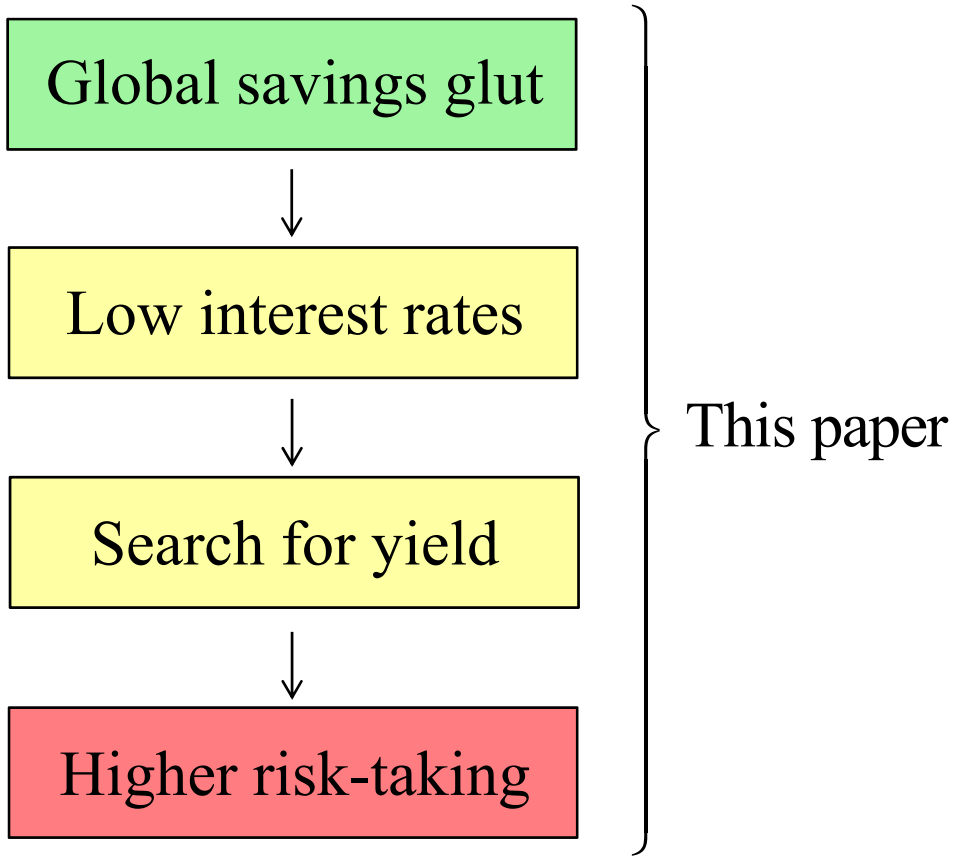
Summing up


Global savings glut
Low interest rates
Search for yield
Higher risk-taking
This paper

Overview of model

- Three types of agents
  - → **Entrepreneurs** require funds for their risky projects
  - → **Banks** fund entrepreneurs' projects
  - → **Investors** provide funds to the banks
- Banks monitor entrepreneur's projects
  - → Reduces probability of failure
- Monitoring is costly and not observed by investors
  - → Moral hazard problem

Two types of contracts

- Contracts with positive monitoring

  → Banks that **originate-to-hold**

  → Traditional banking system

- Contracts with zero monitoring

  → Market finance or banks that **originate-to-distribute**

  → Shadow banking system

Main results

- Equilibrium allocation of savings features
  - → Zero monitoring for safer entrepreneurs
  - → Positive monitoring for riskier entrepreneurs
- An increase in the supply of savings
  - → Reduces interest rates and interest rate spreads
  - → **Reduces monitoring incentives**
  - → Increases probability of failure of traditional banks
  - → Expands relative size of shadow banking system

Roadmap

- A model of bank finance
- Search for yield
- Extensions
  - → Short- vs long-run effects of savings glut
  - → Risk-averse investors
  - → Endogenous booms and busts
- Concluding remarks

Part 1

A model of bank finance

Model setup

- Two dates ($t = 0, 1$)
- Agents: → Set of potential entrepreneurs
  → Set of risk-neutral investors
  → Single risk-neutral bank
- Entrepreneurs have projects that require bank finance
- Bank has to raise funds from investors
- Investors require expected return R_0

Entrepreneurs

- Each entrepreneur has risky project

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

where $m \in [0, p]$ is monitoring by lending bank

$\rightarrow$ Monitoring reduces probability of failure

Bank monitoring

- Monitoring is not observed by investors

  → Moral hazard problem

- Monitoring entails cost $c(m)$

  → For numerical results assume

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

Bank

- Bank can only fund one project
  - → Short side of the market
  - → Loan rate equal to success return R
- Bank raises funds from investors
  - → Limited liability
  - → Borrowing rate denoted B

Optimal contract between bank and investors

$$(B^*, m^*) = \arg\max_{(B,m)} \left[(1 - p + m)(R - B) - c(m)\right]$$

→ subject to bank's incentive compatibility constraint (IC)

$$m^* = \arg\max_{m} \left[(1 - p + m)(R - B^*) - c(m)\right]$$

→ bank's participation constraint (PCB)

$$(1 - p + m^*)(R - B^*) - c(m^*) \geq 0$$

→ and investors' participation constraint (PCI)

$$(1 - p + m^*)B^* = R_0$$

Characterization of optimal contract (i)

- Bank's IC constraint

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

→ Interior solution characterized by FOC

$$\boxed{R - B^* = c'(m^*)}$$

→ Marginal revenue (intermediation margin) = marginal cost

Characterization of optimal contract (ii)

- Investors' PC

$$(1-p+m^*)B^* = R_0$$

→ Substituting it into FOC

$$R - B^* = c'(m^*) \quad \rightarrow \quad c'(m^*) + B^* = R$$

→ Key equation

$$c'(m^*) + \frac{R_0}{1-p+m^*} = R$$

Proposition 1

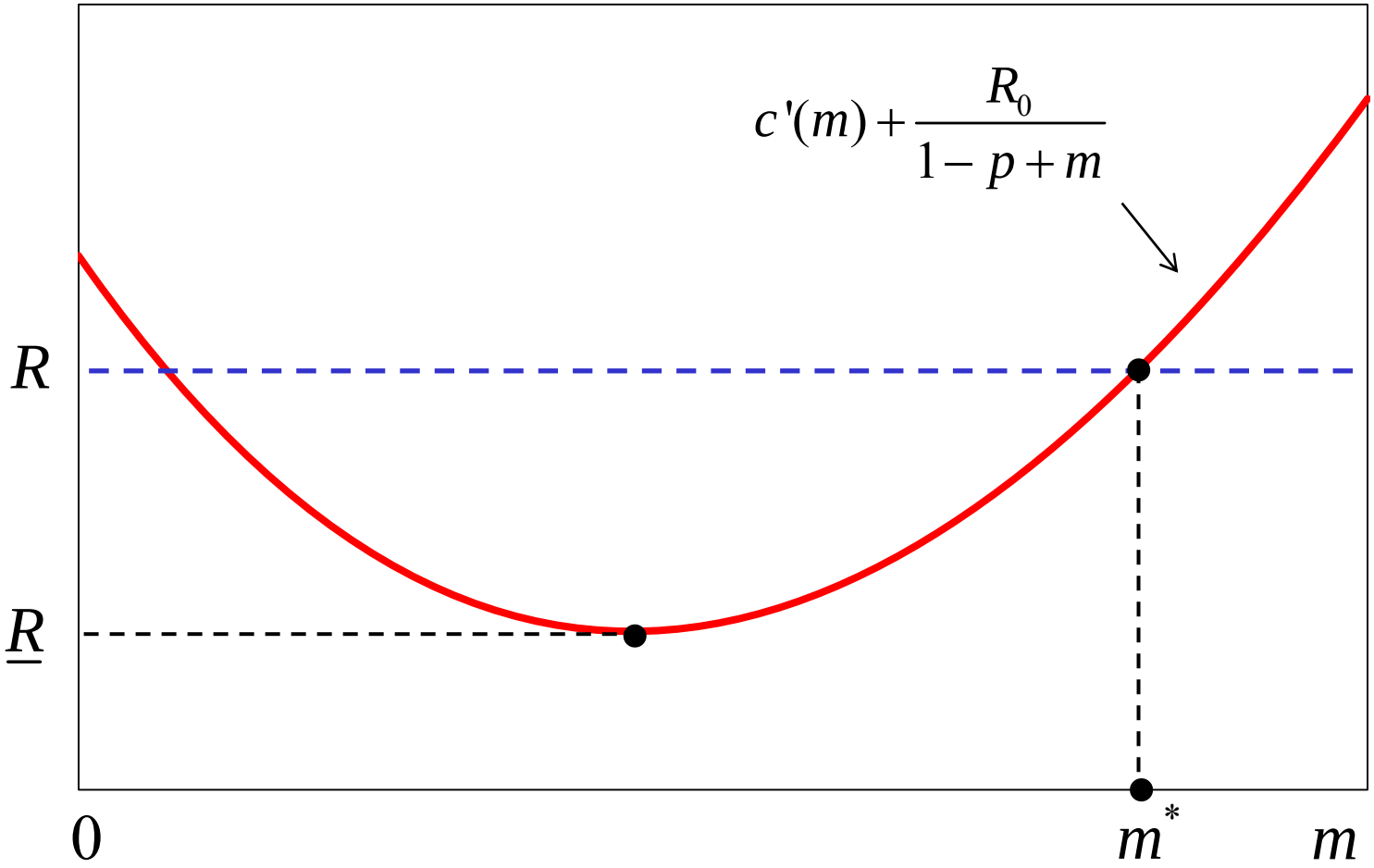
- Bank finance is feasible if loan rate R satisfies

$$R \geq \underline{R} = \min_{m \in [0,p]} \left(c'(m) + \frac{R_0}{1-p+m} \right)$$

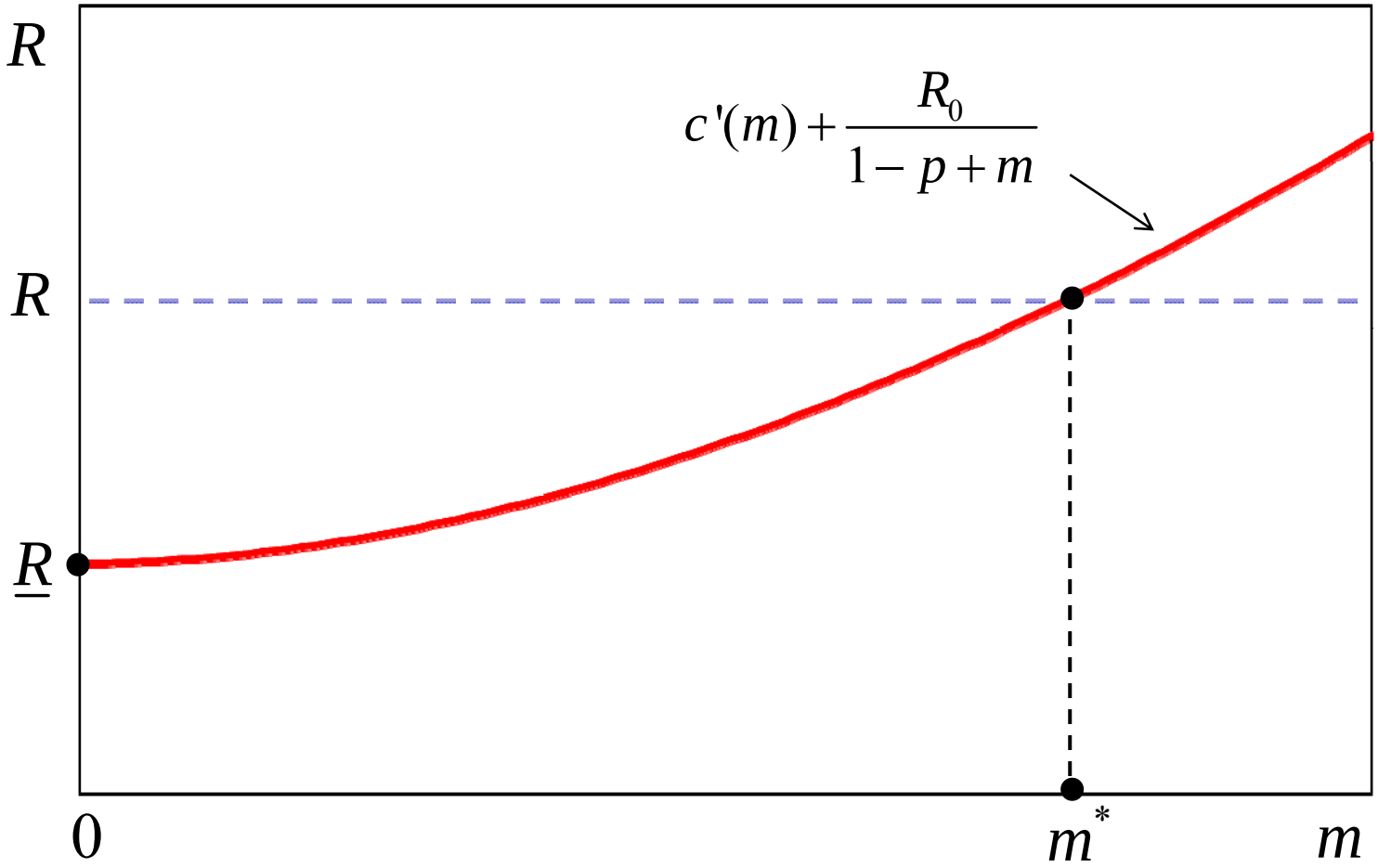
- Optimal monitoring m^* given by highest value of m that satisfies

$$c'(m) + \frac{R_0}{1-p+m} \leq R$$

A case with positive monitoring



Another case with positive monitoring



Proposition 2

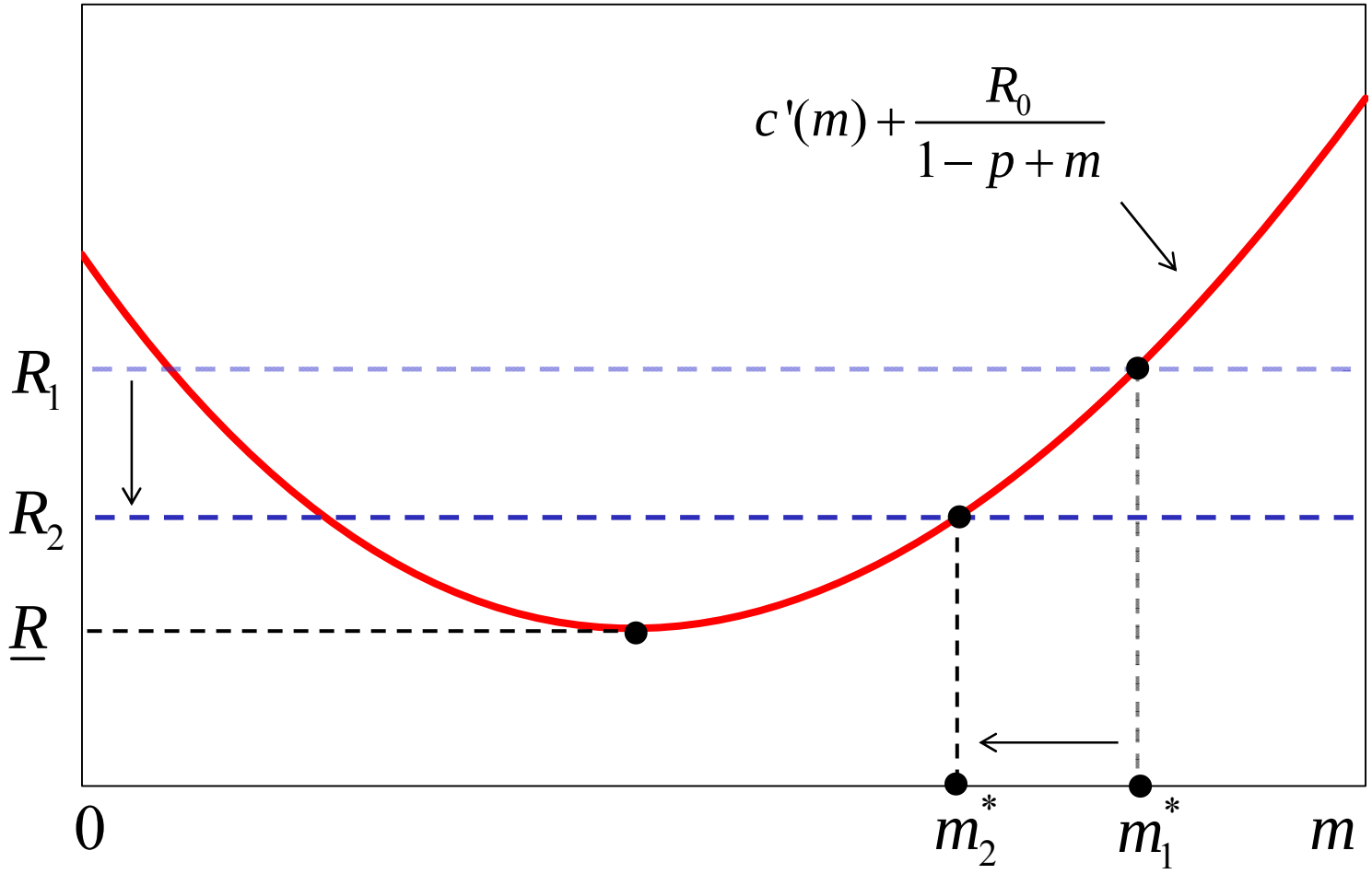
- If bank finance is feasible and we have interior solution

  → Monitoring is decreasing in funding cost R_0

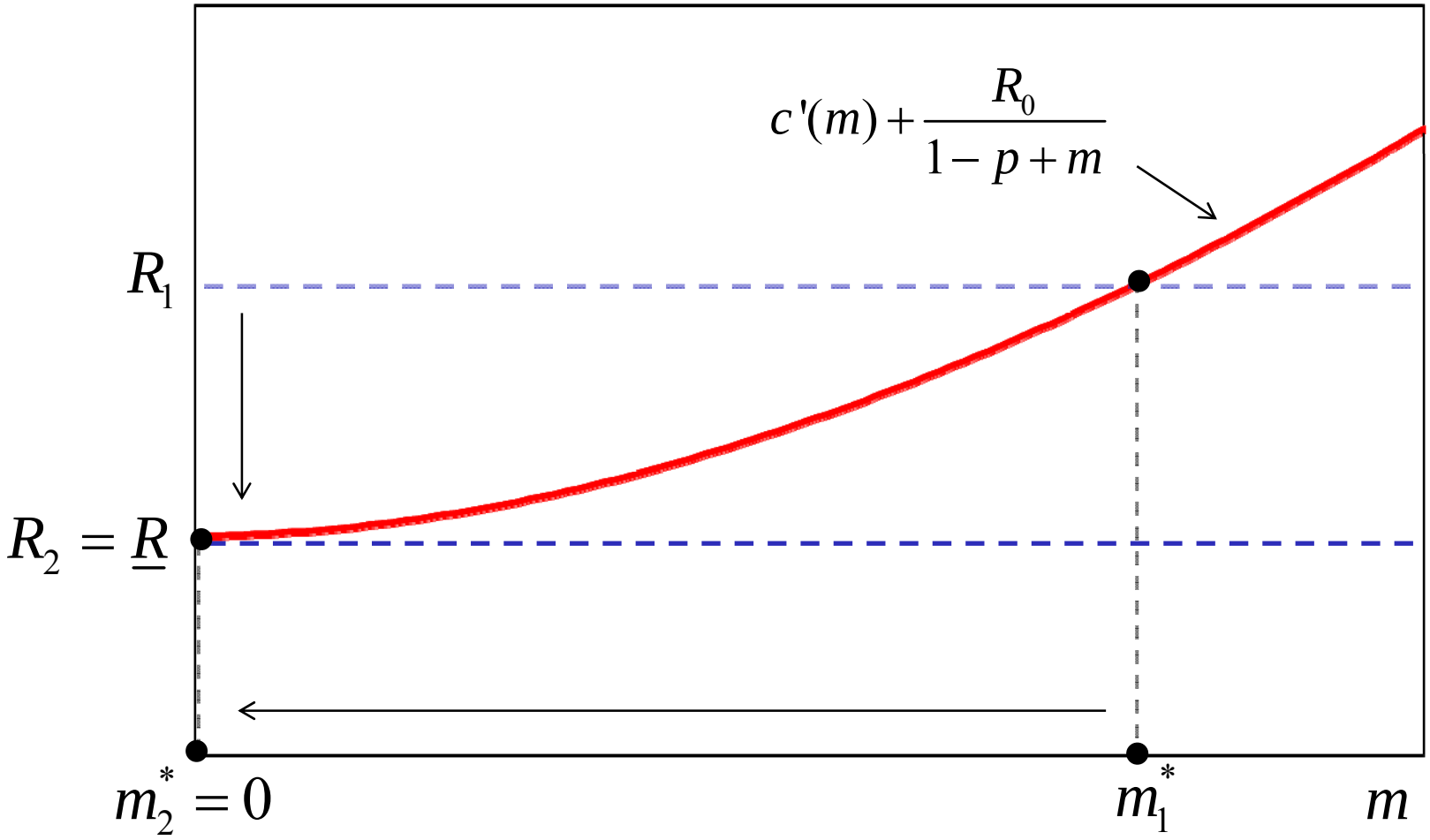
  → Monitoring is increasing in loan rate R

  → **Monitoring is increasing in spread** $R - R_0$

Effect of a decrease in loan rate *R*



Effect of a decrease in loan rate *R*



Summing up

- Monitoring m^* depends on interest rate spread $R - R_0$
- Lower spreads lead to
  - → Lower monitoring and higher default risk
  - → Possible switch from positive to zero monitoring
  - → Form originate-to-hold to originate-to-distribute
- Results assume exogenous interest rates
  - → General equilibrium model

Part 2

Search for yield

Model setup

- Two dates ($t = 0, 1$)
- Agents: → Set of potential entrepreneurs
  → Set of risk-neutral investors
  → Set of risk-neutral banks
- Entrepreneurs have projects that require bank finance
- Banks have to raise funds from investors
- Investors have a **fixed aggregate supply of savings** w

Entrepreneurs

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

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

where $m \in [0, p]$ is monitoring by lending bank

Entrepreneurs and banks

- Single bank for each type of entrepreneur

  → All entrepreneurs of type *p* borrow from this bank

- Loan market is contestable

  → Equilibrium loan rate is lowest feasible rate

- Returns of entrepreneurs of type *p* are perfectly correlated

  → Portfolio return coincides with single project return

Equilibrium loan rates

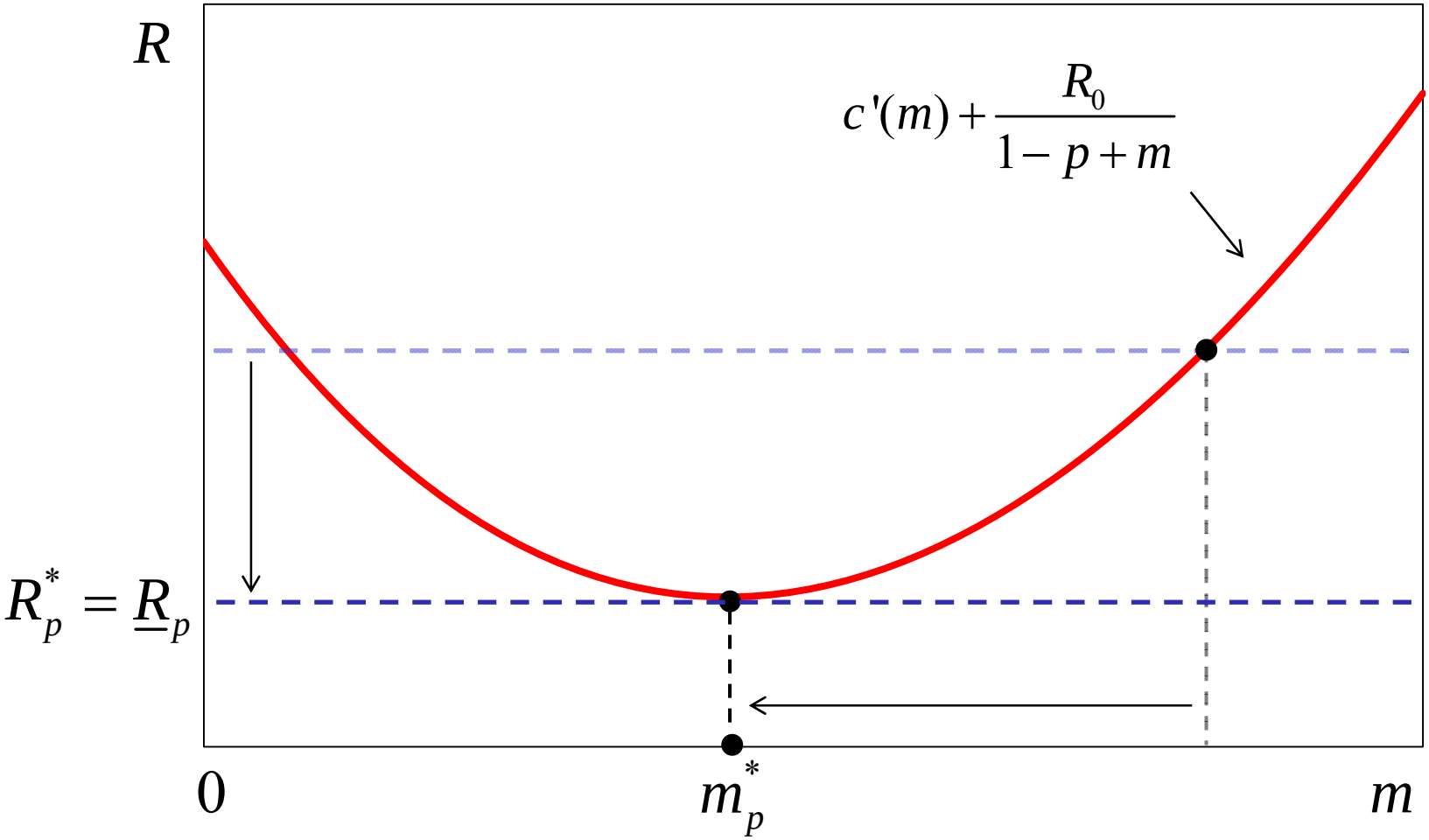
- These assumptions imply

$$R_p^* = \underline{R}_p = \min_{m \in [0,p]} \left(c'(m) + \frac{R_0}{1 - p + m} \right)$$

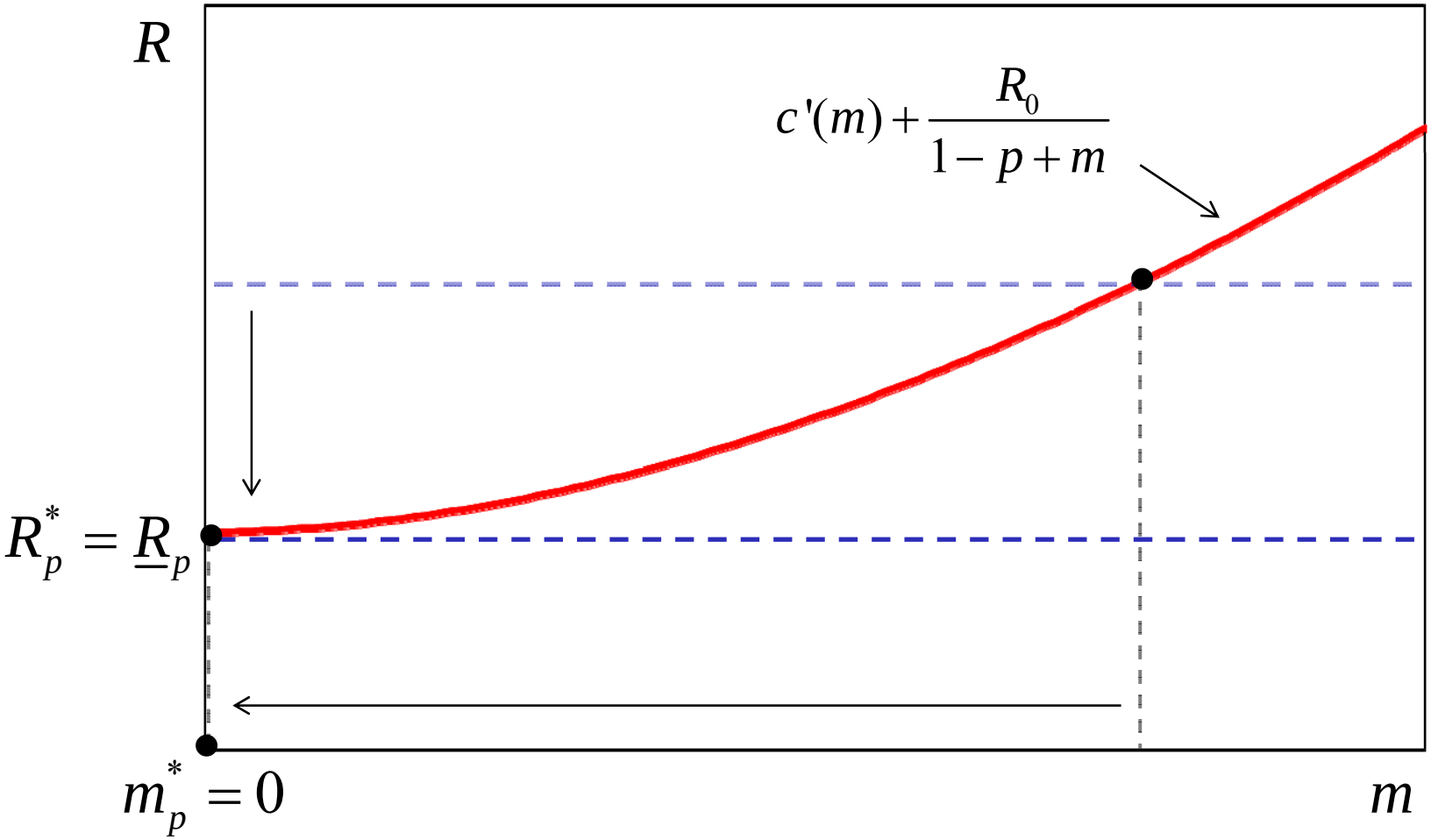
→ Entrepreneurs of type p borrow at the lowest feasible rate

→ Otherwise another bank would undercut incumbent

Equilibrium with positive monitoring



Equilibrium with zero monitoring



Investment returns

- Success return R_p is a decreasing function of investment x_p

$$R_p = R(x_p), \text{ with } R'(x_p) < 0$$

→ For numerical results assume

$$R(x_p) = (x_p)^{-1/\sigma}, \text{ with } \sigma > 1$$

Equilibrium

An equilibrium is investment allocation $\{x_p^*\}$ such that

1. Interest rates satisfy

$$R_p^* = R(x_p^*) = \underline{R}_p, \text{ for all } p \in [0,1]$$

2. The market clears

$$\int_0^1 x_p^* \, dp = w$$

Proposition 3

- There is a marginal type

$$p^* = 1 - \sqrt{R_0^* / c''(0)}$$

$\rightarrow$ Banks lending to types $p \leq p^*$ will choose $m_p^* = 0$

$\rightarrow$ Banks lending to types $p > p^*$ will choose $m_p^* > 0$

Comment on Proposition 3 (i)

- Loan rate for riskier types $p > p^*$ satisfies

$$R_p^* = \underline{R}_p = \min_{m \in [0,p]} \left(c'(m) + \frac{R_0^*}{1 - p + m} \right)$$

$\rightarrow$ which implies

$$c''(m_p^*) - \frac{R_0^*}{(1 - p + m_p^*)^2} = 0$$

Comment on Proposition 3 (ii)

- If monitoring cost function is quadratic this condition becomes

$$c''(m_p^*) - \frac{R_0^*}{(1-p+m_p^*)^2} = \gamma - \frac{R_0^*}{(1-p+m_p^*)^2} = 0$$

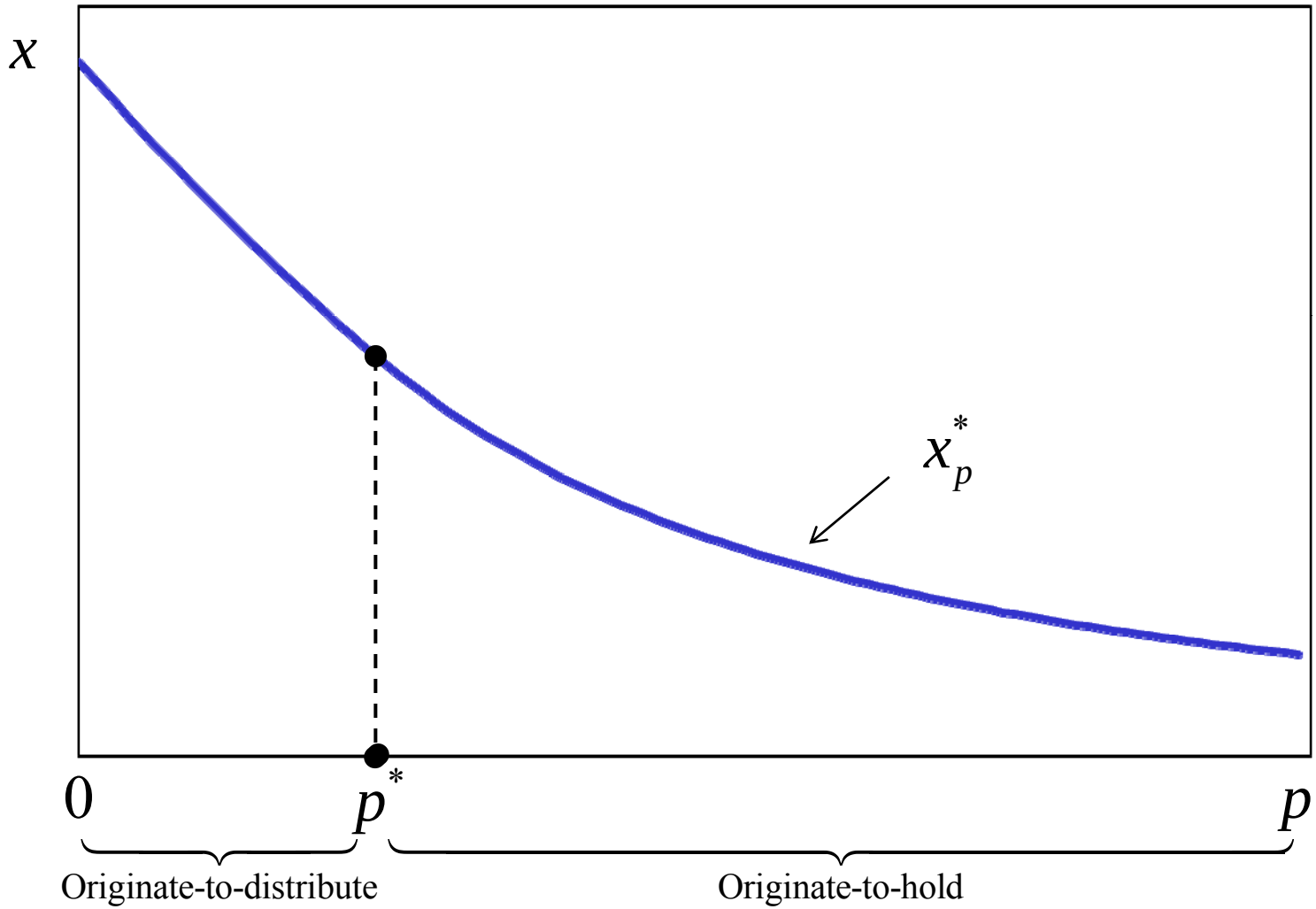
$$\downarrow$$

$$p - m_p^* = 1 - \sqrt{R_0^* / \gamma} = p^*$$

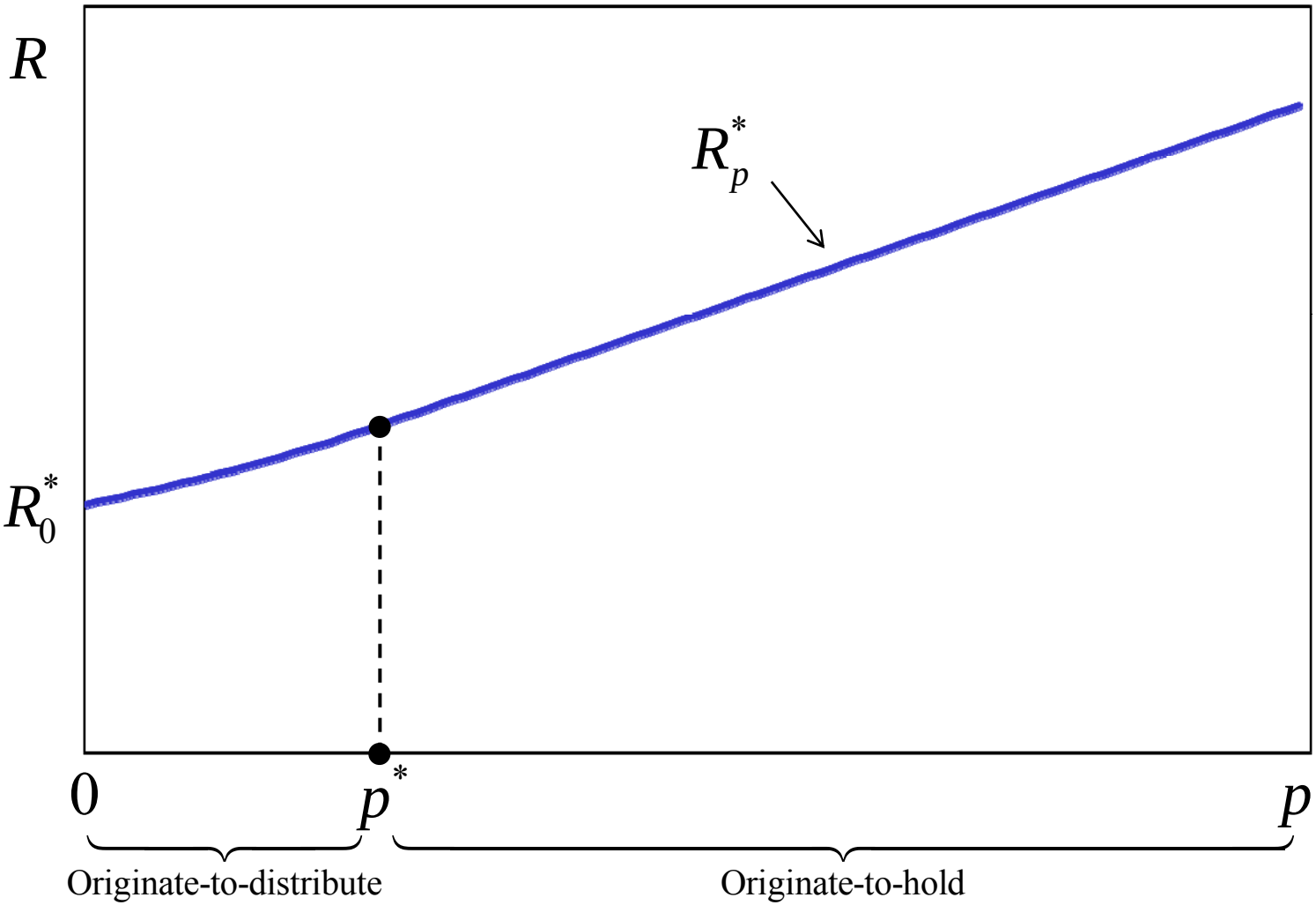
→ Originate-to-hold banks have same probability of failure

→ Equal to the type p^* of marginal entrepreneur

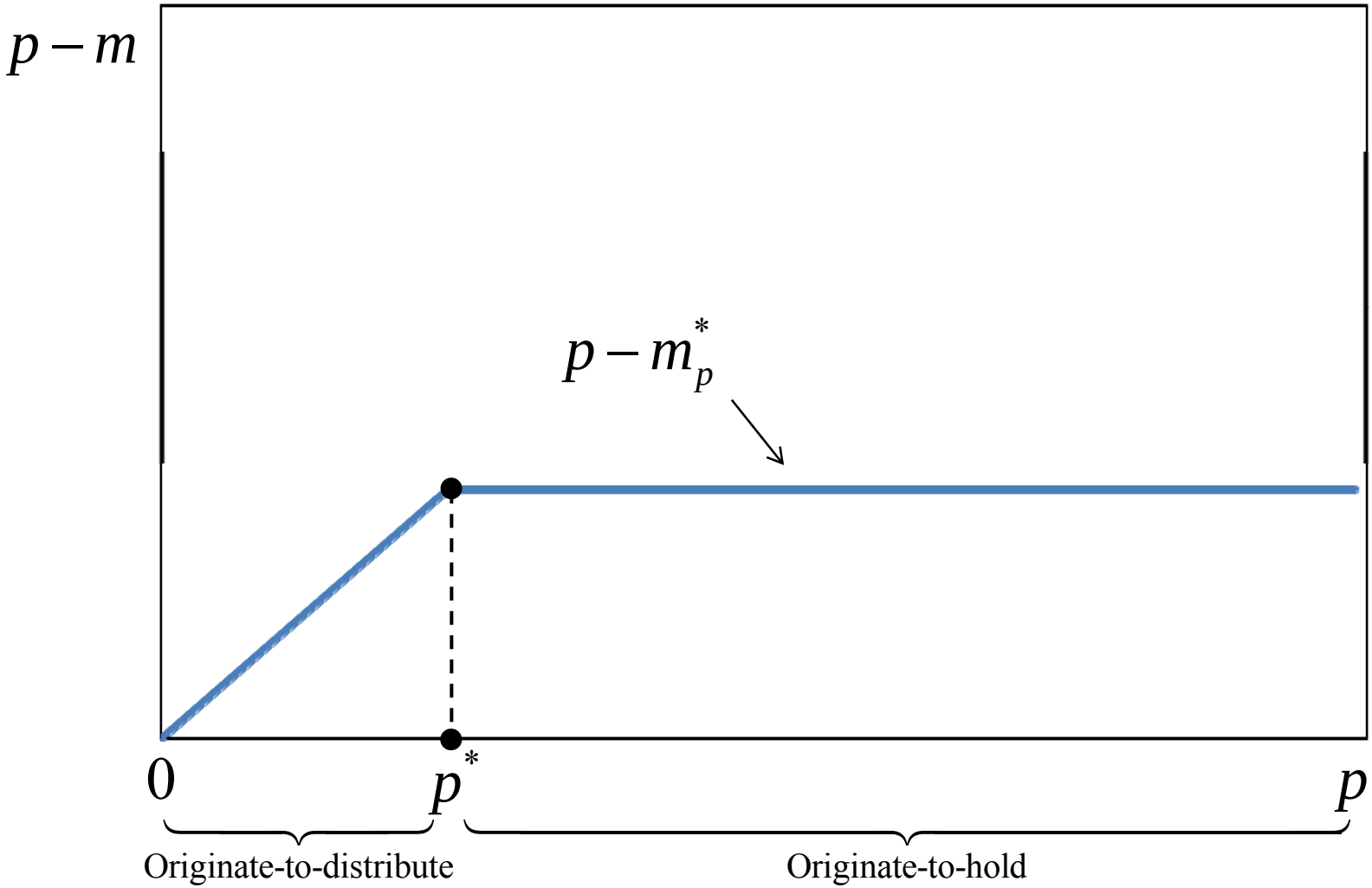
Equilibrium investment allocation



Equilibrium loan rates



Equilibrium probabilities of bank failure



Proposition 4

- Increase in aggregate supply of savings w leads to

  → Reduction in interest rates R_p^*

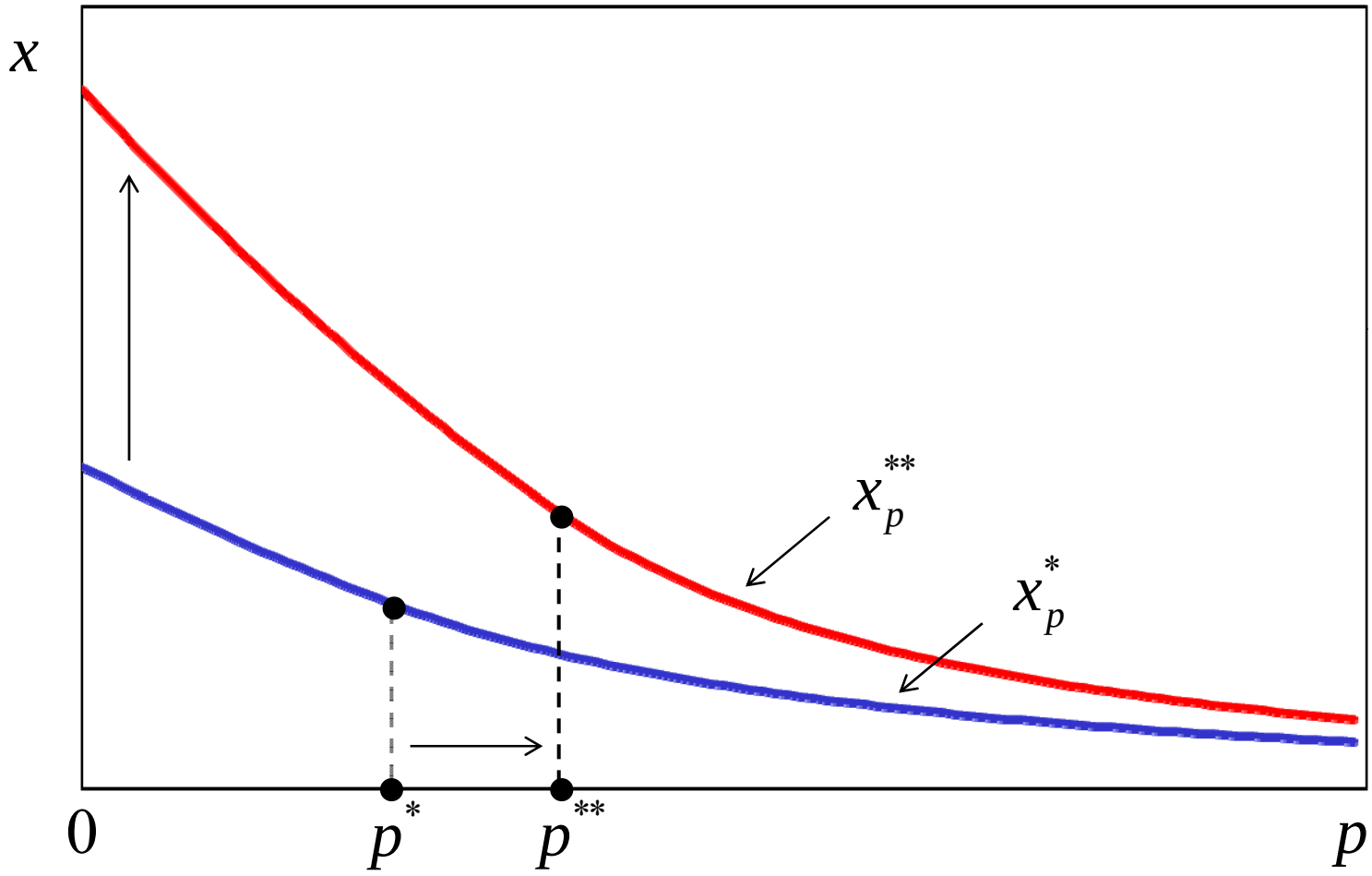
  → Reduction in interest rate spreads $R_p^* - R_0^*$

  → Increase in bank lending and bank size x_p^*

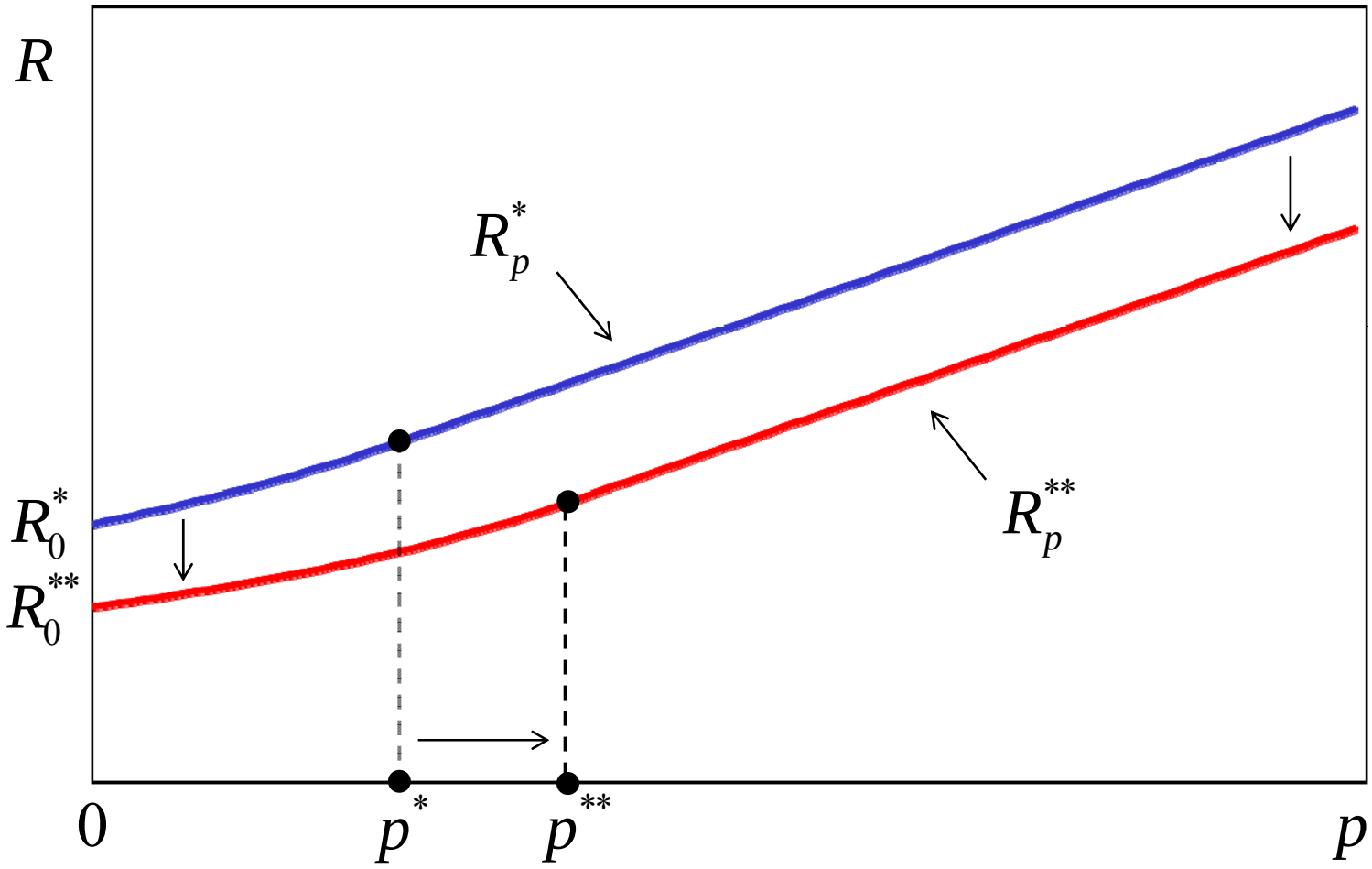
  → Expansion of originate-to-distribute region $[0, p^*]$

  → Increase in probability of failure of originate-to-hold banks

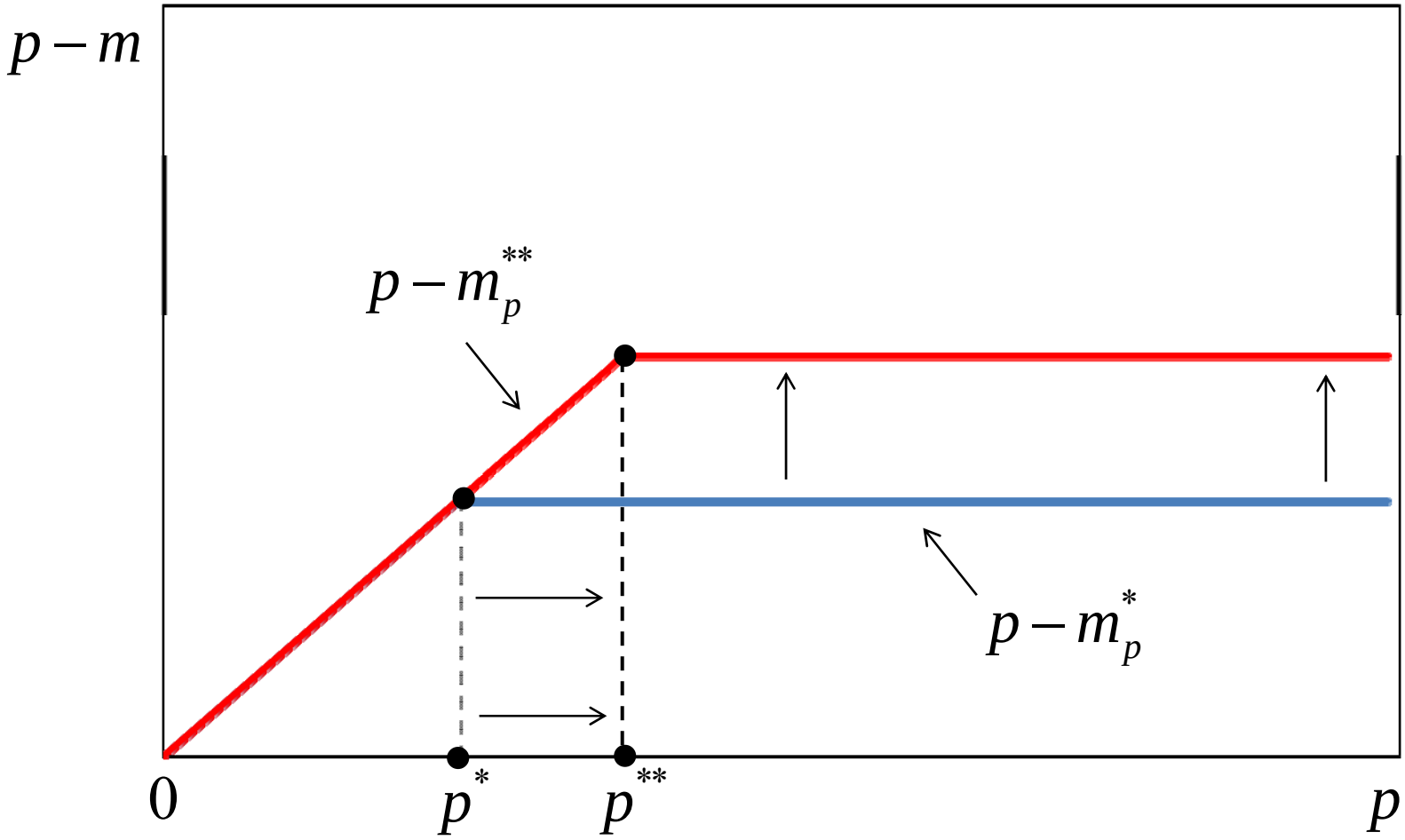
Equilibrium investment allocation



Equilibrium loan rates



Equilibrium probabilities of bank failure



Two effects of savings glut

- **Extensive margin** effect

  → Originate-to-hold banks lend to riskier borrowers

$$p^{*} \rightarrow p^{**} > p^{*}$$

- **Intensive margin** effect

  → Originate-to-hold banks take more risk

$$p - m_p^{*} = p^{*} \rightarrow p - m_p^{**} = p^{**} > p^{*}$$

Co-movement of spreads and monitoring

- Effects on spreads of change in R_0^*

  → By envelope theorem

$$\frac{dR_p^*}{dR_0^*} = \frac{d}{dR_0^*}\left(c'(m_p^*) + \frac{R_0^*}{1-p+m_p^*} \right) = \frac{1}{1-p+m_p^*}$$

  → Hence we have

$$\frac{d(R_p^* - R_0^*)}{dR_0^*} = \frac{1}{1-p+m_p^*} - 1 > 0$$

- Savings glut leads to a reduction in safe rate R_0^*

  → which implies a reduction in spreads $R_p^* - R_0^*$

Co-movement of spreads and monitoring

- Effects on monitoring of change in R_0^*

  → Zero slope condition at m_p^*

$$c''(m_p^*) - \frac{R_0^*}{(1-p+m_p^*)^2} = 0$$

  → Differentiating this condition gives

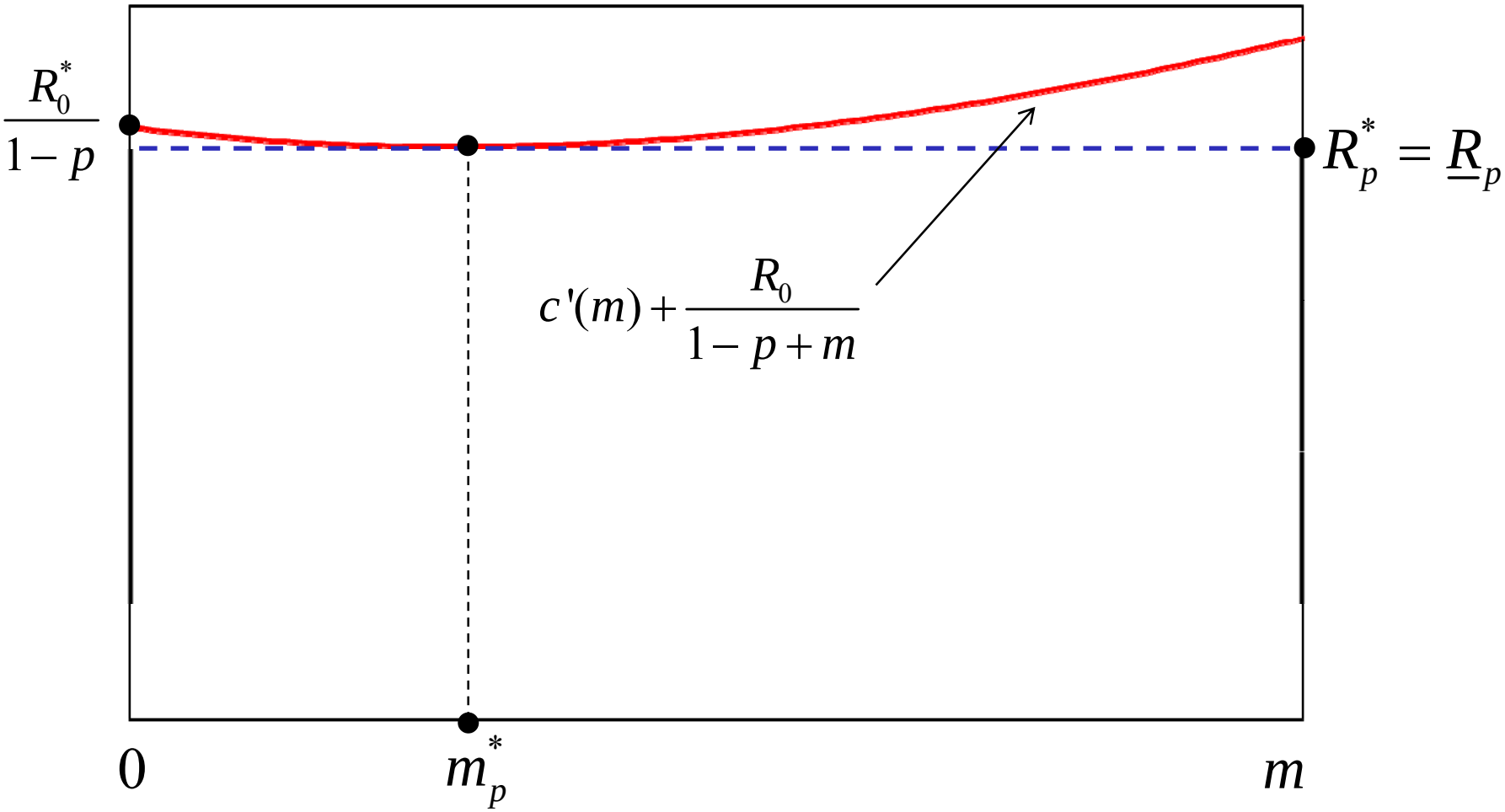
$$\frac{dm_p^*}{dR_0^*} > 0$$

- Savings glut leads to a reduction in safe rate R_0^*

  → which implies a reduction in monitoring m_p^*

  → which could go to the corner $m_p^* = 0$

Effect of a reduction in safe rate



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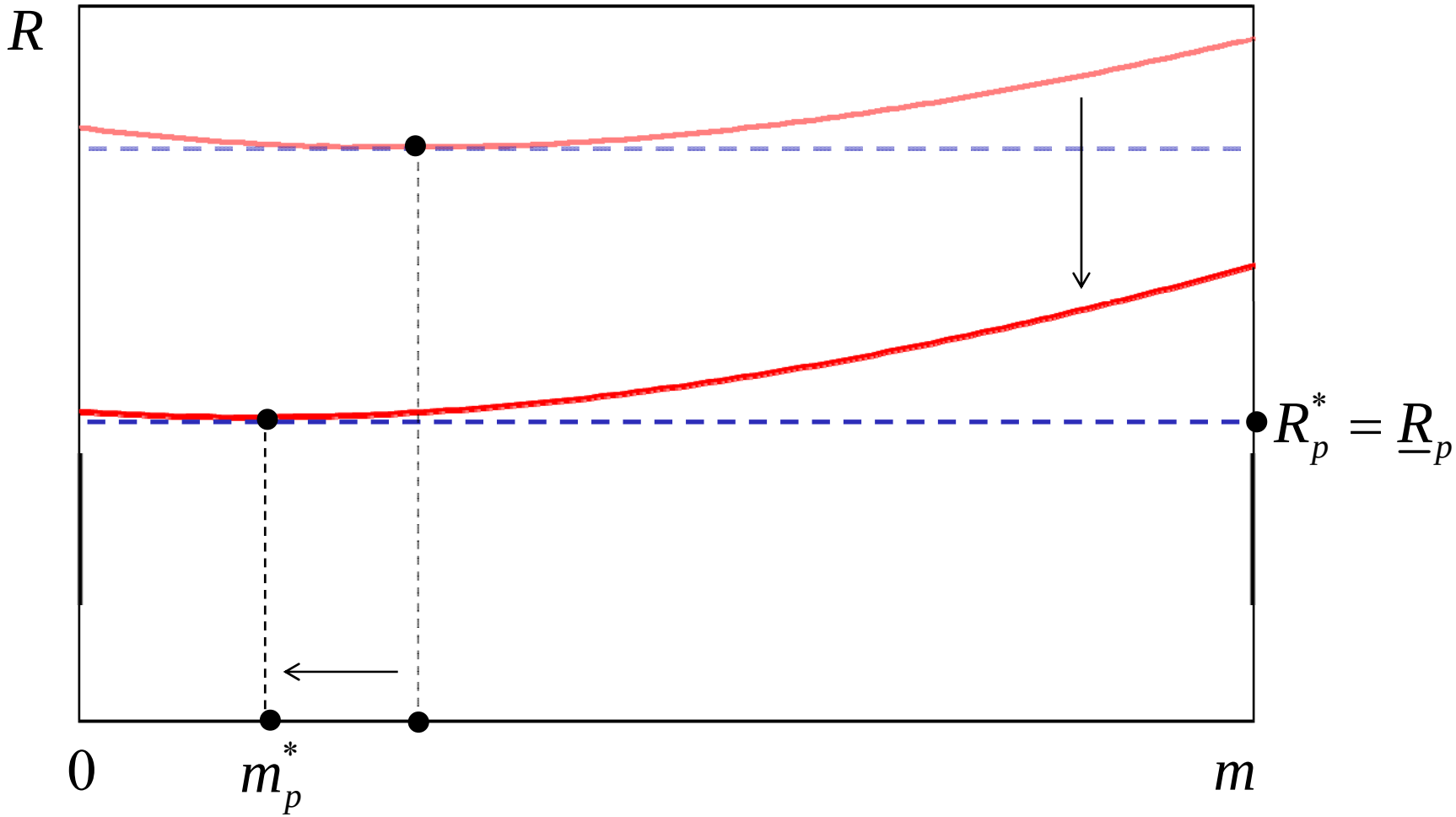

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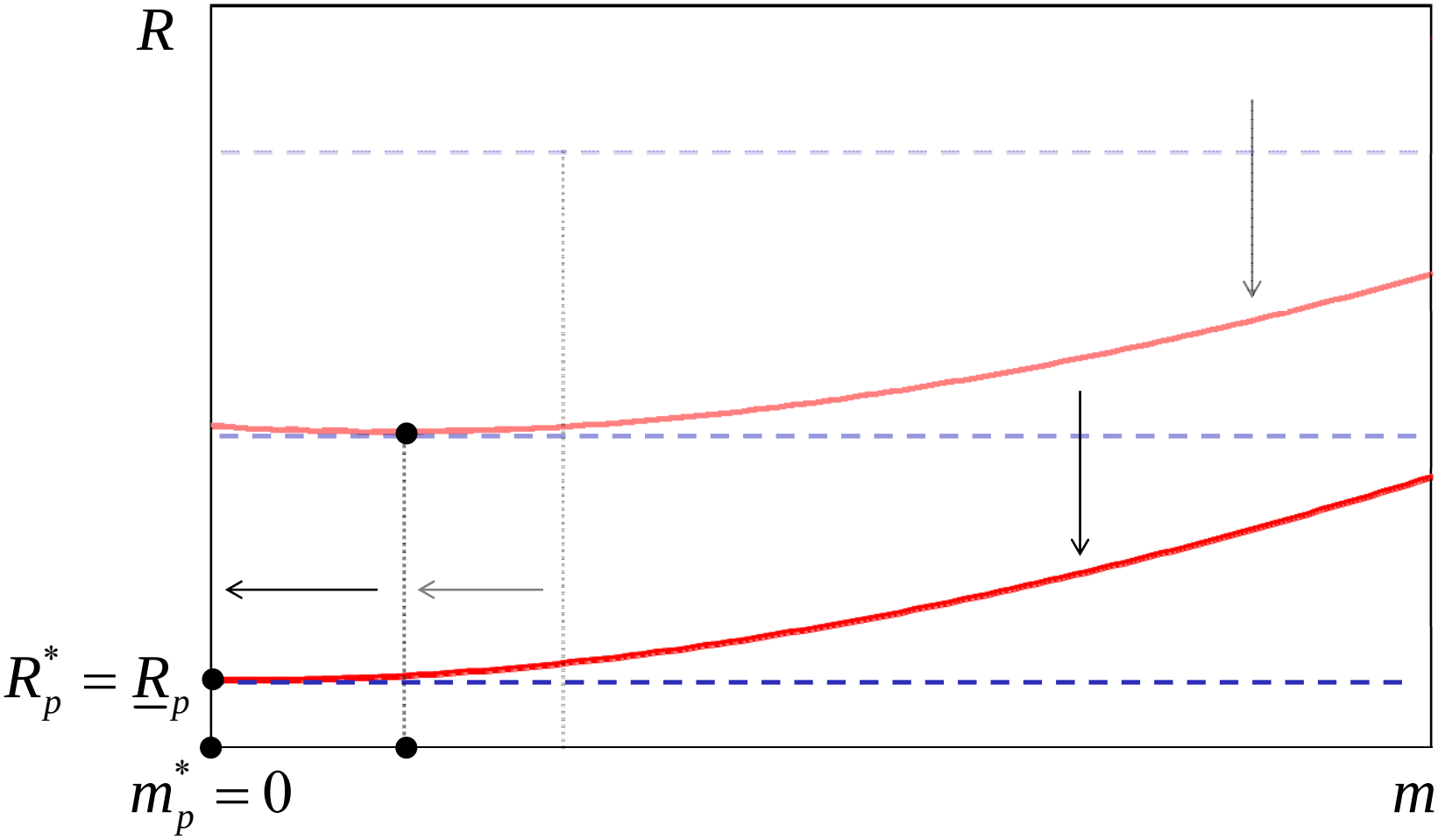


Summing up

- Model of the effects of savings glut
  - → Partial equilibrium (moral hazard) model of bank finance
  - → General equilibrium model of interest rates
- Results show link between savings glut and
  - → Interest rates and interest rate spreads
  - → Increases probability of failure of traditional banks
  - → Increase in relative size of shadow banking system

Part 3

Extensions

Part 3 (i)

Short- vs long-run effects of savings glut

Short-run effects of savings glut

- Suppose that originate-to-hold banks cannot increase x_p^*

  → Due to some capacity constraint (e.g. capital requirements)

Results

- If traditional banks cannot expand
  - → Greater increase in shadow banking system
  - → Greater reduction in safe rate
  - → Wider spreads for traditional banks
  - → They become safer!
- The effect will only be temporary
  - → They become riskier as soon as constraint is relaxed

Connection with Shin (2012)

- Key role of European global banks intermediating dollar funds

  → Tapping the wholesale funding market in the US

"The culprit of the easy credit conditions in the US up to 2007 may have been the **global banking glut** rather than the global savings glut."

Part 3 (ii)

Risk-averse investors

Risk-averse investors

- Continuum of risk-averse investors of mass w

  → Unit wealth

  → Utility function

$$u(c) = c^{\alpha}, \text{ with } 0 < \alpha < 1$$

- Assume that they can only invest in one asset

  → Indifferent between funding all types of banks

- Look at effects of a **reduction in risk aversion**

Results

- If investors are less risk-averse
  - → Higher loan rates for safer entrepreneurs
  - → Lower loan rates for riskier entrepreneurs
  - → Narrower spreads for traditional banks
  - → They become riskier
- Key difference with effect of savings glut
  - → The safe rate R_0^* goes up (instead of down)

Part 3 (iii)

Endogenous booms and busts

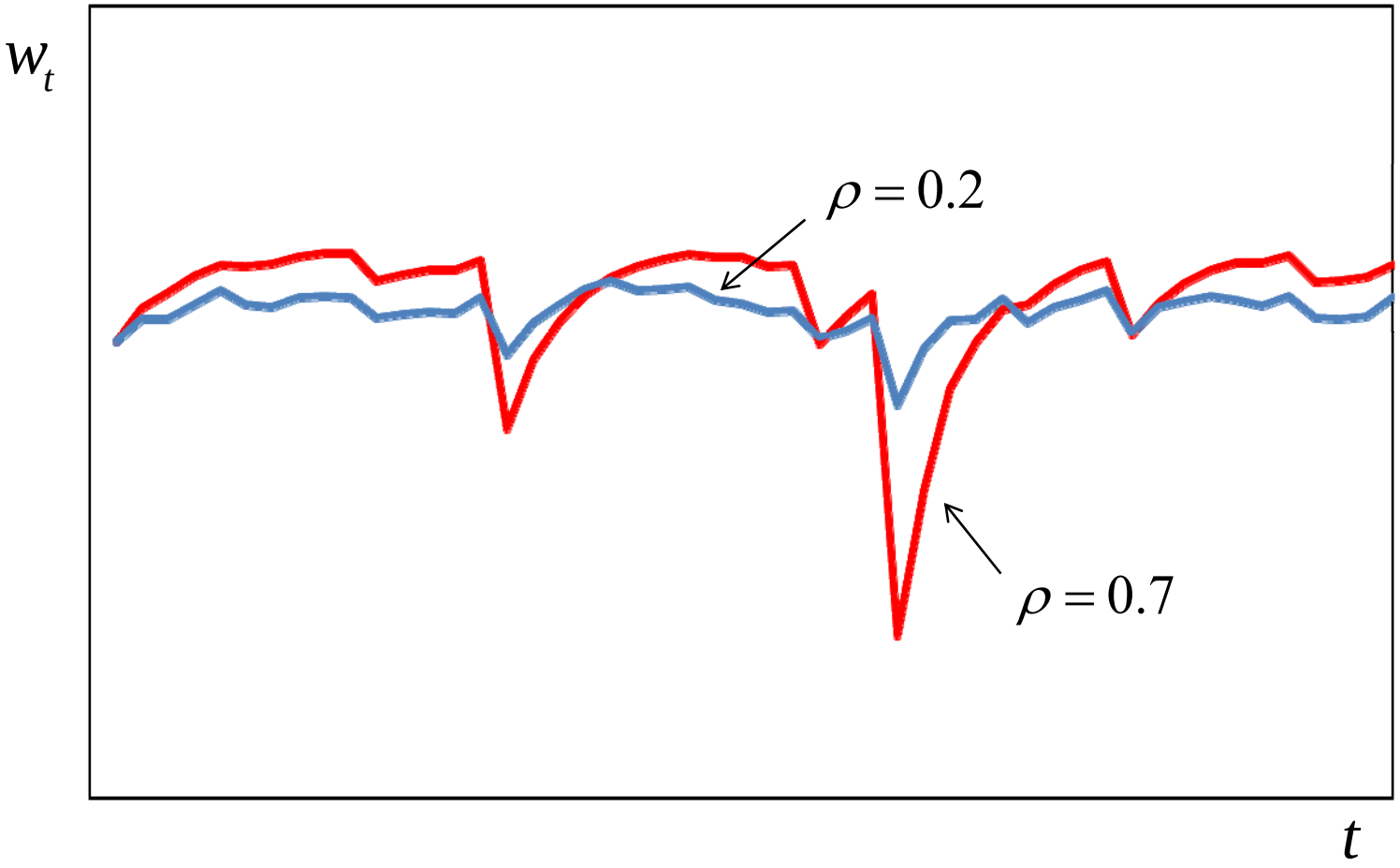
A simple dynamic model

- Suppose that supply of funds w_{t+1} at date $t + 1$ is the outcome of
  - → Investment of funds w_t at date t
  - → Realization of a systematic risk factor z_t
- Single risk factor of Vasicek (2002)
  - → Effect of shocks determined by correlation across types
  - → Correlation parameter $\rho \in (0,1)$

Endogenous booms and busts

- Good realizations of systematic risk factor lead to
  - → Accumulation of savings (boom state)
  - → Reduction in spreads & higher probabilities of failure
  - → Banking system vulnerable to bad realization of risk factor
- Bad realizations of systematic risk factor lead to
  - → Reduction in savings (bust state)
  - → Increase in spreads & lower probabilities of failure
  - → Restart process that generates another boom

Two sample paths of savings



Concluding remarks

Summing up

- Simple model to explain effects of savings glut

  → Focus on key role of bank intermediation

- Main result: If savings glut is accompanied by banking glut

  → Higher risk-taking by banks

- Results consistent with a number of stylized facts

  → More work needs to be done!

Role of macro-prudential policy

- Macroeconomic variables can have effects on systemic risk

  → Macro-prudential policy may play significant role

- Policy should not focus narrowly on credit growth

  → As in latest regulation of Basel Committee (Basel III)

- Broader macro-finance perspective would be required

  → More work needs to be done!

What about monetary policy?

- Our story has nothing to do with monetary policy

  → Real model

- Interestingly, we show that build-up of risk may take some time

  → Interest rates have to be “too low for too long”

  → As noted by many critics of Fed policy

- Broader money-macro-finance perspective would be required

  → More work needs to be done also here!

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