

Credit supply and the housing boom

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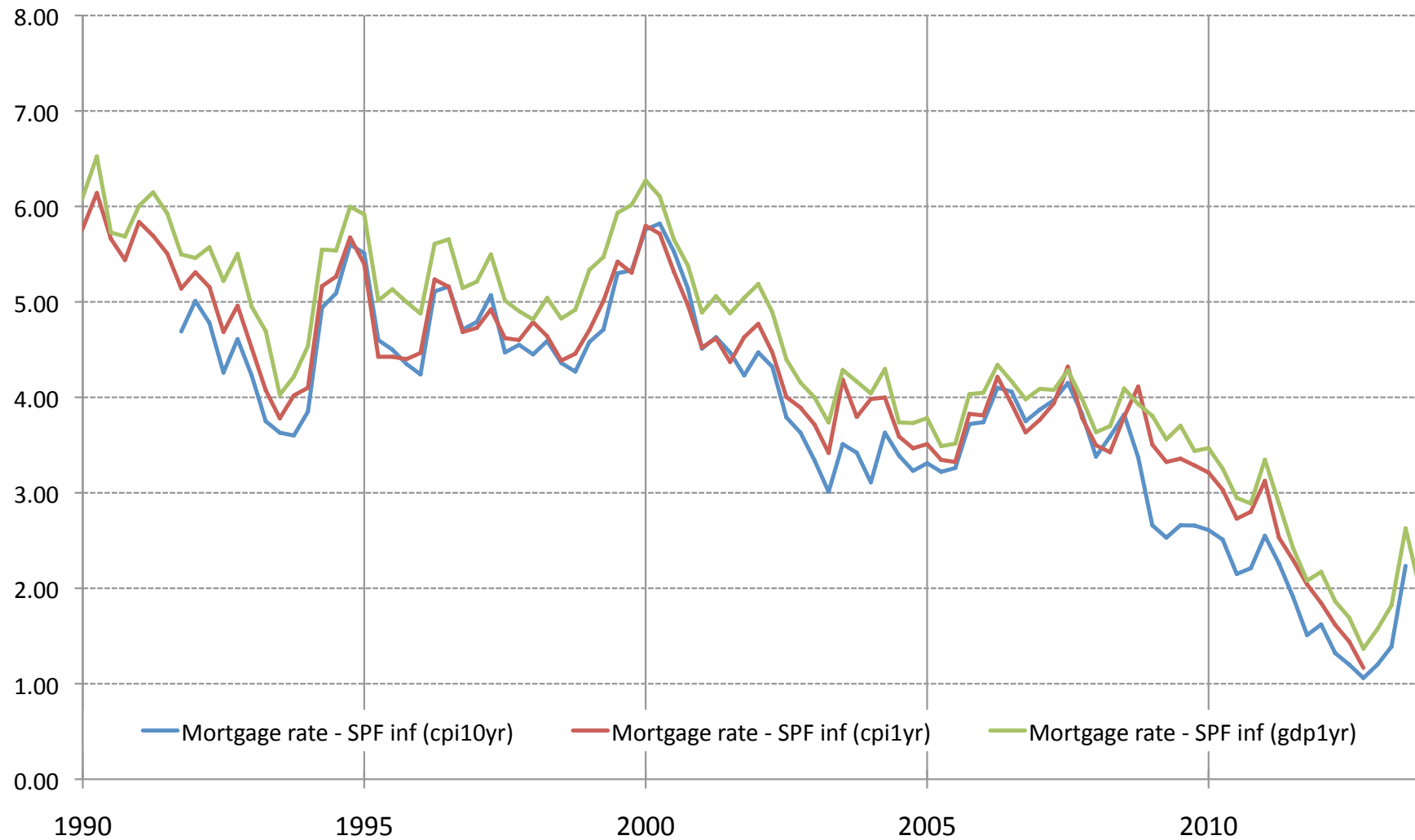
European Central Bank

February 6, 2014

The US economy in the 2000s: Four stylized facts

① Decline in mortgage rates

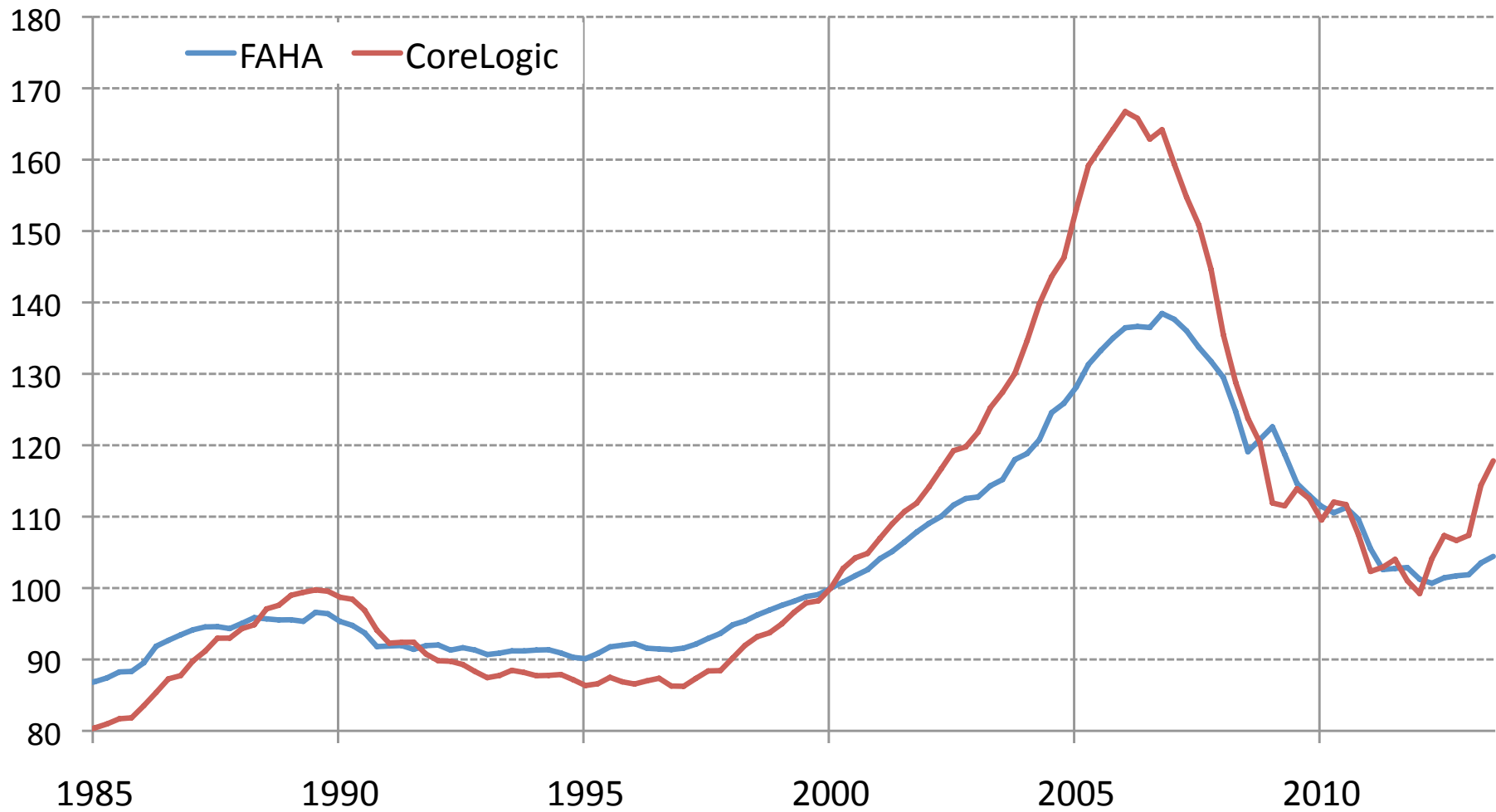
1. Real mortgage rates



The US economy in the 2000s: Four stylized facts

- ① Decline in mortgage rates
- ② Unprecedented boom-bust cycle in house prices

2. Real house price

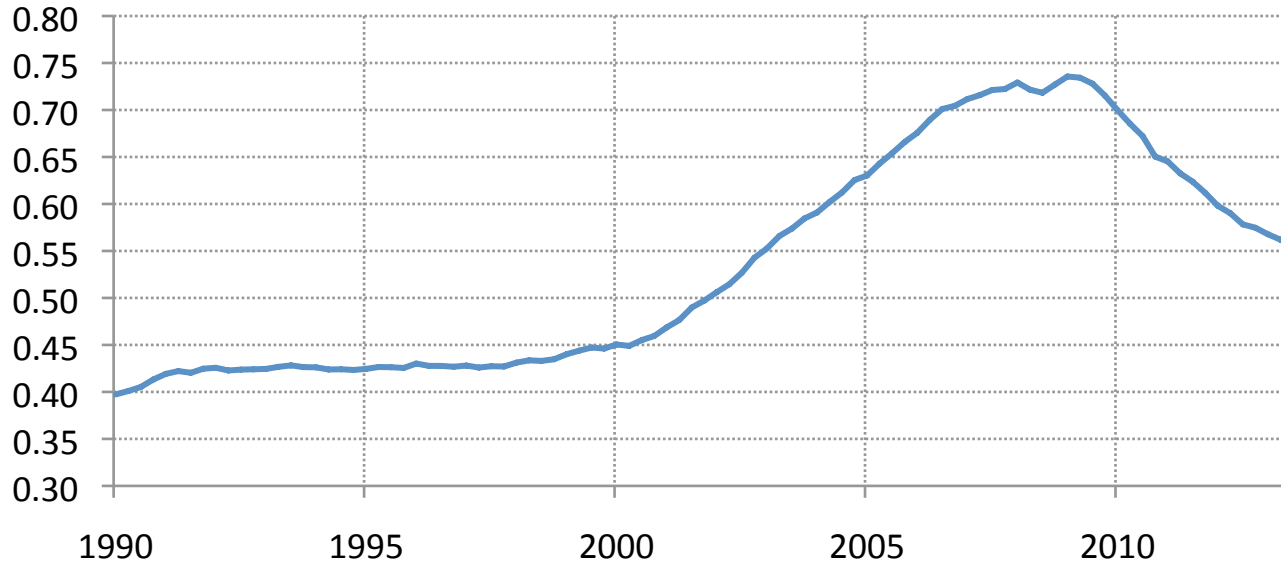


The US economy in the 2000s: Four stylized facts

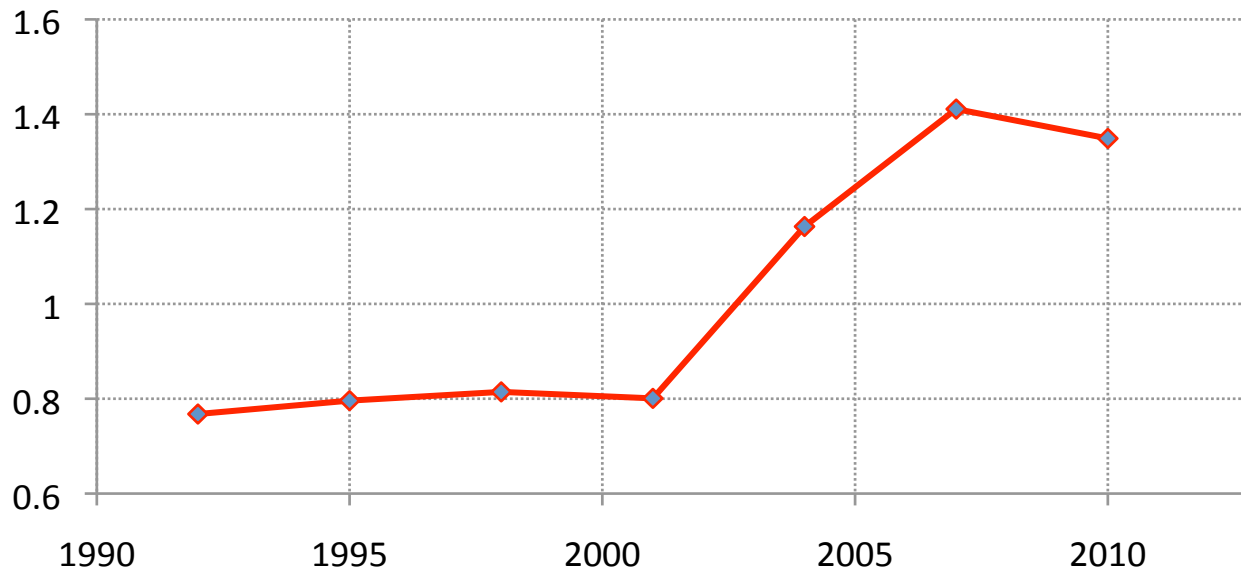
- ① Decline in mortgage rates
- ② Unprecedented boom-bust cycle in house prices
- ③ Massive HH debt accumulation, and then deleveraging

3. Household debt

HH Mortgages-to-GDP ratio (Flow of Funds)

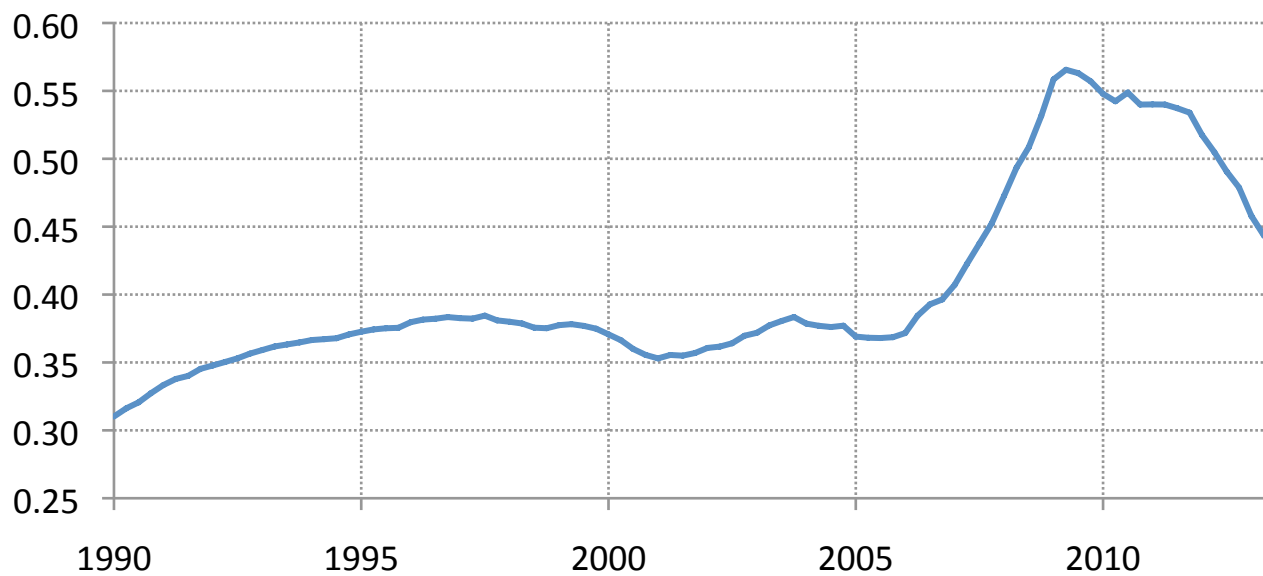


Mortgages-to-income ratio for liquidity constrained HHs (SCF)

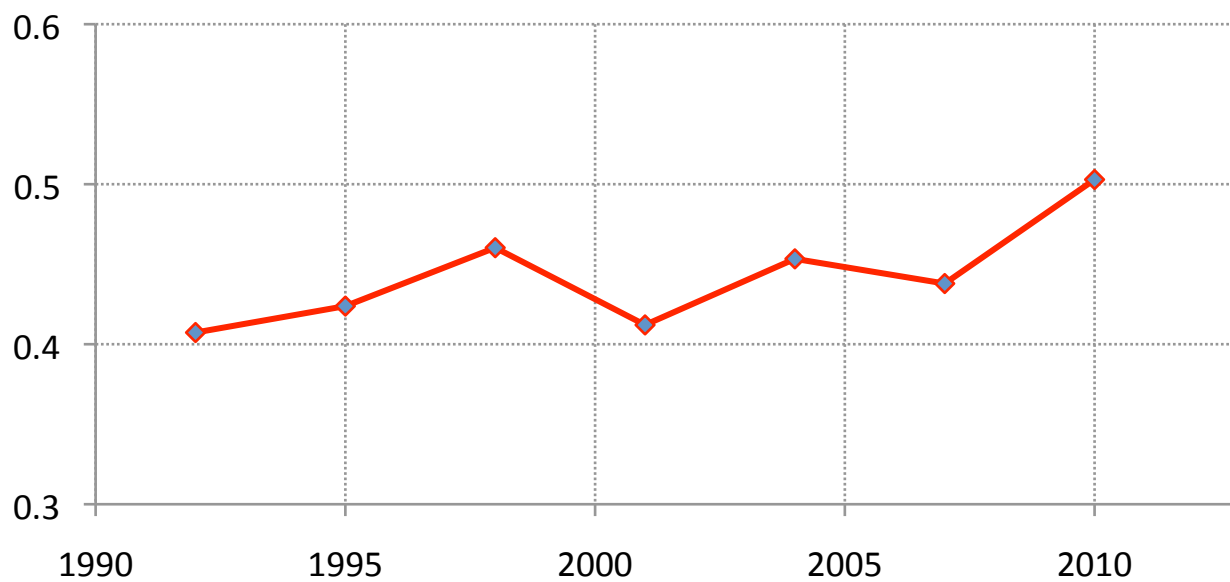


4. Debt-to-collateral ratio

HH Mortgages-to-real estate ratio (Flow of Funds)



Mortgages-to-real estate ratio for liquidity constrained HHs (SCF)



The US economy in the 2000s: Four stylized facts

- ① Decline in mortgage rates
- ② Unprecedented boom-bust cycle in house prices
- ③ Massive HH debt accumulation, and then deleveraging
- ④ Debt-to-collateral ratio constant, and then spikes

- **Question:** What explains the unprecedented boom in house prices and HH debt preceding the Great Recession?

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- **Approach:** GE model as laboratory
 - Model of household borrowing with
 - borrowing constraints, houses as collateral
 - lending constraints
 - Calibrated with micro data from the Survey of Consumer Finances

Summary of the results

- **Increased capacity to lend** explains a large fraction of the boom in house prices and HH debt
- Also consistent with
 - decline in mortgage rates
 - constant debt-to-collateral ratio

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- Increased capacity to lend explains a large fraction of the boom in house prices and HH debt
- Also consistent with
 - decline in mortgage rates
 - constant debt-to-collateral ratio
- **Loosening of collateral requirements** not an important driving force. At odds with the behavior of
 - mortgage rates
 - house prices
 - debt-to-collateral ratio

Some literature

- Large literature on the importance of looser collateral constraints
 - Favilukis, Ludvigson, Van Nieuwerburgh (2013)
 - Boz and Mendoza (2012)
 - Garriga, Manuelli and Peralta-Alva (2012)
 - Geanakoplos (various)
 - Etc...

- Constraints on composition of balance sheet of intermediaries
 - Acharya and Schnabel, 2009
 - Various papers by Adrian, Shin, and coauthors

- Model
- Parameterization
- Quantitative results
 - Expansion in credit supply
 - Loosening of collateral requirements

Simplest model

- Build on

- Iacoviello (2005)
- Campbell and Hercowitz (2006)

- 2 groups of households

- Patient → Lenders
- Impatient → Borrowers

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- Build on
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- 2 groups of households
 - Patient → Lenders
 - Impatient → Borrowers
- No production → income is exogenous
- Fixed supply of (new) houses

The problem of the borrowers

$$\max E_0 \sum_{t=0}^{\infty} \beta_b^t \left[u(c_{b,t}) + v(h_{b,t}) \right]$$

$$c_{b,t} + p_t \left[h_{b,t+1} - (1 - \delta)h_{b,t} \right] + R_{t-1}D_{b,t-1} \leq y_{b,t} + D_{b,t}$$

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- Borrowing is limited by a **collateral constraint**

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- Associated multiplier: **$\mu \geq 0$**

The problem of the lenders ($\beta_l > \beta_b$)

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- Mortgage lending is limited by a **lending constraint**

$$-D_{l,t} \leq \bar{L}$$

The lending constraint

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The lending constraint

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- Regulatory requirements on risk-weighted capital ratio
 - Risk-weighted assets/Capital (taking bank capital as given)

The lending constraint

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- Implicit or explicit regulatory and technological constraints on mortgage lending
- Regulatory requirements on risk-weighted capital ratio
 - Risk-weighted assets/Capital (taking bank capital as given)
- Example: Money-market funds, pension funds and insurance companies are restricted by their bylaws to holding only the safest securities

Two additional simplifying assumptions

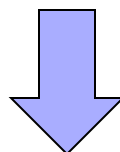
Linear utility in consumption

Rigid demand for houses by the
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Two additional simplifying assumptions

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Rigid demand for houses by the lenders



$$p_t = \frac{\beta_b}{1 - \mu_t \theta} [mrs + (1 - \delta)p_{t-1}]$$

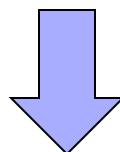
■ Implications

- Variation in house prices due to variation in discounting
- Borrowers are marginal buyers of houses

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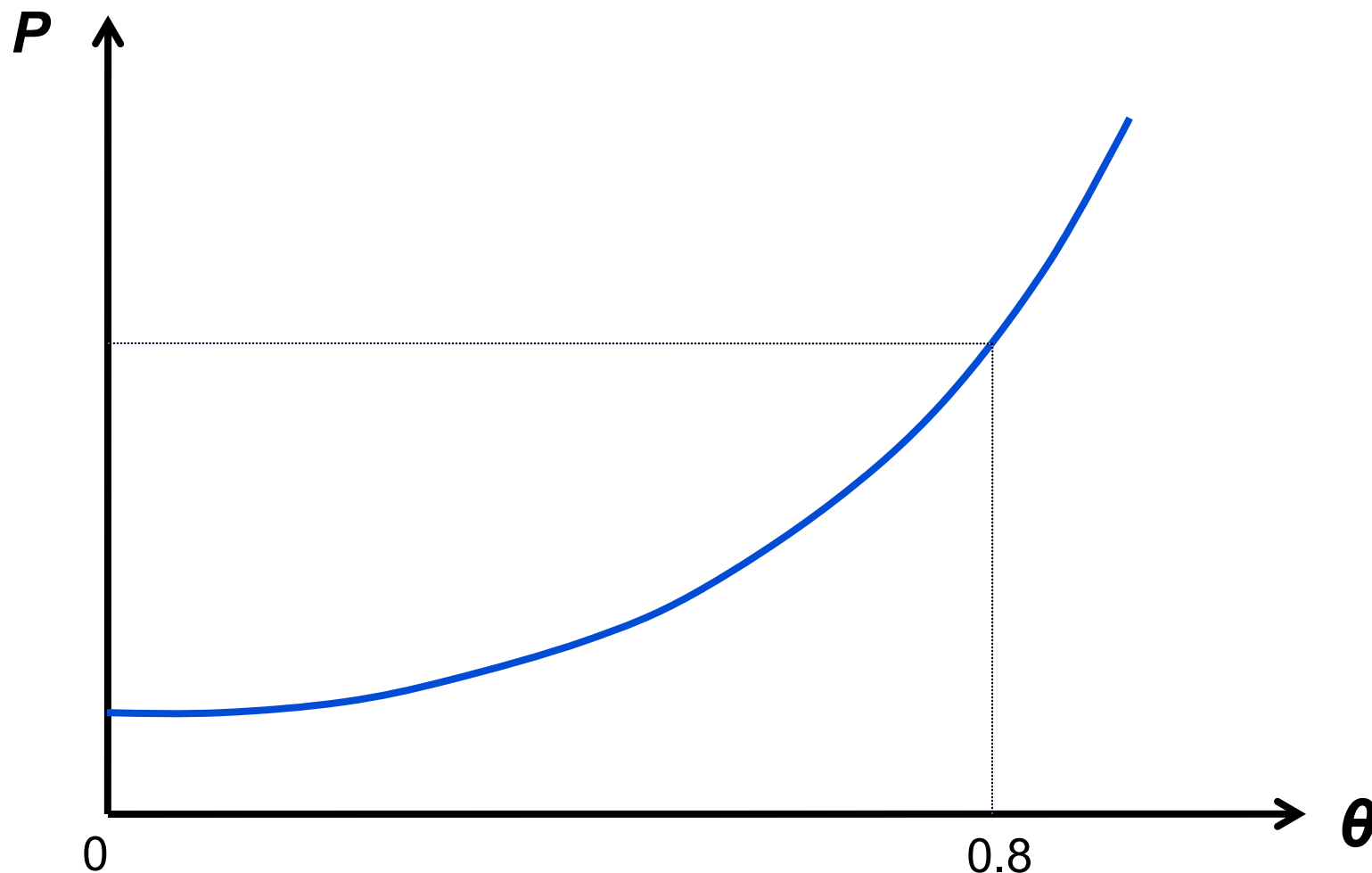
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■ When collateral constraint binds ($\mu > 0$), $\theta \uparrow \rightarrow p \uparrow$

House prices as a function of θ when collateral constraint is binding

$$p_t = \frac{\beta_b}{1 - \mu_t \theta} [mrs + (1 - \delta)p_{t-1}] \Rightarrow p_t = \frac{\beta_b \cdot mrs}{1 - \mu_t \theta - (1 - \delta)\beta_b}$$



Interaction of borrowing and lending constraints

■ Borrowing constraint:

$$D_{b,t} \leq \theta p_t h_{b,t+1}$$

■ Lending constraint: $-D_{l,t} \leq \bar{L} \rightarrow$

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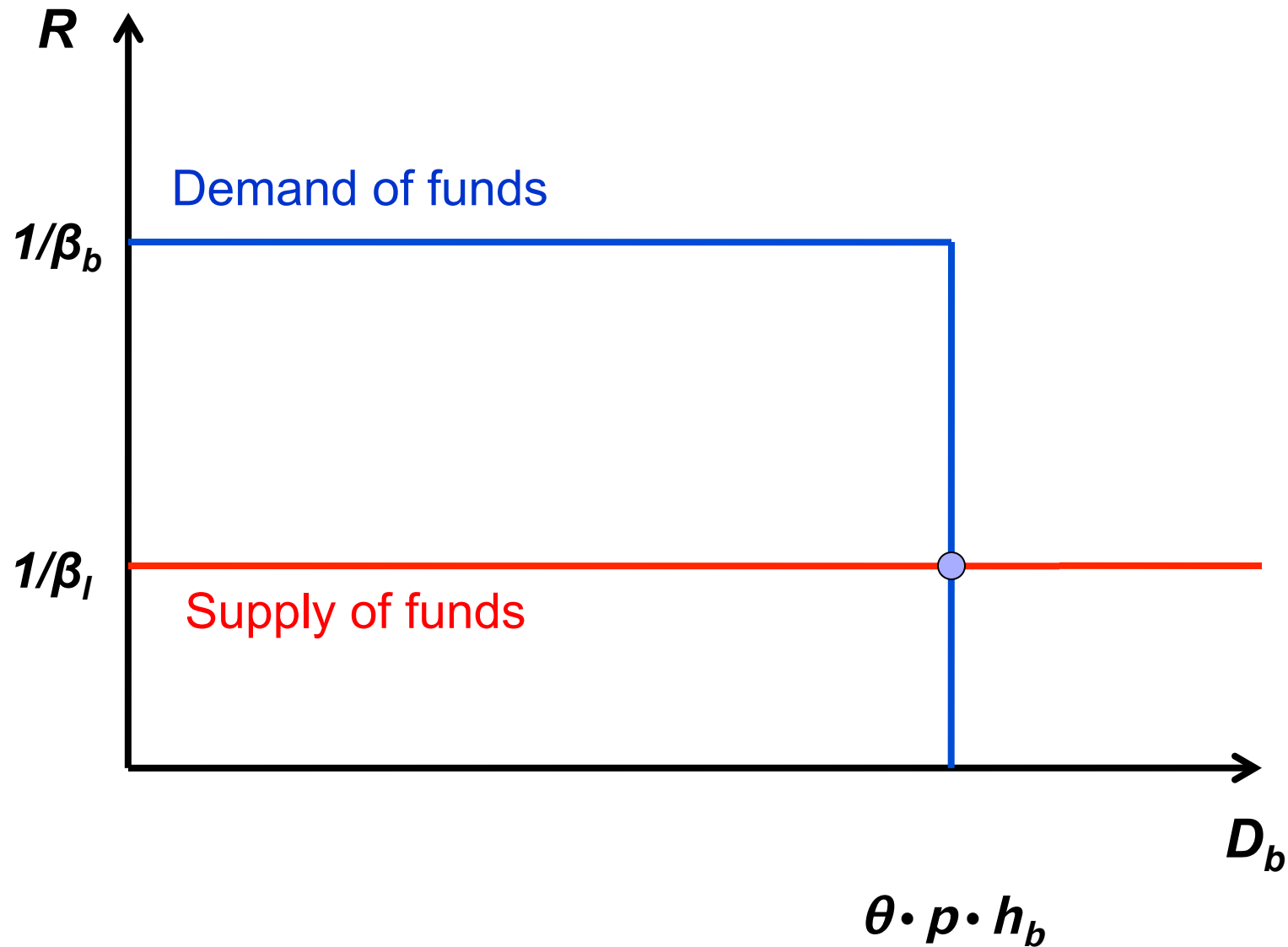
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■ Which constraint binds is

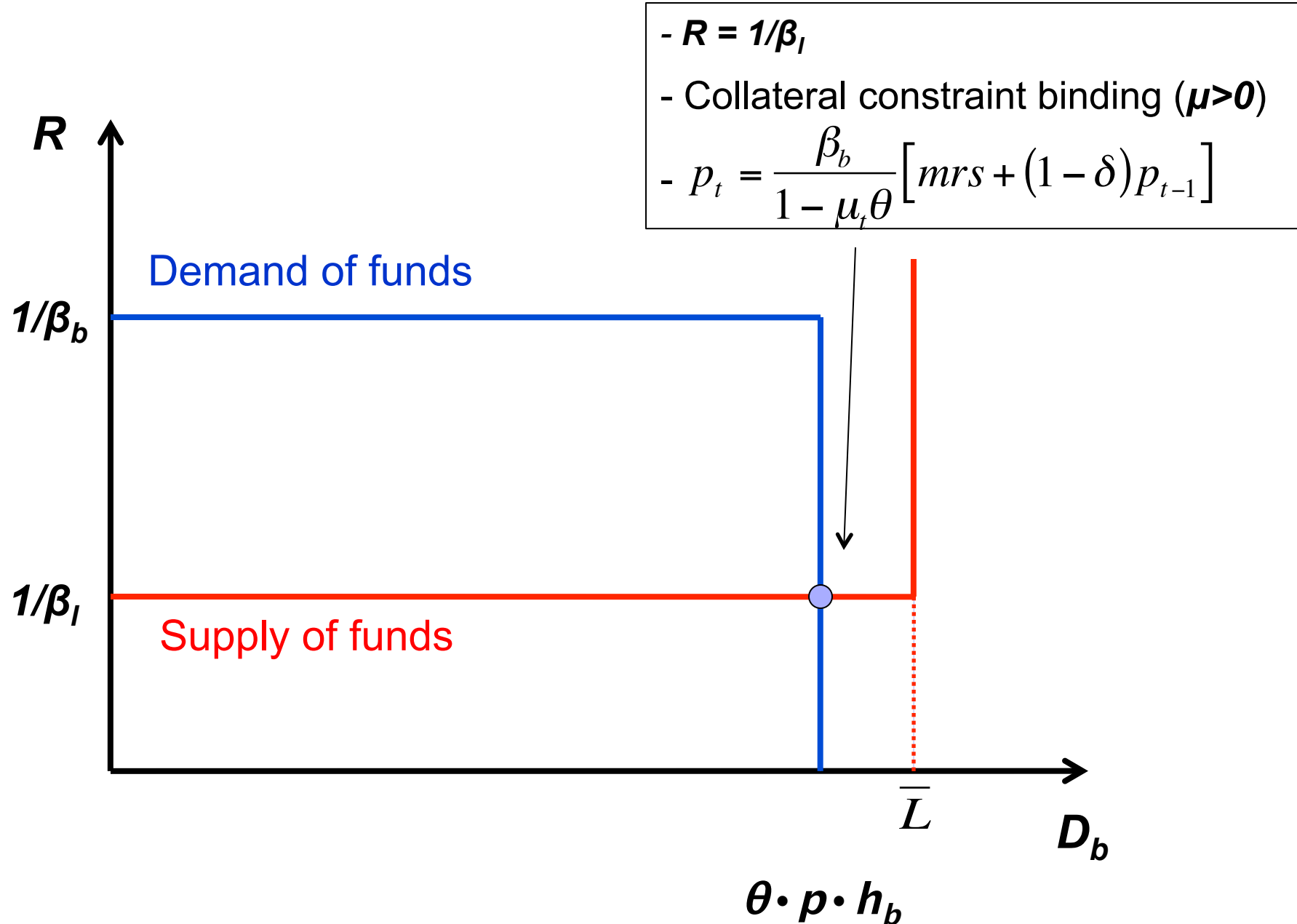
➤ exogenous: \bar{L} and θ

➤ endogenous: $p_t = \frac{\beta_b}{1 - \mu_t \theta} [mrs + (1 - \delta)p_{t-1}]$

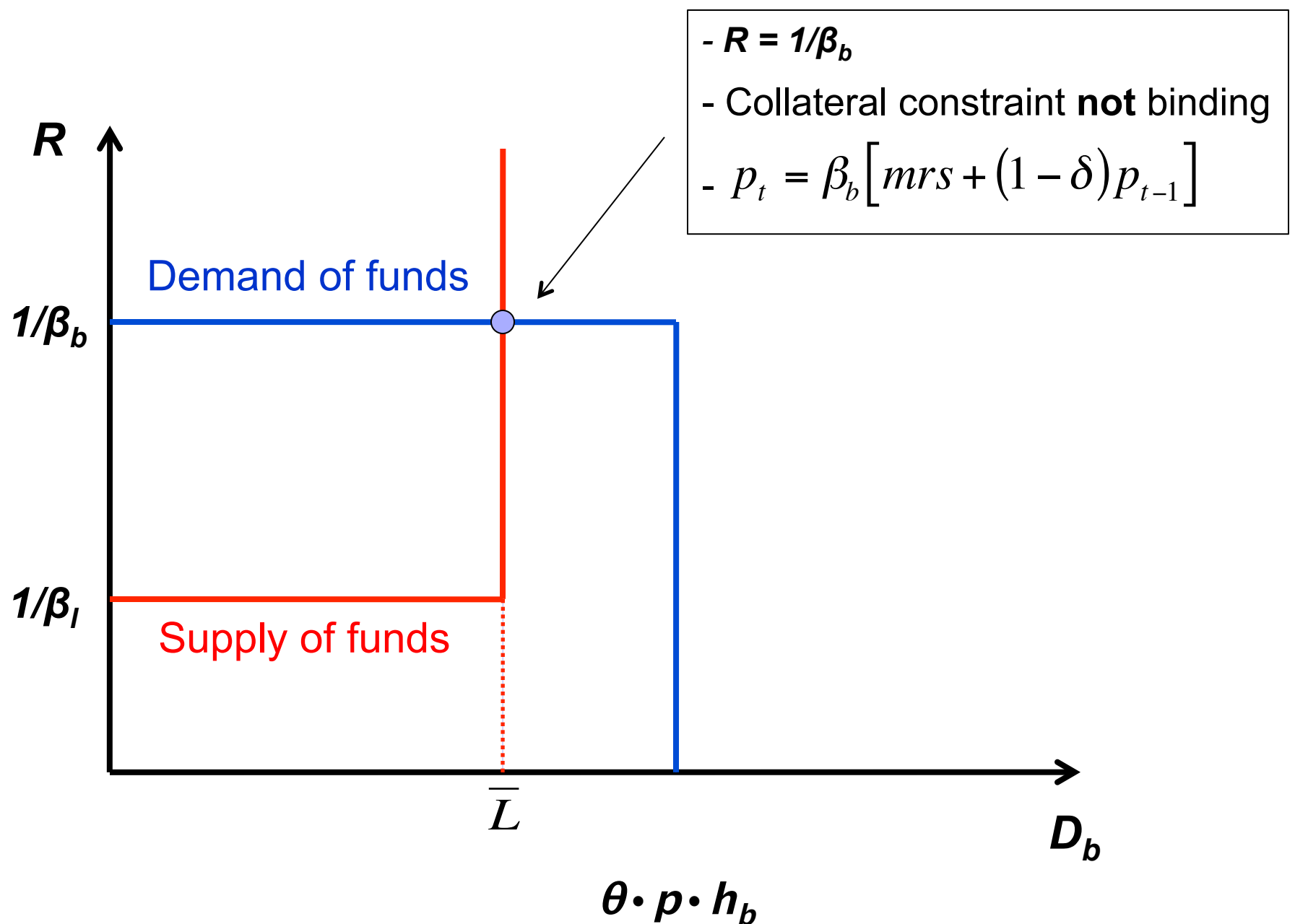
Standard model without lending constraint



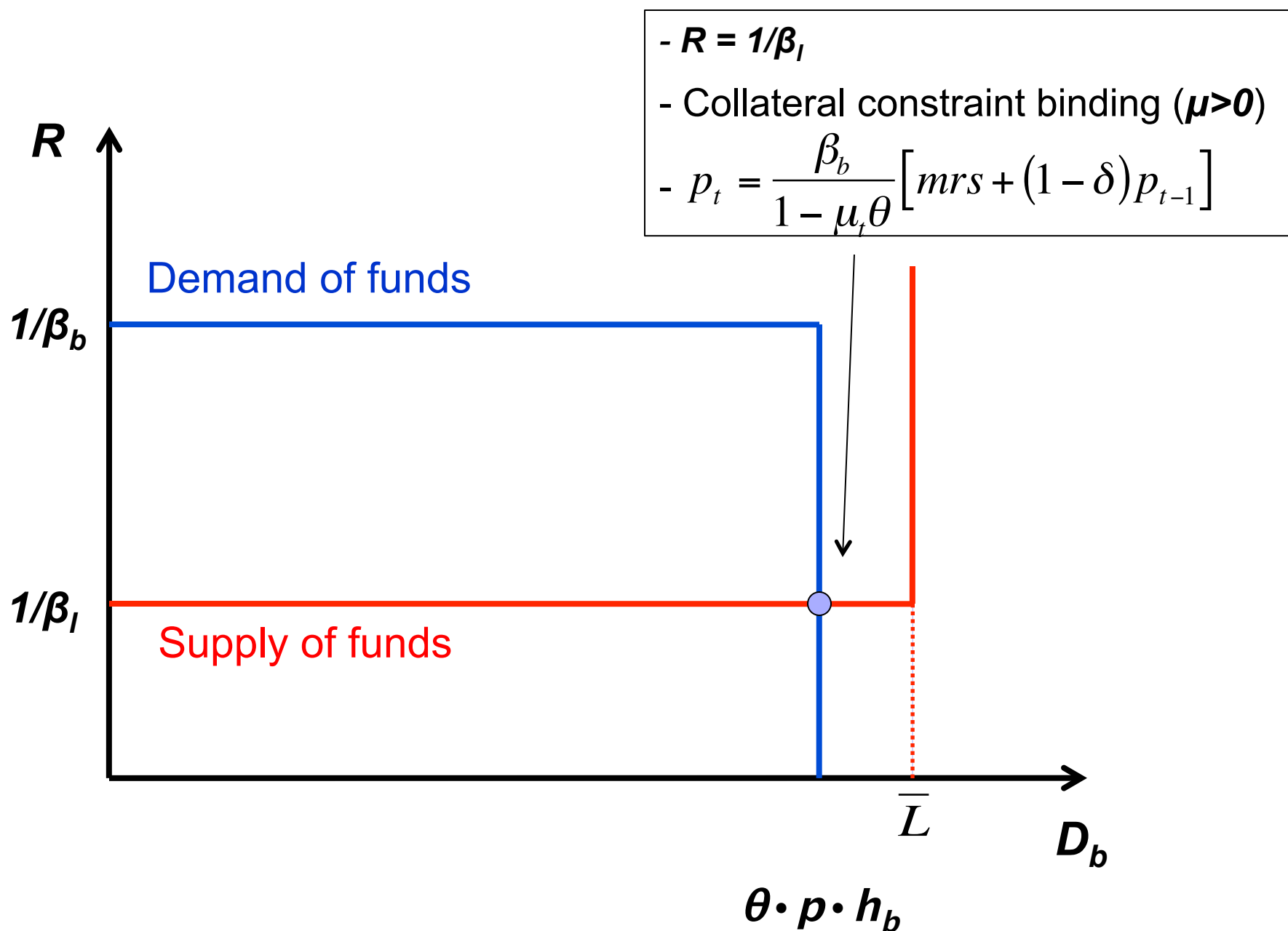
Non-binding lending constraint



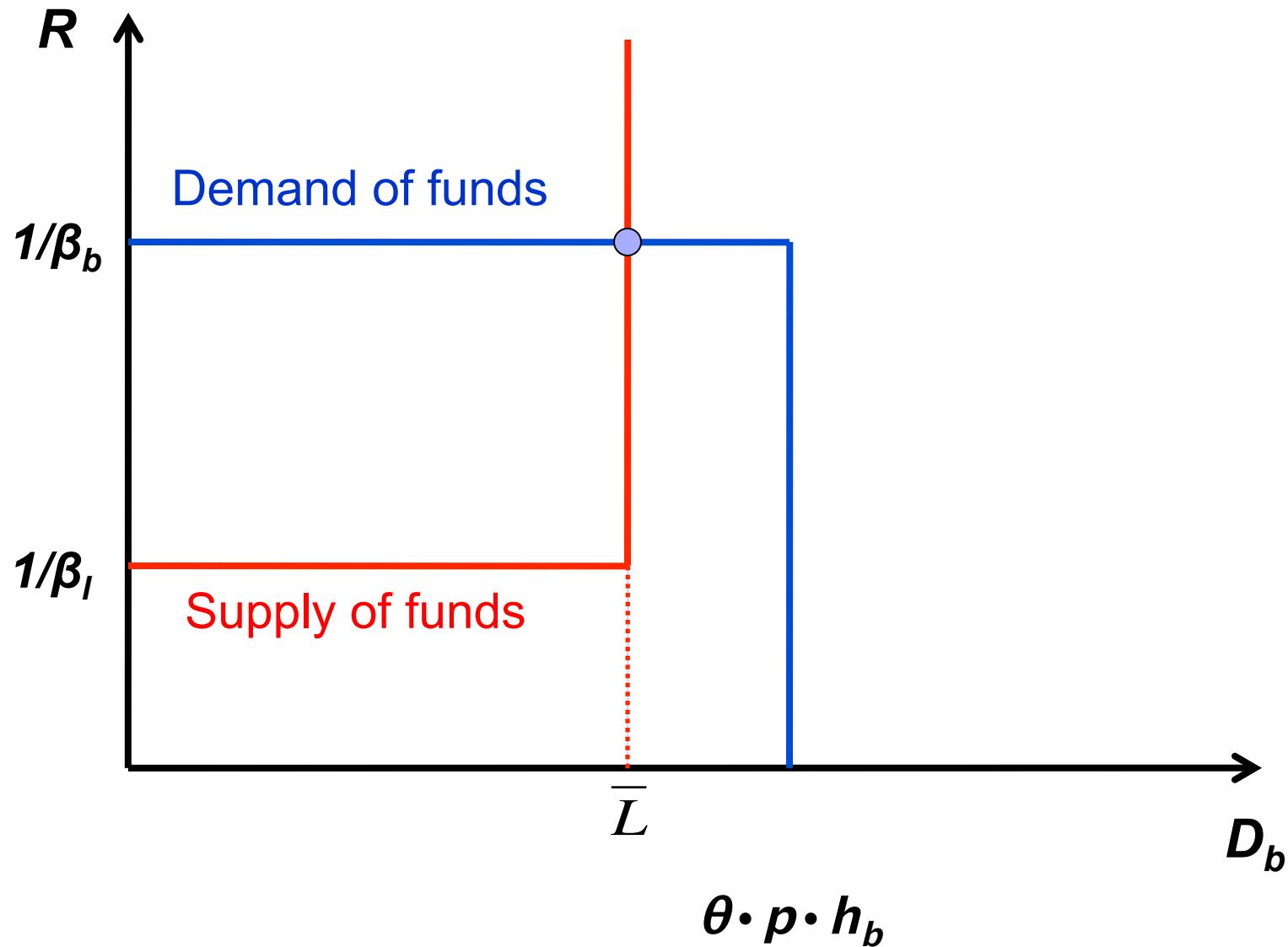
Binding lending constraint



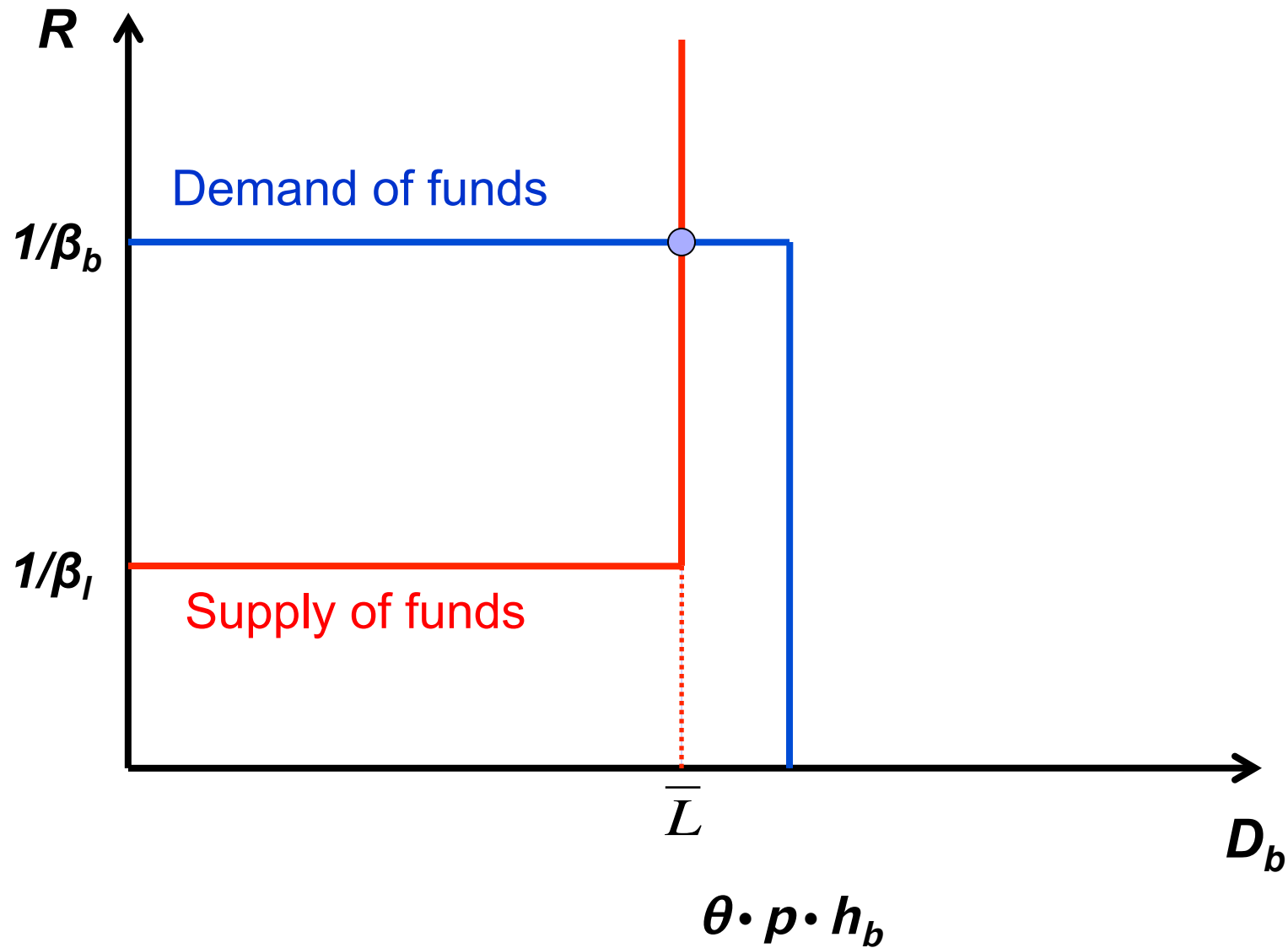
Relaxing the lending constraint



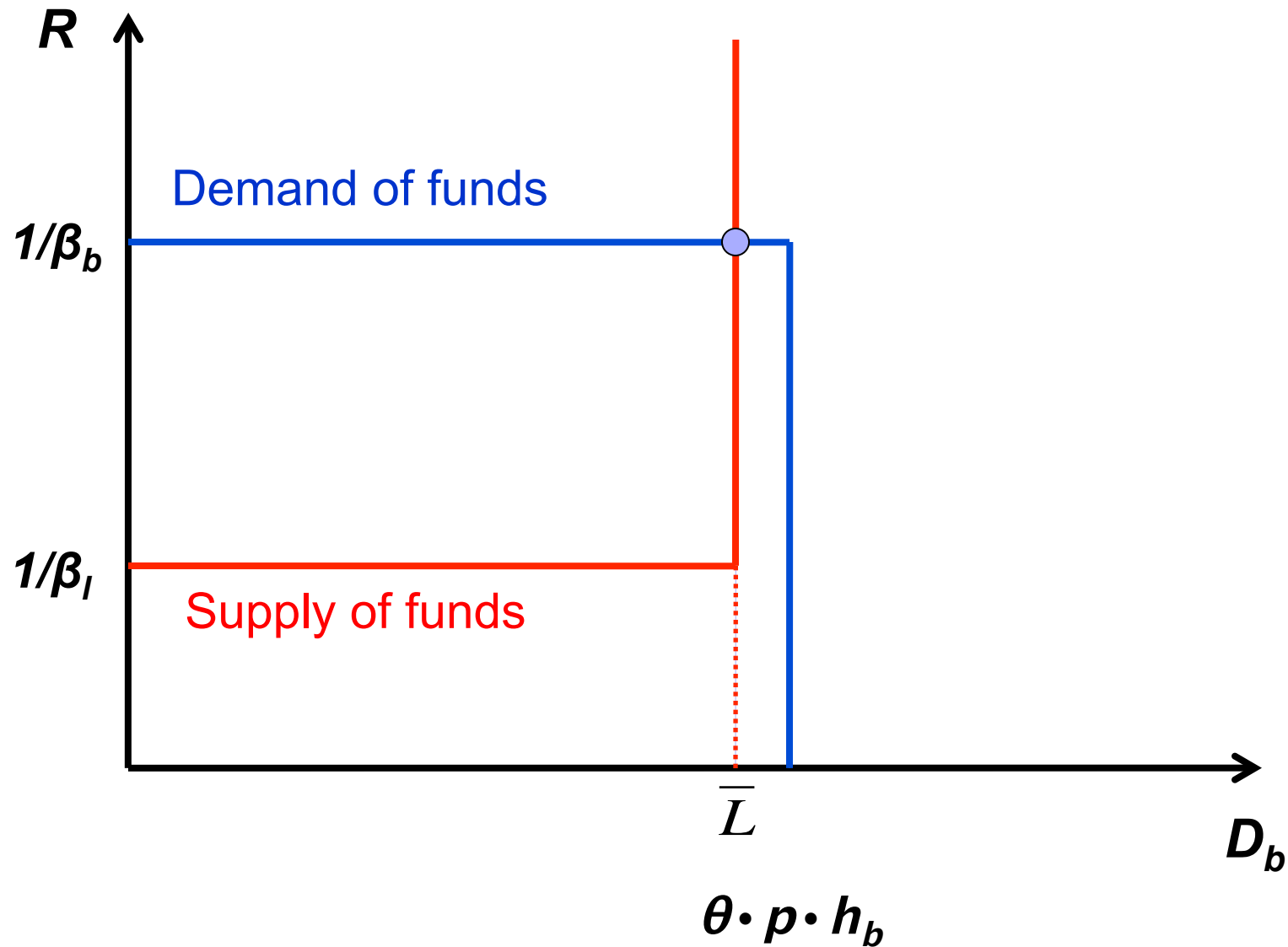
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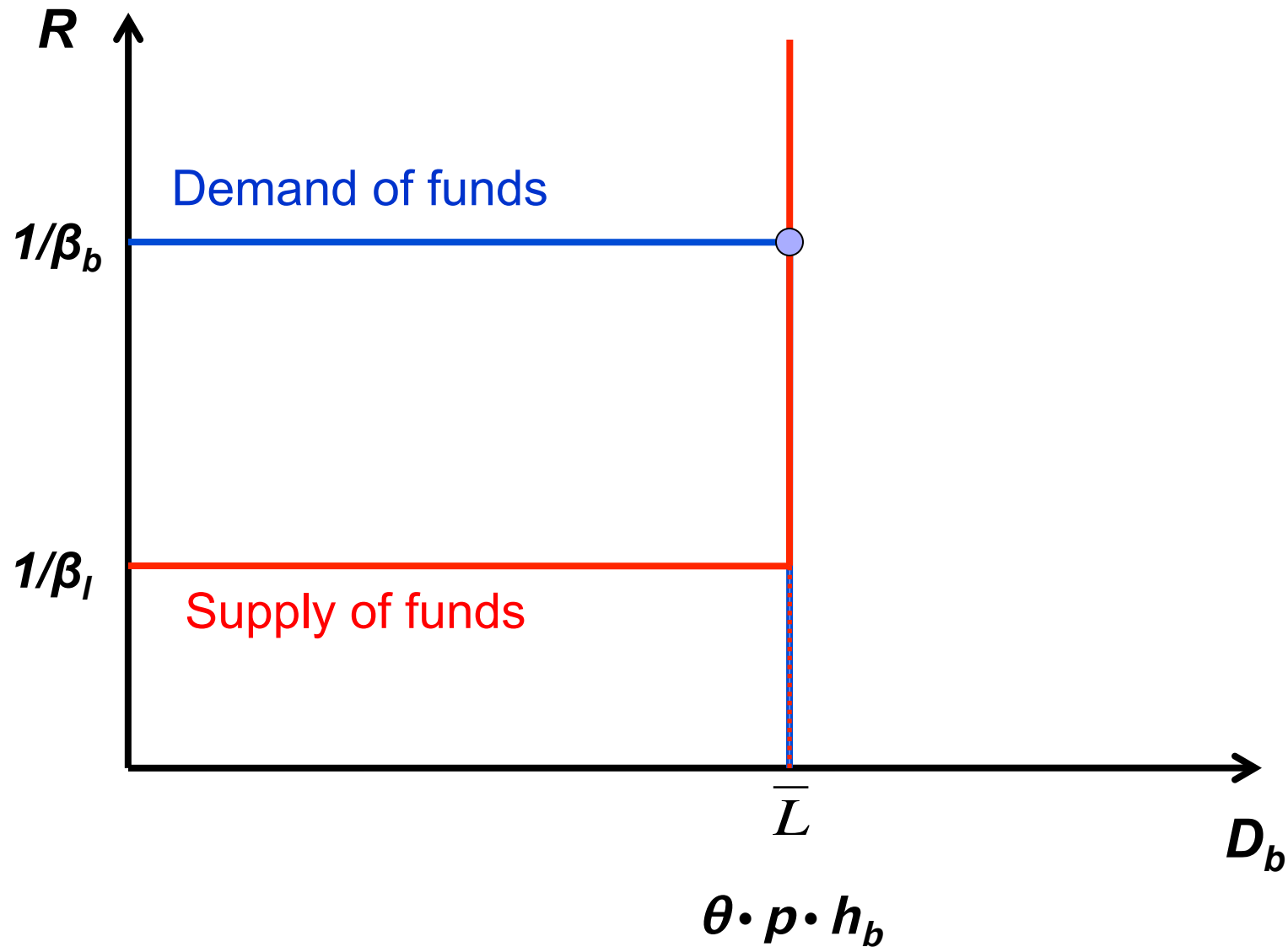
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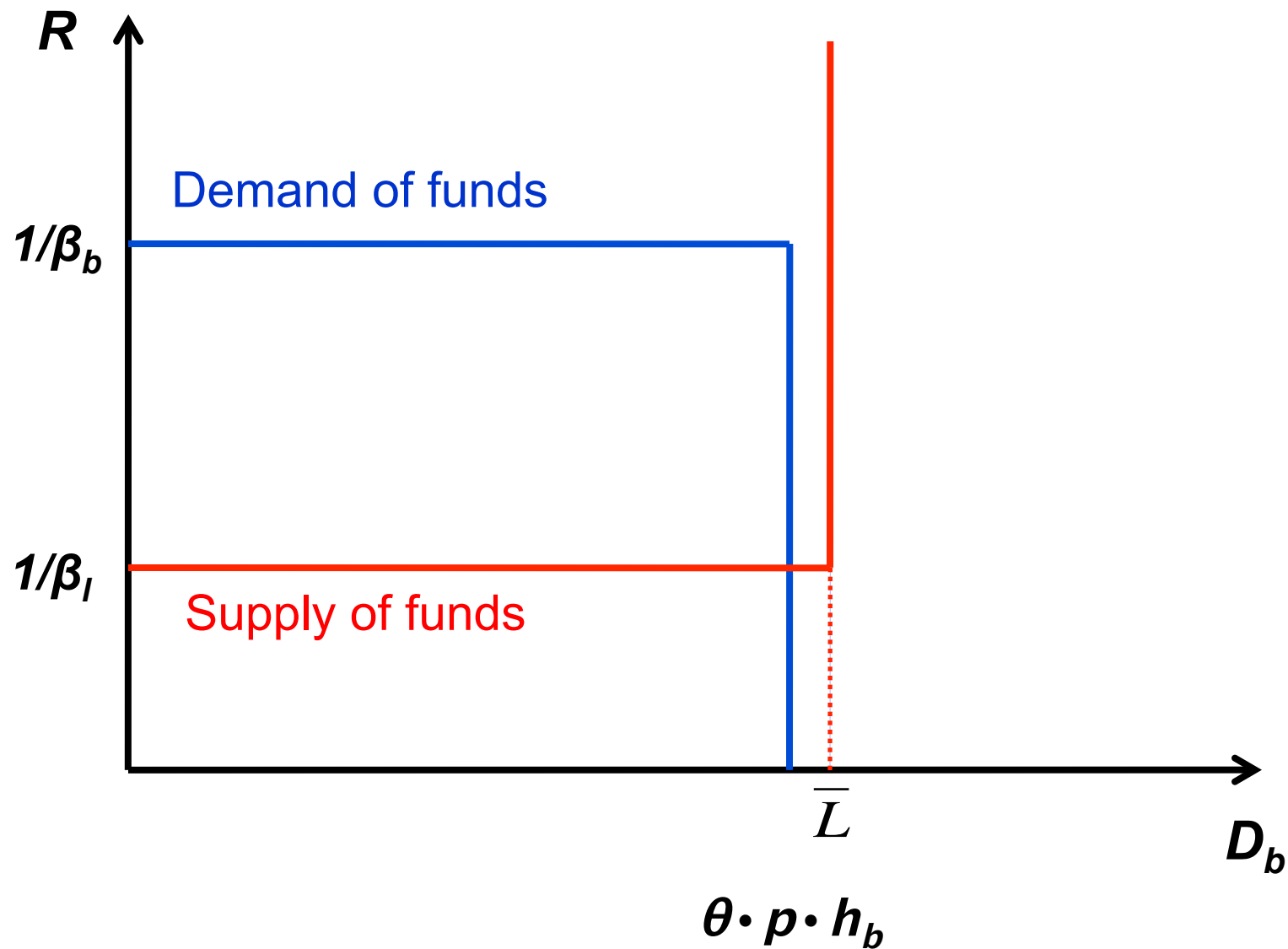
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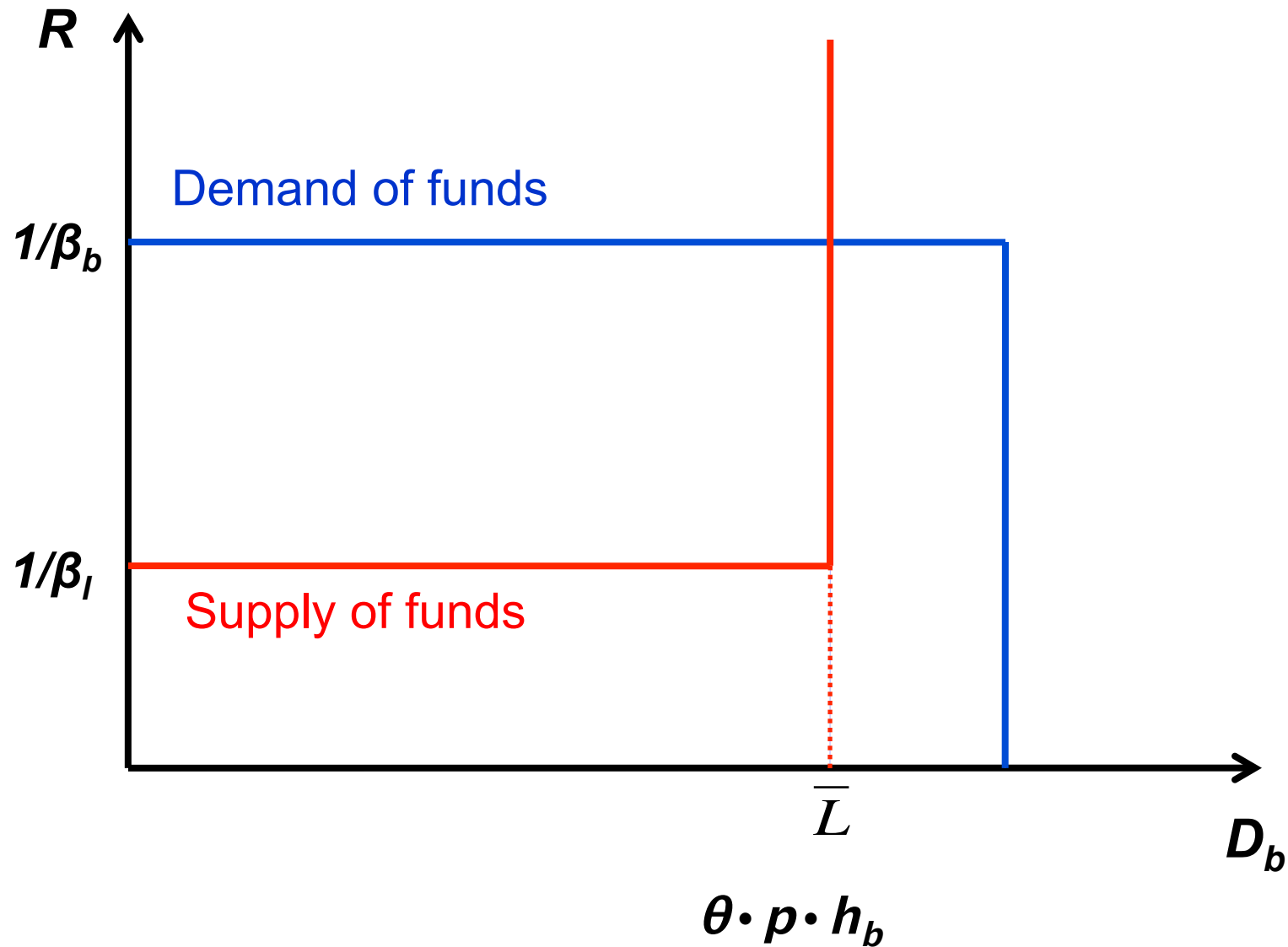
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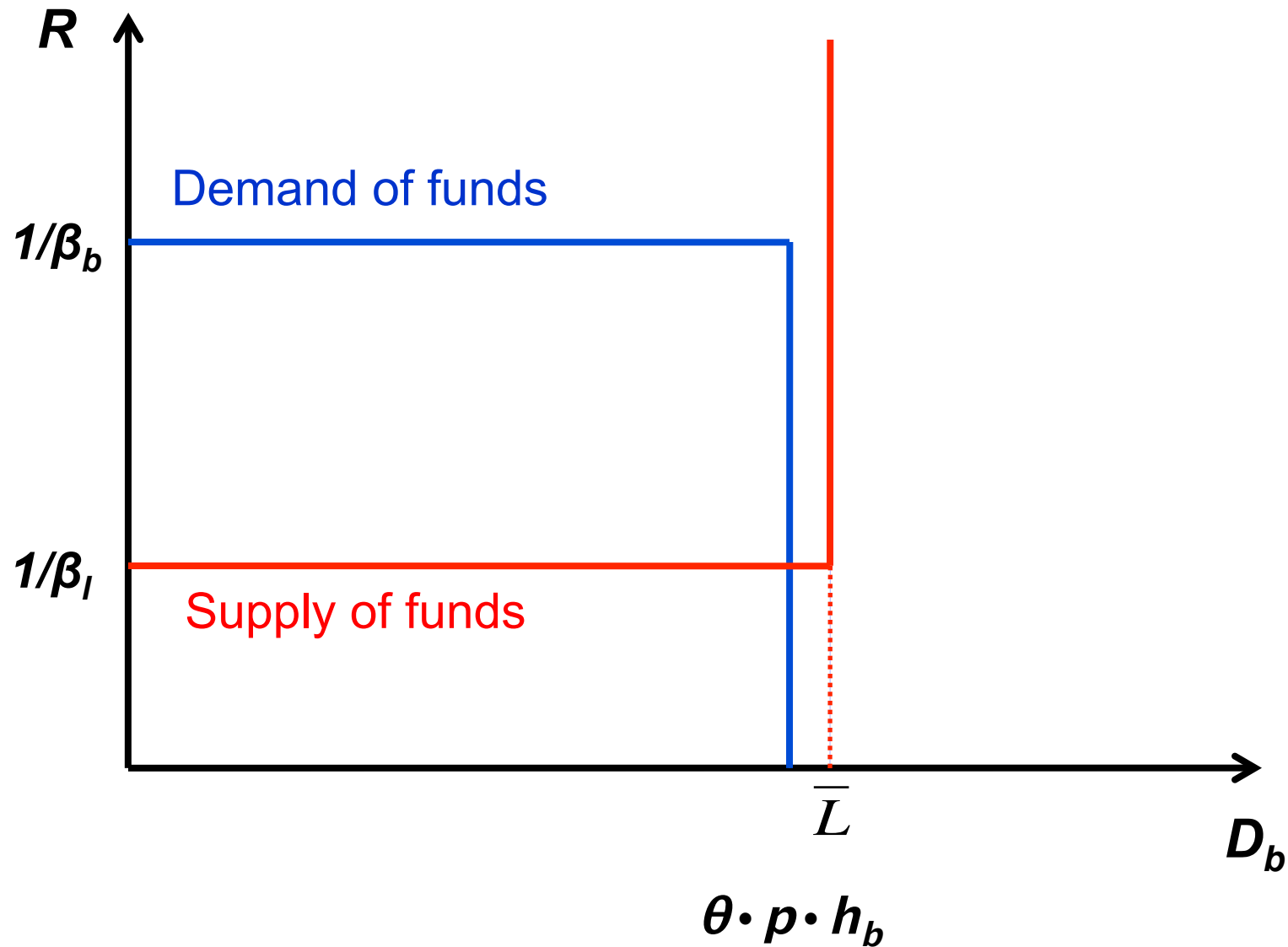
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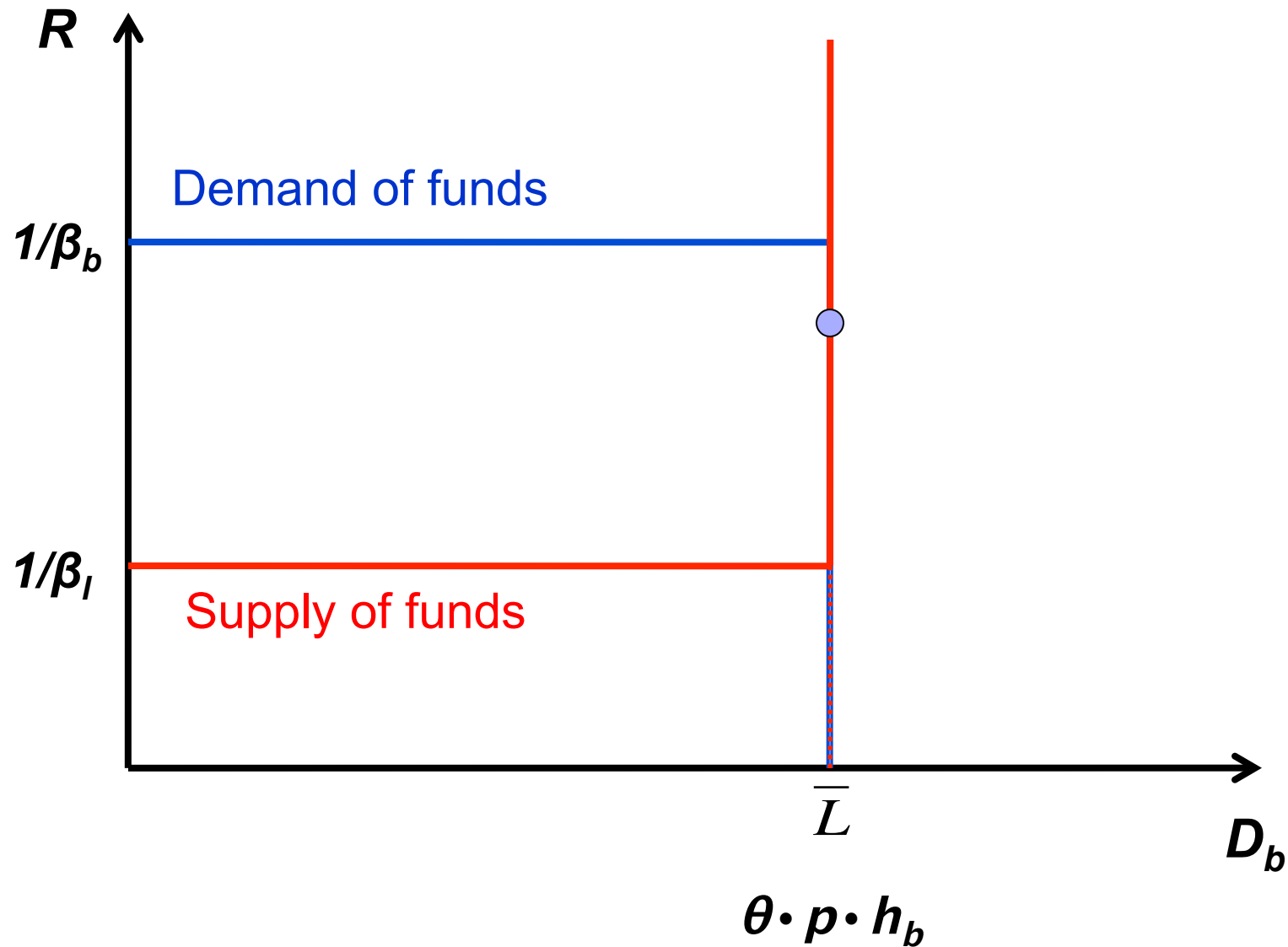
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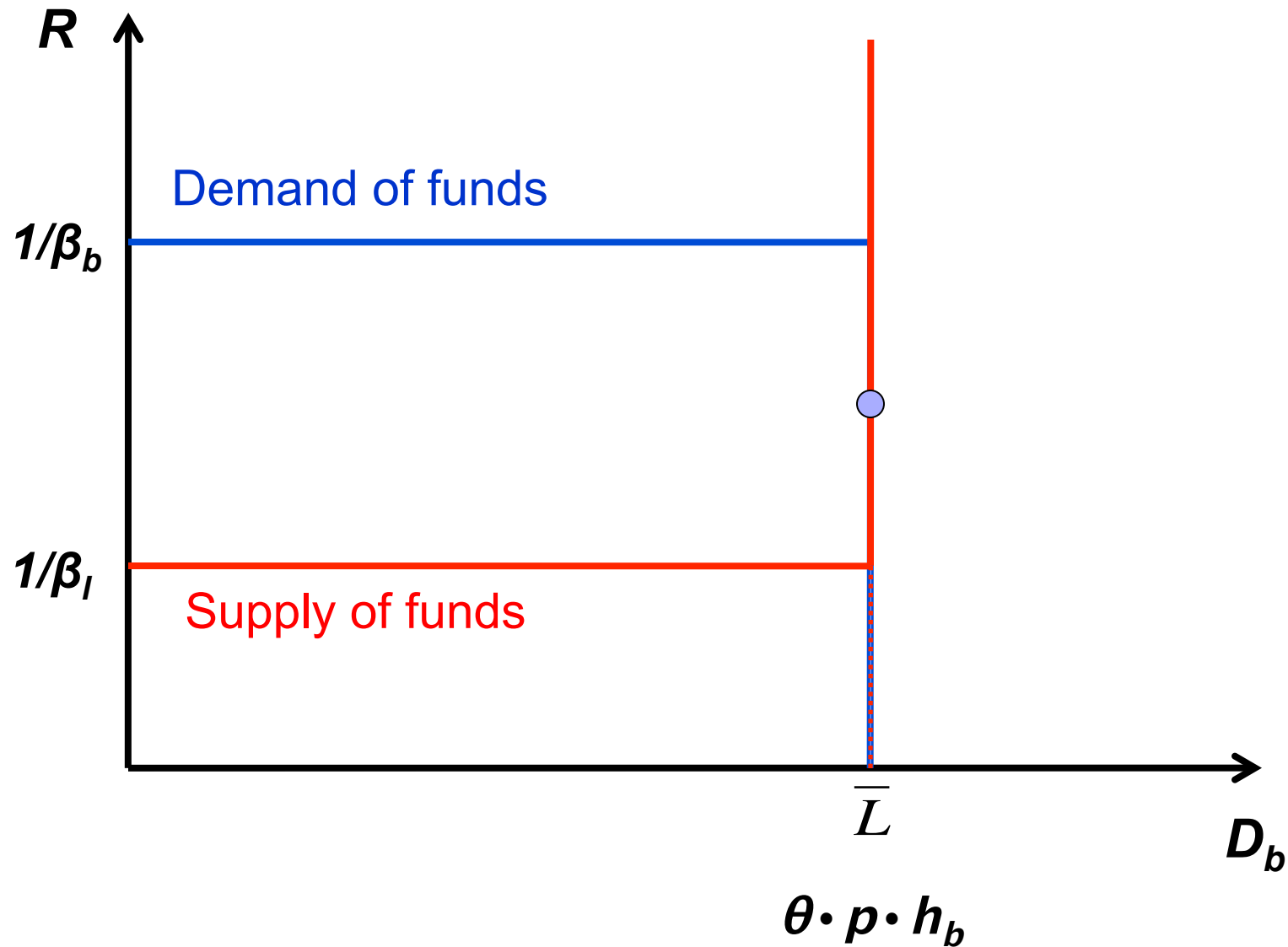
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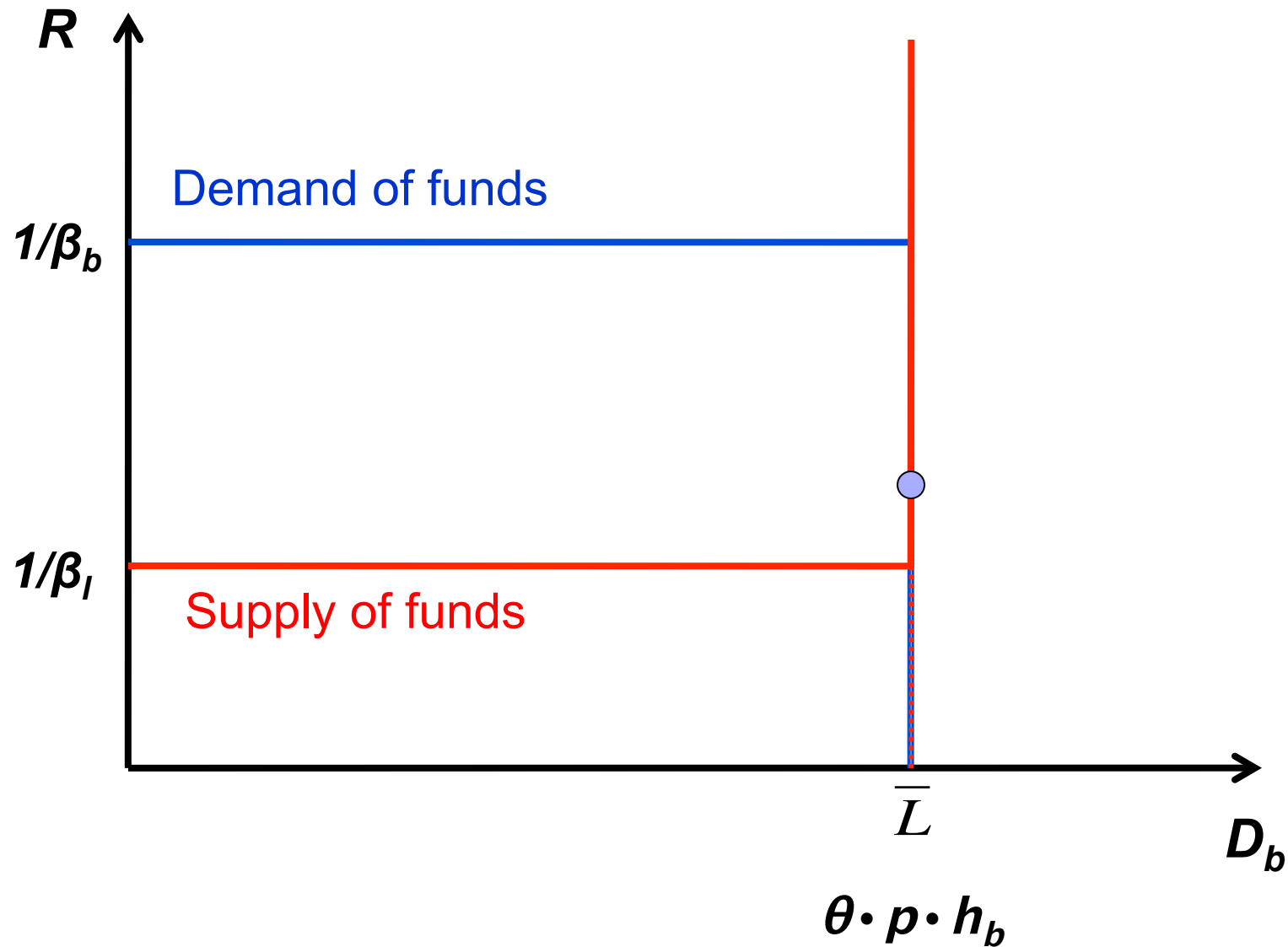
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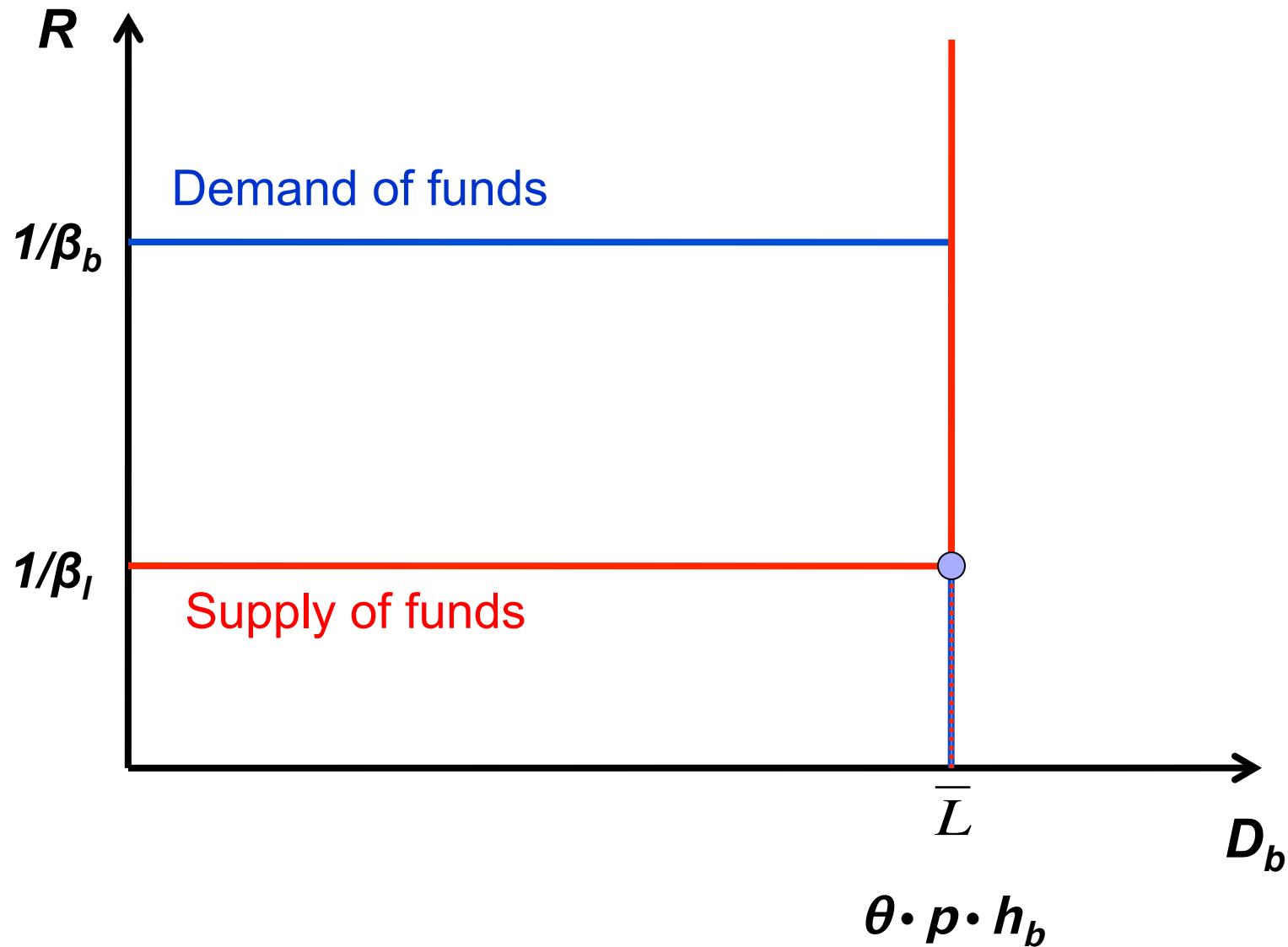
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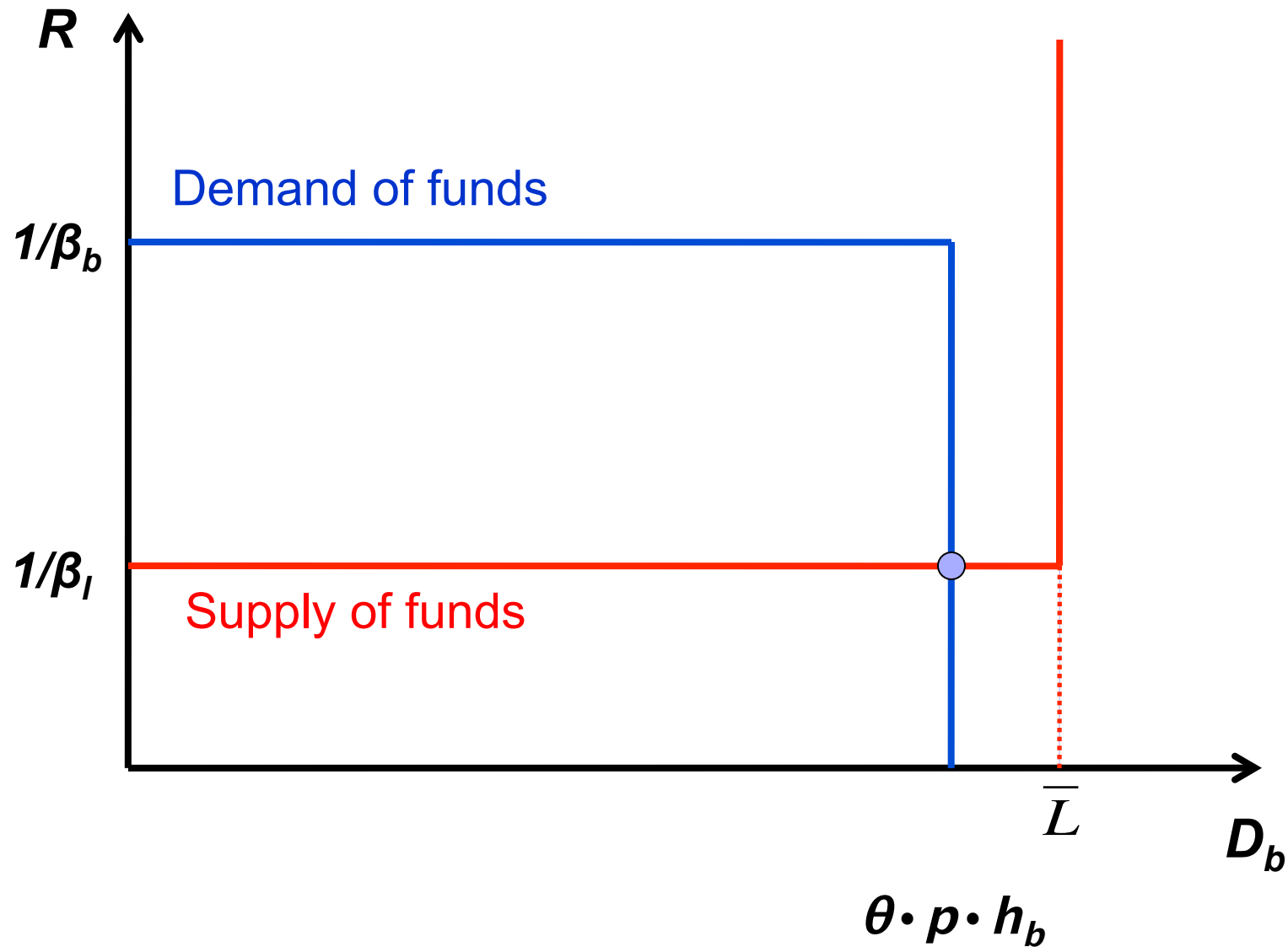
Relaxing the lending constraint



Relaxing the lending constraint



Relaxing the lending constraint



- Model
- Parameterization
- Quantitative results
 - Expansion in credit supply
 - Loosening of collateral requirements

Parameter values

- Calibrate parameters to match 1990-2000
- Micro data: Survey of Consumer Finances
 - Triennial detailed survey data of US households' balance sheet

Taking the model to the data: Challenges

- ① In the data, many HHs have both mortgages and assets
 - Identify borrowers as agents with little liquid financial assets in SCF
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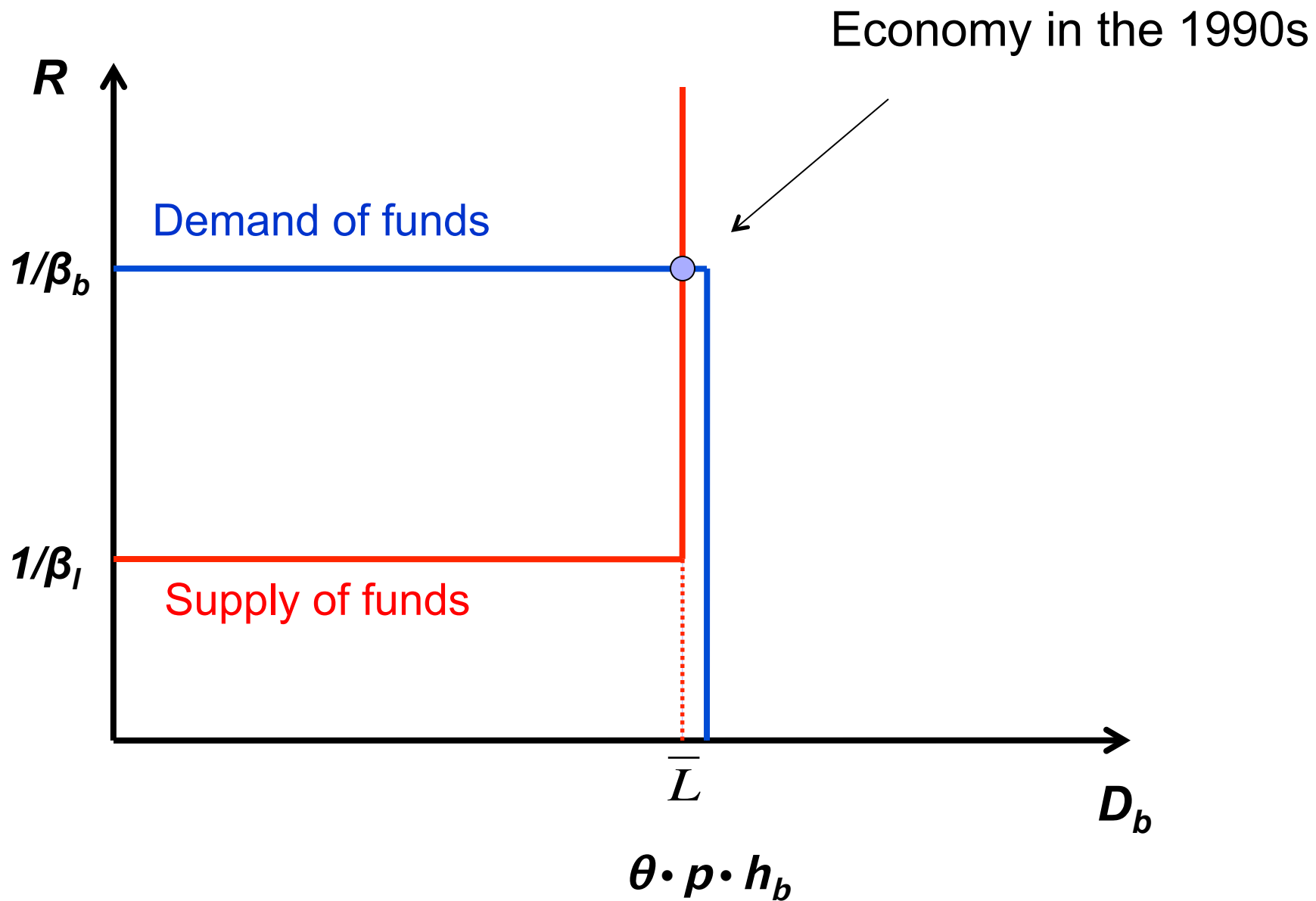
$$D_{b,t} \leq \theta p_t d_t$$

$$d_t = (1 - \rho)d_{t-1} + h_{b,t+1} - (1 - \delta)h_{b,t}$$

➤ $\rho = \delta$ ➔ $D_{b,t} \leq \theta p_t h_{b,t+1}$

➤ $\rho > \delta$ ➔ HHs accumulate equity over time

Calibration



Quarterly calibration

Parameter	Value	Source/Target
Discount factor borrower (β_b)	0.9879	5% real mortgage rate
Discount factor lender (β_l)	0.9938	<ul style="list-style-type: none">• 2.5% decline in real mortgage rates• ~ Krusell and Smith (1998)
Depreciation (δ)	0.003	Fixed assets tables
Maximum LTV (θ)	0.80	<ul style="list-style-type: none">• Median LTV of new or recently refinanced mortgages of liquidity constrained HHs in the SCF• Evidence from Duca et al. (2012)
Amortization (ρ)	0.0056	<ul style="list-style-type: none">• Collateral constraint close to binding• Mortgage-to-RE ratio of liquidity constrained HHs in the SCF (43%)

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Experiment 1: Loosening of lending constraints

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 - Securitization and tranching → pension and money market funds gain access to mortgage lending
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 - SIVs allow banks to move assets off balance sheets
 - not counting them towards risk-weighted capital
 - Around 2003 regulators disregarded recommendations to apply to them the same risk-weighted capital requirements as other types of assets, thereby facilitating massive regulatory arbitrage (Achrya and Schnabel, 2009)
 - Investment banks use internal models for risk management that reduce capital requirements

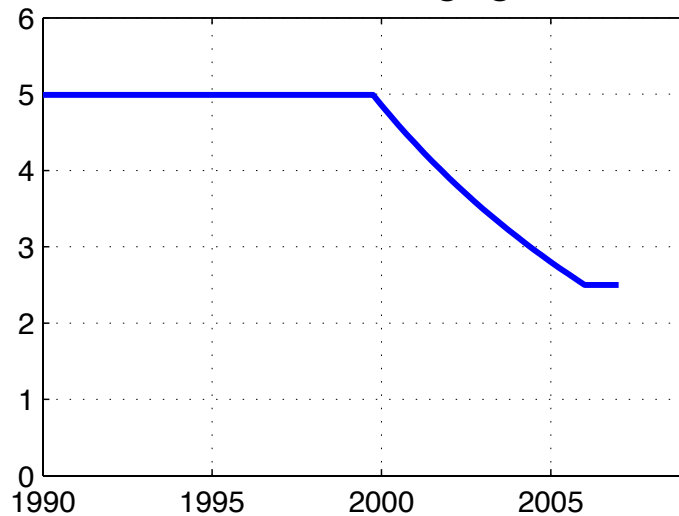
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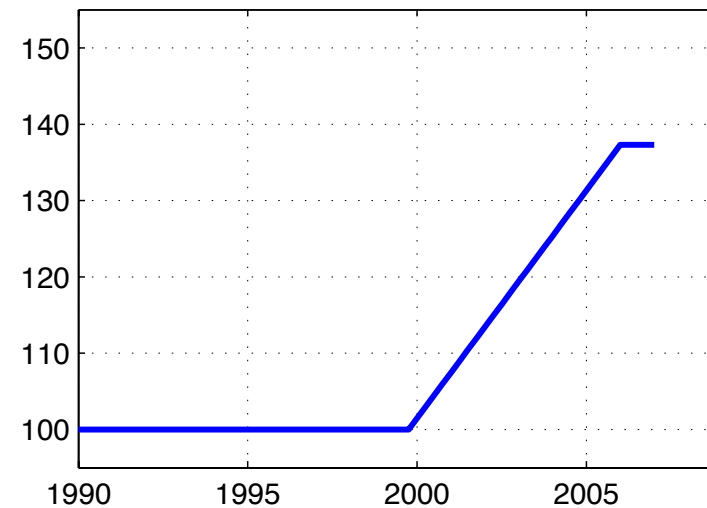
- Experiment timed to “complete” the transition in 2006

Experiment 1: Loosening of lending constraints

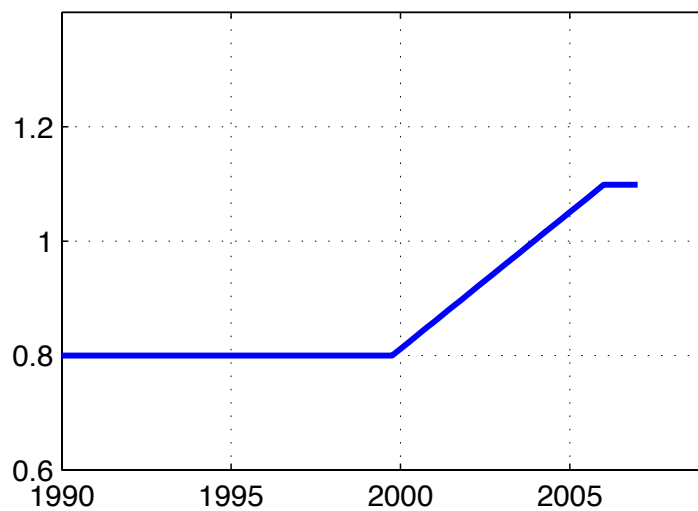
Annualized mortgage rate



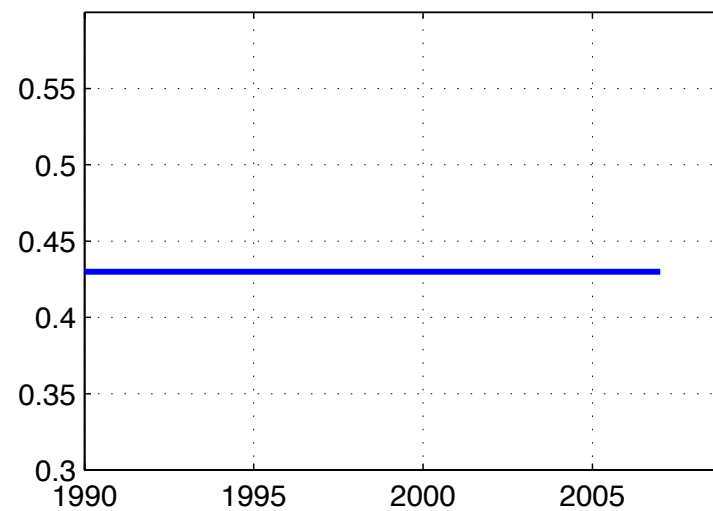
House prices



Debt-to-GDP ratio



Debt-to-real estate ratio

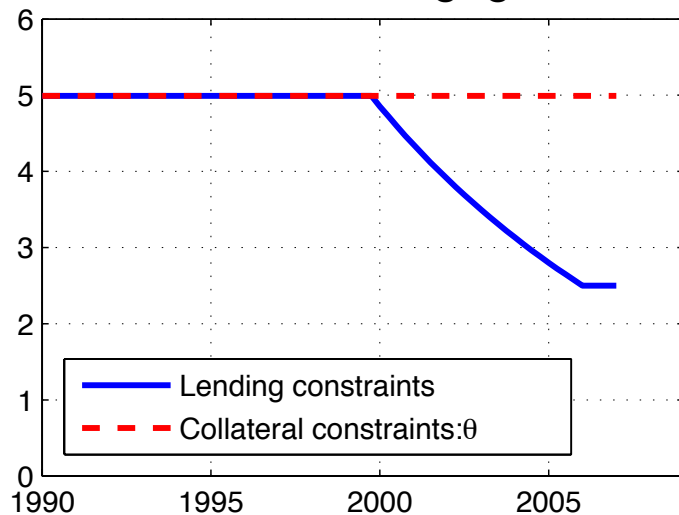


Experiment 2: Loosening of collateral requirements

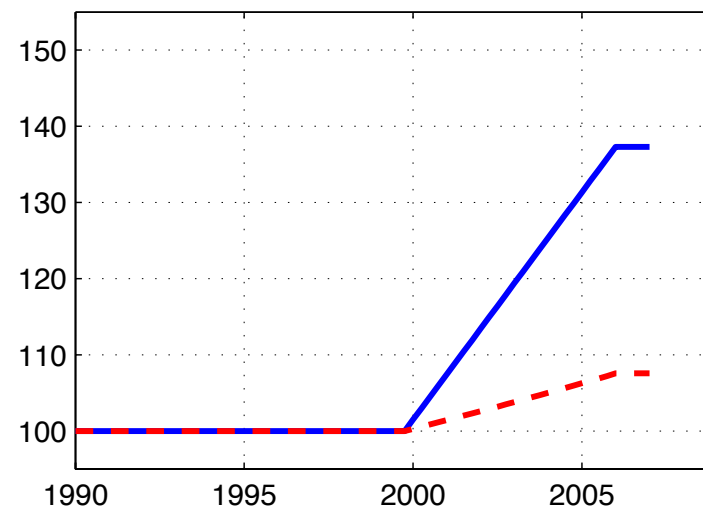
- Standard model without lending constraints
- Simulate the effects of a gradual relaxation of collateral requirements
 - θ from 0.8 to 1.02, to match the increase in HH debt of experiment 1
 - ρ from 0.0056 to 0.0041, to match the increase in HH debt of experiment 1

Experiment 2: Loosening of collateral requirements (θ)

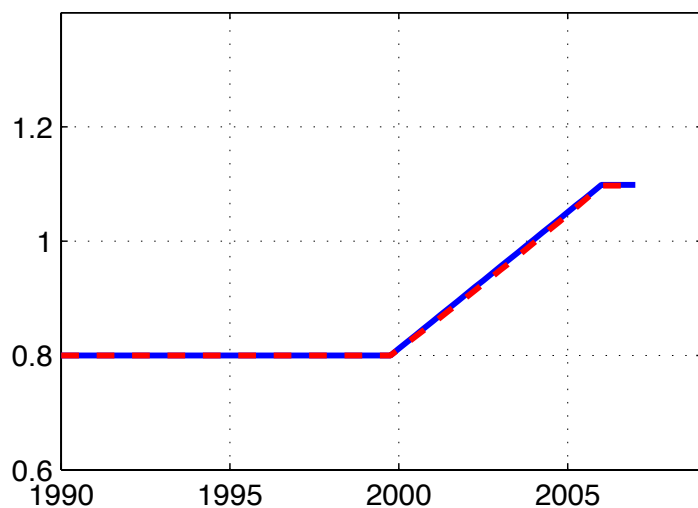
Annualized mortgage rate



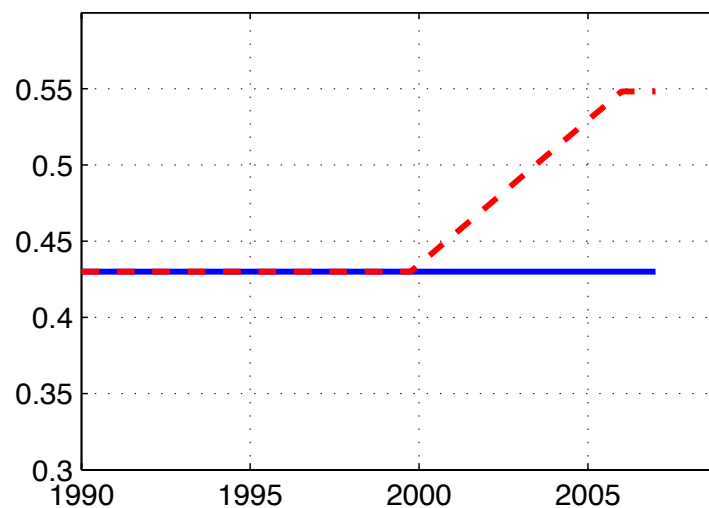
House prices



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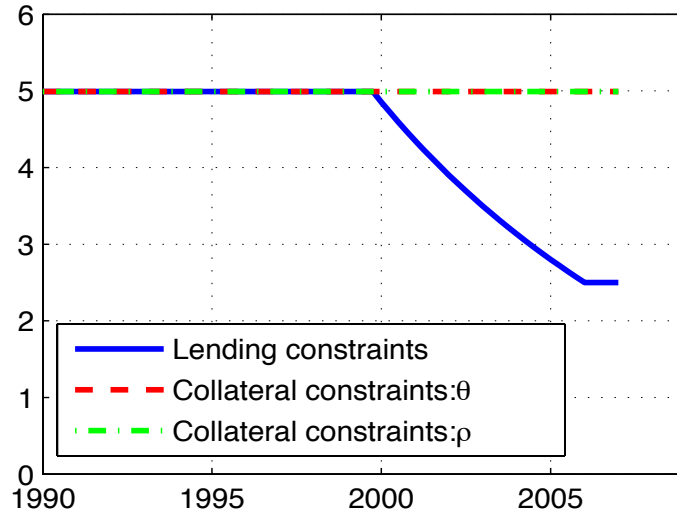


Debt-to-real estate ratio

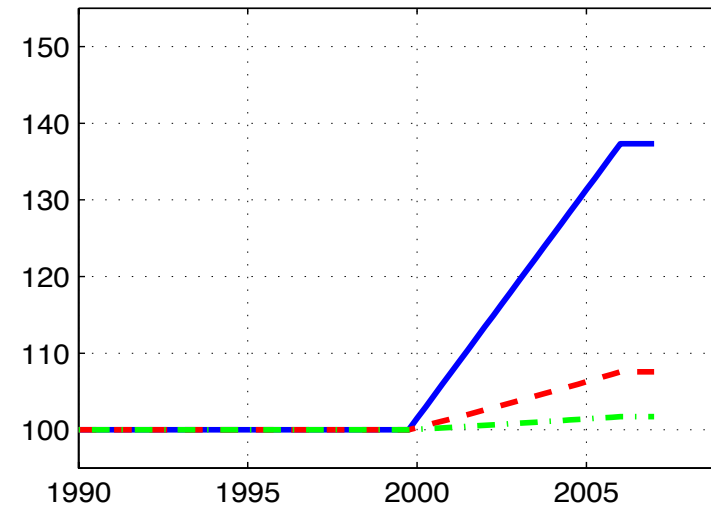


Experiment 2: Loosening of collateral requirements (ρ)

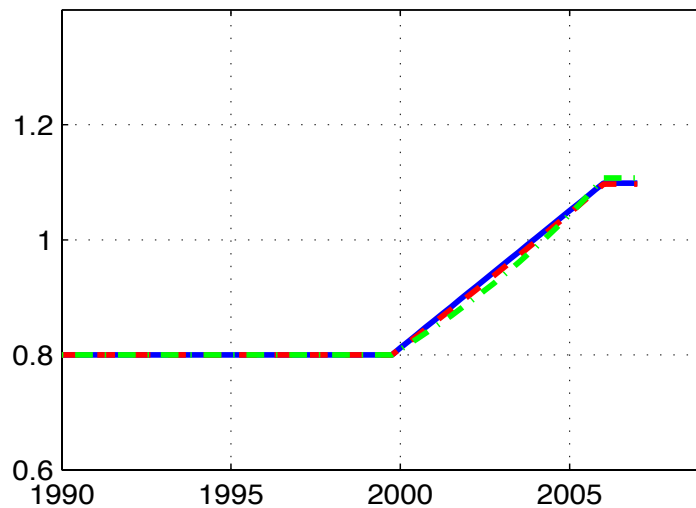
Annualized mortgage rate



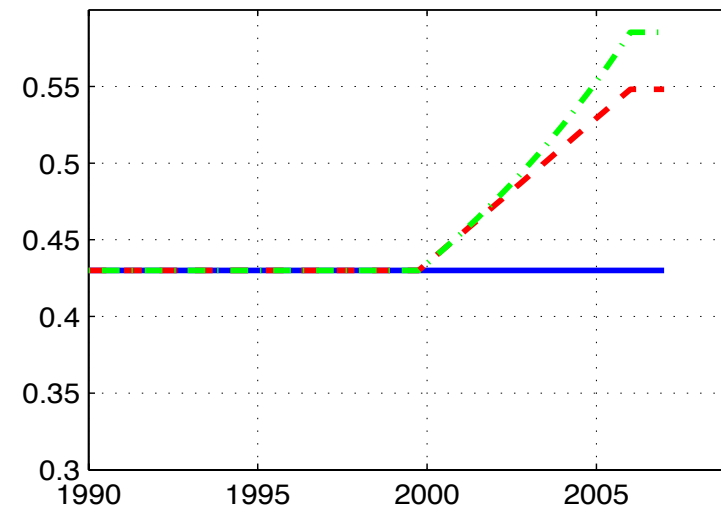
House prices



Debt-to-GDP ratio



Debt-to-real estate ratio



Conclusions

- Increased capacity to lend → outward shift in supply of credit
- Explains a large fraction
 - boom in house prices
 - boom in HH debt
 - decline in mortgage rates
 - constant debt-to-collateral ratio
- Loosening of collateral requirements not an important driving force. At odds with the behavior of
 - mortgage rates
 - house prices
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To do...

- Robustness with a larger scale model
- Role of monetary policy
- Micro-foundation of the constraint

The story in words

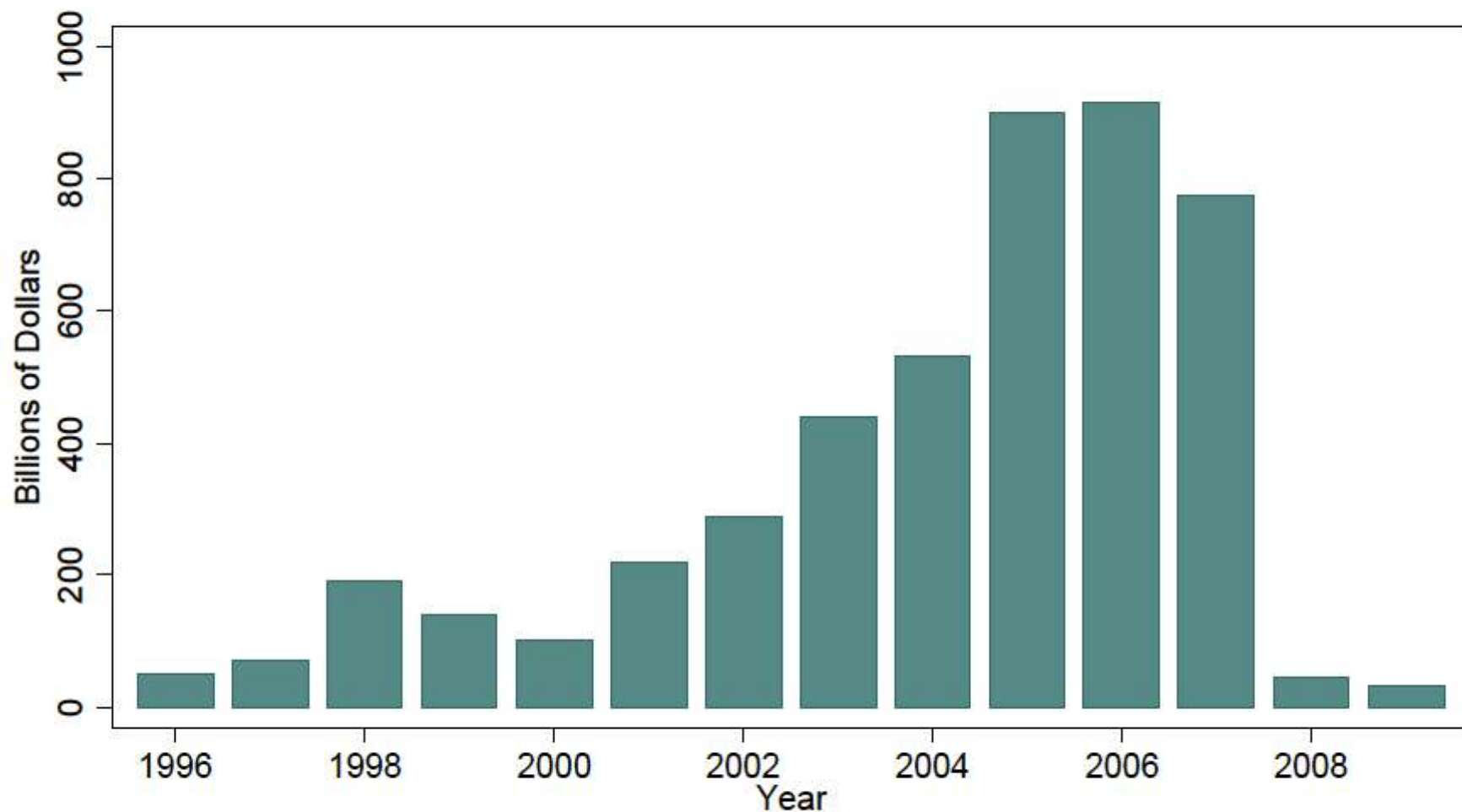
- The apparent safety of the financial sector's collective balance sheet was attributable to the fact that the biggest global banks had amassed vast quantities of AAA-rated ("safe") tranches backed by residential mortgages. These assets had historically been safer than similarly rated corporate loans. This was the principal reason behind their lower risk charge (by a factor of five) under the Basel capital requirements that were in place for European banks, for allowing the US commercial banks to park these in off-balance sheet vehicles with little capital, and letting investment banks use internal models for risk management that largely ignored the tail risk of a secular housing collapse.

Risk-weighted capital ratio

- In the United States, depository institutions are subject to risk-based capital guidelines issued by the Fed. These guidelines are used to evaluate capital adequacy based primarily on the perceived credit risk associated with balance sheet assets, as well as certain off-balance sheet exposures such as unfunded loan commitments, letters of credit, and derivatives and foreign exchange contracts. The risk-based capital guidelines are supplemented by a leverage ratio requirement
- To be adequately (well) capitalized under federal bank regulatory agency definitions, a bank holding company must have a Tier-1 capital ratio of at least 4% (6%), a combined Tier-1 and Tier-2 capital ratio of at least 8% (10%), and a leverage ratio of at least 4% (5%)

Non-agency MBSs (Mayer)

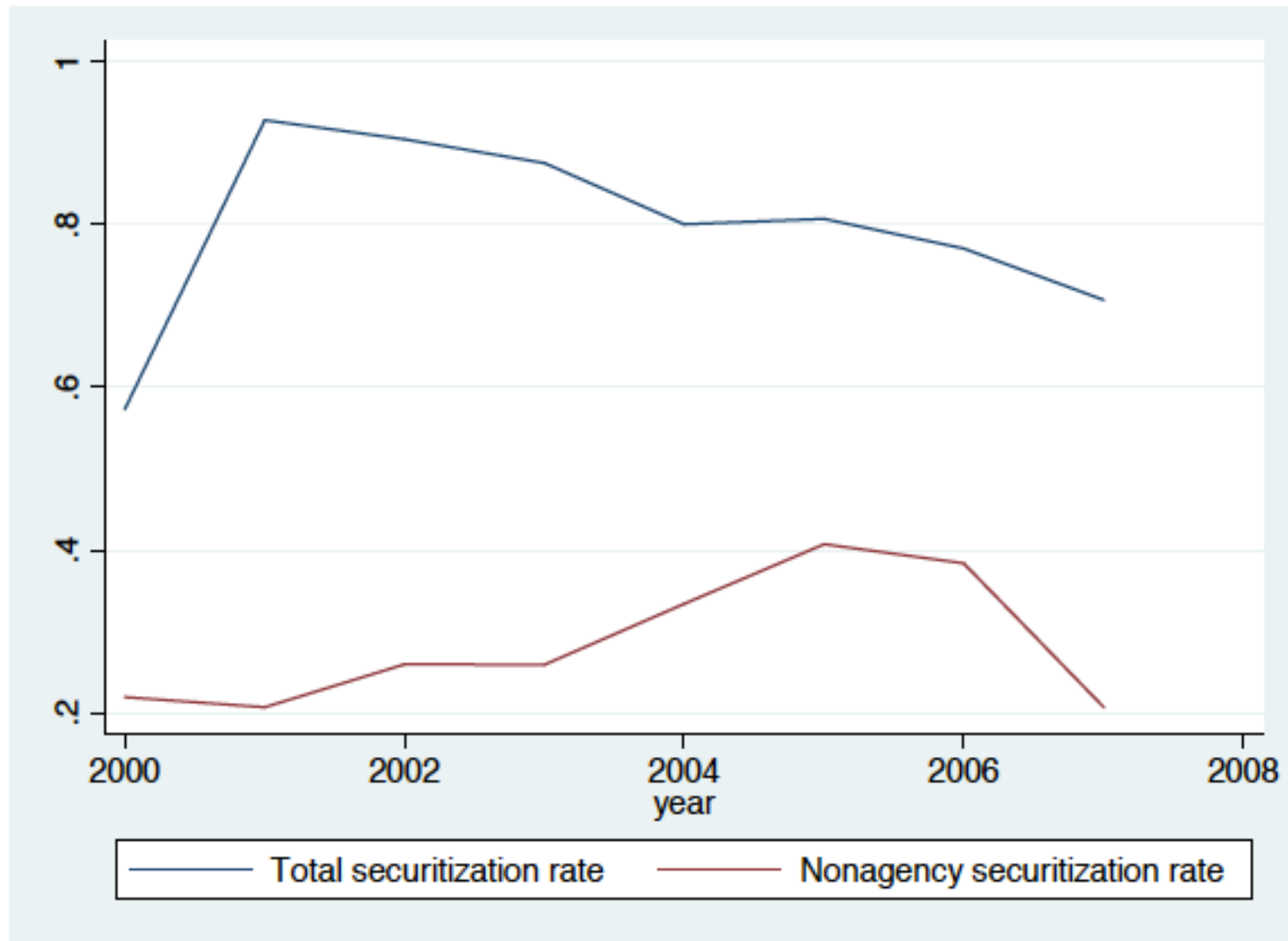
Issuance of Non-Agency Mortgage-Backed Securities



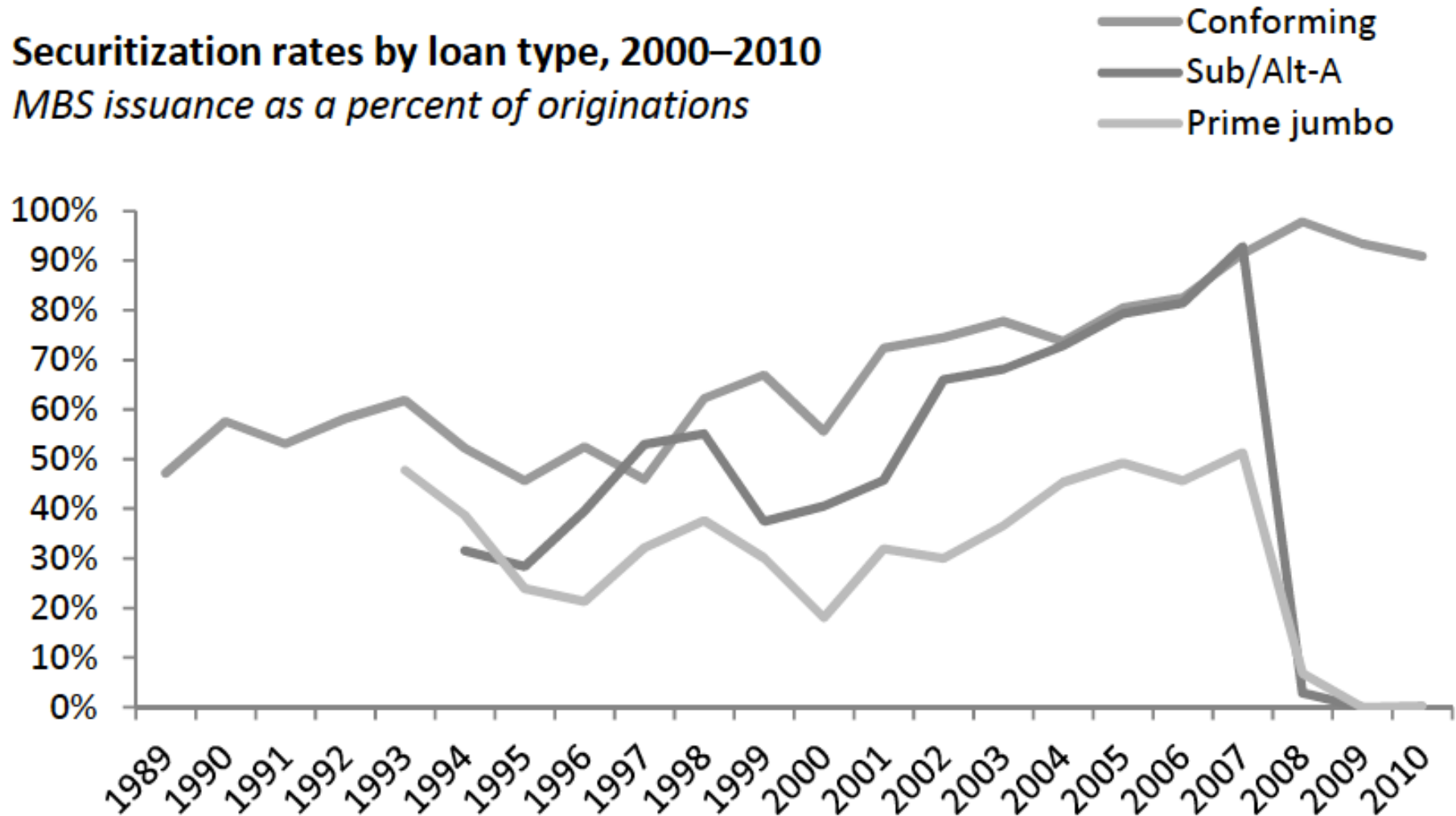
Gross Non-Agency MBS Issuance by Year (Includes CMBS)
Current as of 2010 Q1
Source: SIFMA

Share of securitized mortgages (Krainer and Laderman, 2011)

Figure 2: Securitization by Year



Securitization rates (Simkovic, 2013)



Source: Inside Mortgage Finance, 2011 Mortgage Market Statistical Annual Vol. 2, pg. 3–6.