Credit supply and the housing boom

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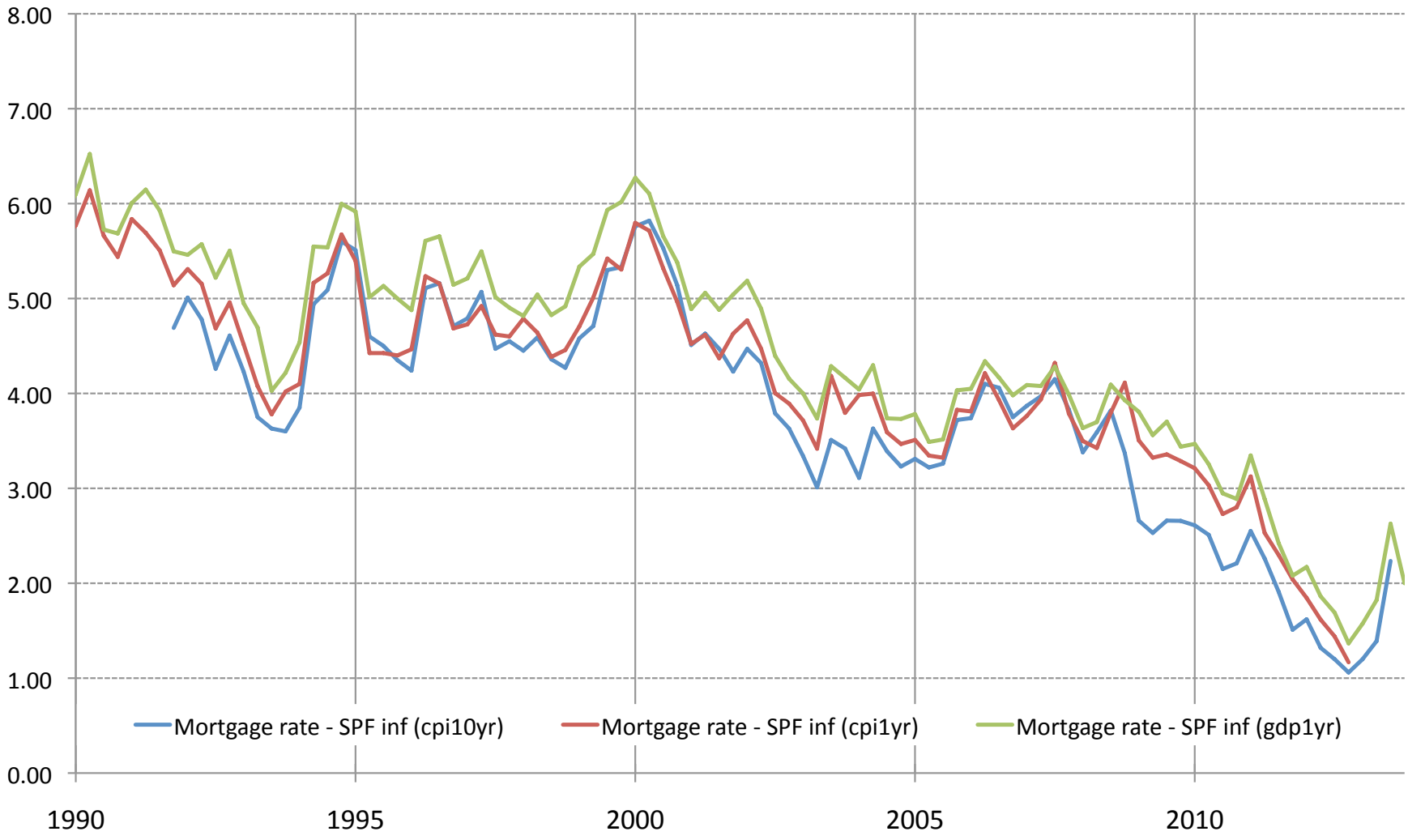
The US economy in the 2000s: Four stylized facts

① Decline in mortgage rates

1. Real mortgage rates



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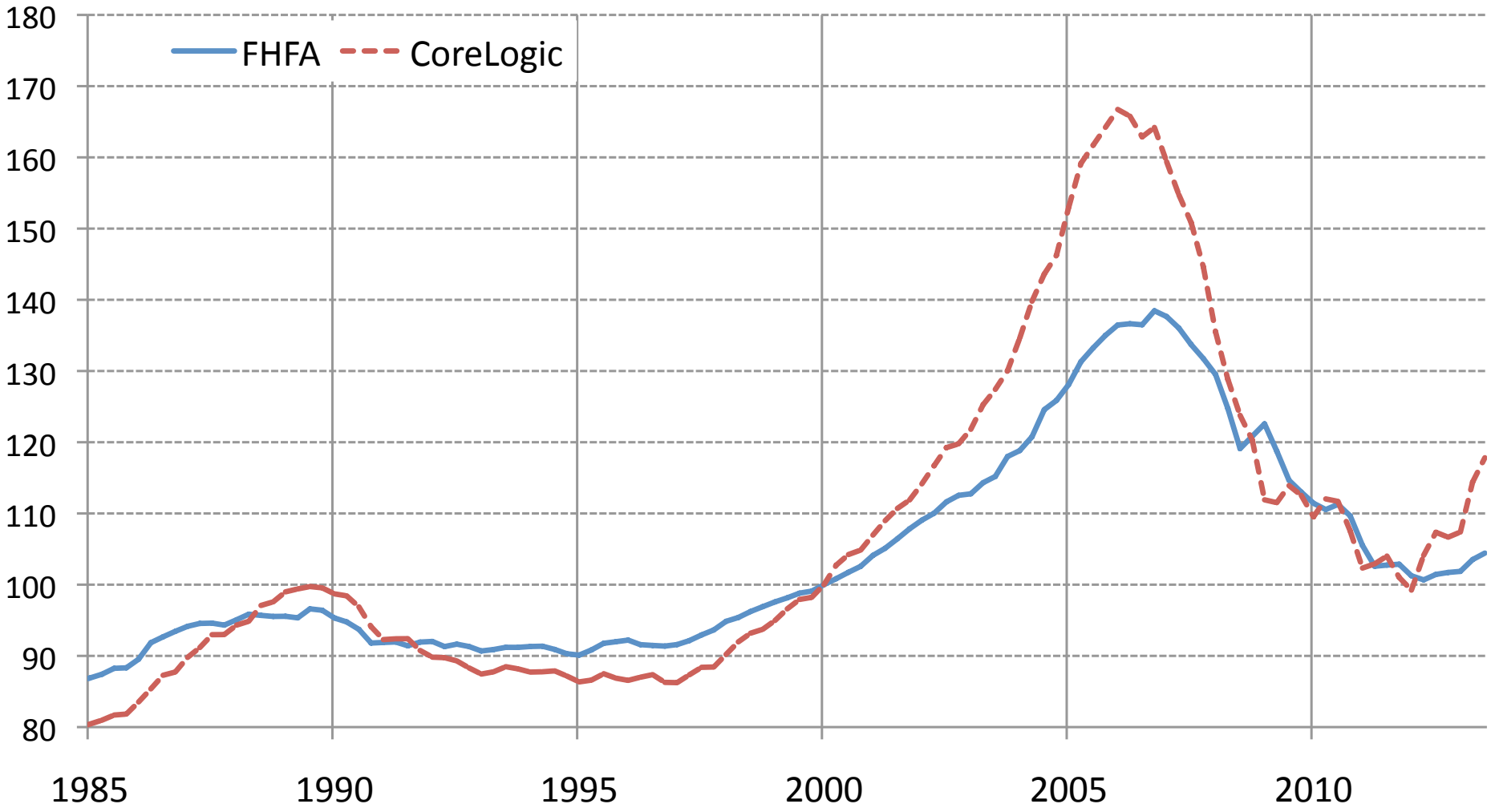
① Decline in mortgage rates

② Unprecedented boom-bust cycle in house prices

2. Real house price



The US economy in the 2000s: Four stylized facts

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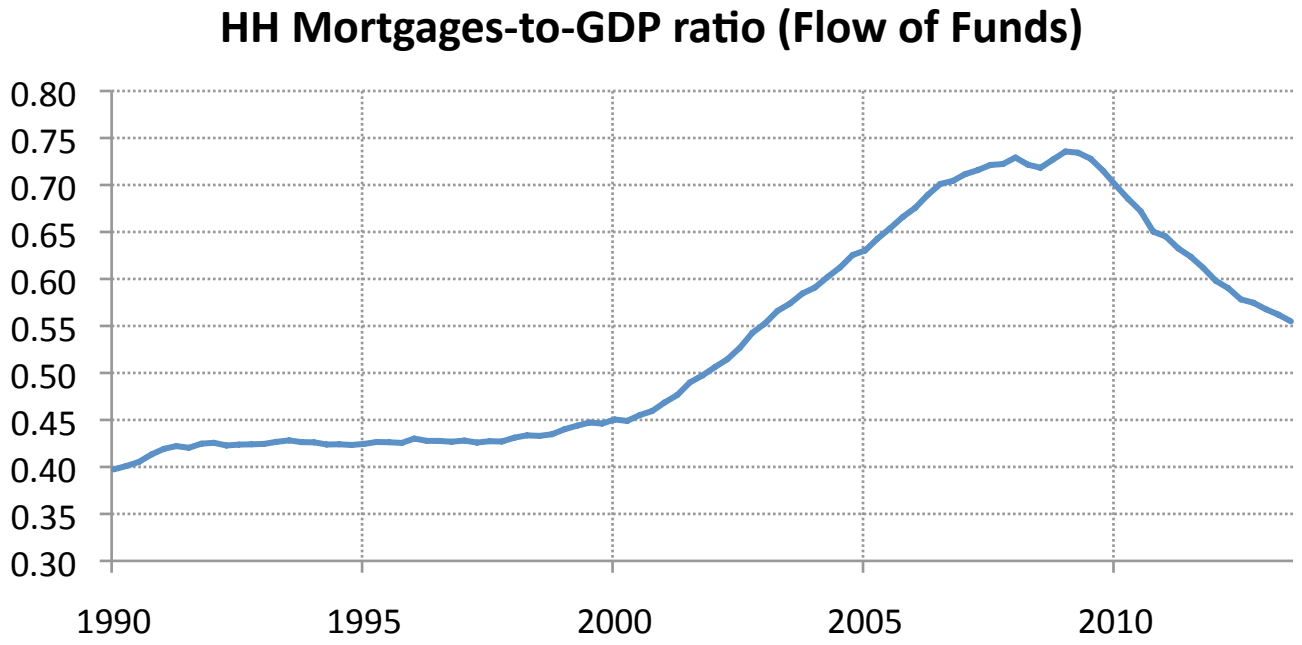
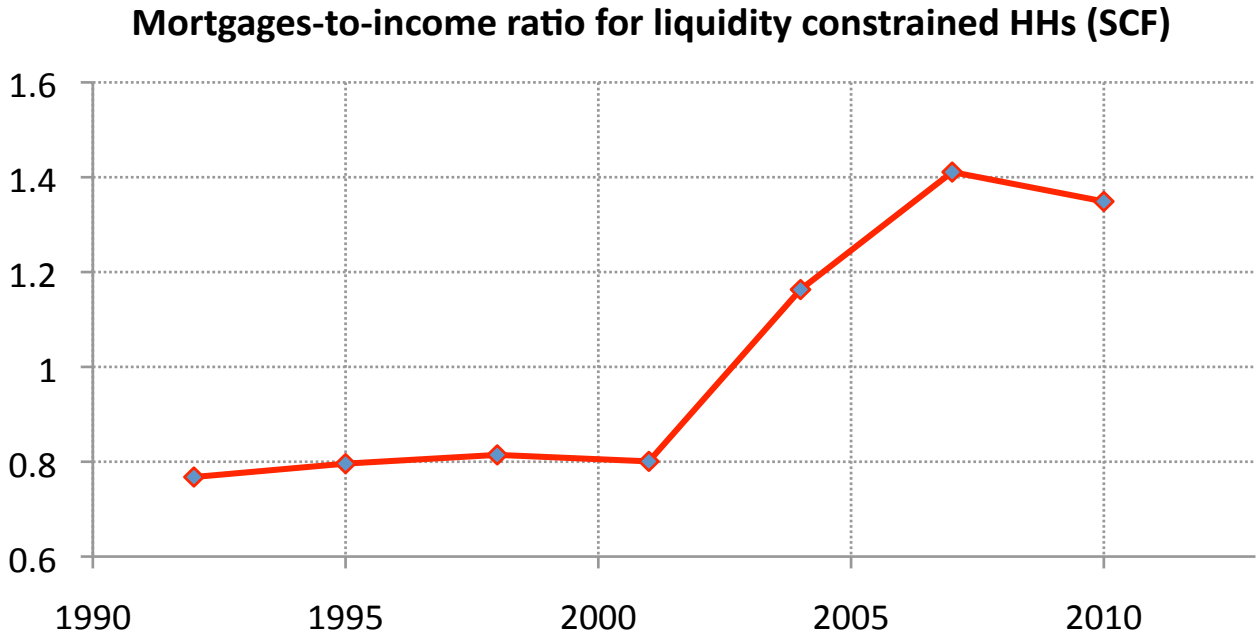
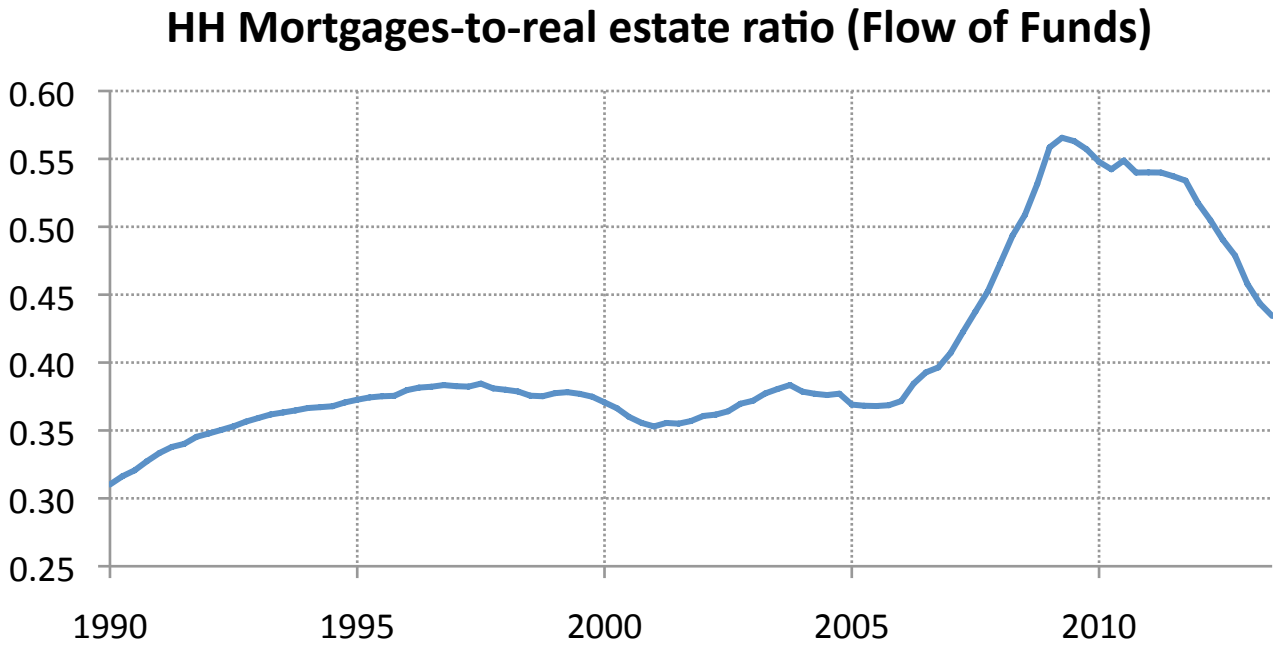
③ Massive HH debt accumulation, and then deleveraging

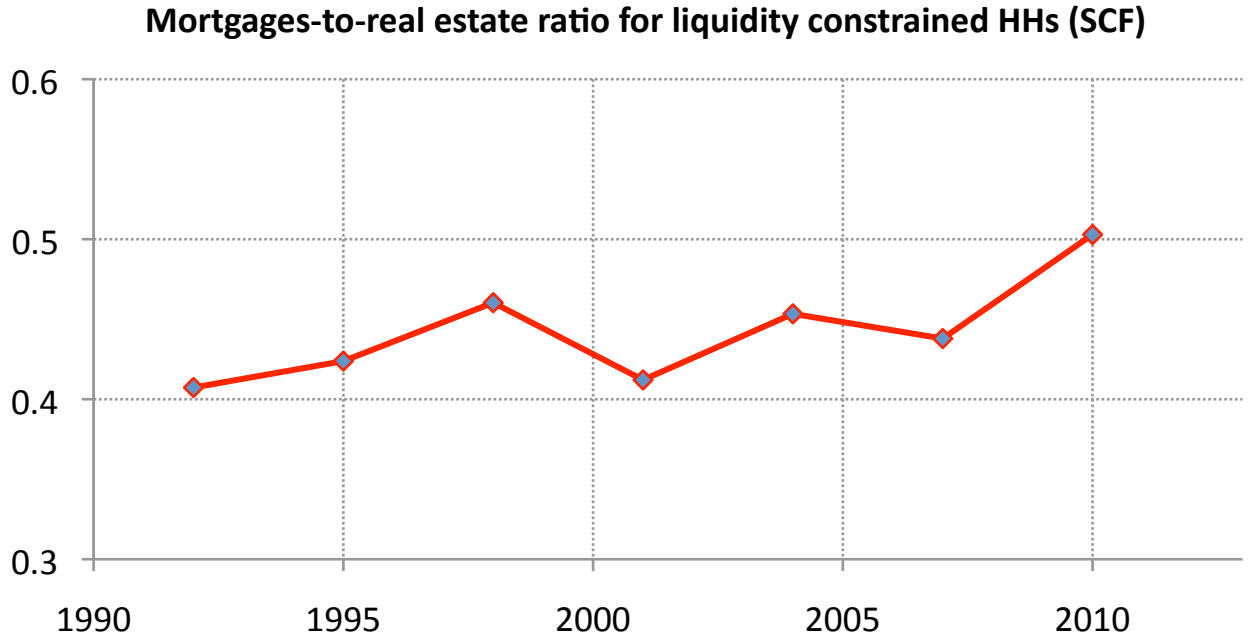
3. Household debt





4. Debt-to-collateral ratio





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③ Massive HH debt accumulation, and then deleveraging

④ Debt-to-collateral ratio constant, and then spikes

This paper

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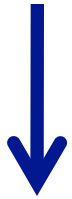

- **Approach:** Model of HH borrowing as laboratory
  - borrowing constraints, houses as collateral
  - lending constraints

Summary of the results

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- **Answer:** An increase in credit supply brought about by looser lending constraints. Consistent with
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- Excessive loosening of collateral requirements can explain why house prices started to fall, even if liberalization was in full swing

Some literature

- Importance of borrowing constraints in the boom-bust of the 2000s
  - Boom:
    Favilukis, Ludvigson, Van Nieuwerburgh (2013), Boz and Mendoza (2012), Garriga, Manuelli and Peralta-Alva (2012), Midrigan and Philippon (2011)
  - Bust:
    Guerrieri and Lorenzoni (2012), Eggertsson and Krugman (2012), Hall (2012)
  - We concentrate on barriers to lending and their interaction with collateral constraints, as in Landvoigt (2014)

- Constraints on composition of balance sheet of intermediaries
  - Gertler and Kiyotaki (2010), Gerali et al. (2010), Adrian and Shin (2010), Adrian and Boyarchenko (2012 and 2013), He and Krishnamurty (2013), Dewachter and Wouters (2014), Brunnermeier and Sannikov (2014), etc…
  - We concentrate on the link between the availability of credit, household debt and home price in the 2000s

- Micro-econometric evidence
  - Mian and Sufi (2009, 2011), Ambrose and Thibodeau (2004), Favara and Imbs(2012), Di Maggio and Kermani (2014)

Outline

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

Simplest model

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- Build on
  - Kiyotaki and Moore (1997)
  - Iacoviello (2005)
  - Campbell and Hercowitz (2006)

- 2 groups of households
  - Patient → Lenders
  - Impatient → Borrowers

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- No production → income is exogenous

- Fixed supply of (new) houses

The problem of the borrowers

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

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

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  - Associated multiplier: ***μ ≥ 0***

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

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

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- Can be interpreted as stemming from leverage or regulatory-capital requirement of financial intermediaries

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Rigid demand for houses by the lenders	

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

Interaction of borrowing and lending constraints

- Borrowing constraint:

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

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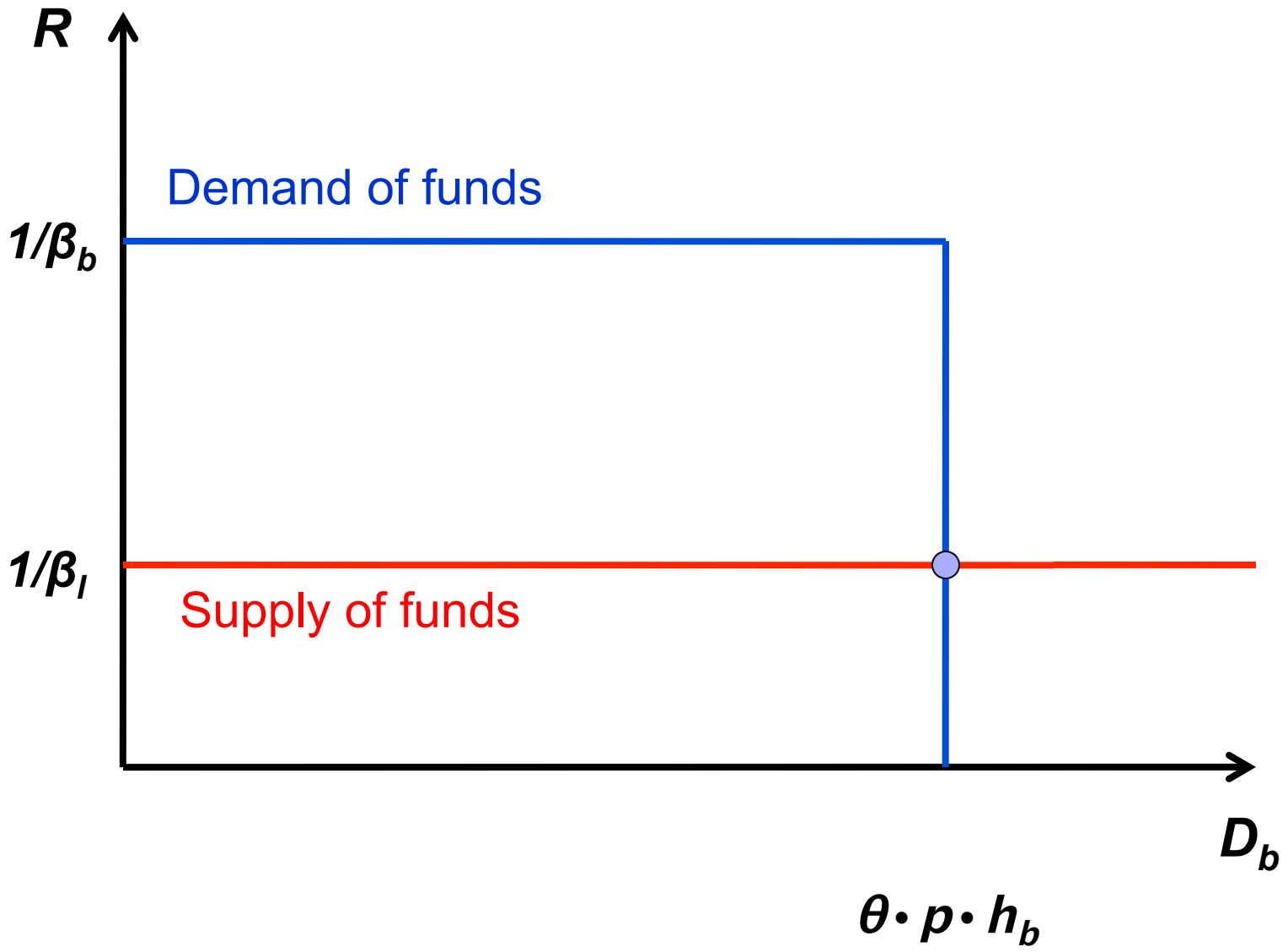
- Which constraint binds is
  - exogenous: $\bar{L} \quad and \quad \theta$
  - endogenous: $p_t = \frac{\beta_b}{1 - \mu_t \theta}\left[mrs + (1-\delta)p_{t+1}\right]$

Standard model without lending constraint



Non-binding lending constraint

- $R = 1/\beta_l$
- Collateral constraint binding ($\mu > 0$)
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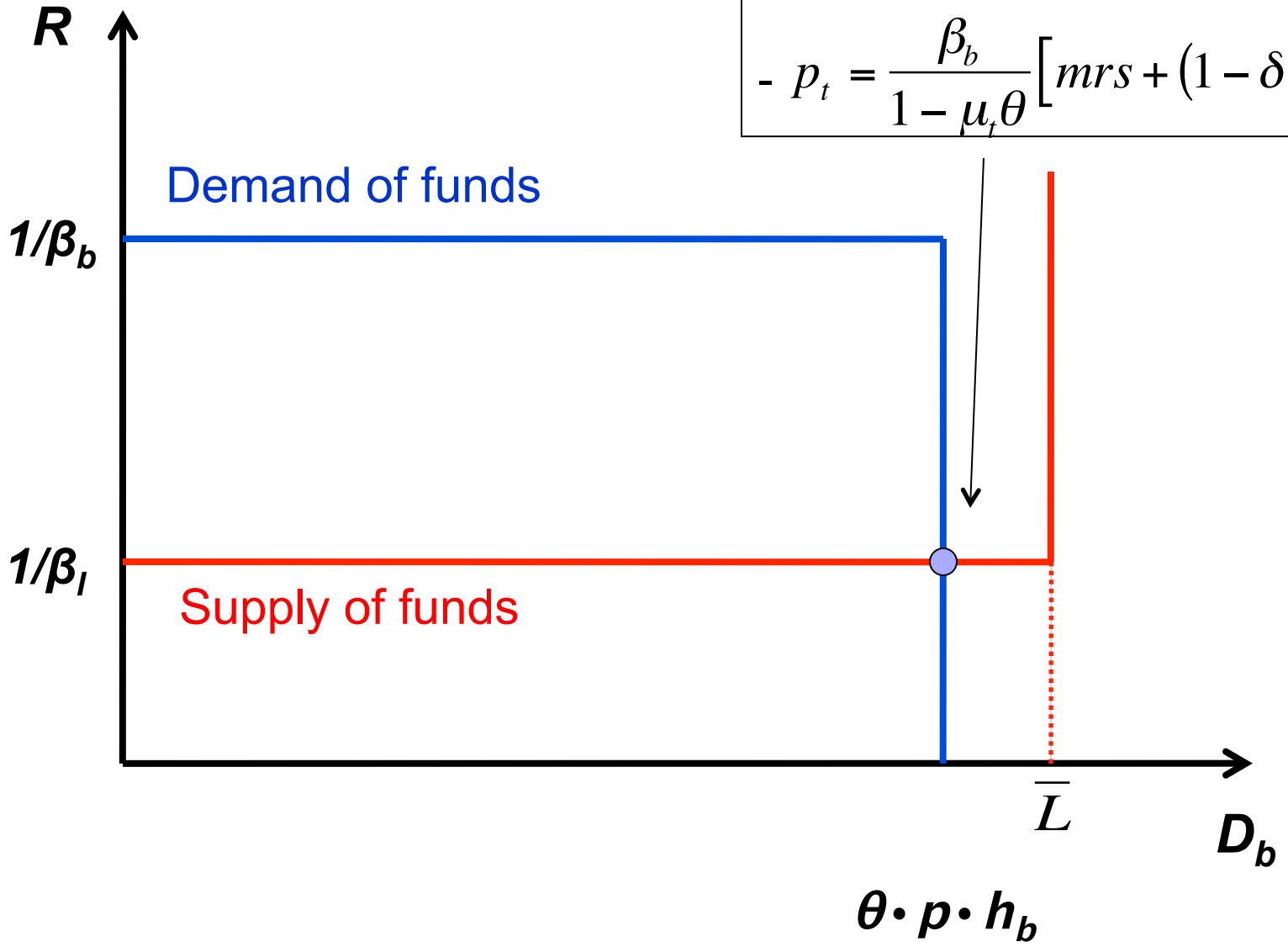
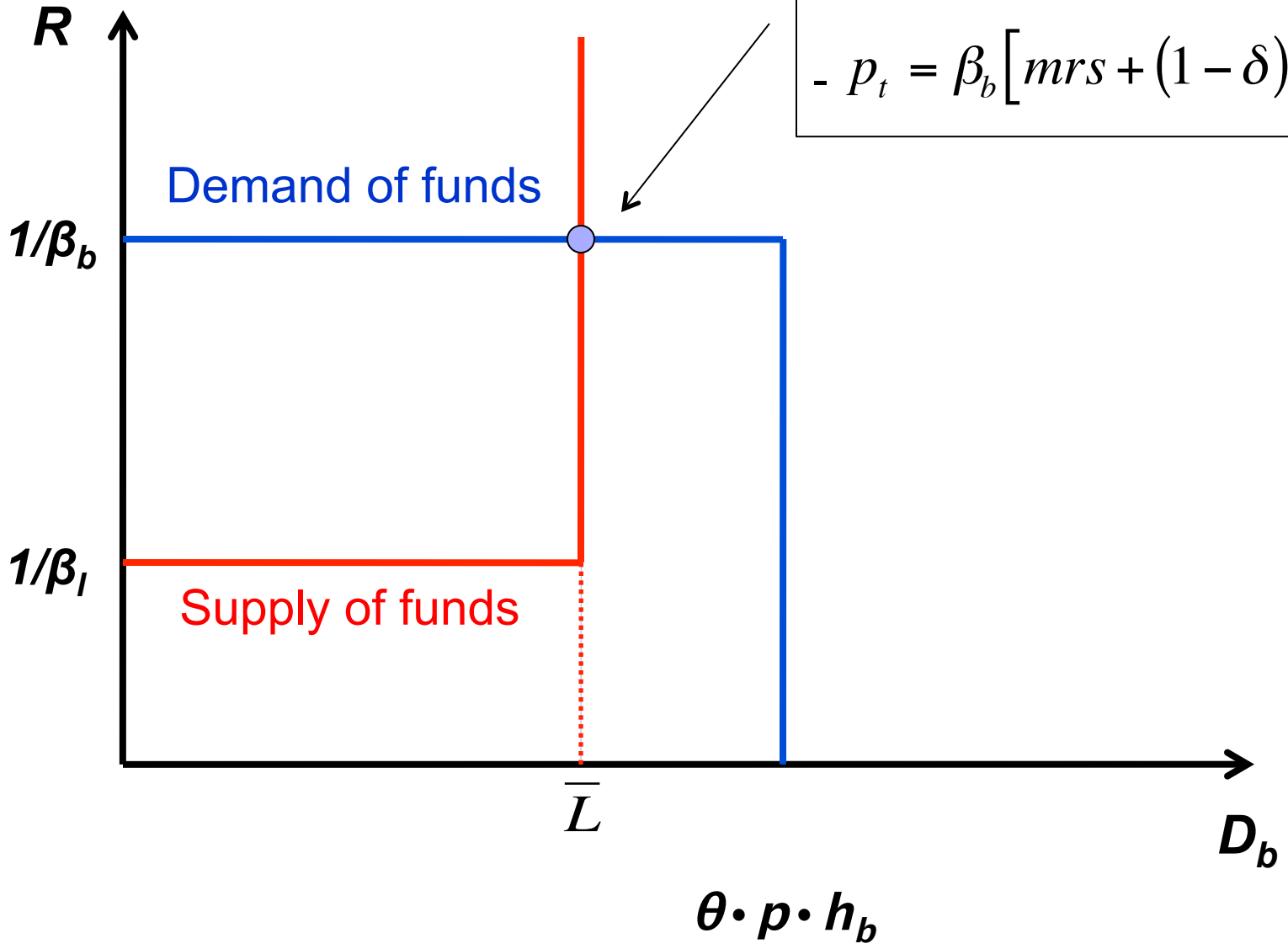


Binding lending constraint

- $R = 1/\beta_b$
- Collateral constraint **not** binding
- $p_t = \beta_b \left[mrs + (1-\delta) p_{t+1} \right]$



Relaxing the lending constraint

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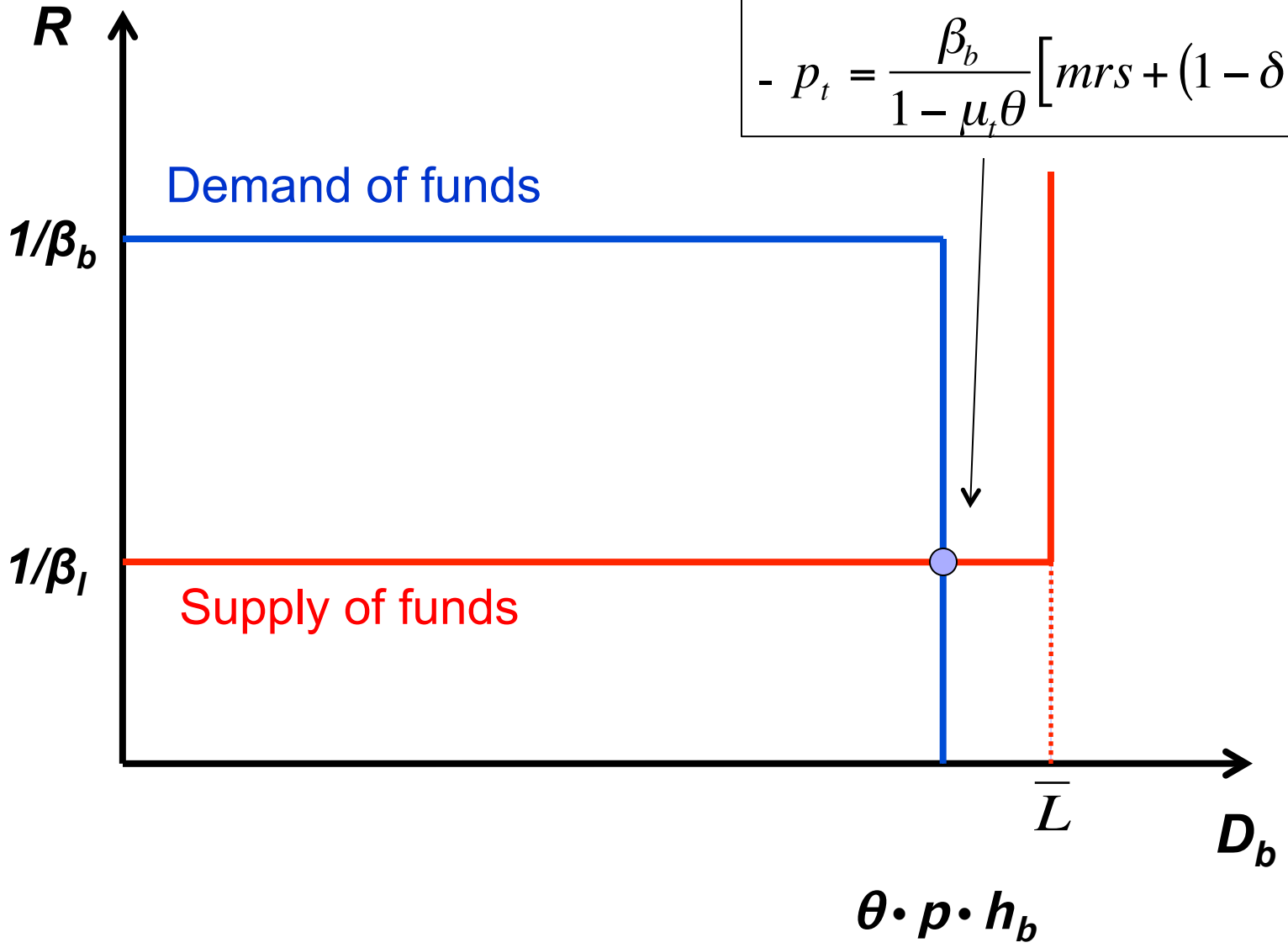

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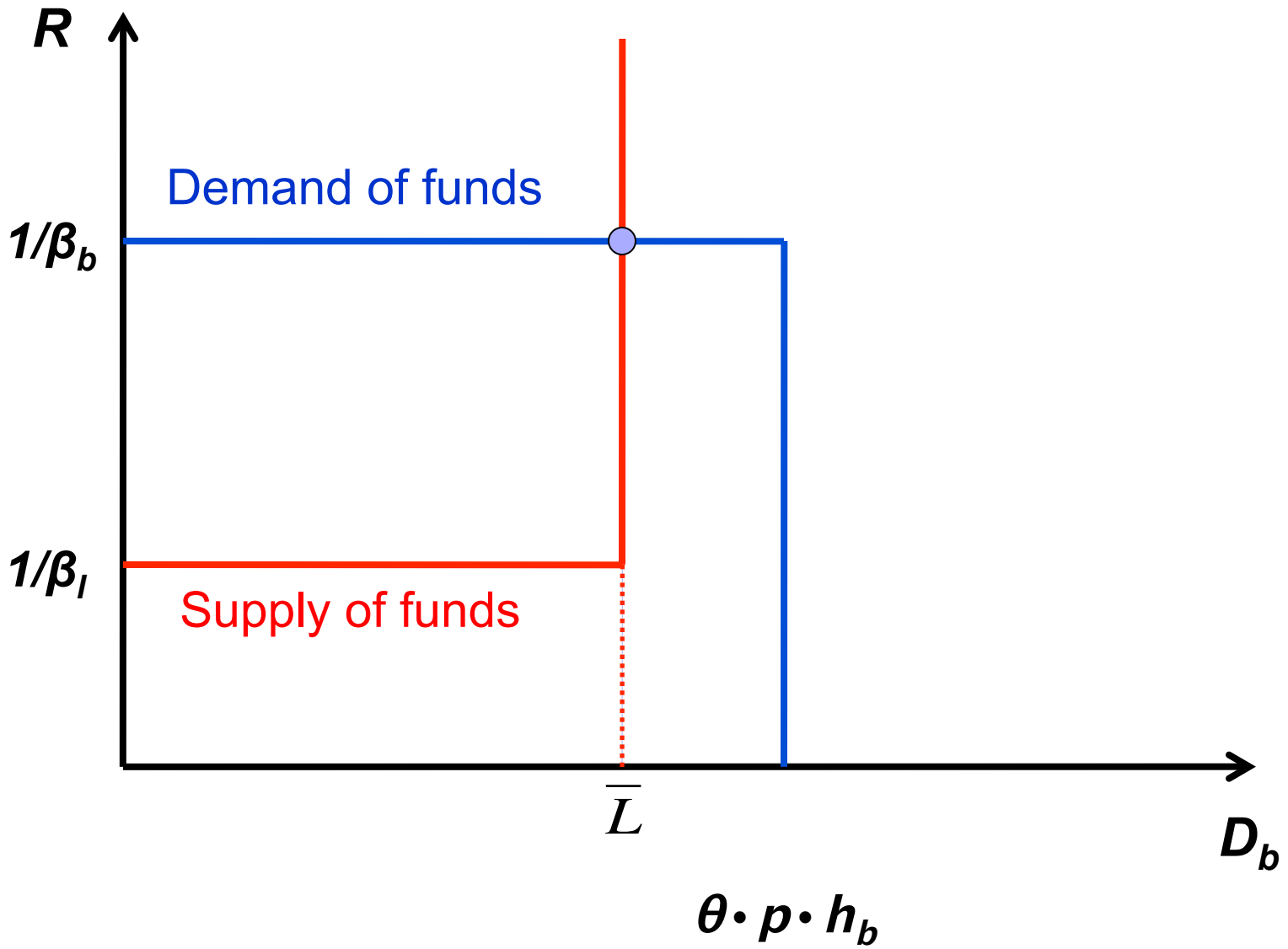

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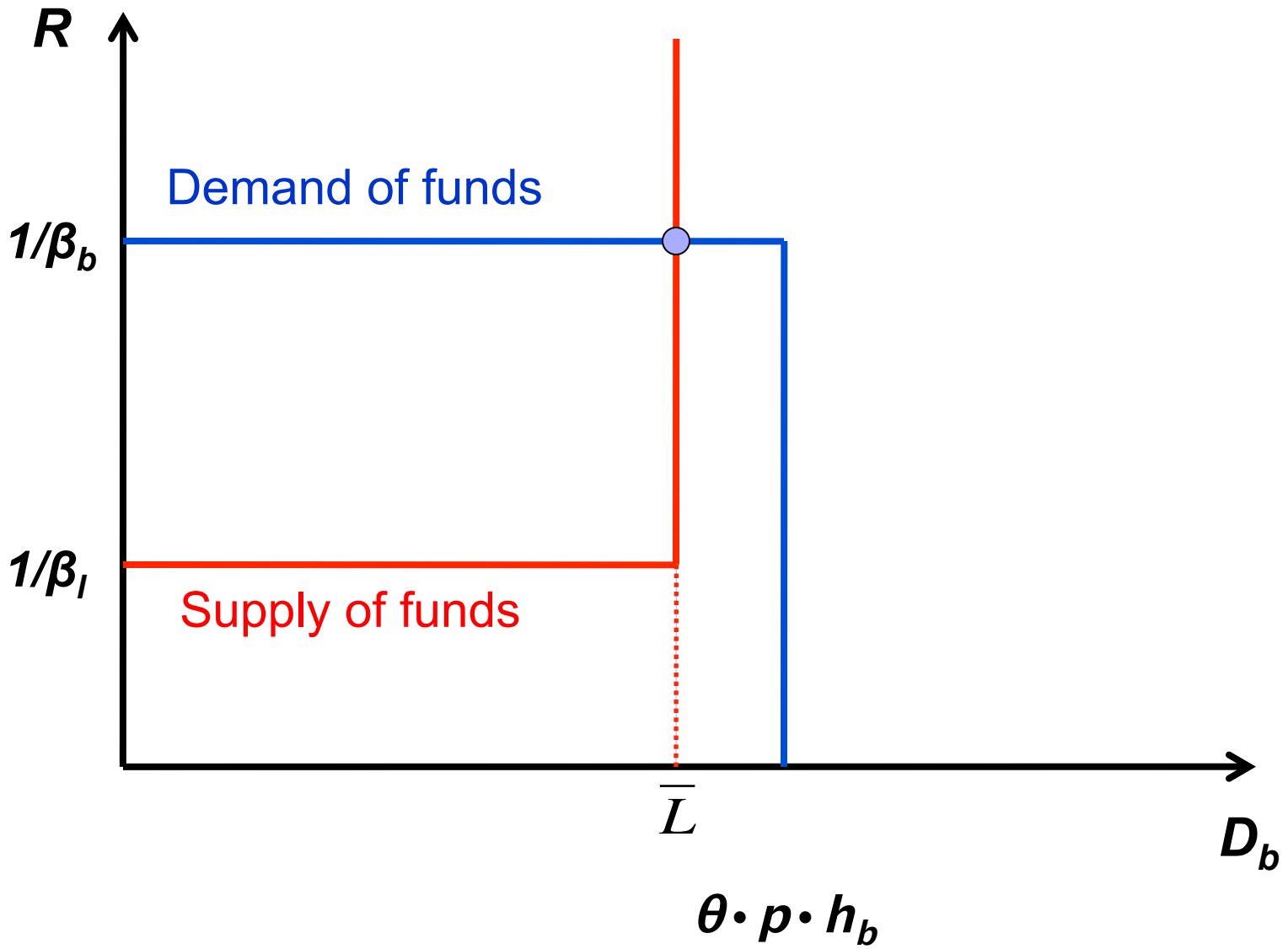

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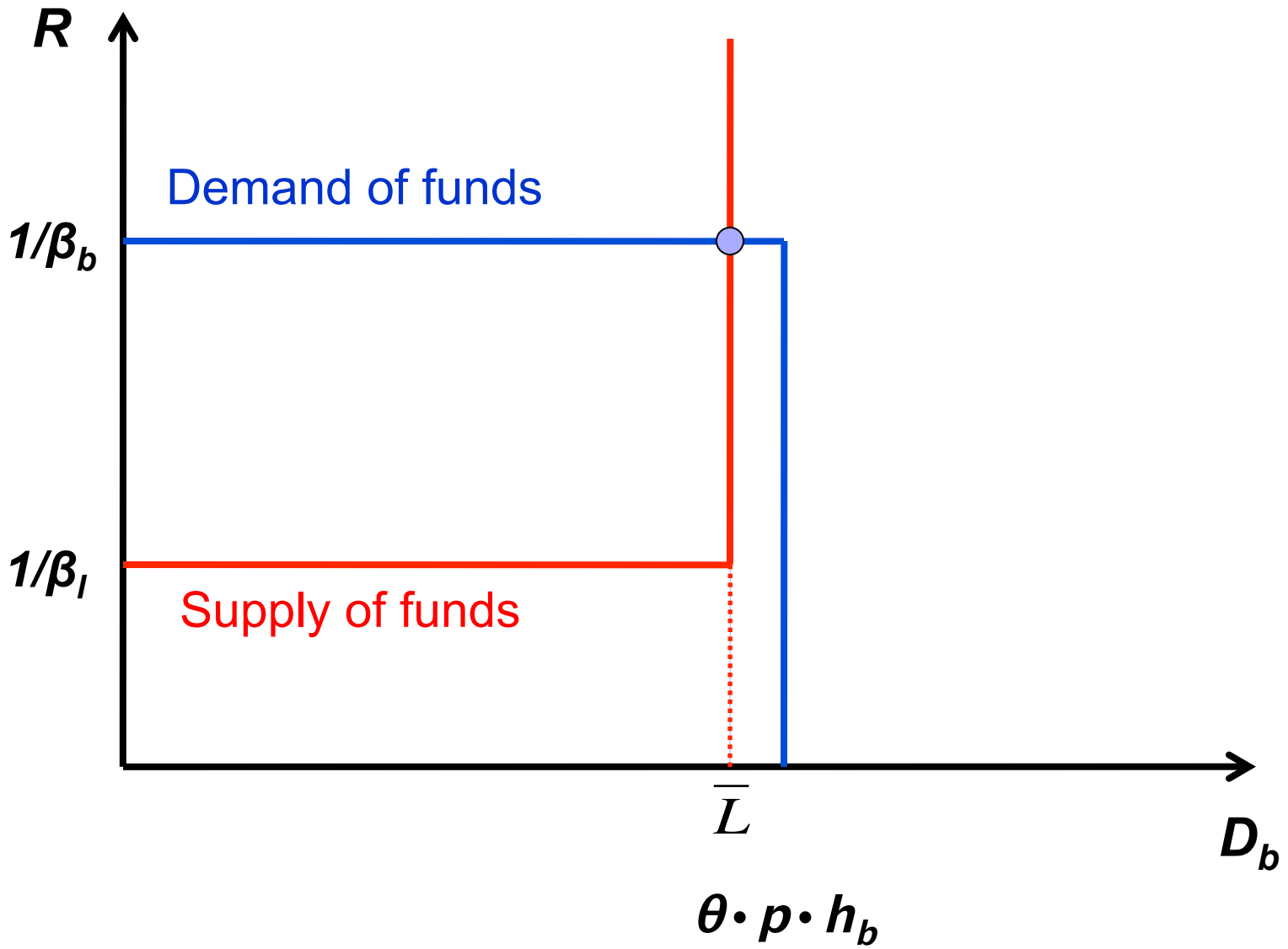

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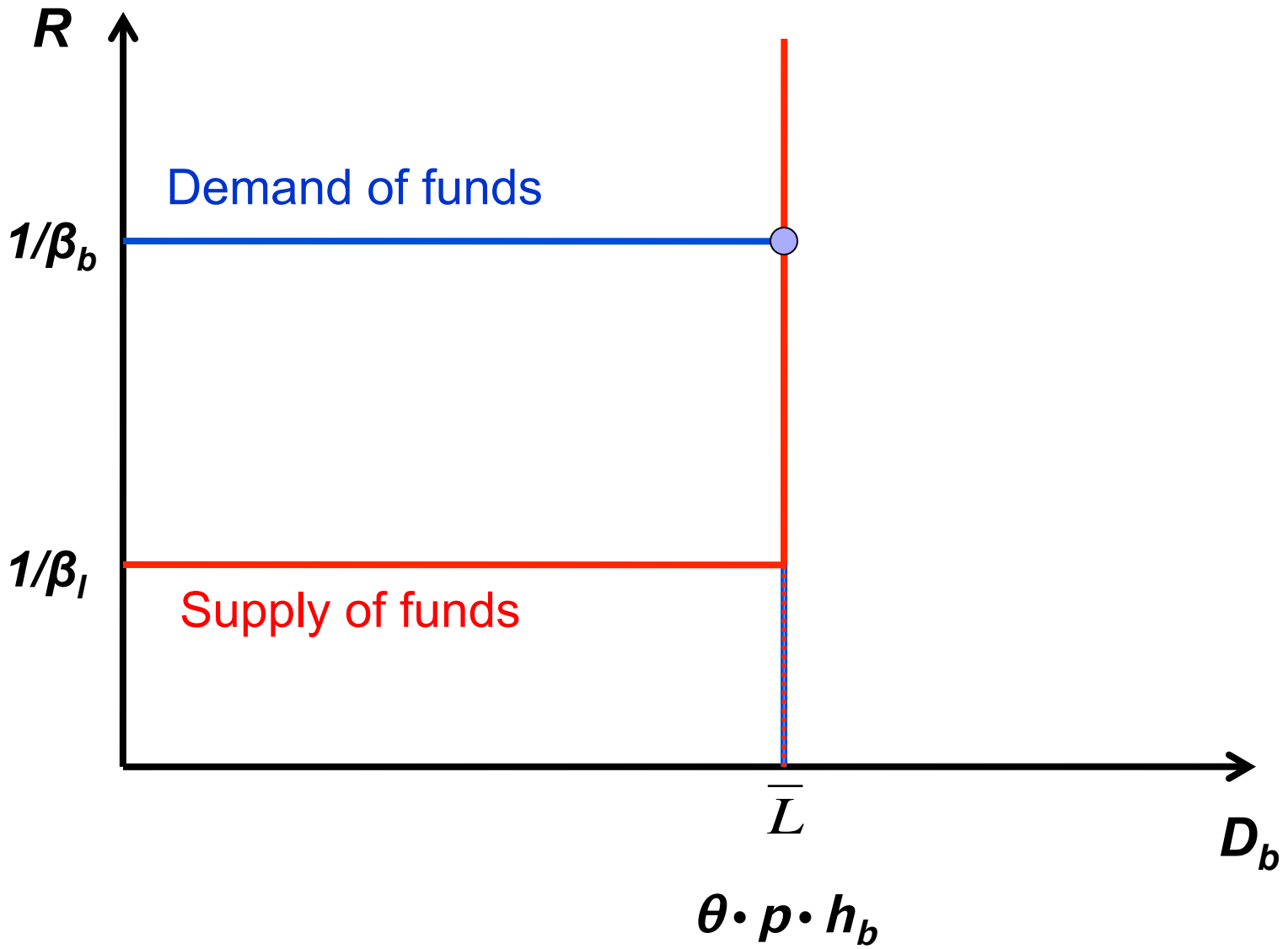

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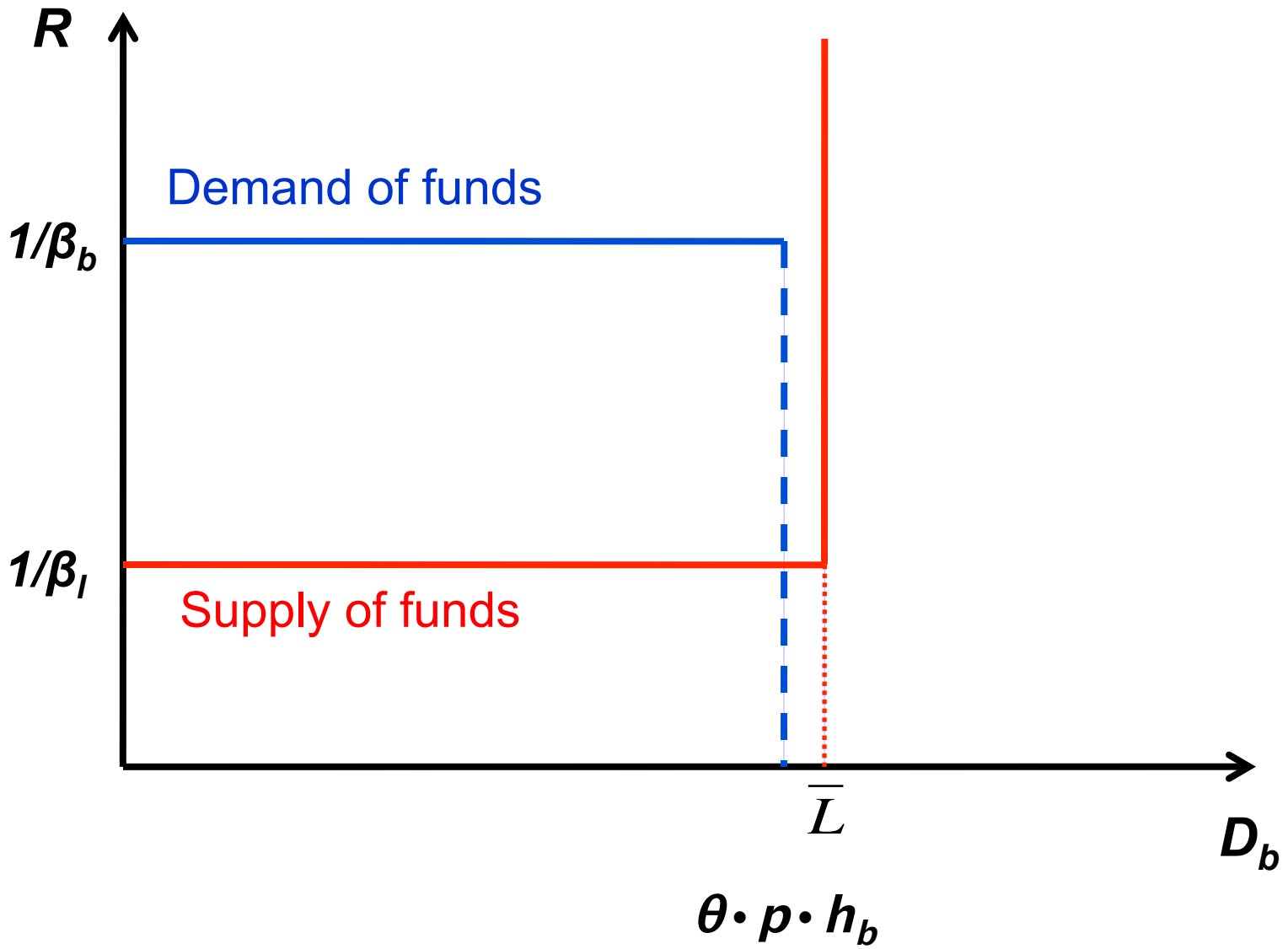

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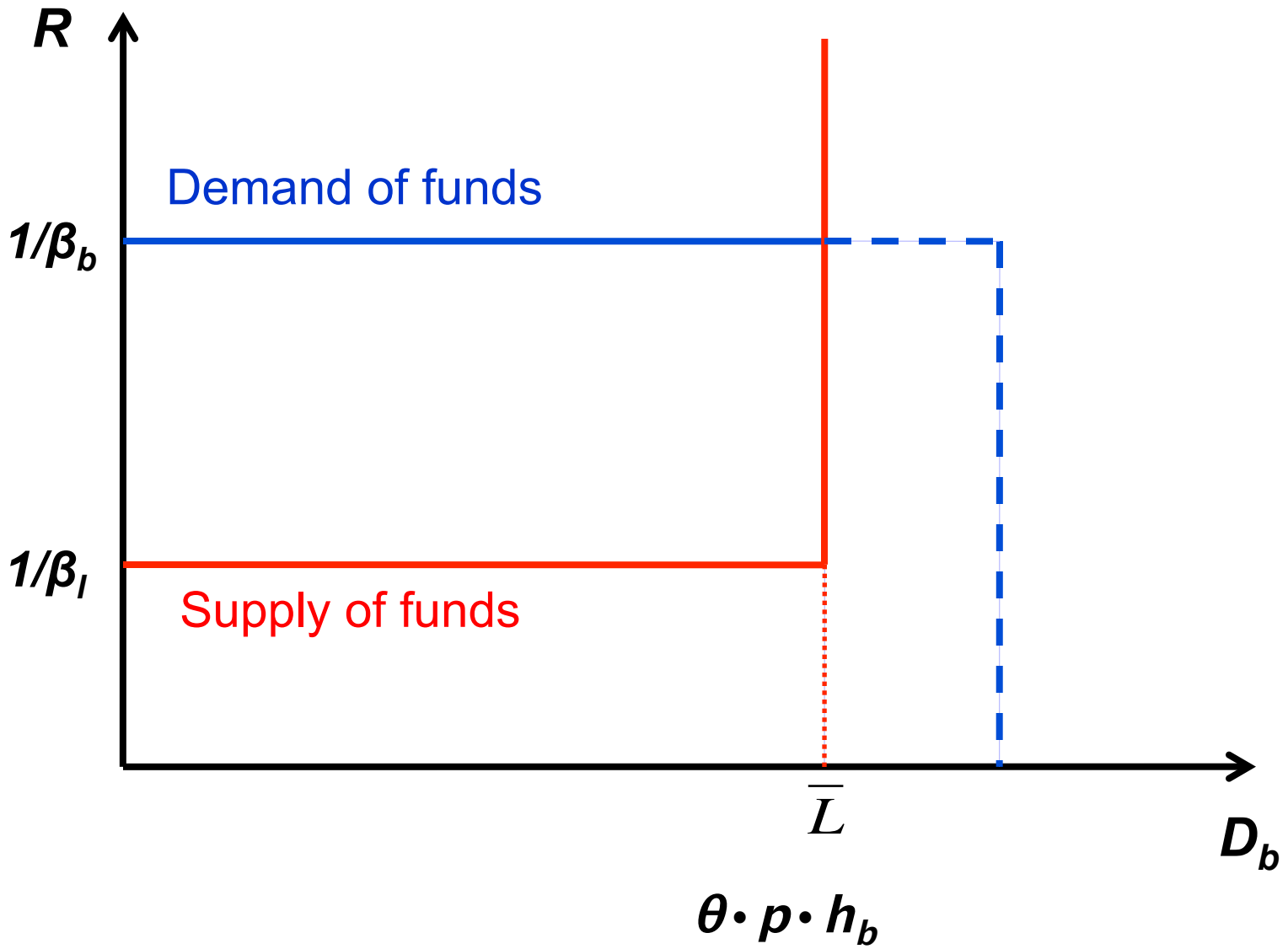

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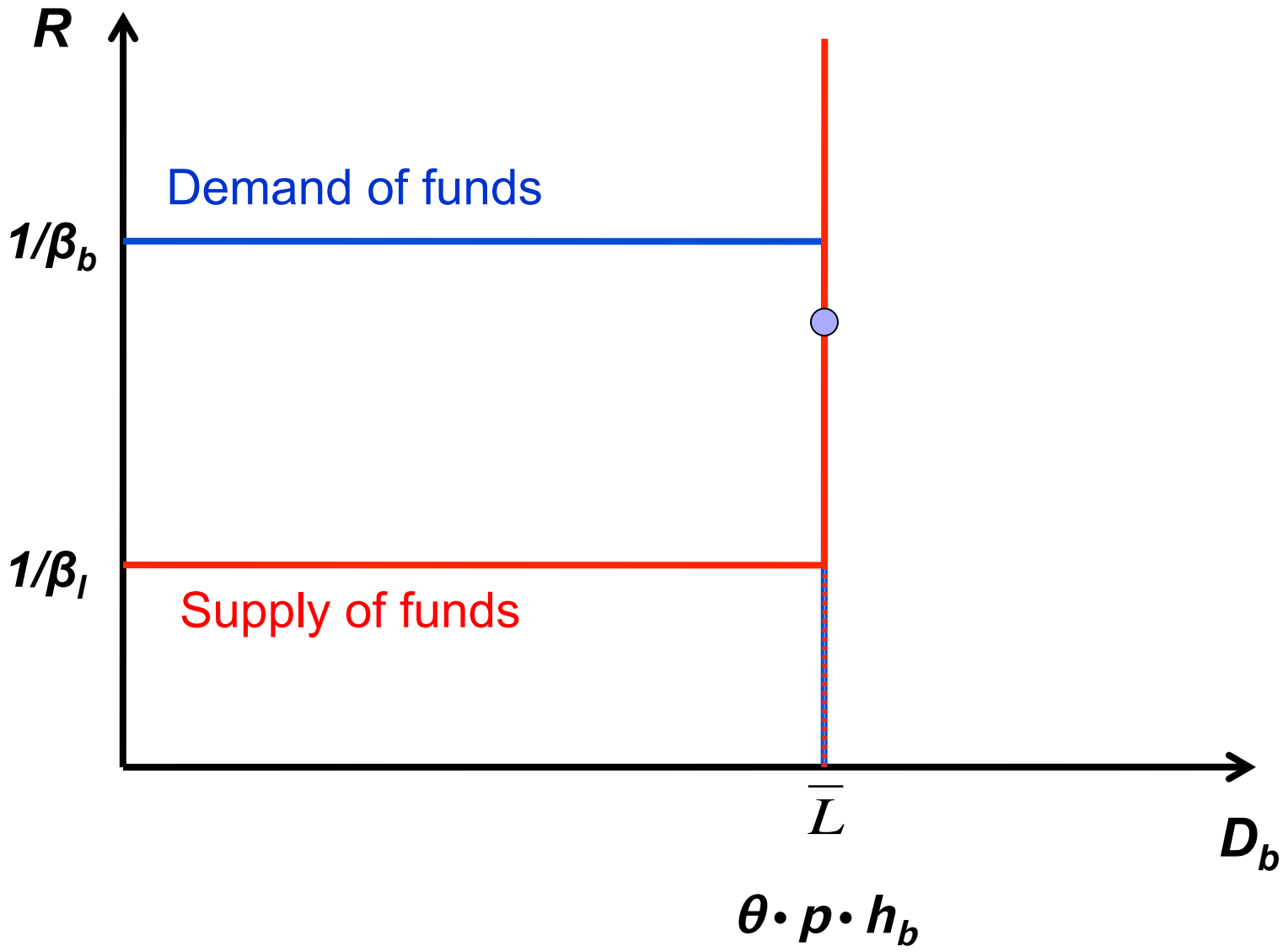

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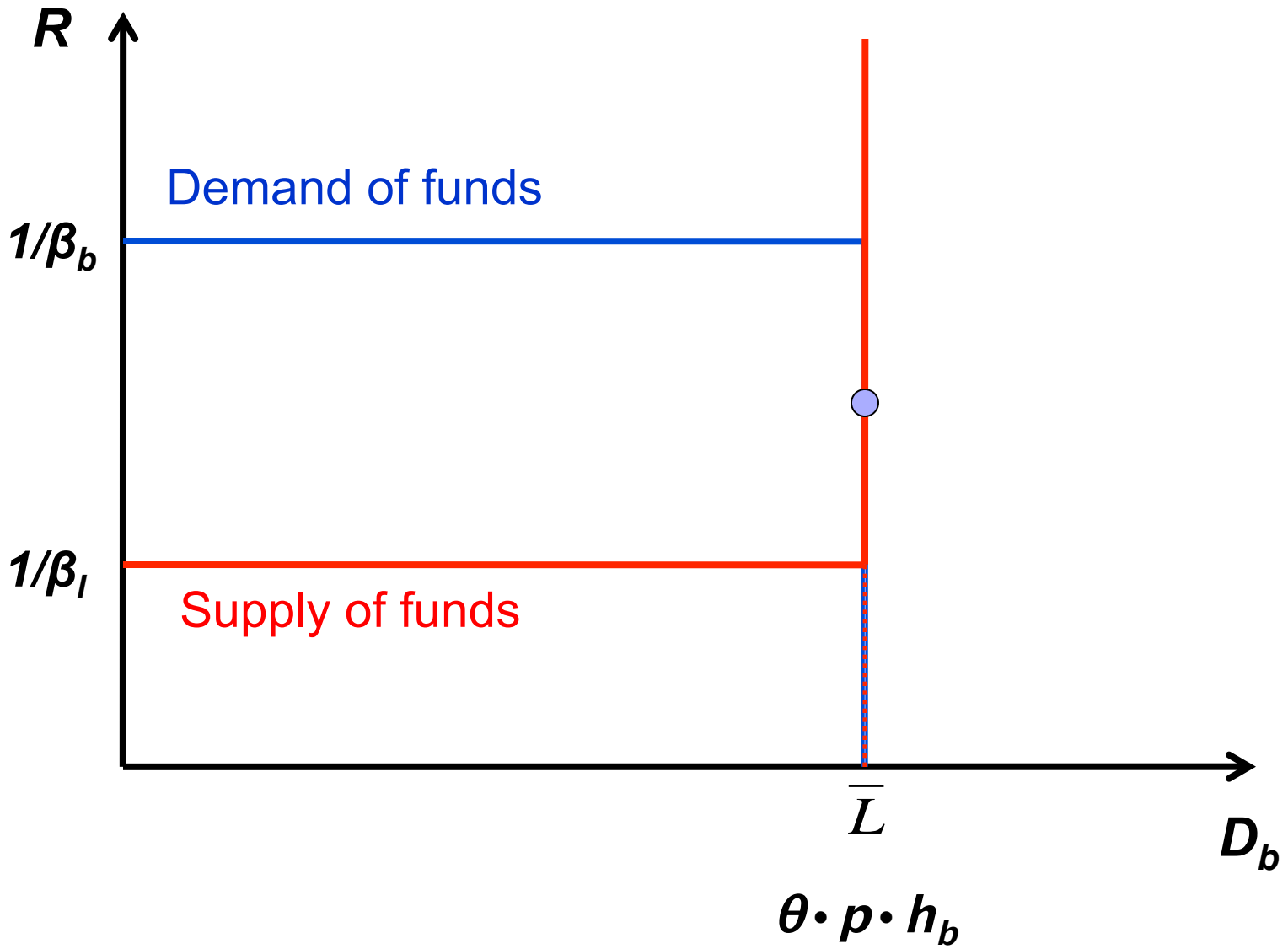

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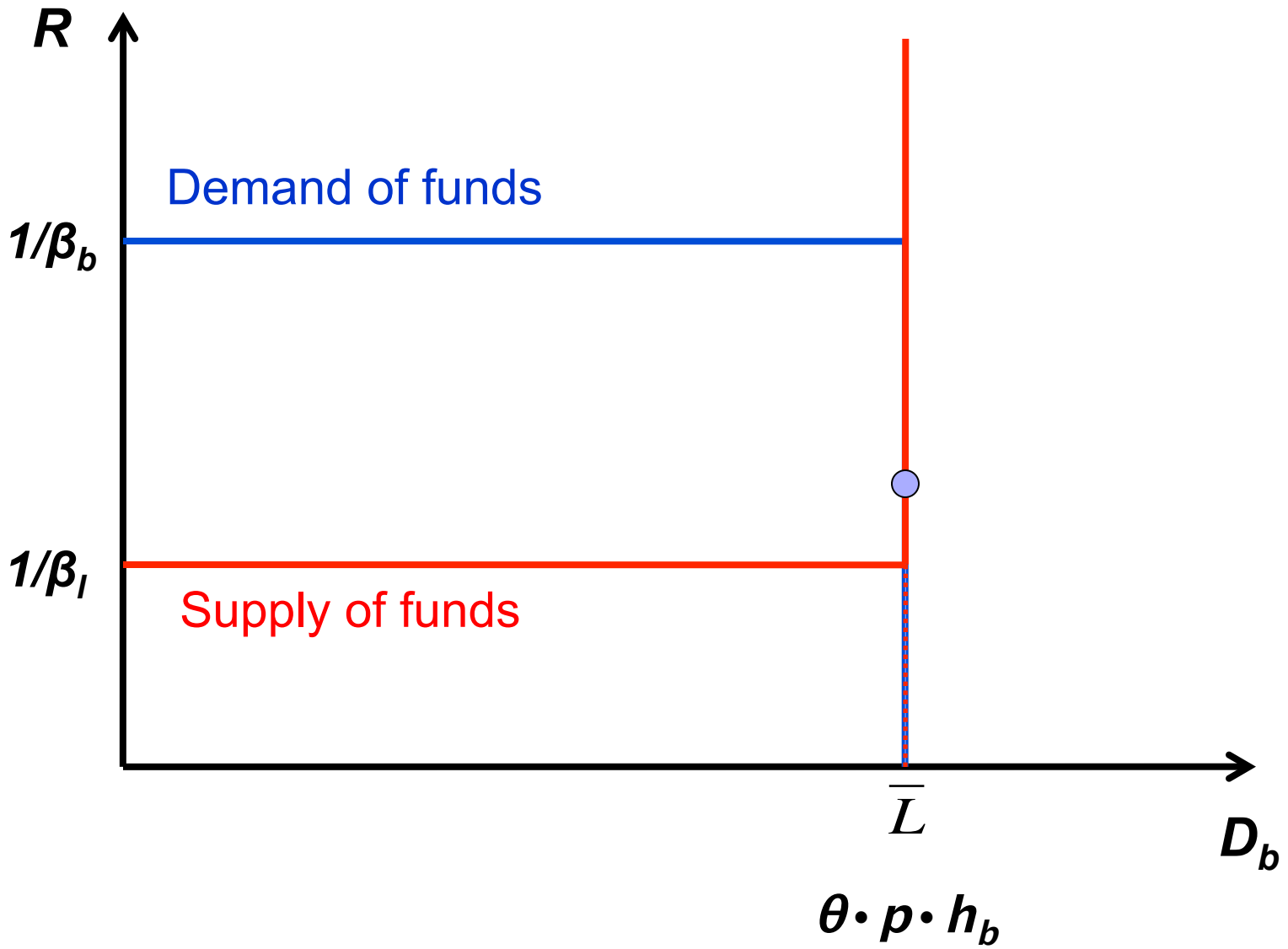

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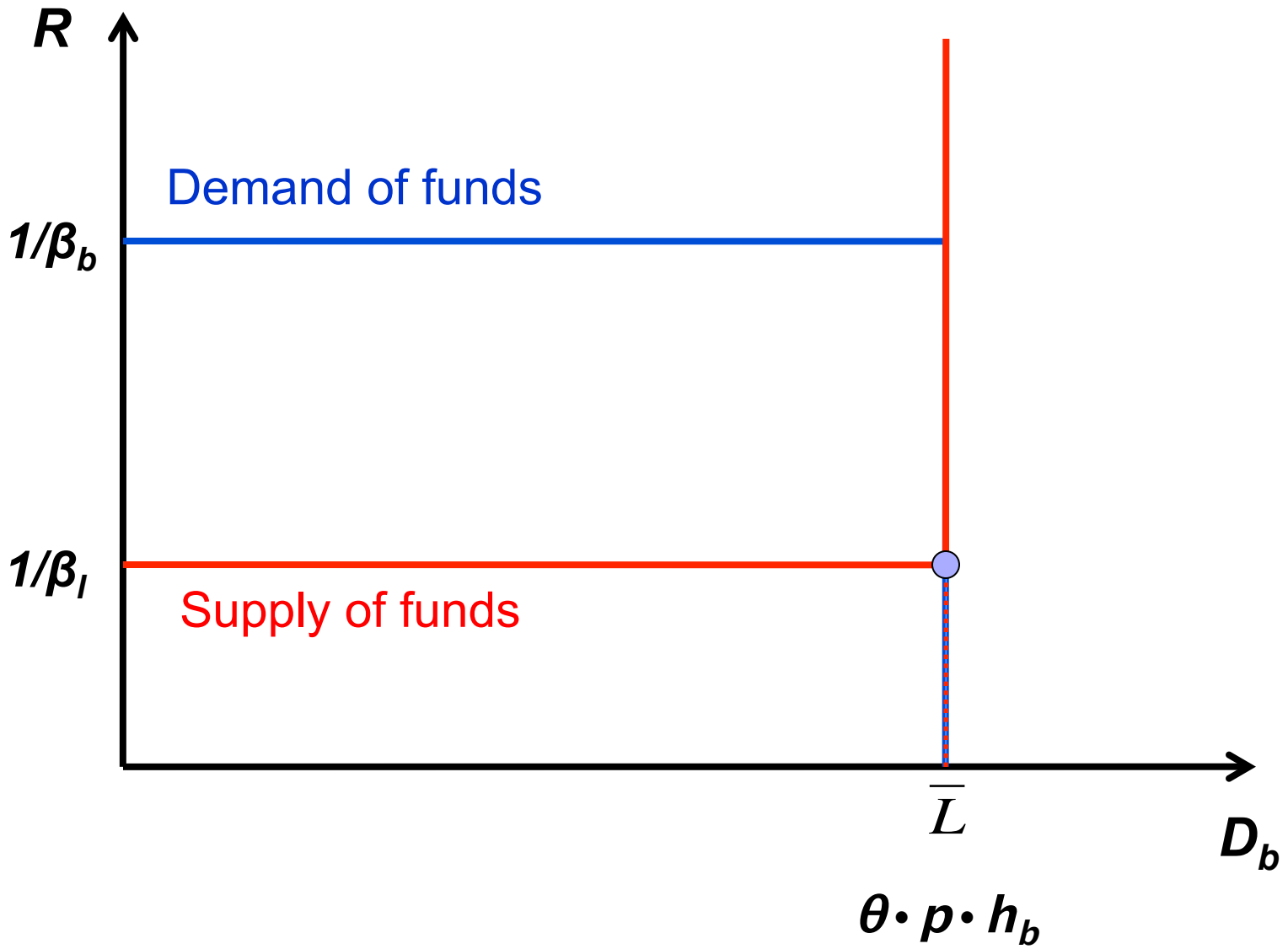

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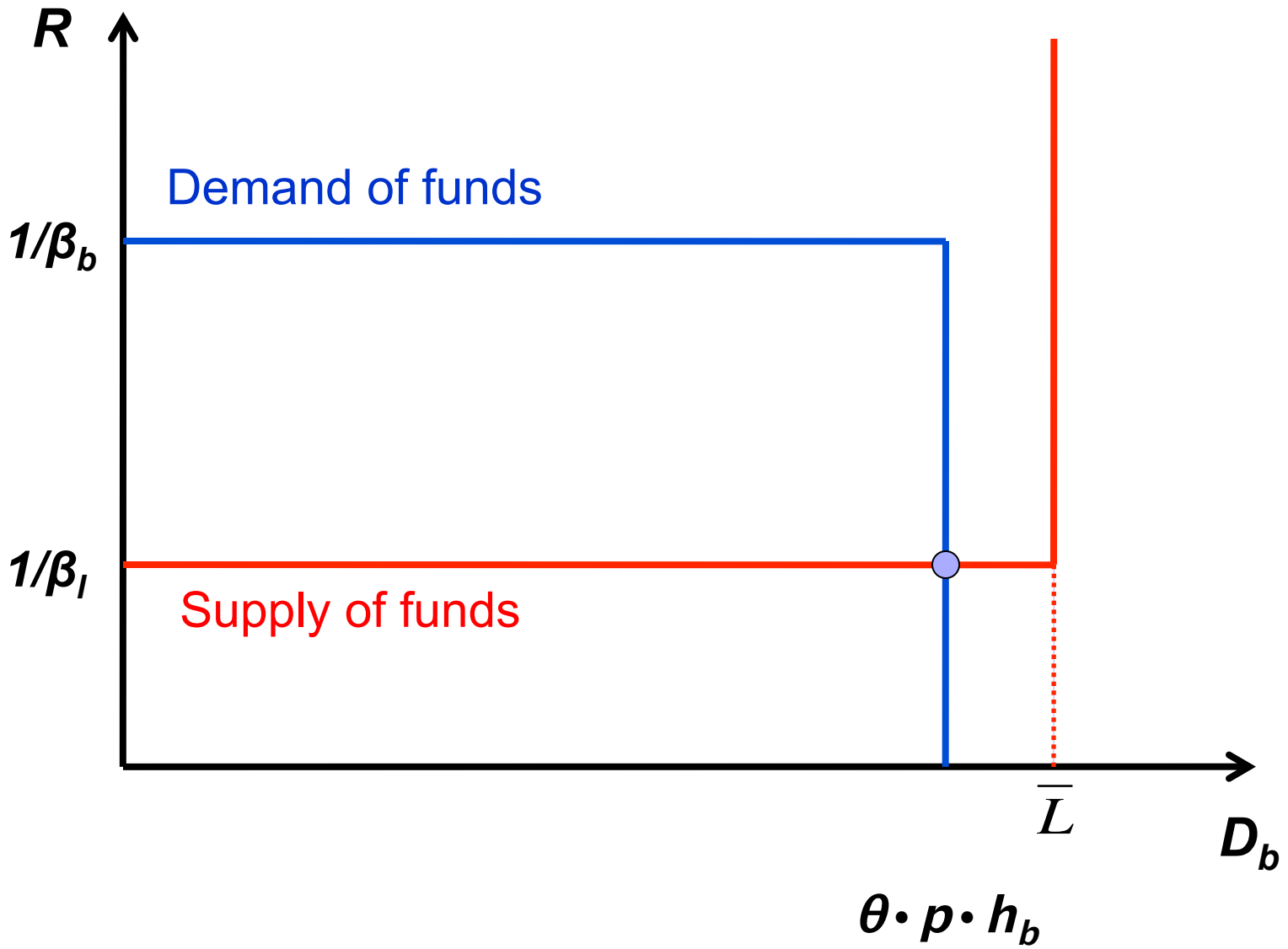

Outline

- 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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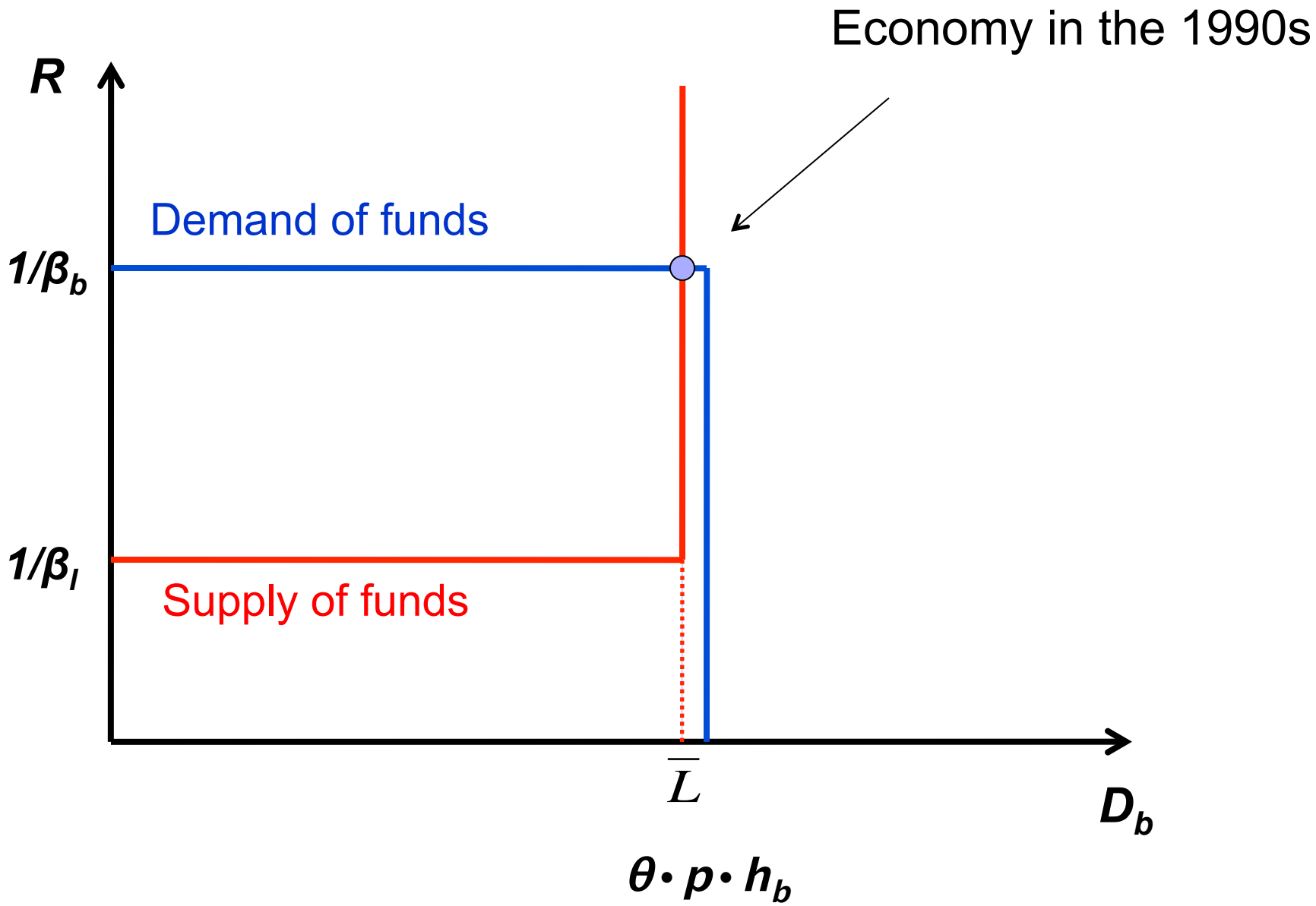
- $\rho = \delta$ ➔ $D_{b,t} \leq \theta \, p_t \, h_{b,t+1}$
- $\rho > \delta$ ➔ HHs accumulate equity over time

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**	• 2.5% decline in real mortgage rates • ~ Krusell and Smith (1998) • ~ Carroll et al. (2013)
Depreciation (δ)	**0.003**	Fixed Asset Tables
Maximum LTV (θ)	**0.80**	• 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**	• Collateral constraint close to binding • Mortgage-to-RE ratio of liquidity constrained HHs in the SCF (43%)

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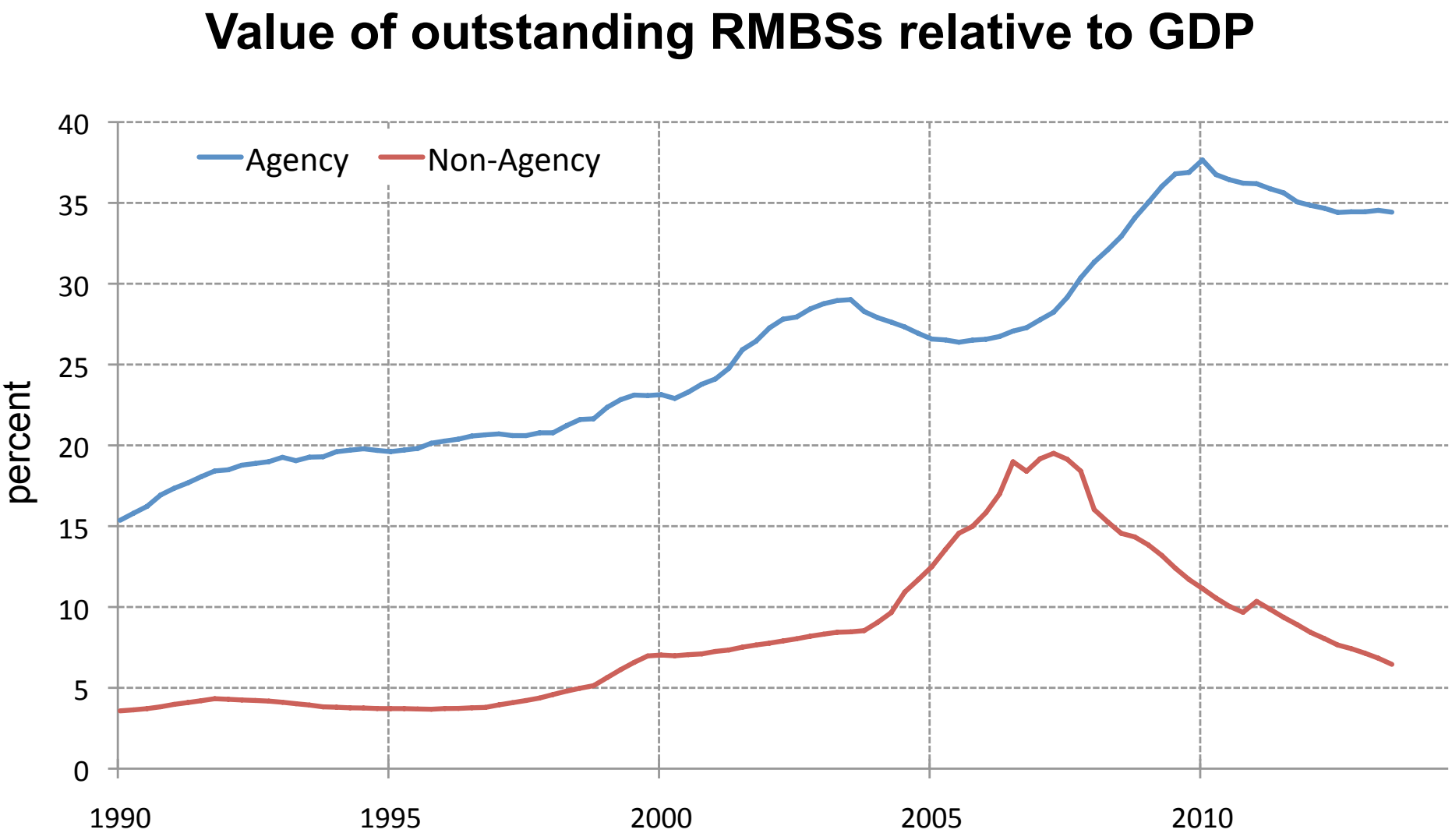
Securitization over time



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    - not counting them towards risk-weighted capital
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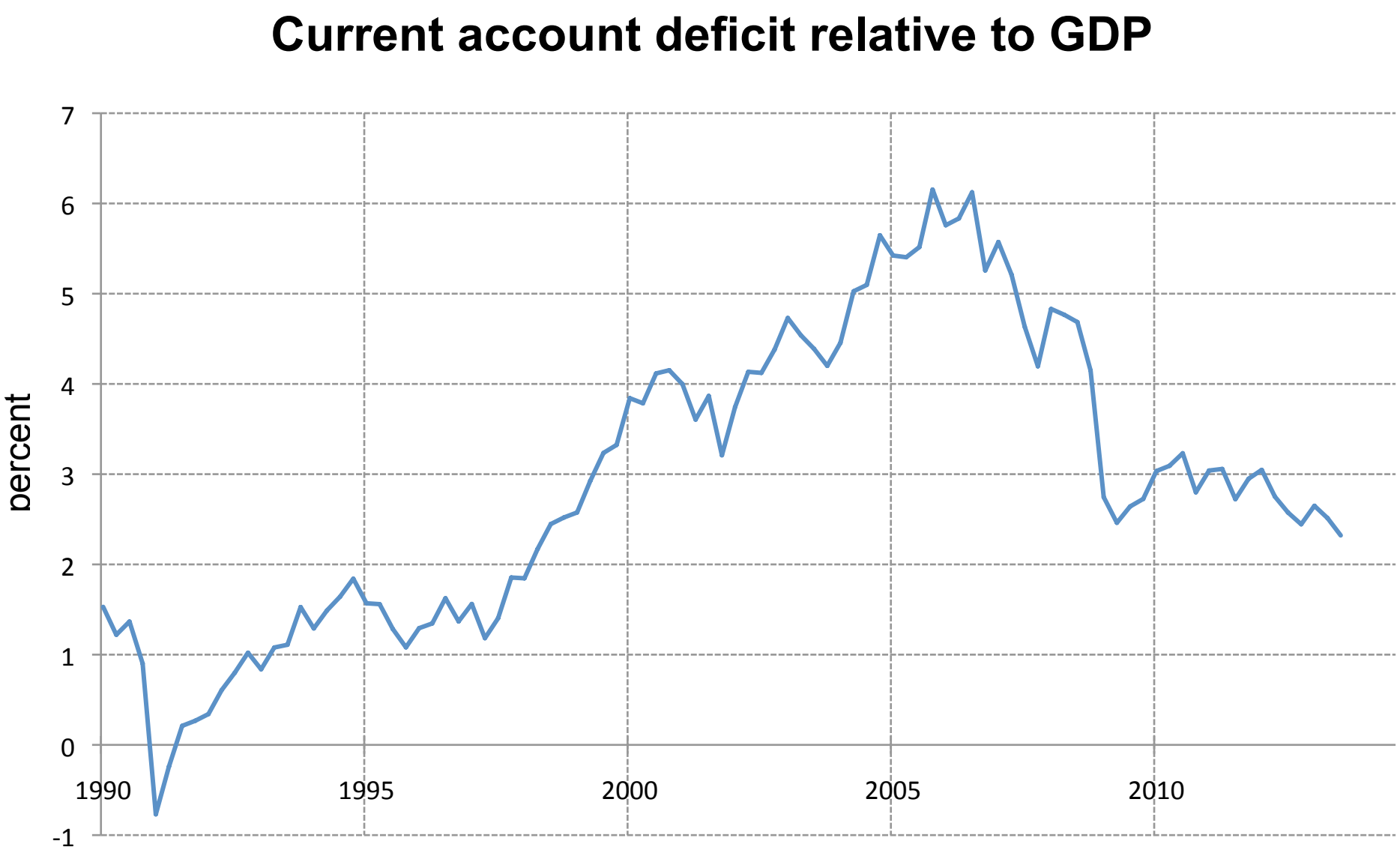
Foreign capital inflows



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- Experiment timed to "complete" the transition in 2006

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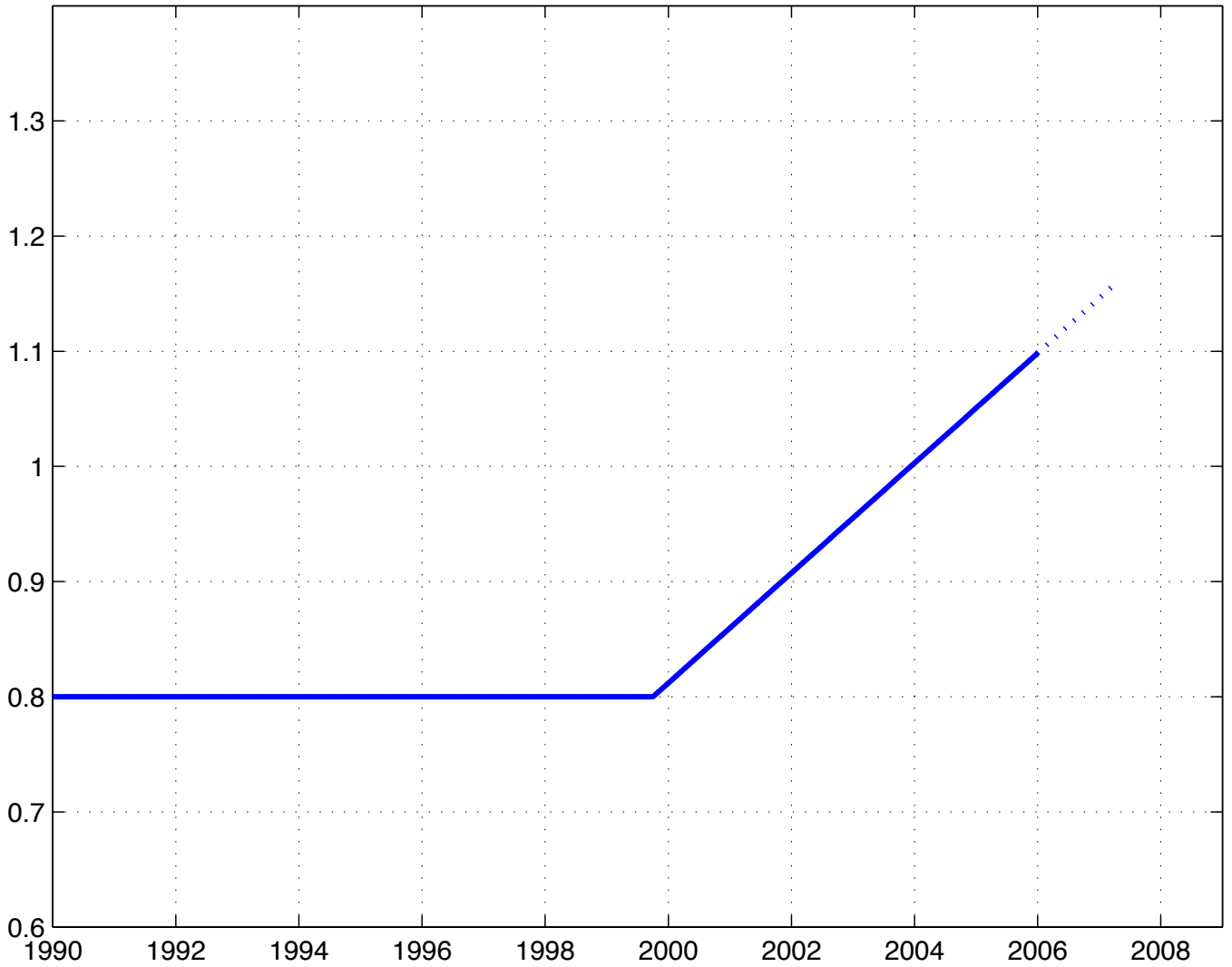
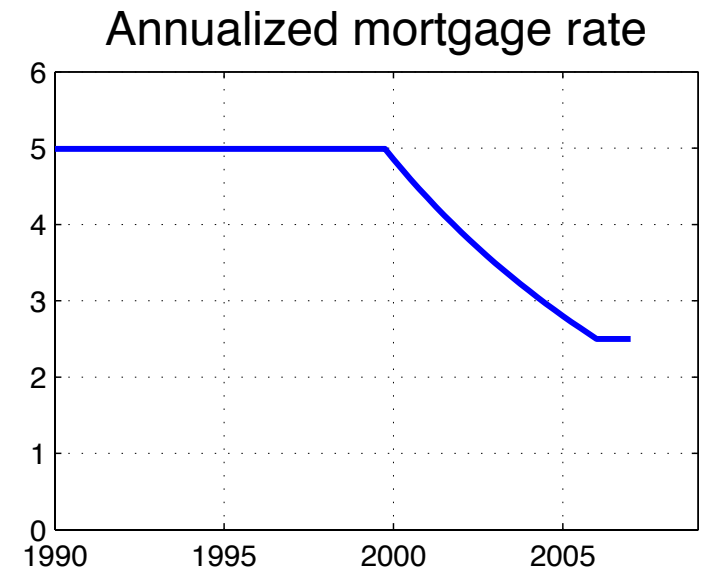
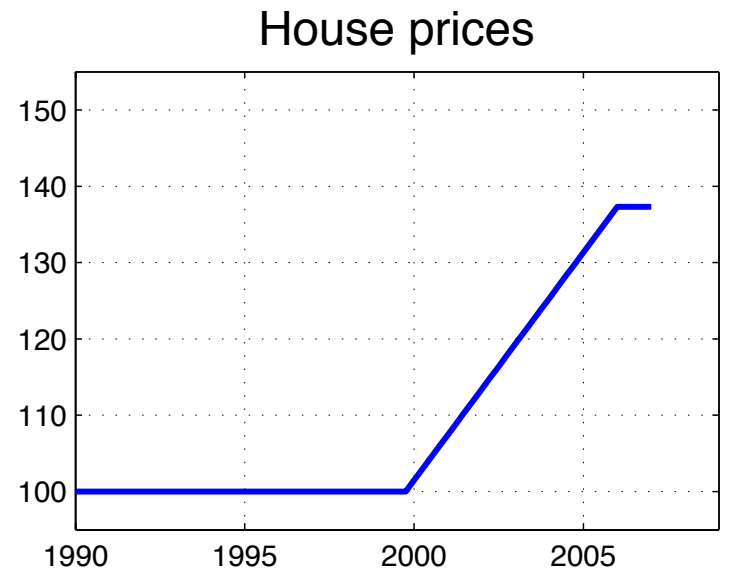
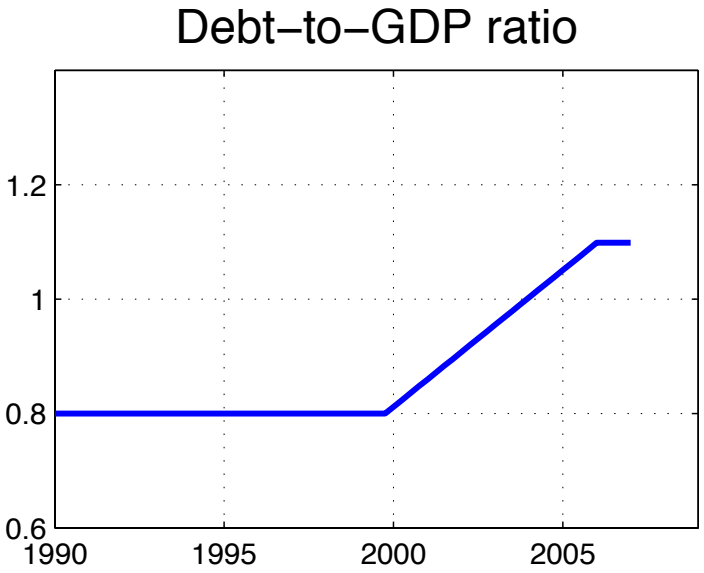
$\bar{L}$ *relative to income*

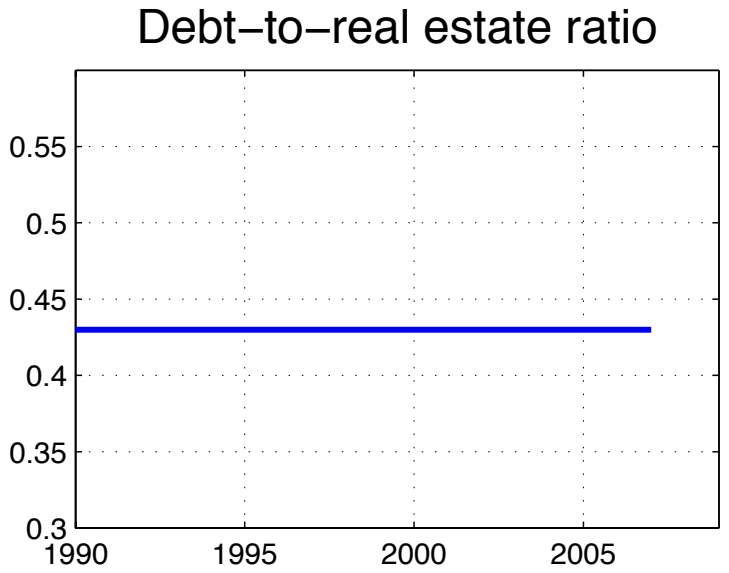


Experiment 1: Loosening of lending constraints







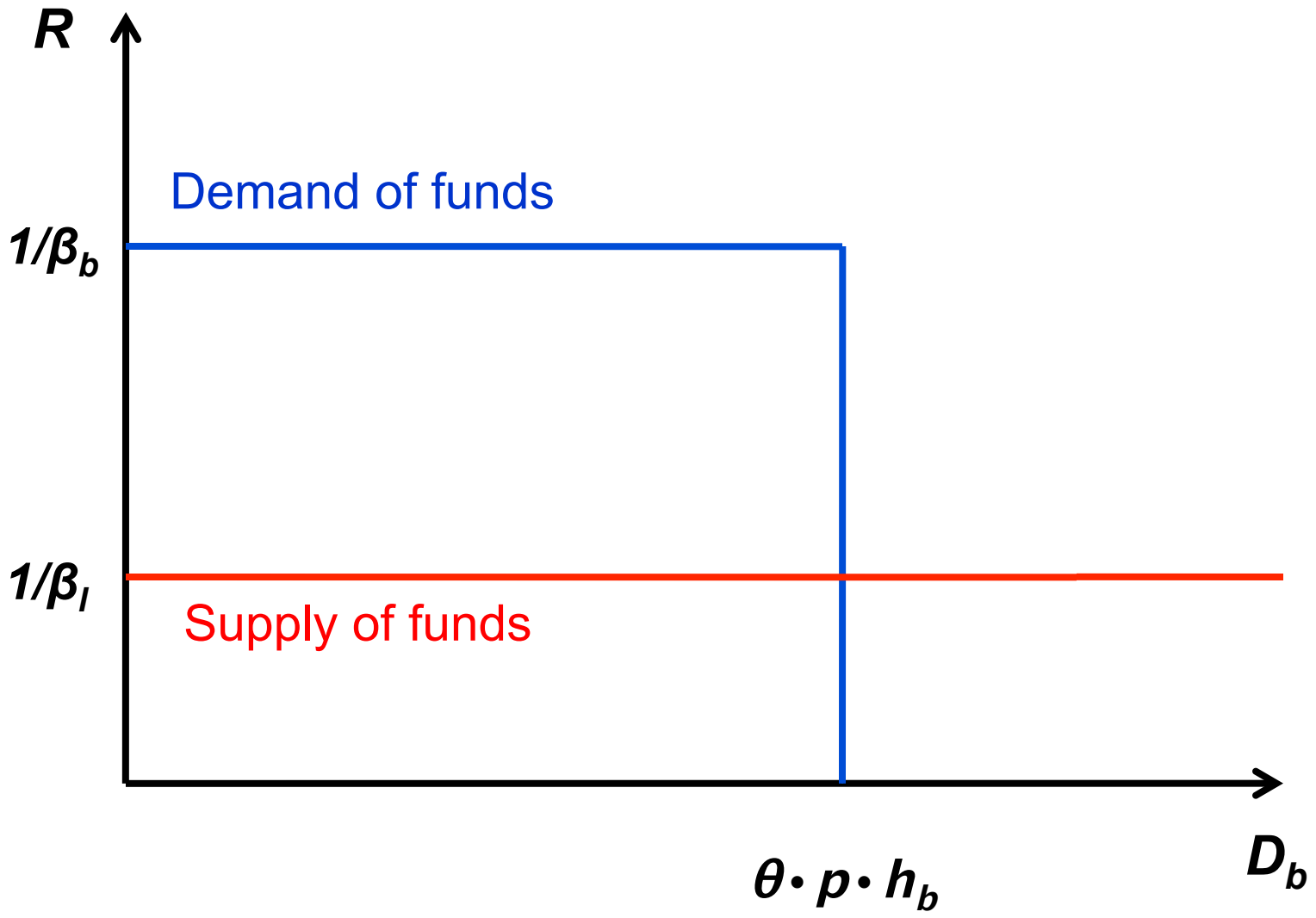


Experiment 2: Loosening of collateral requirements

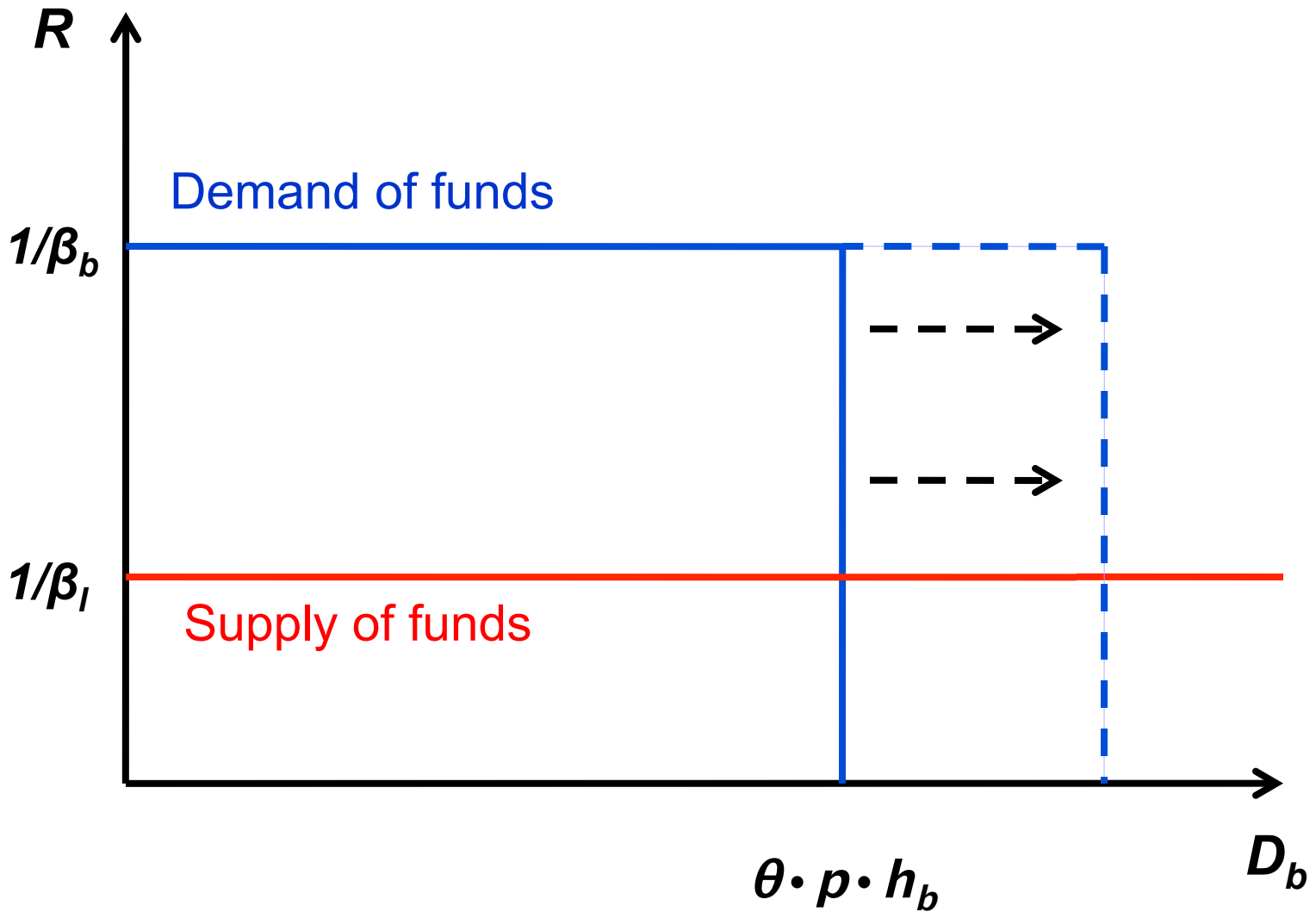
- Standard model without lending constraints

- Simulate the effects of a gradual relaxation of collateral requirements

Standard model without lending constraint



Standard model without lending constraint

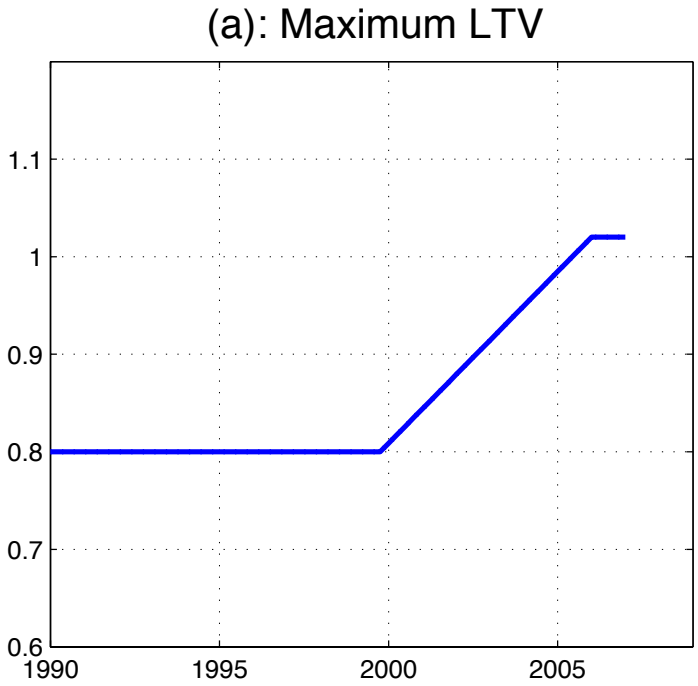


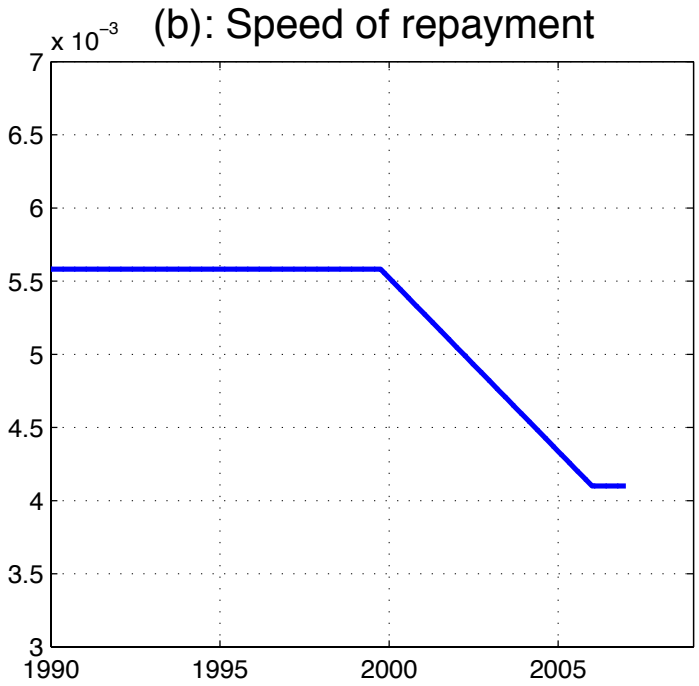
Experiment 2: Loosening of collateral requirements

- Standard model without lending constraints

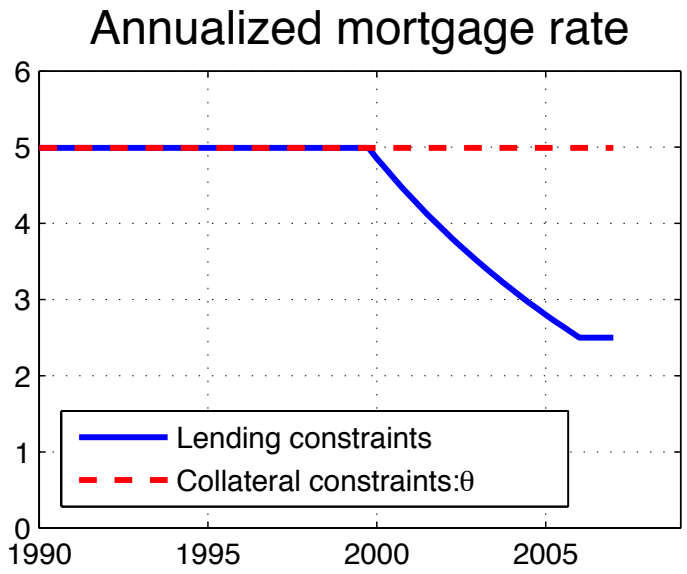
- Simulate the effects of a gradual relaxation of collateral requirements
  - θ from 0.8 to 1.02, to match the increase in HH debt of experiment 1
  - ρ from 0.0056 to 0.0041, to match the increase in HH debt of experiment 1

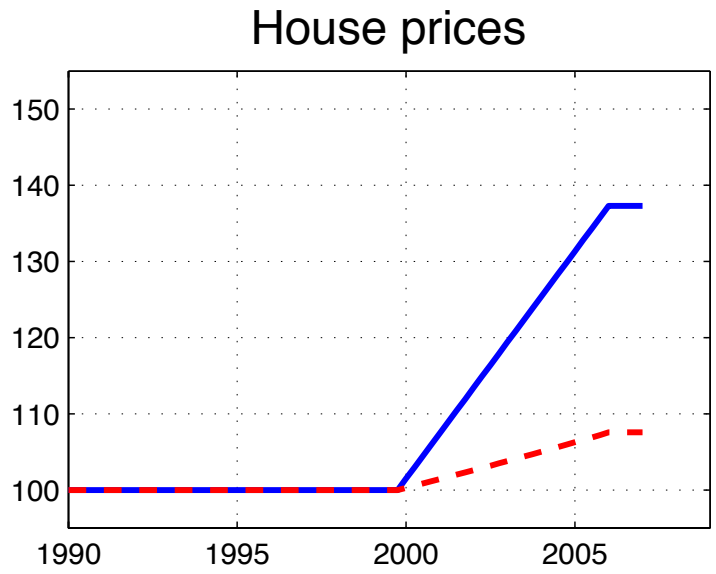
Experiment 2: Loosening of collateral requirements

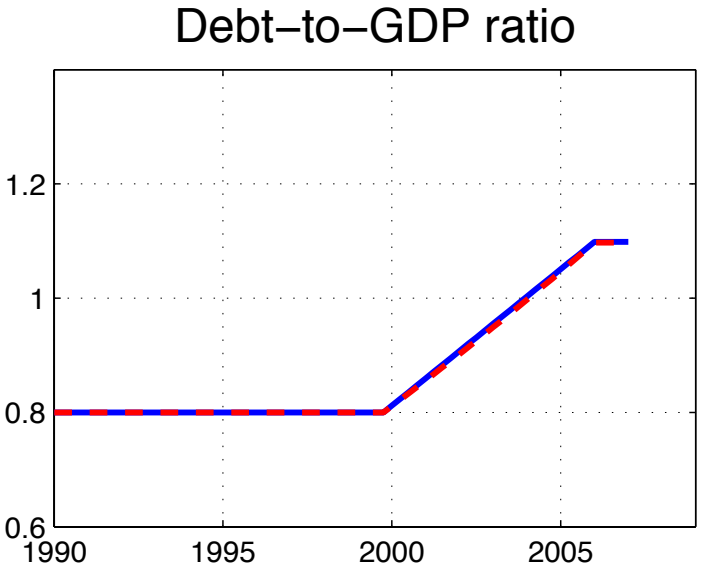


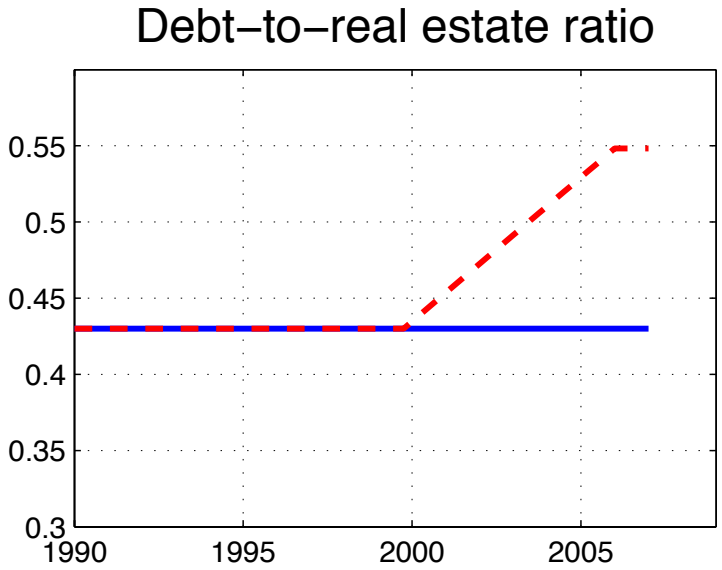


Experiment 2: Loosening of collateral requirements (θ)

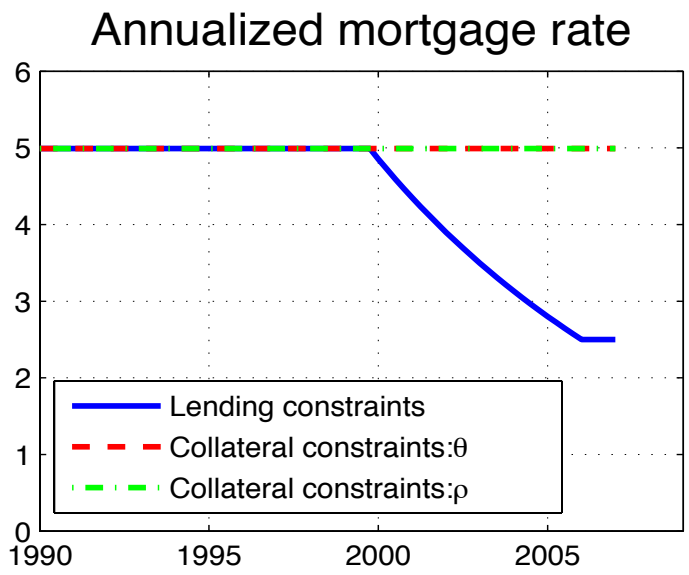


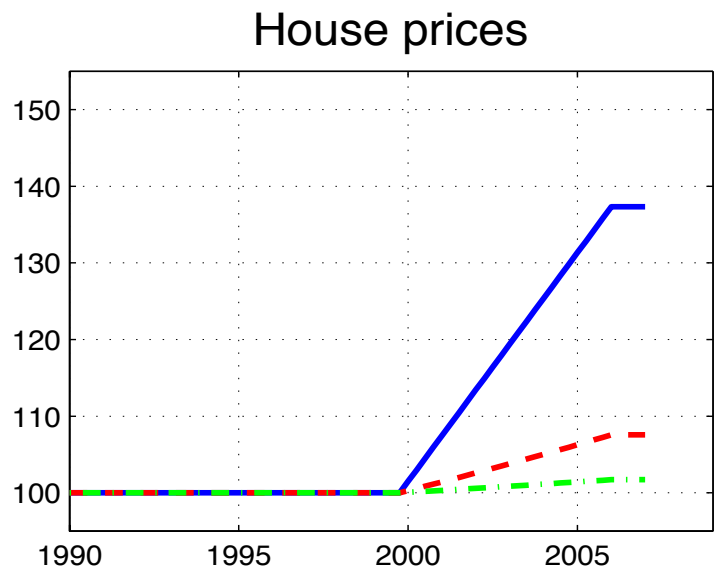


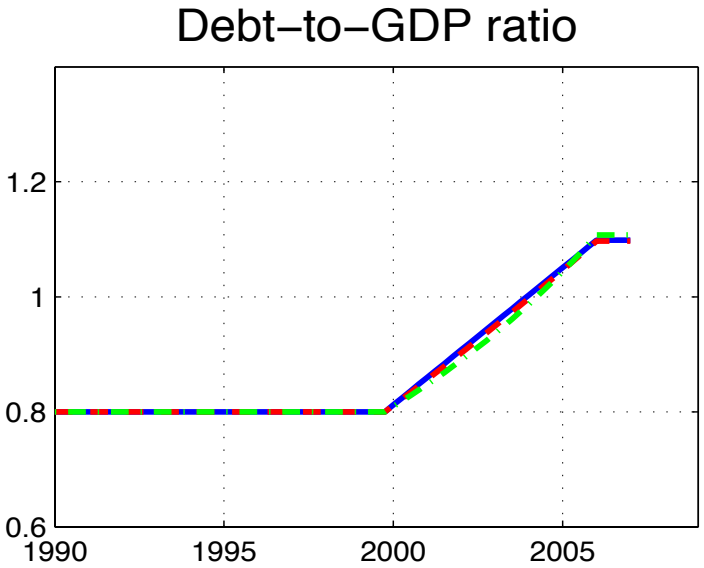


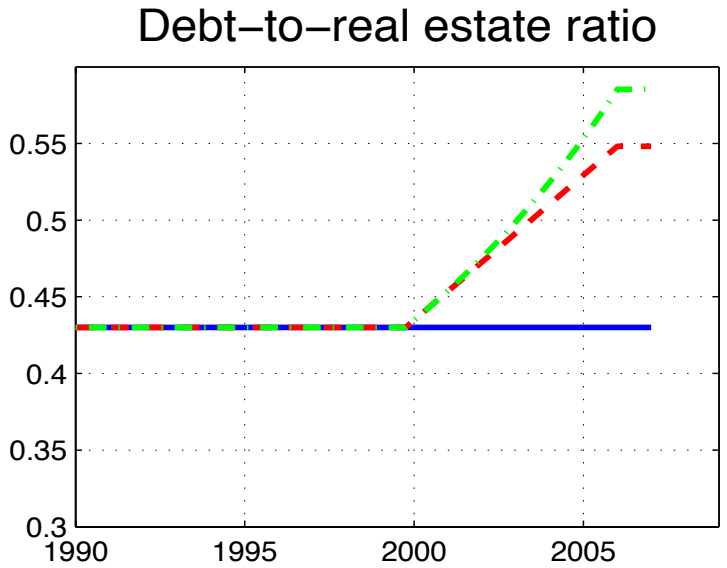


Experiment 2: Loosening of collateral requirements (ρ)









Experiment 3: Loosening of collateral requirements (θ) in a model with lending constraints

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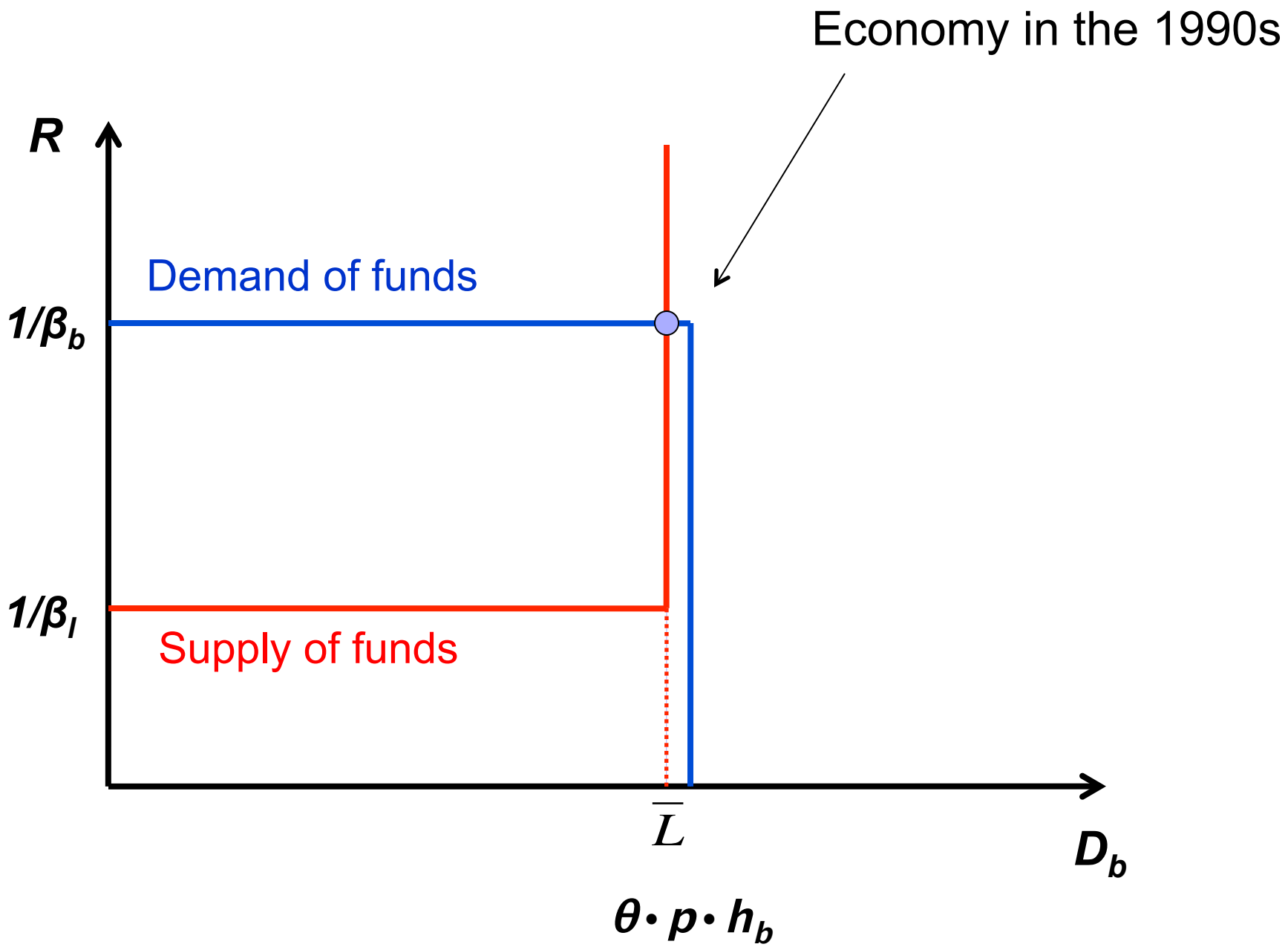

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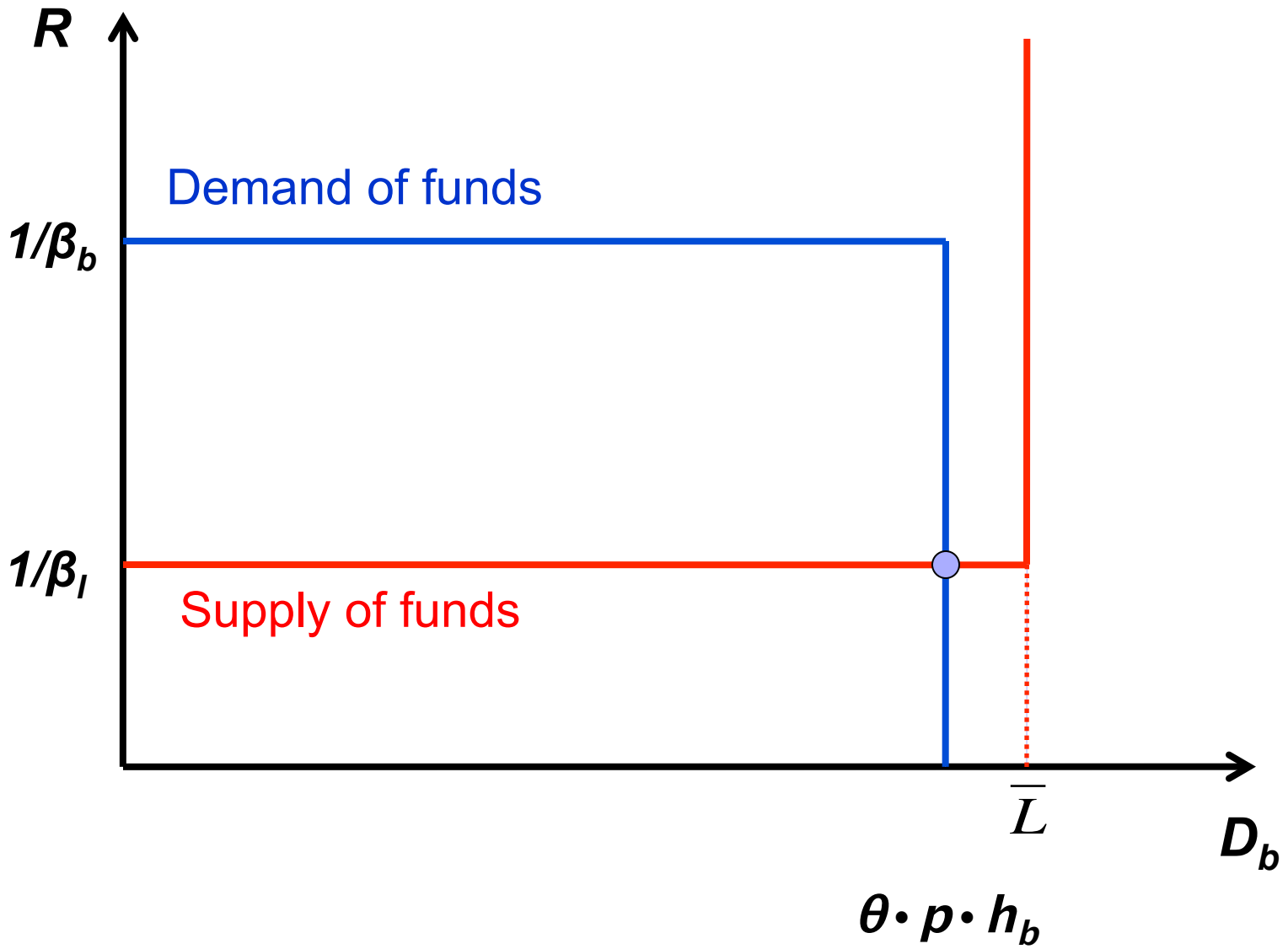
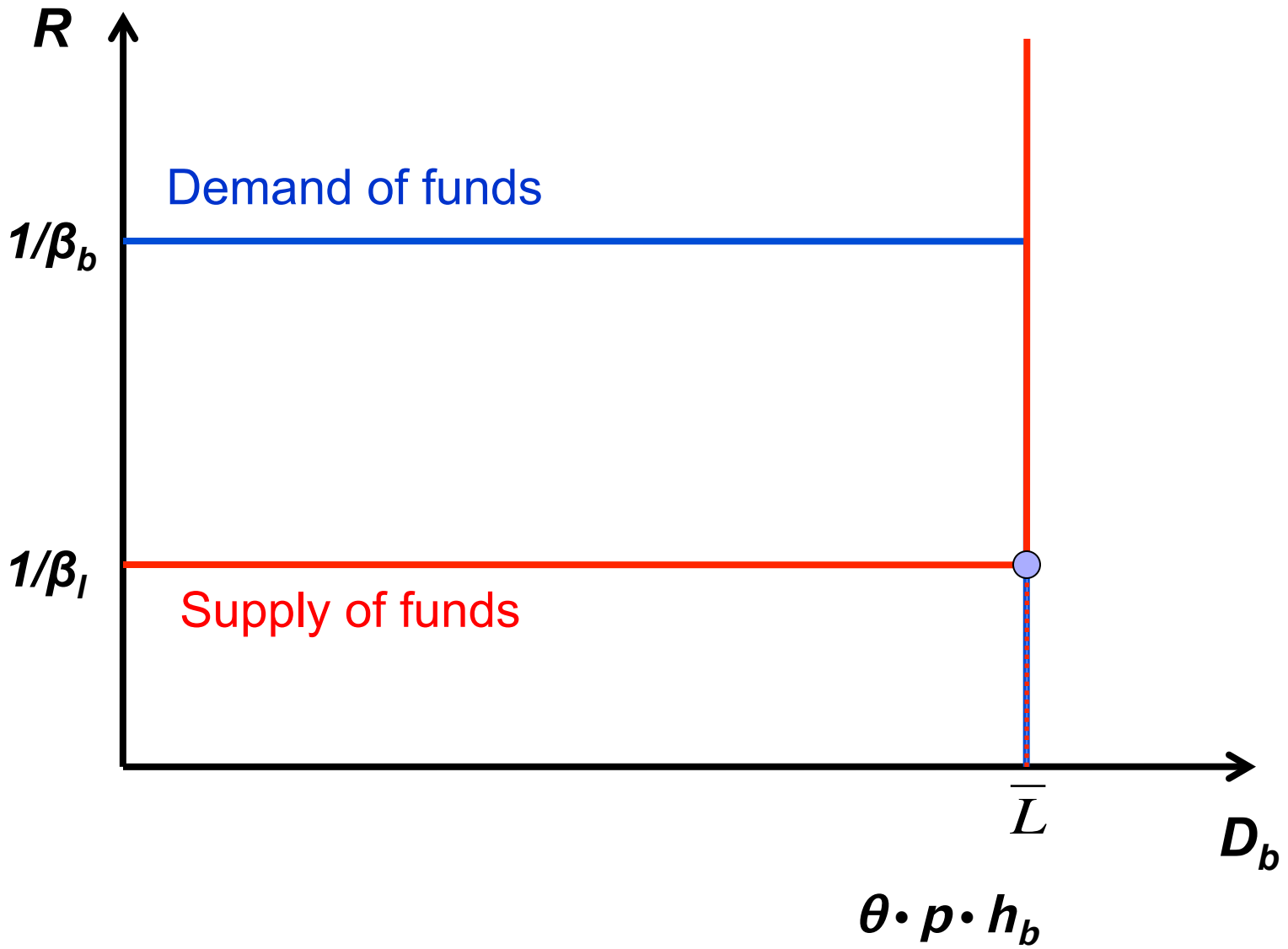


Experiment 3: Loosening of collateral requirements (θ) in a model with lending constraints



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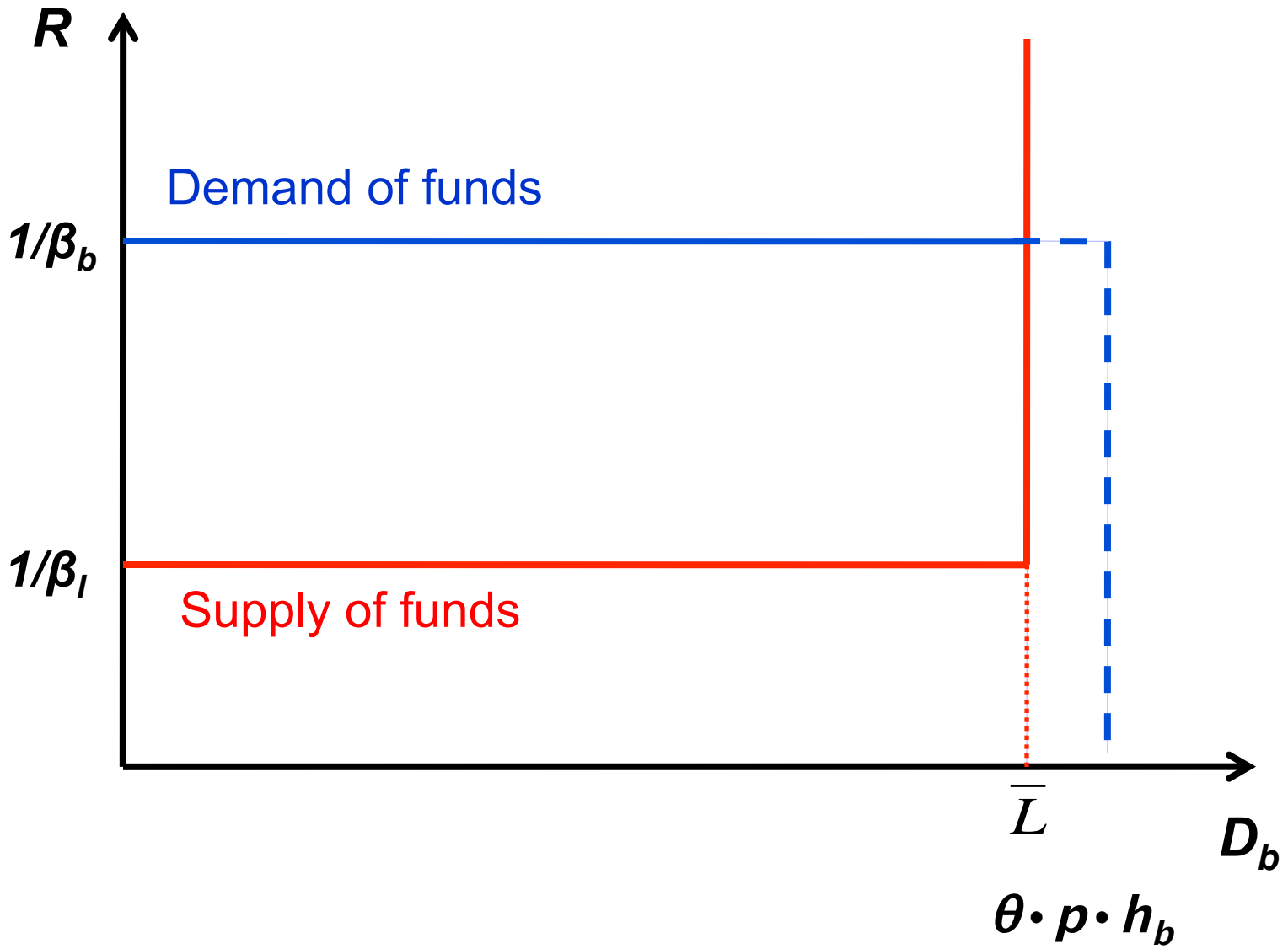

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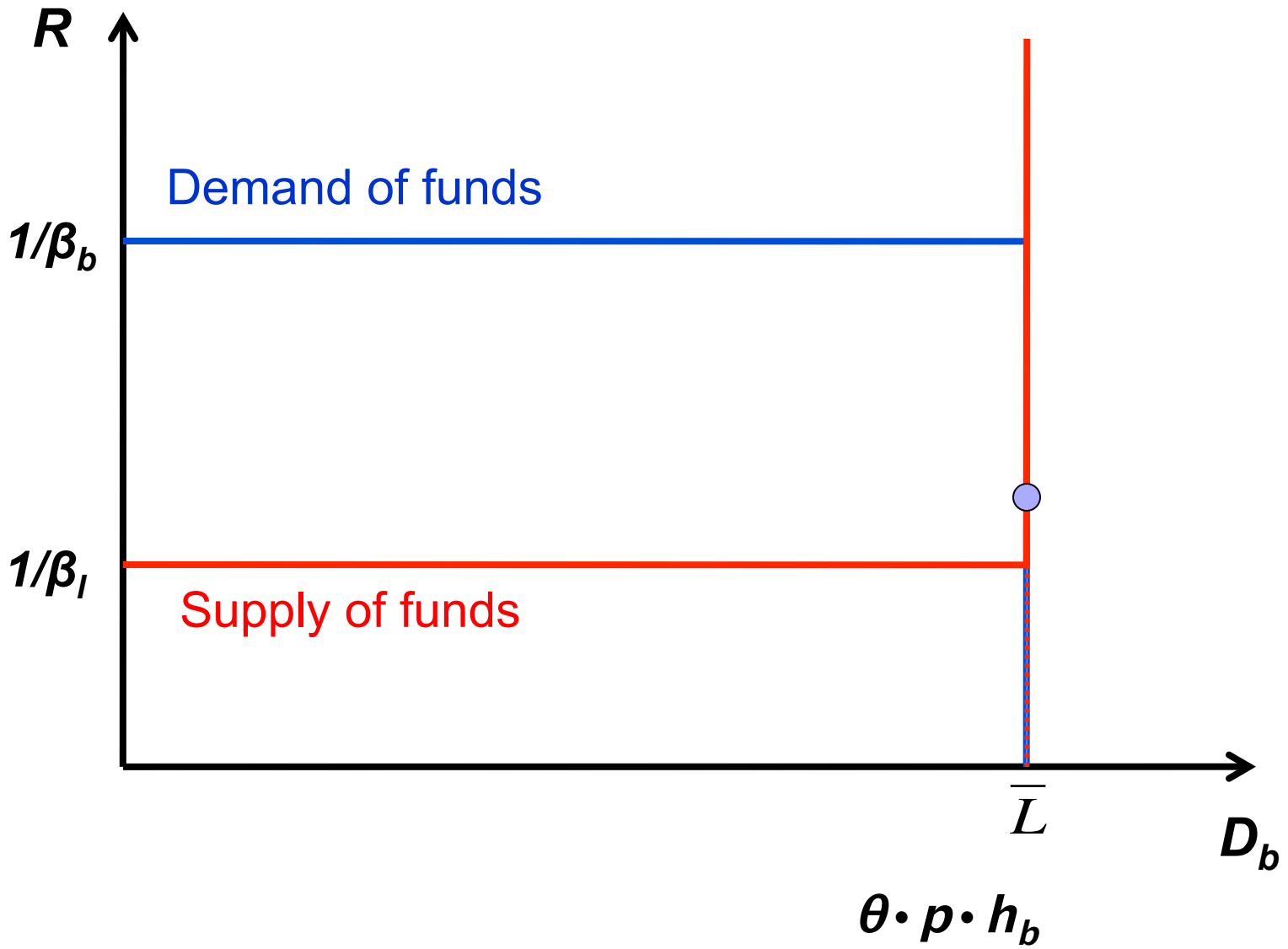

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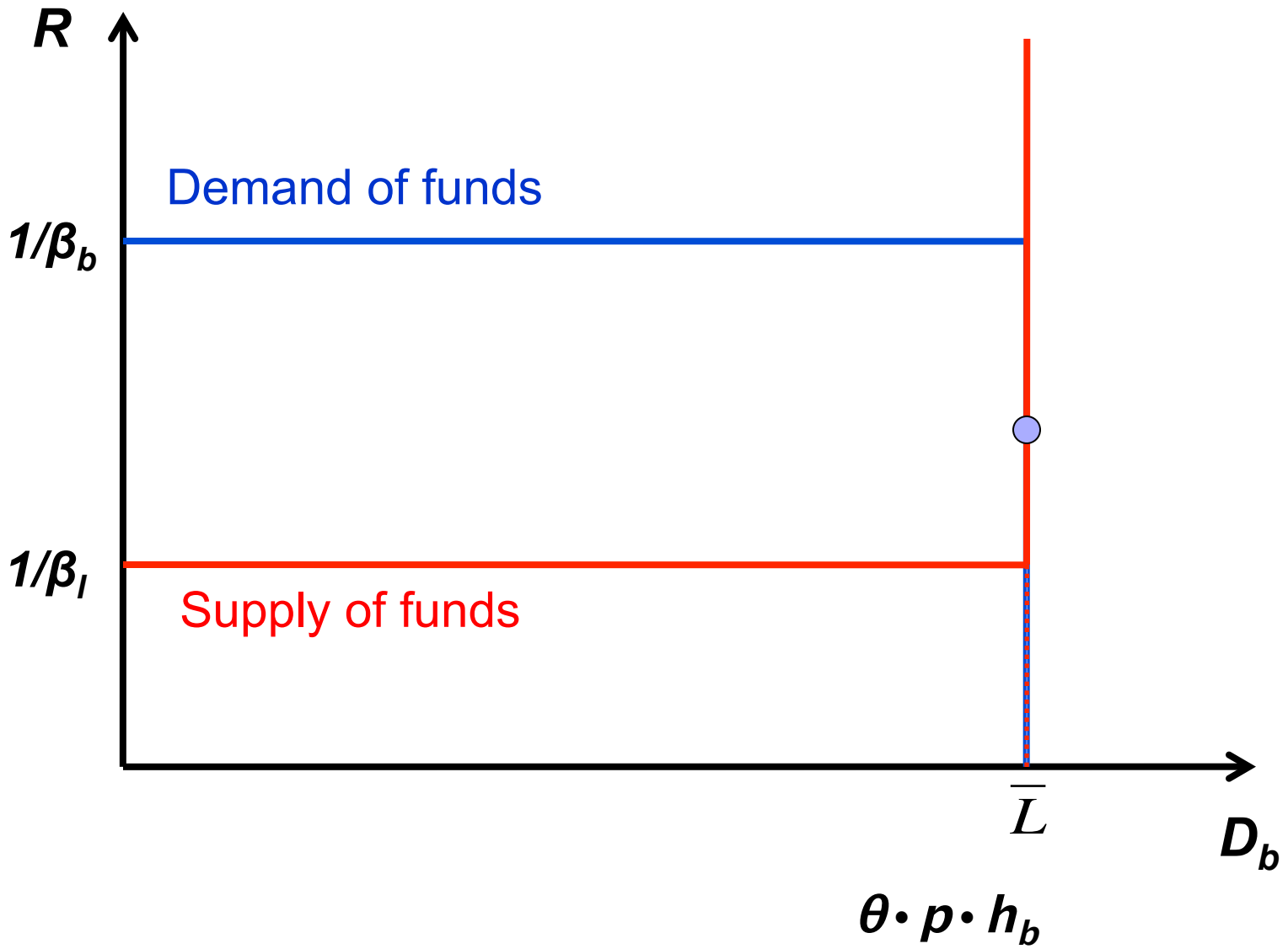
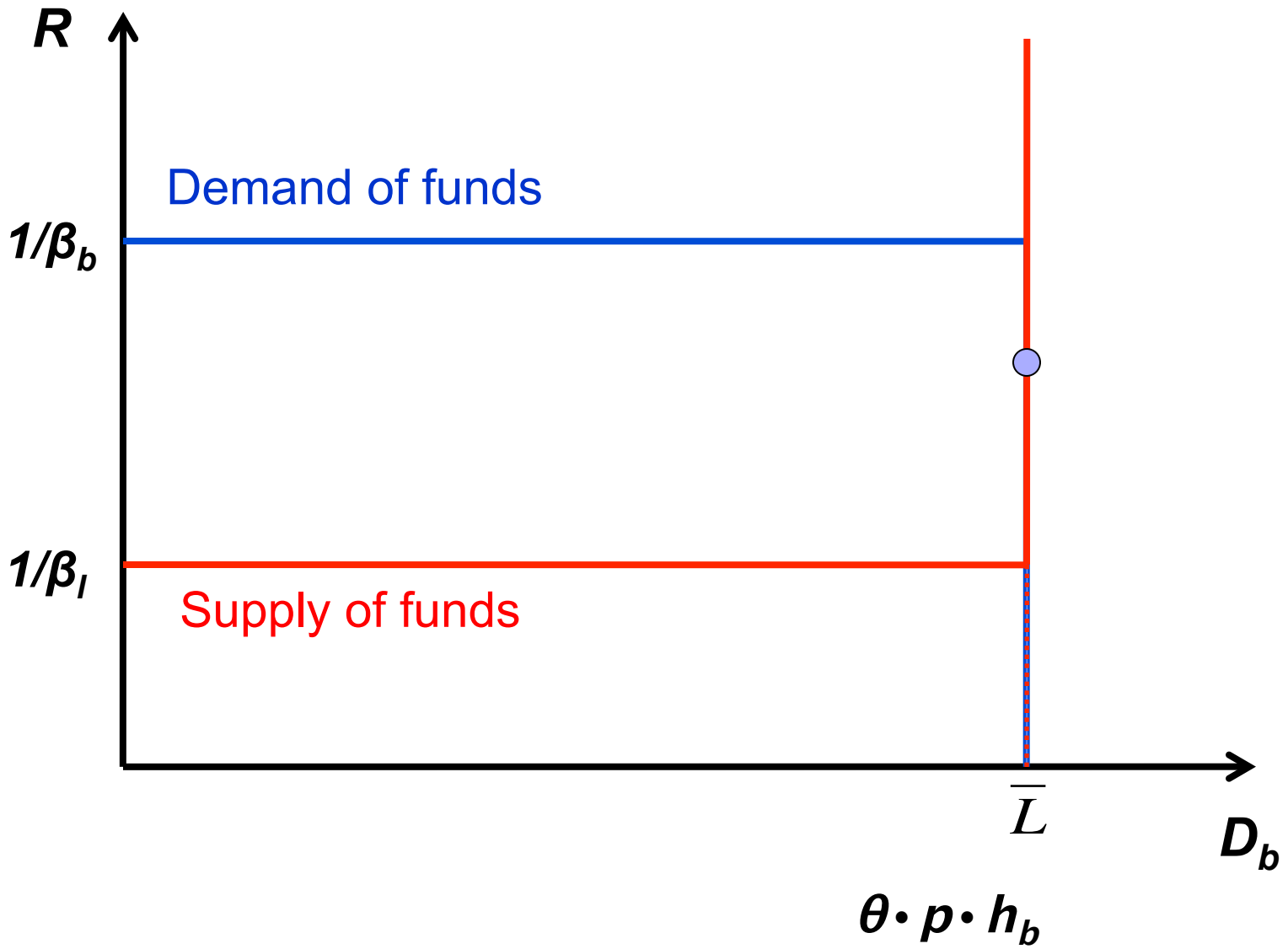


Experiment 3: Loosening of collateral requirements (θ) in a model with lending constraints



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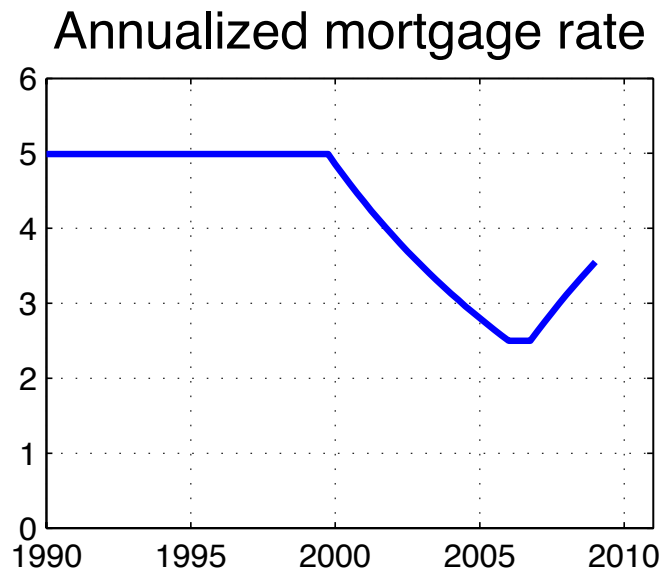
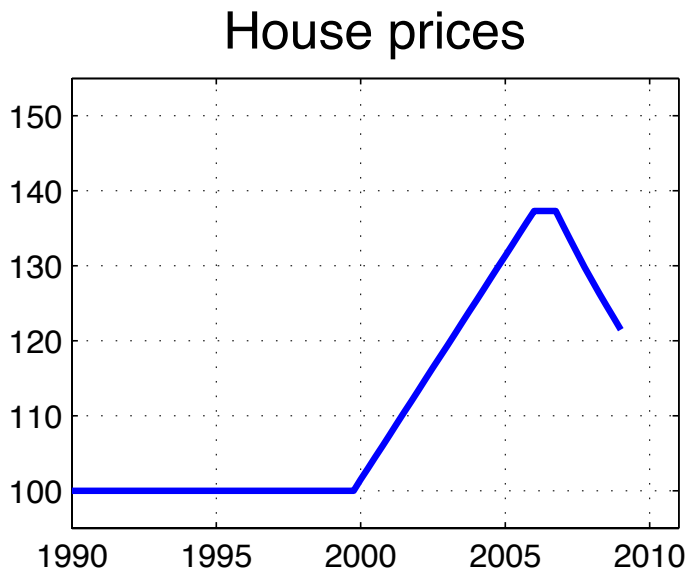
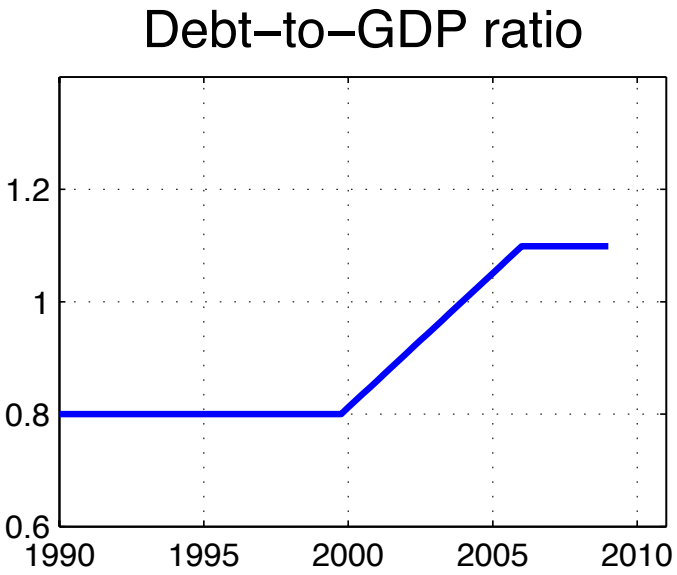
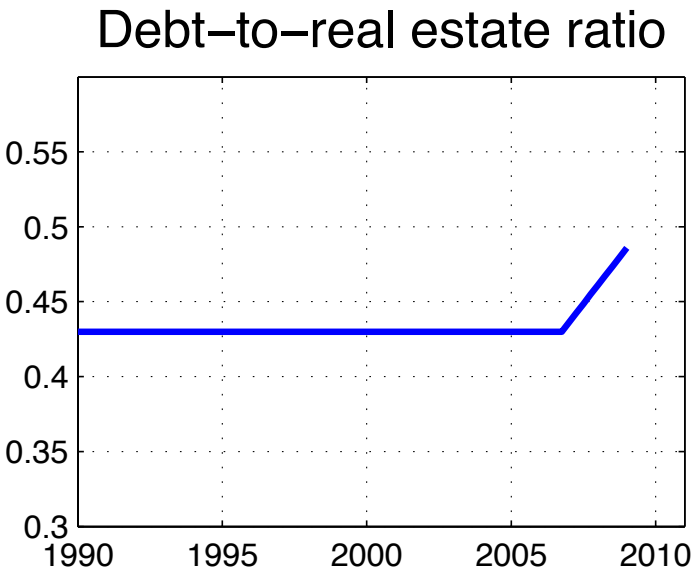








Conclusions

- 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
  - debt-to-collateral ratio
  - If anything, explains why prices started to fall

More generally

- Shift the focus from borrowing constraints to lending constraints
- Interaction between the two is key

The story in words

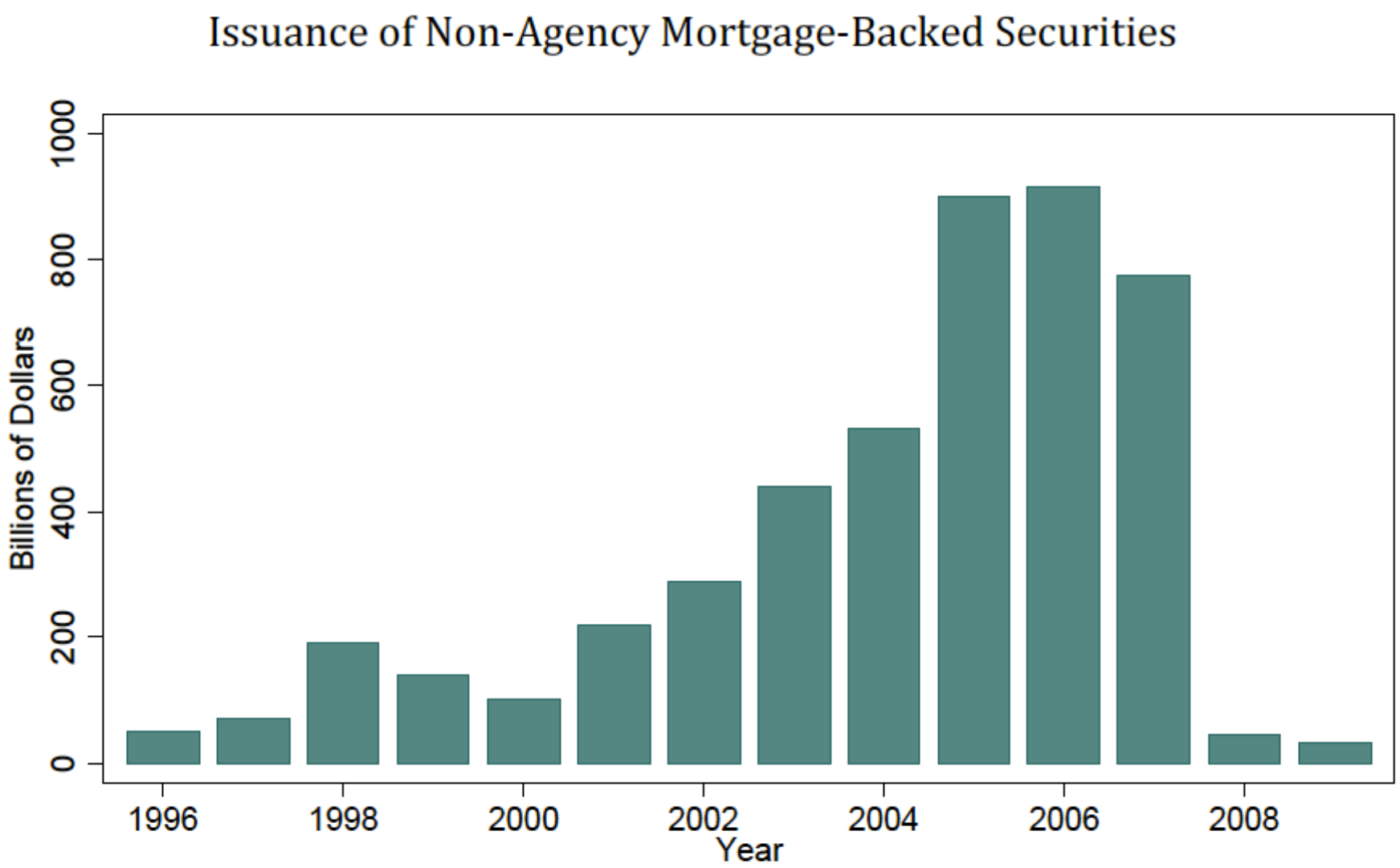
- The apparent safety of the financial sector's collective balance sheet was attributable to the fact that the biggest global banks had amassed vast quantities of AAA-rated ("safe") tranches backed by residential mortgages. These assets had historically been safer than similarly rated corporate loans. 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%)

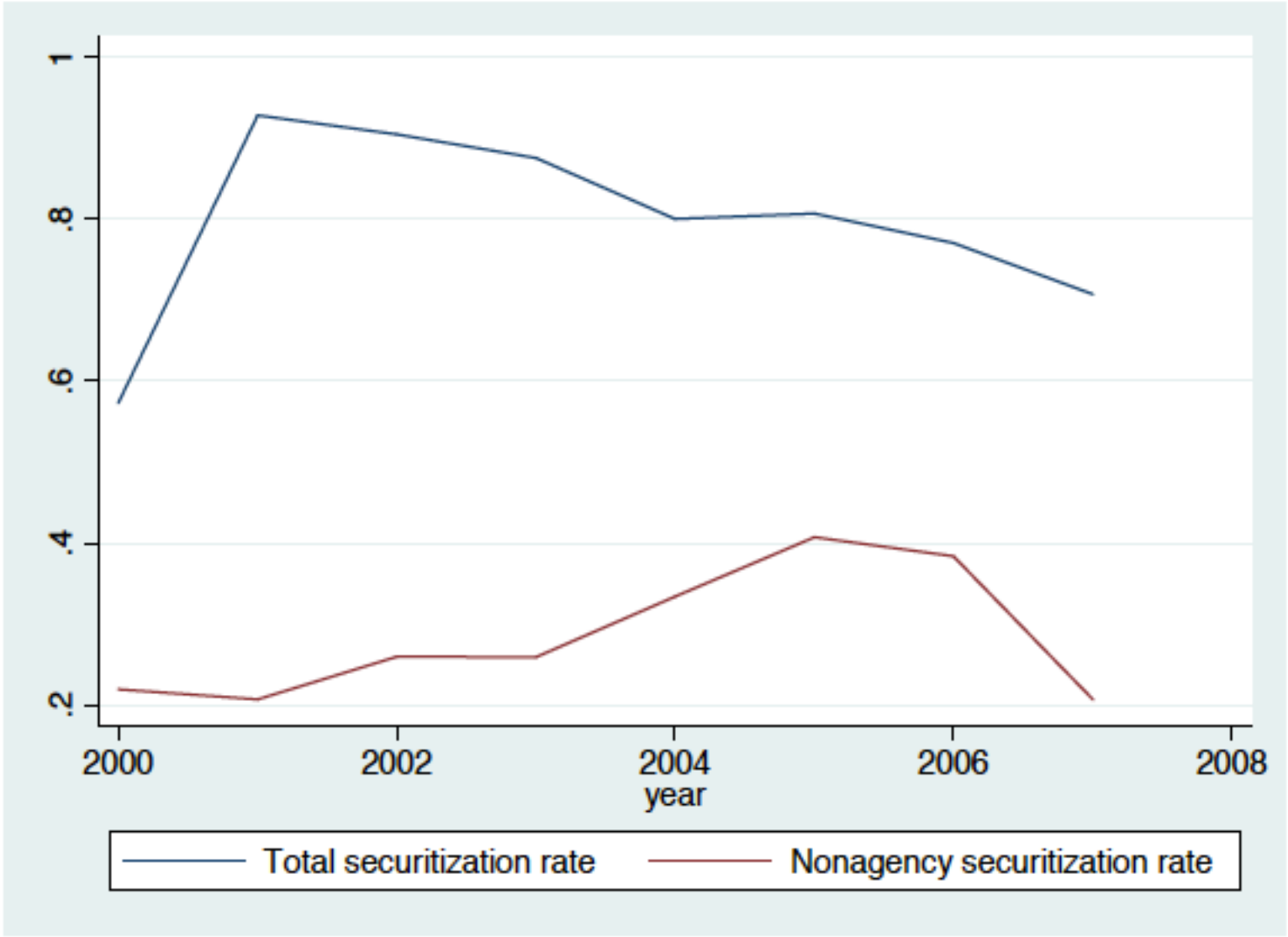
Non-agency MBSs (Mayer)



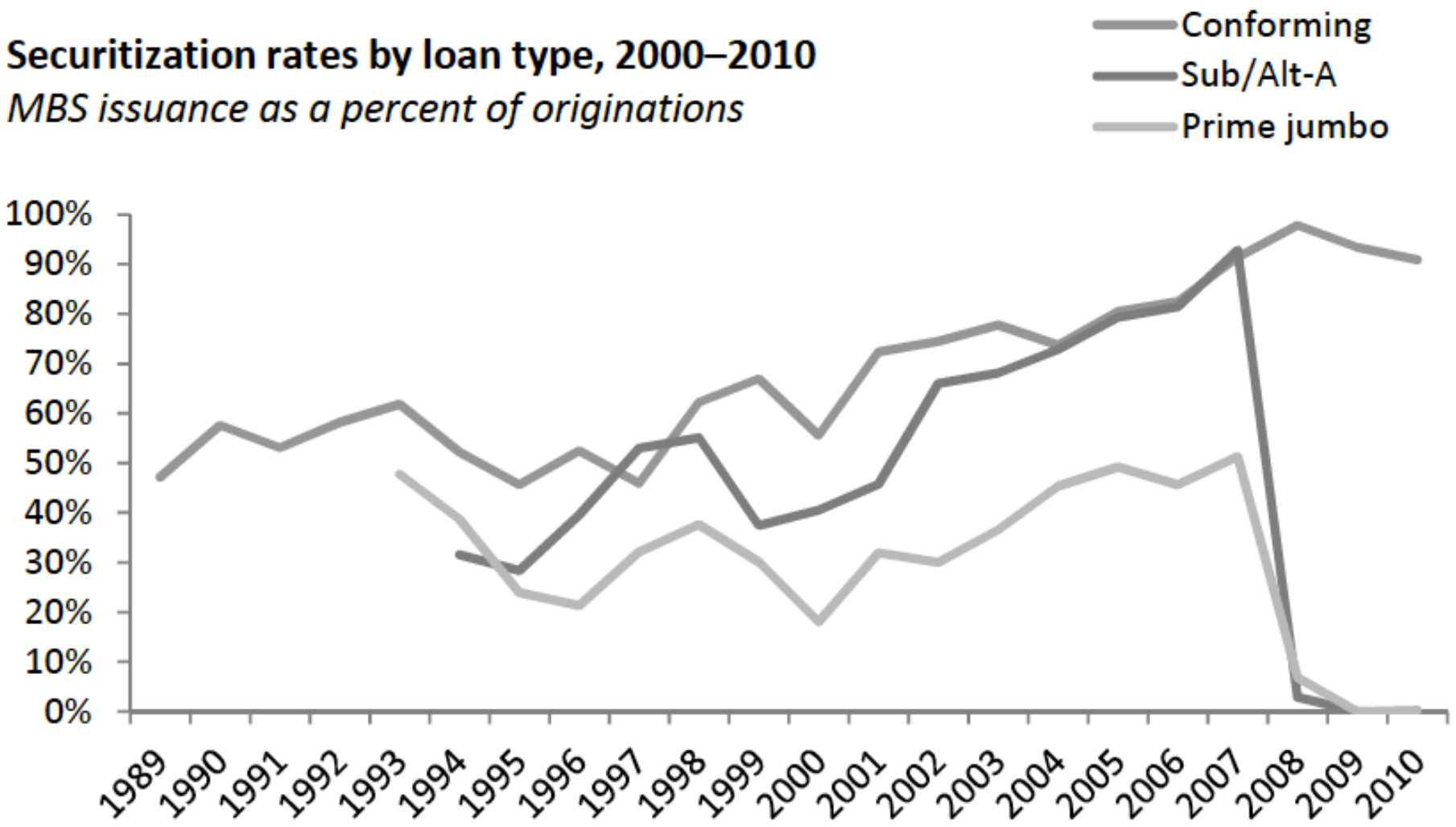
Gross Non-Agency MBS Issuance by Year (Includes CMBS)
Current as of 2010 Q1
Source: SIFMA

Share of securitized mortgages (Krainer and Laderman, 2011)

Figure 2: Securitization by Year

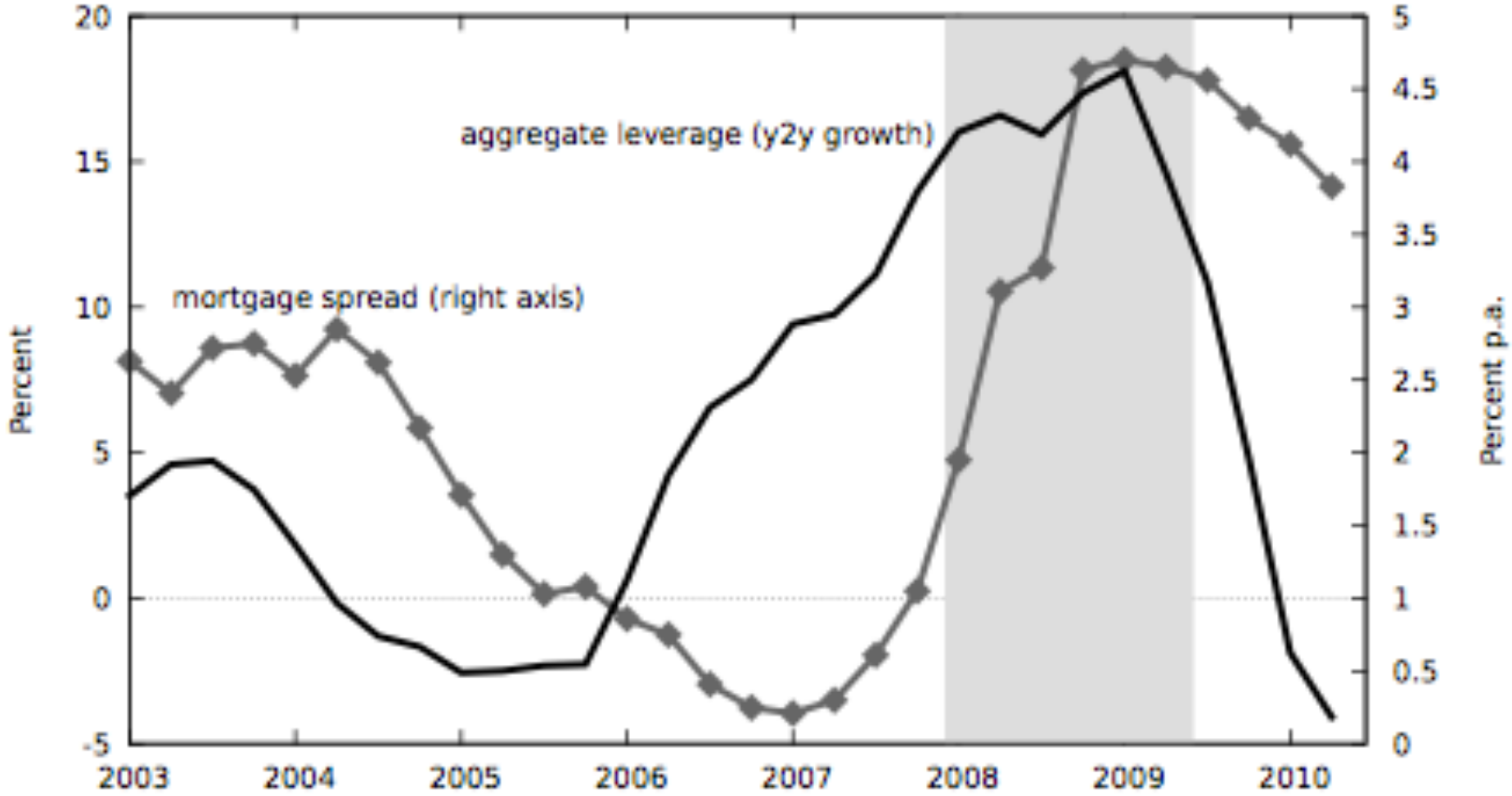


Securitization rates (Simkovic, 2013)



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

Mortgage spreads (1-year-ARM minus the FFR)



Senior Loan Officer Opinion Survey