

# Credit supply and the housing boom

Alejandro Justiniano

Federal Reserve Bank of Chicago

Giorgio Primiceri

Northwestern University

Andrea Tambalotti

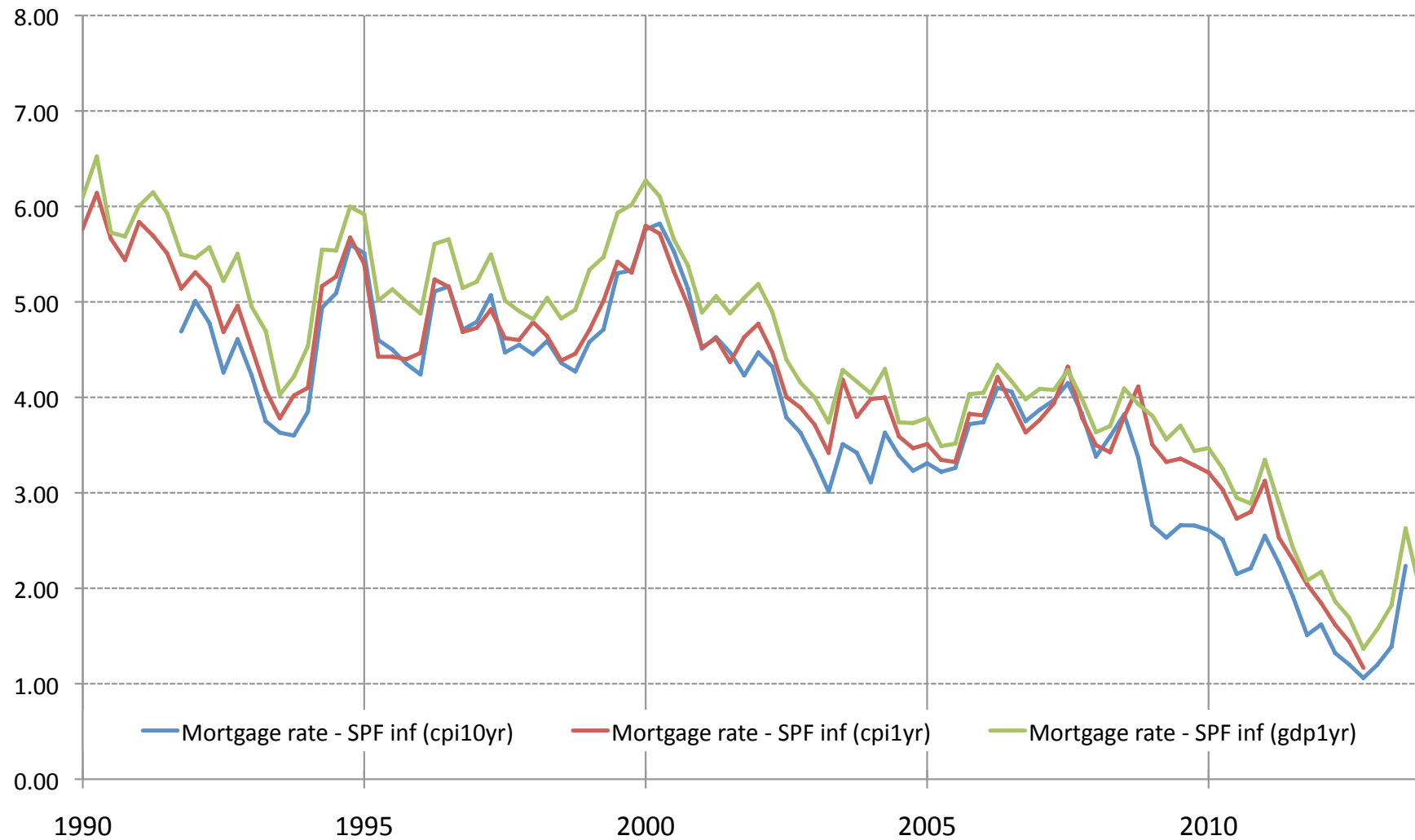
Federal Reserve Bank of New York

Nonlinearities in light of crises

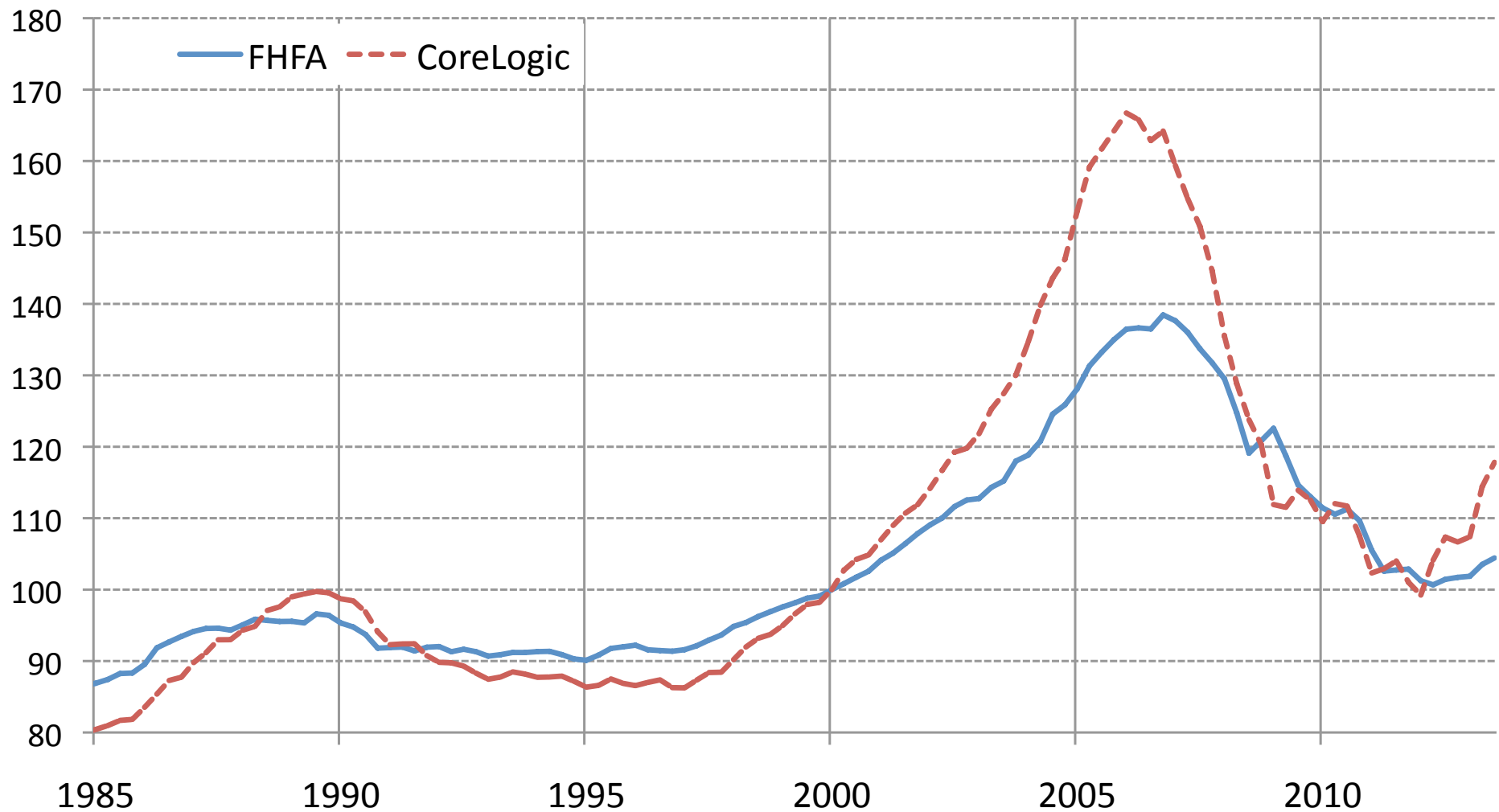
Frankfurt

December 15, 2014

# 1. Decline in real mortgage rates

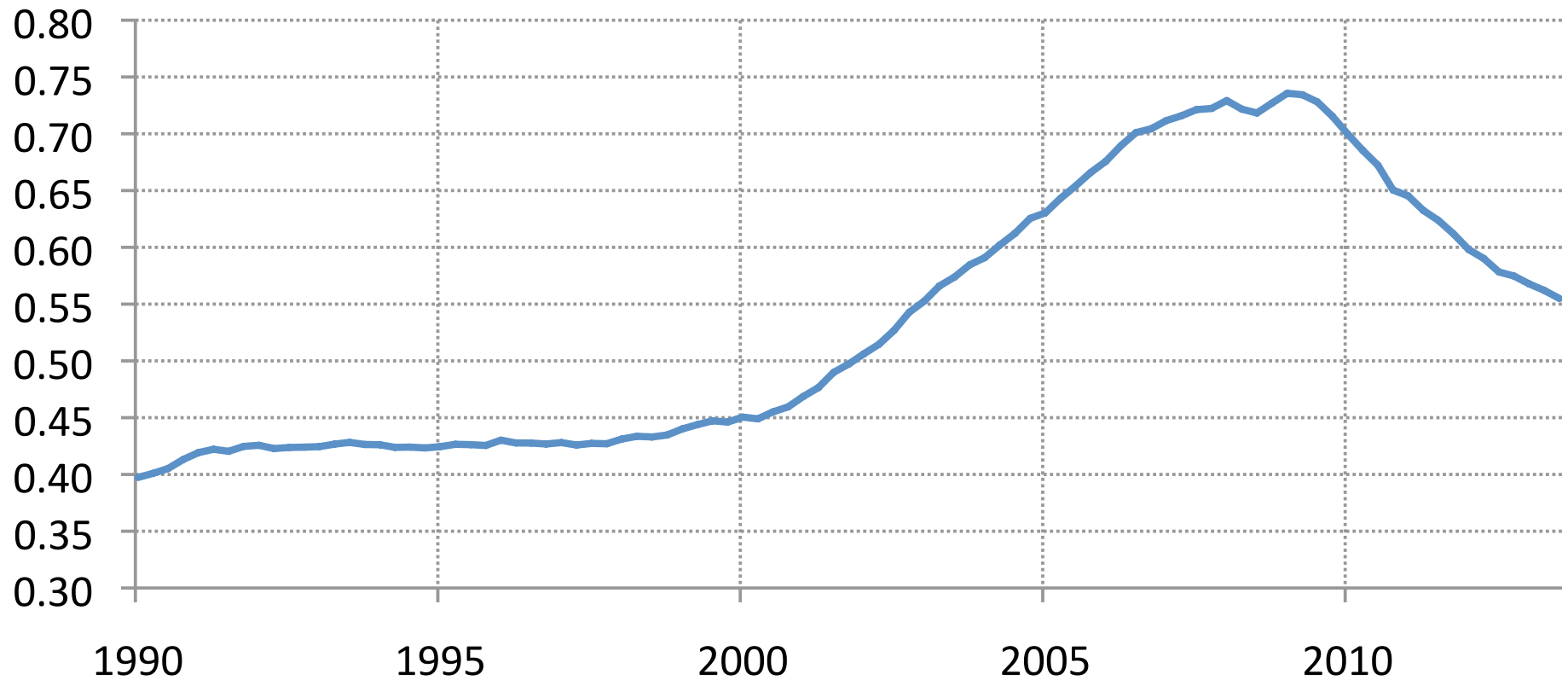


## 2. Unprecedented boom and bust in (real) house price



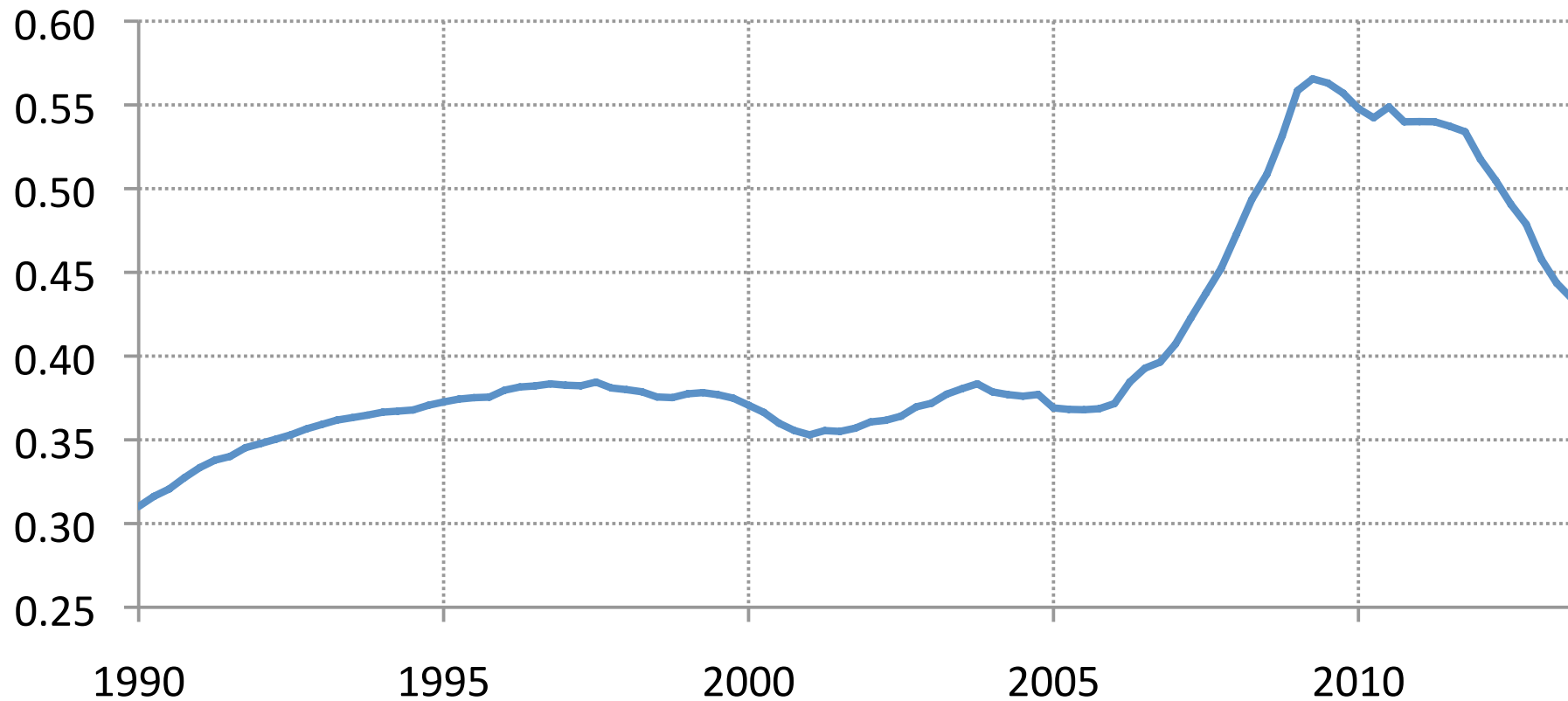
### 3. Boom and bust in household debt

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



## 4. Debt-to-collateral ratio: constant and then spikes

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



# 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

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



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- **Answer:** An increase in credit supply brought about by looser lending constraints. Consistent with
  - decline in mortgage rates
  - large increase in house prices
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- Looser collateral requirements not an important driving force of the boom. At odds with the behavior of
  - mortgage rates, house prices, household leverage
- **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
  
- 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), Dewachter and Wouters (2012), He and Krishnamurty (2013), 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)

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

# Simplest model

- Build on

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

- 2 groups of households

- Patient → Lenders
- Impatient → Borrowers

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- Patient → Lenders
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- No production → income is exogenous

- Fixed supply of (new) houses

# The problem of the borrowers

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

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



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- 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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- Example: Money-market funds, pension funds and insurance companies are restricted by regulations to holding only the safest securities
- Isomorphic to a leverage restriction or regulatory-capital requirement in economy with financial intermediaries

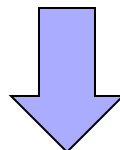
# Two additional simplifying assumptions

Rigid demand for houses by the lenders	
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$$p_t = \frac{\beta_b}{1 - \mu_t \theta} \frac{u'(c_{b,t+1})}{u'(c_{b,t})} \left[ mrs_{b,t+1}^{h,c} + (1 - \delta) p_{t+1} \right]$$

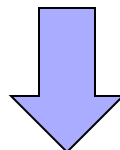
### ■ Implications

- Borrowers are marginal buyers of houses

# Two additional simplifying assumptions

Rigid demand for houses by the lenders

Linear utility in consumption



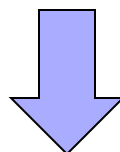
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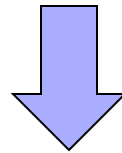
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## ■ Implications

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

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

# 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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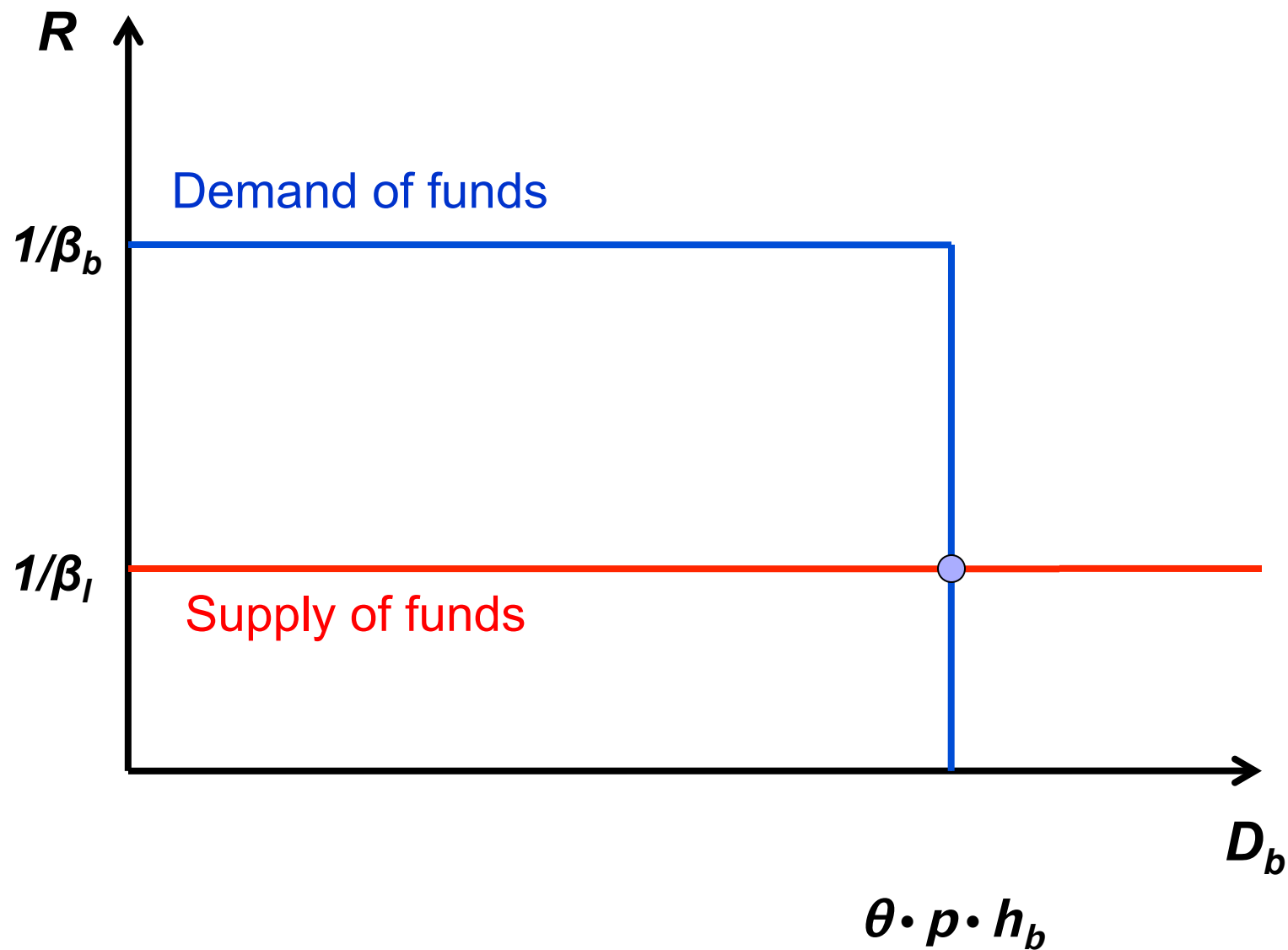
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■ Which constraint binds is

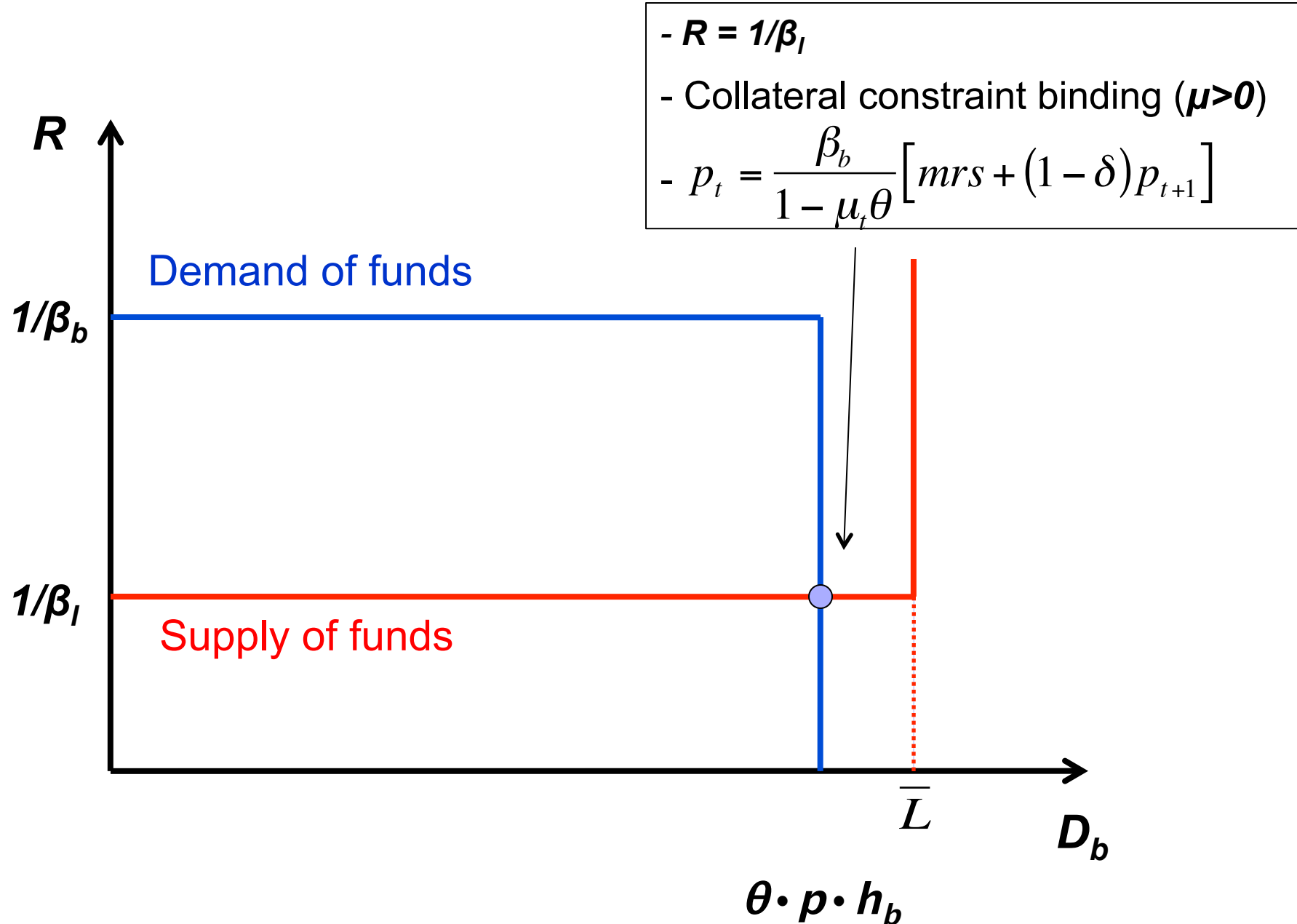
➤ exogenous:  $\bar{L}$  and  $\theta$

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

# Standard model without lending constraint

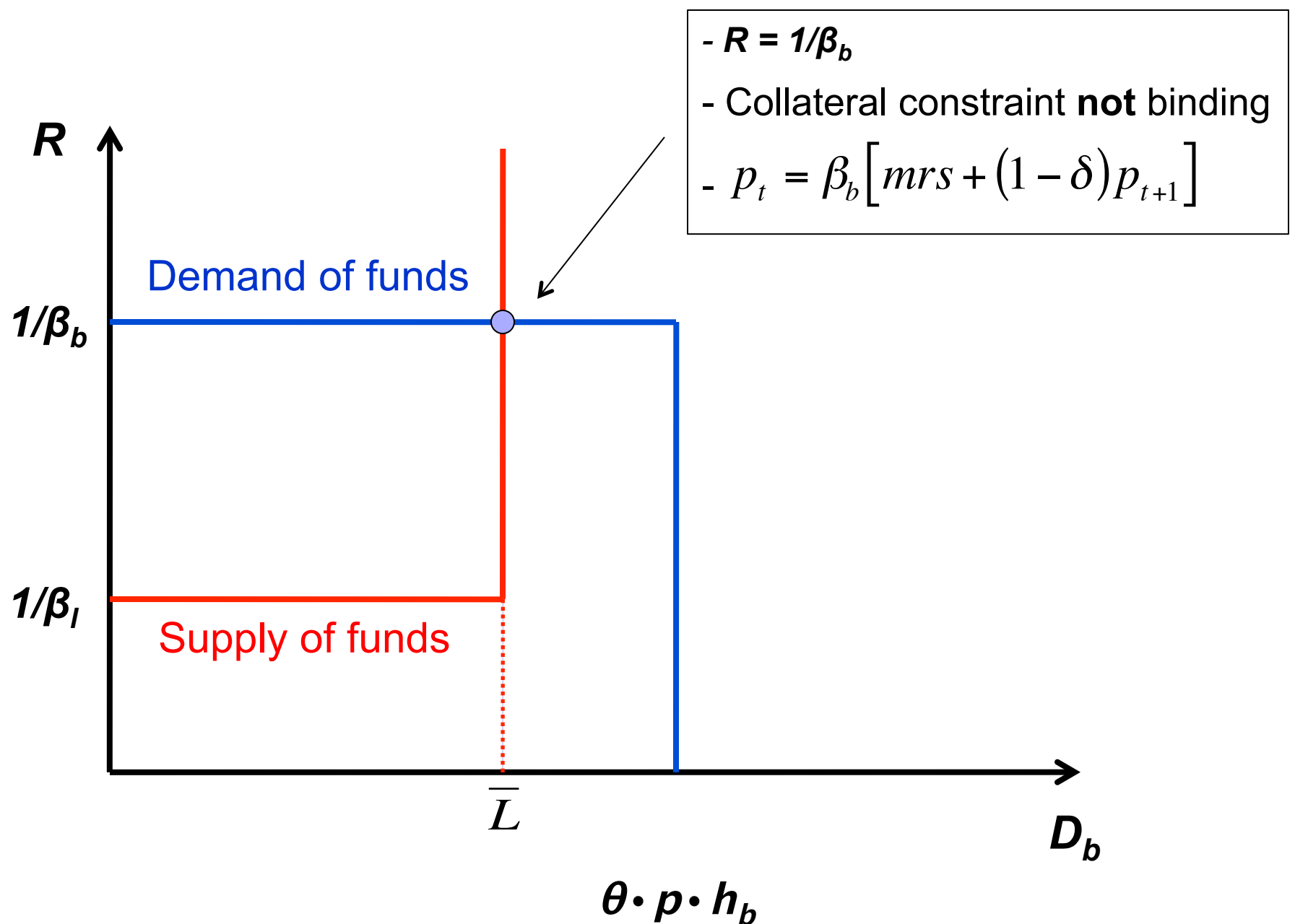


# Non-binding lending constraint

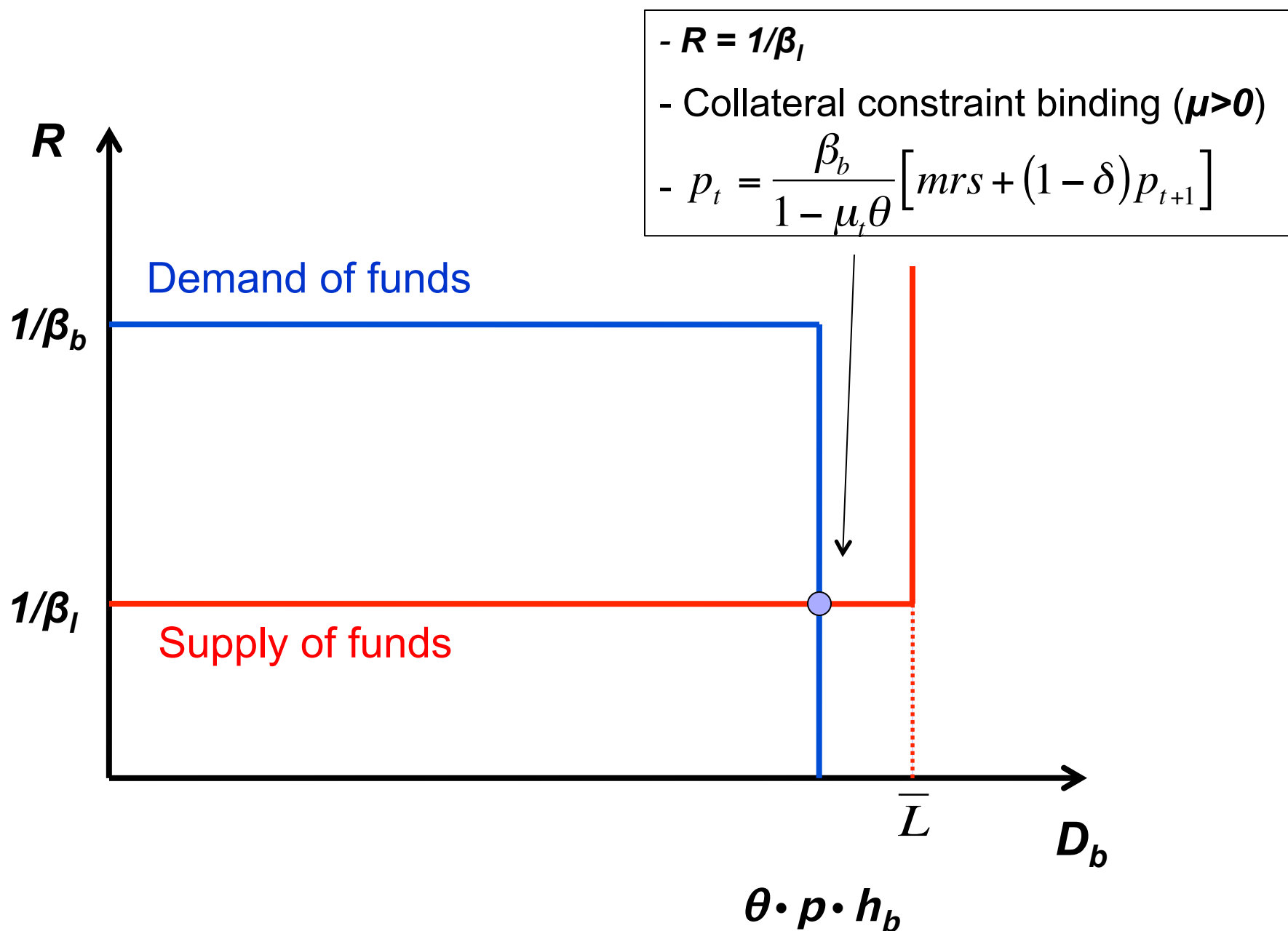




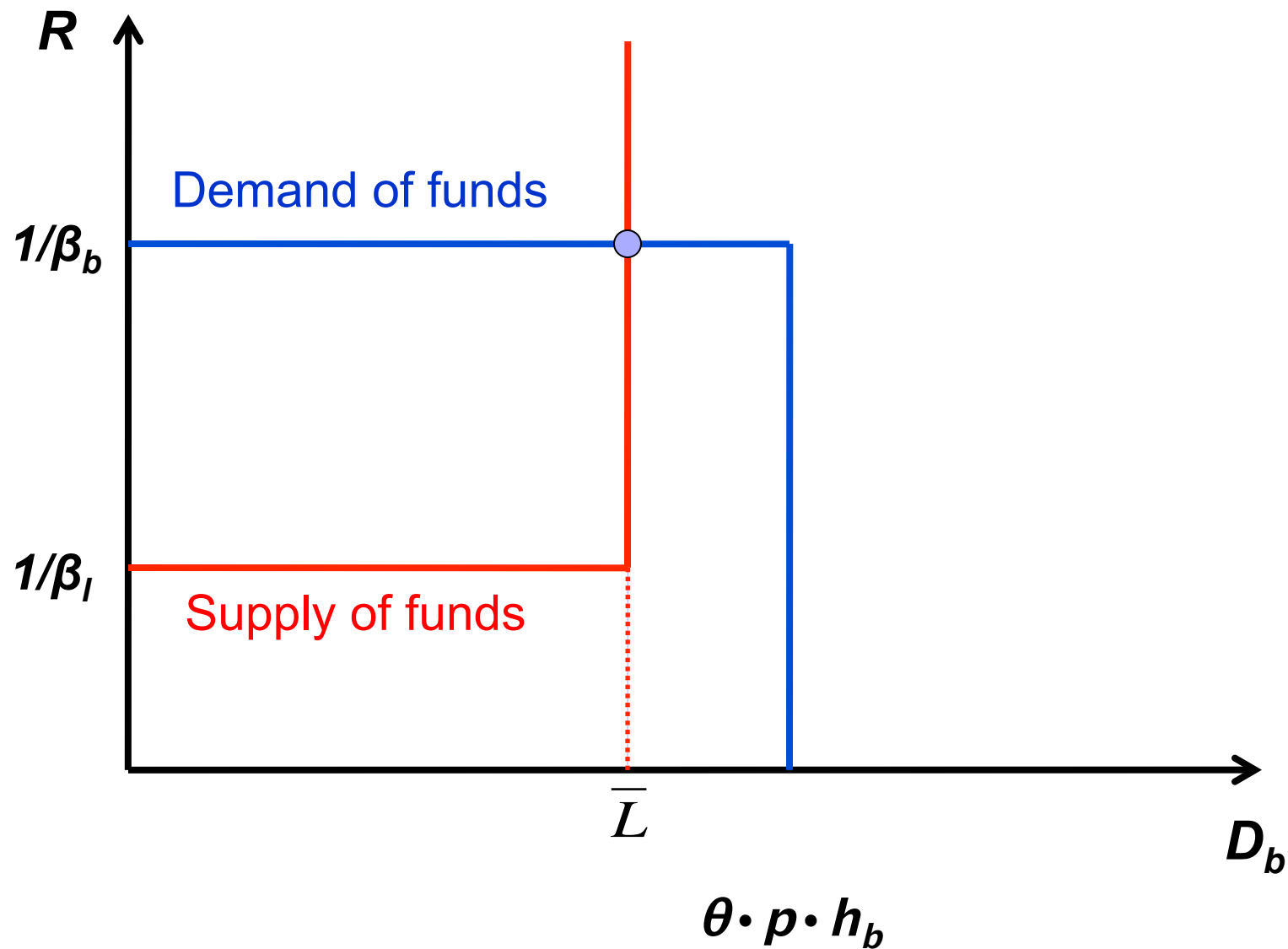
# Binding lending constraint



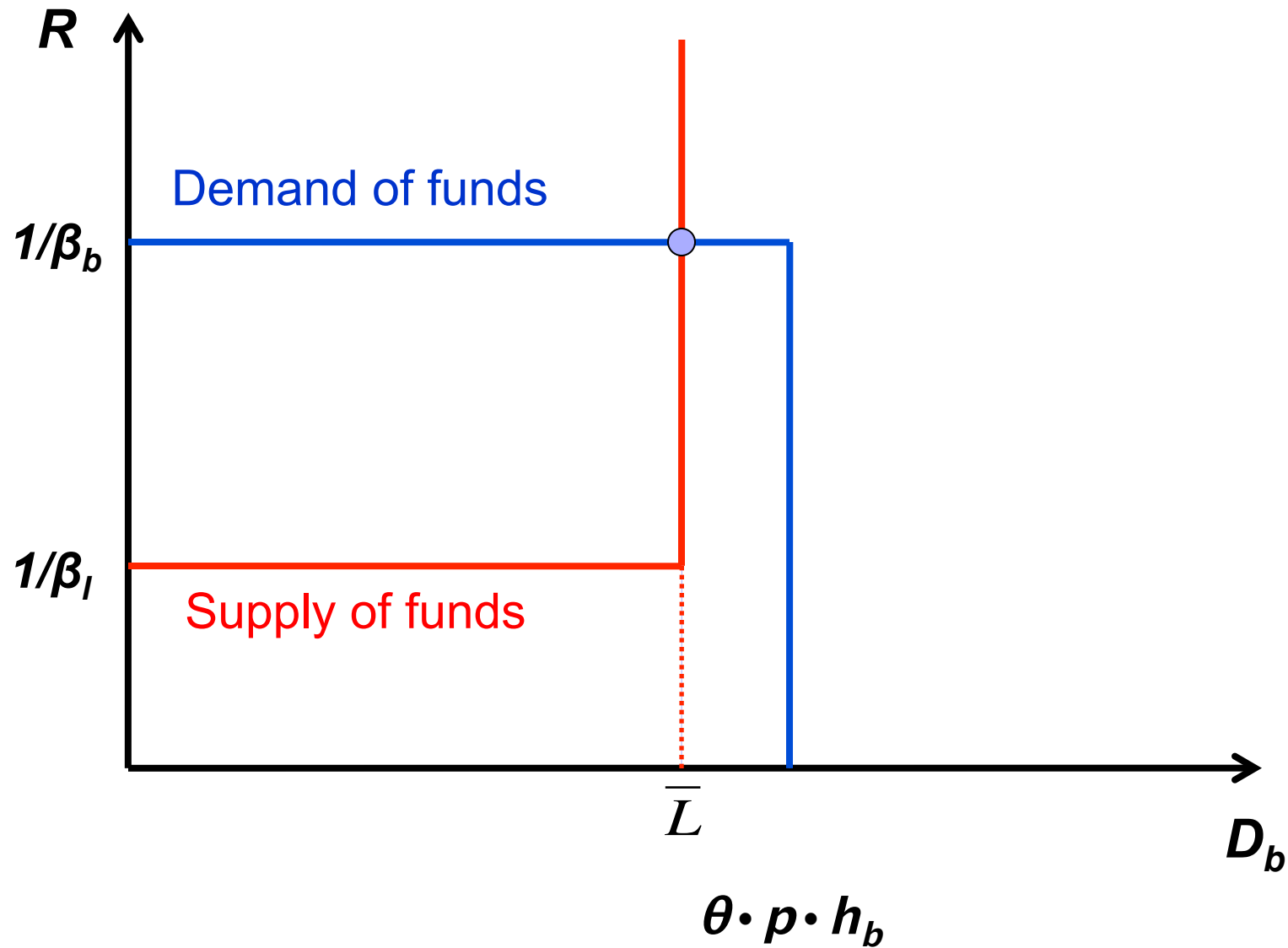
# Relaxing the lending constraint



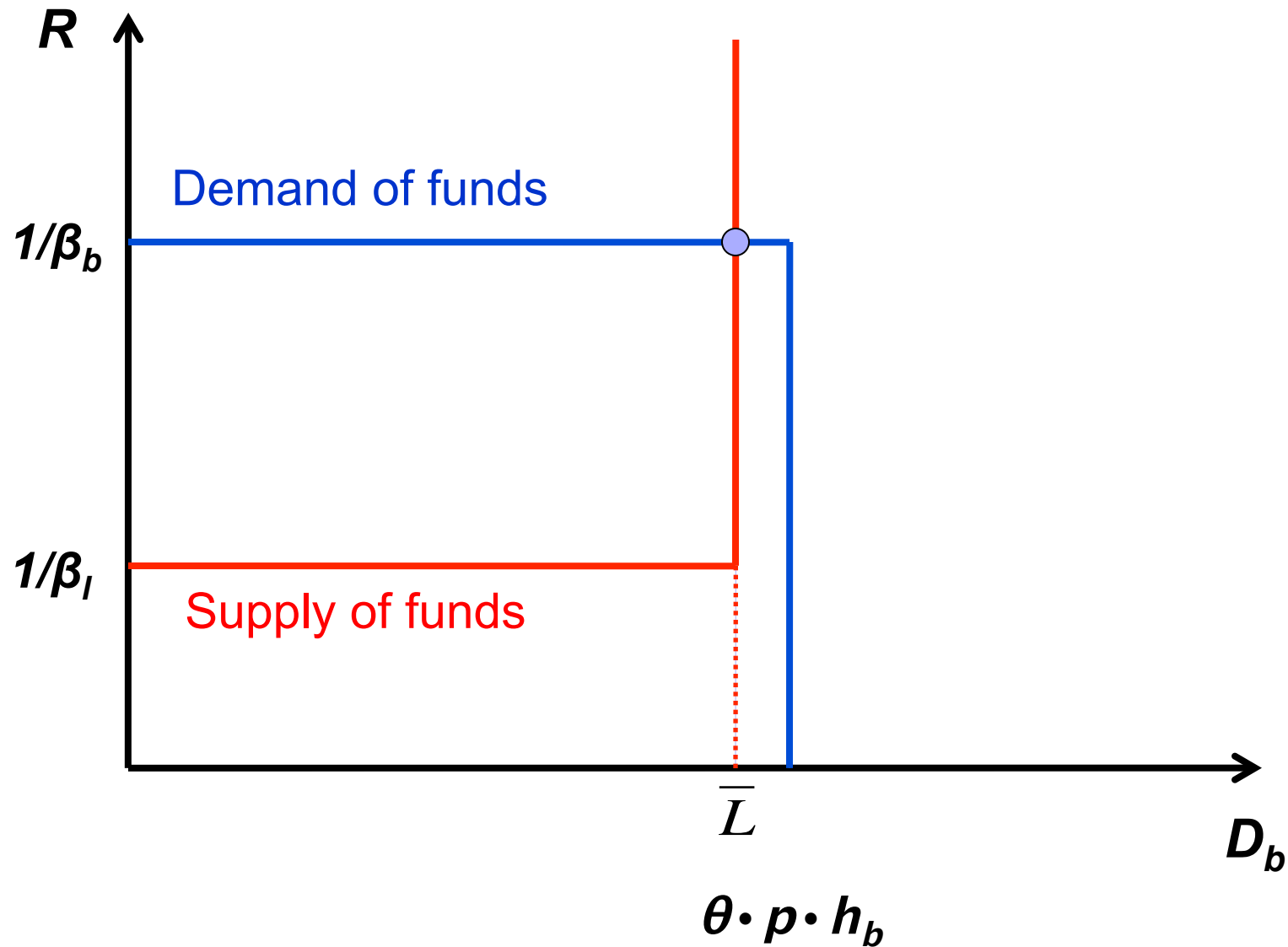
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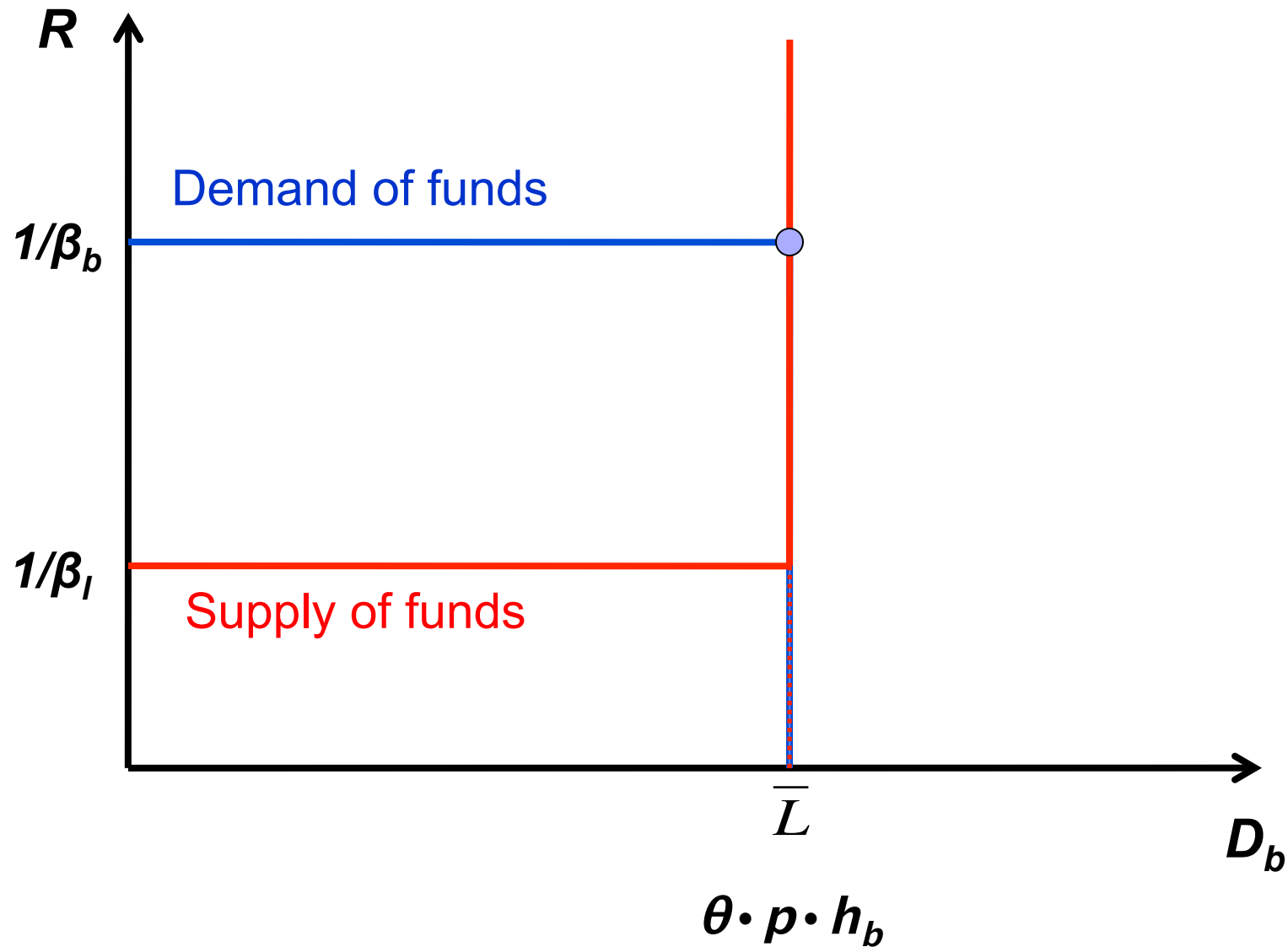
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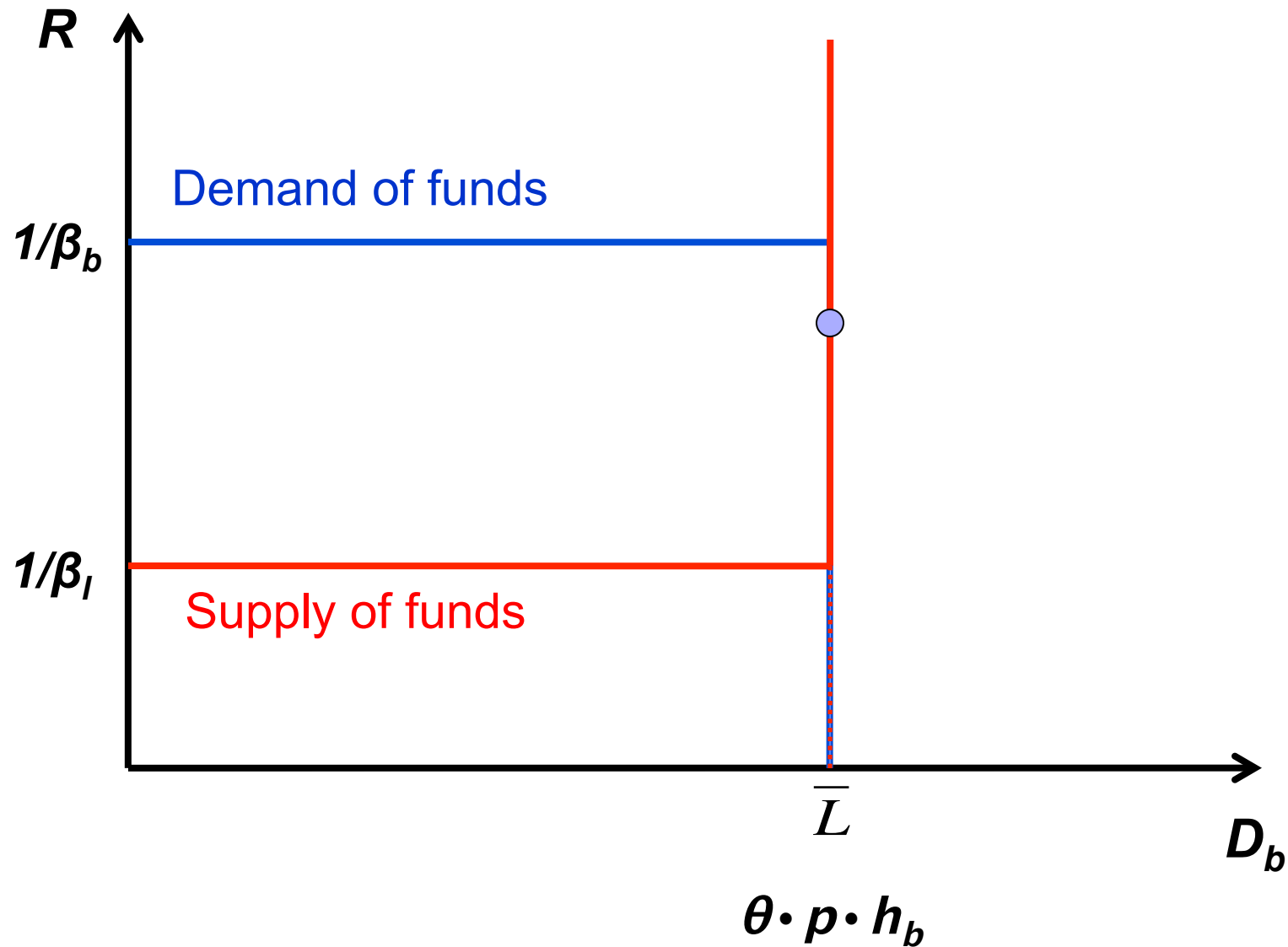
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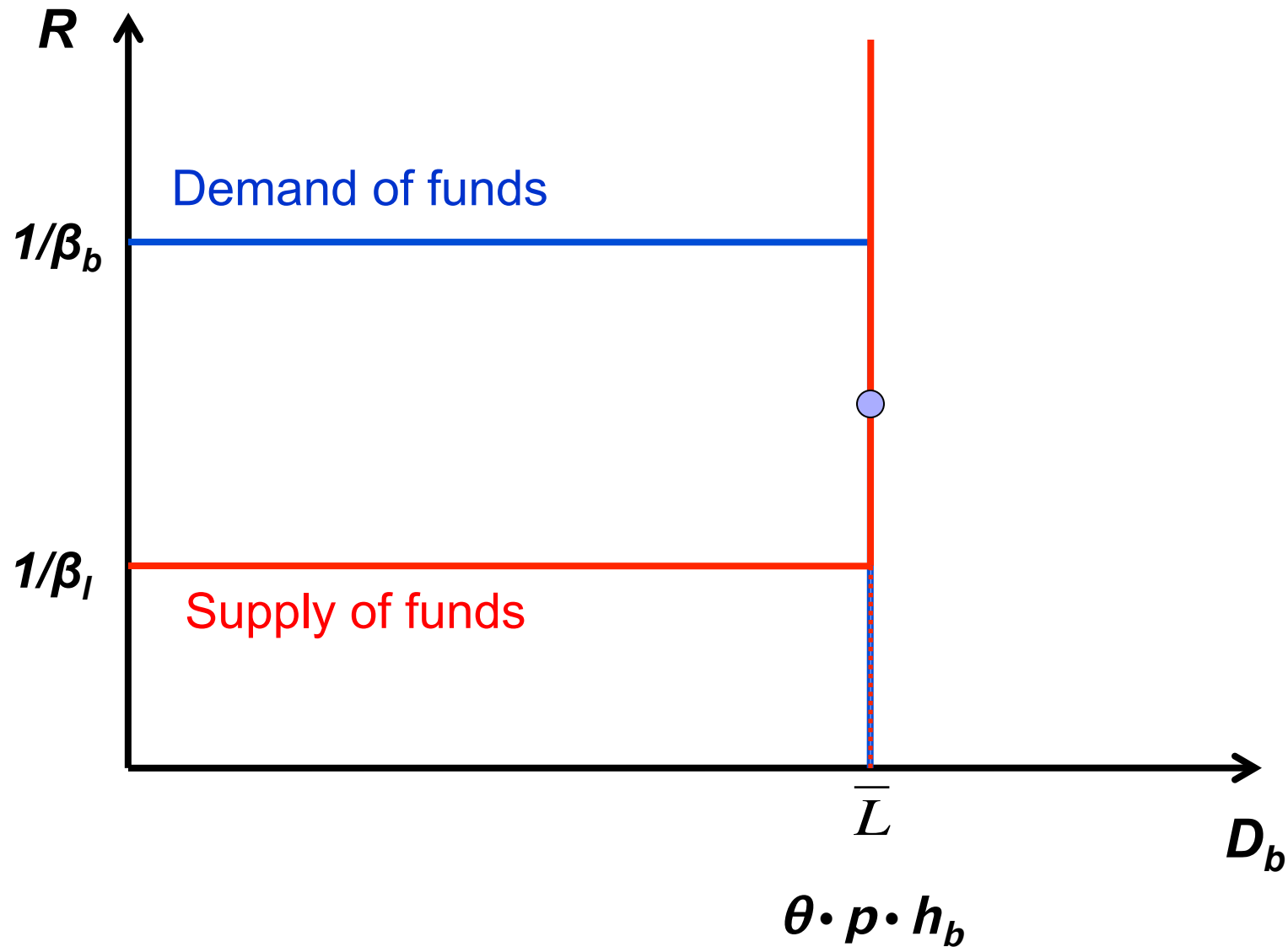
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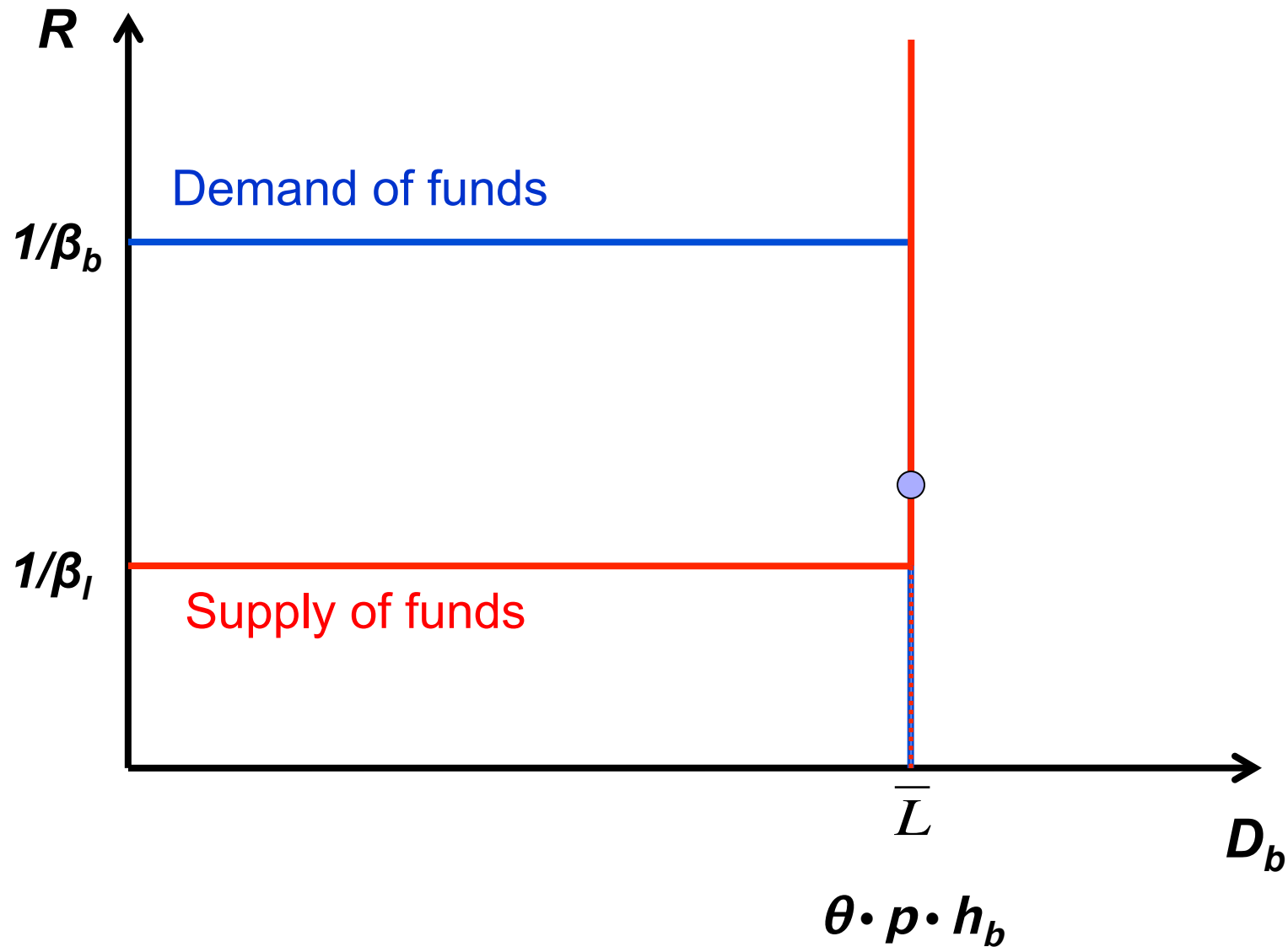


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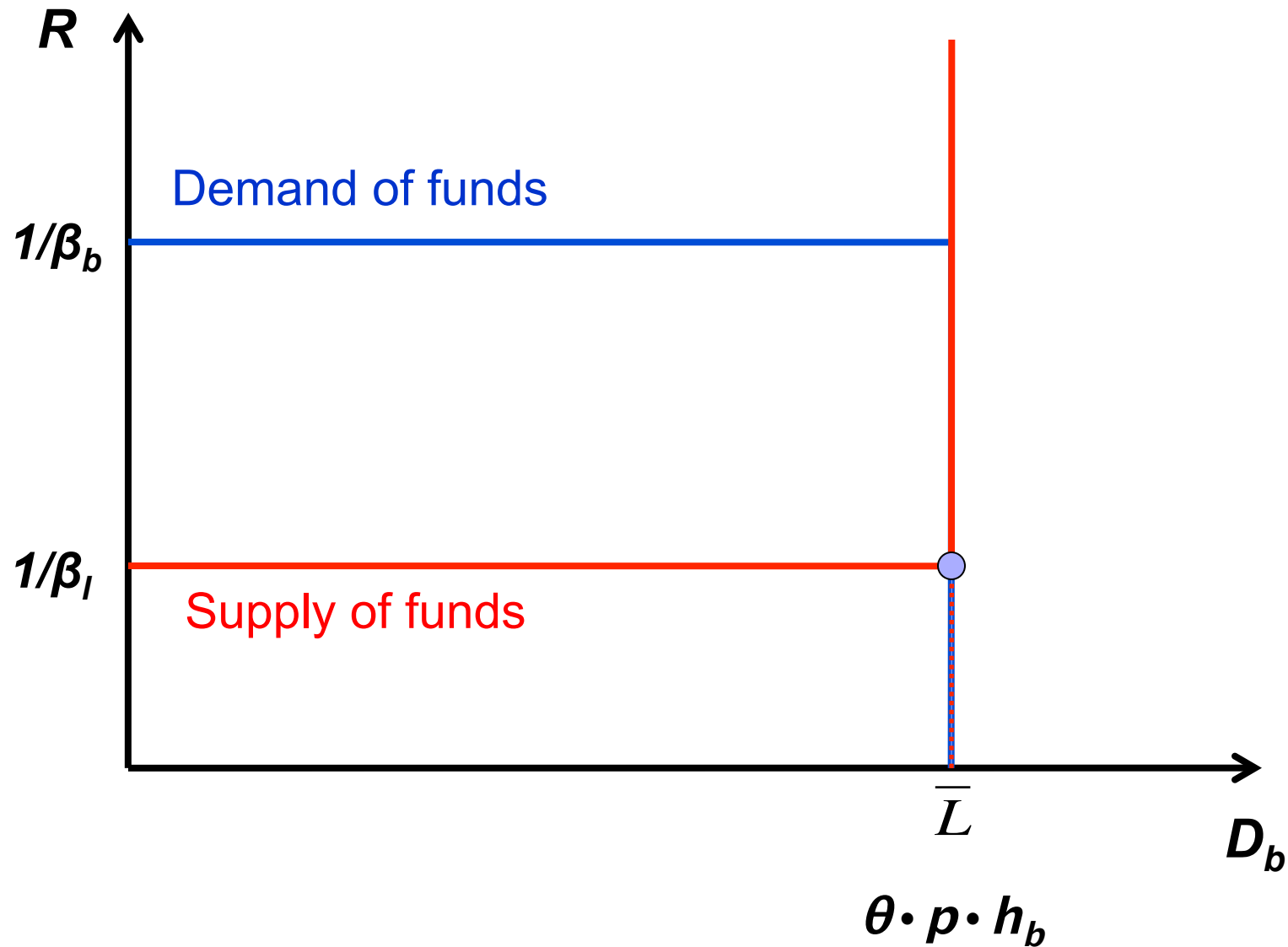




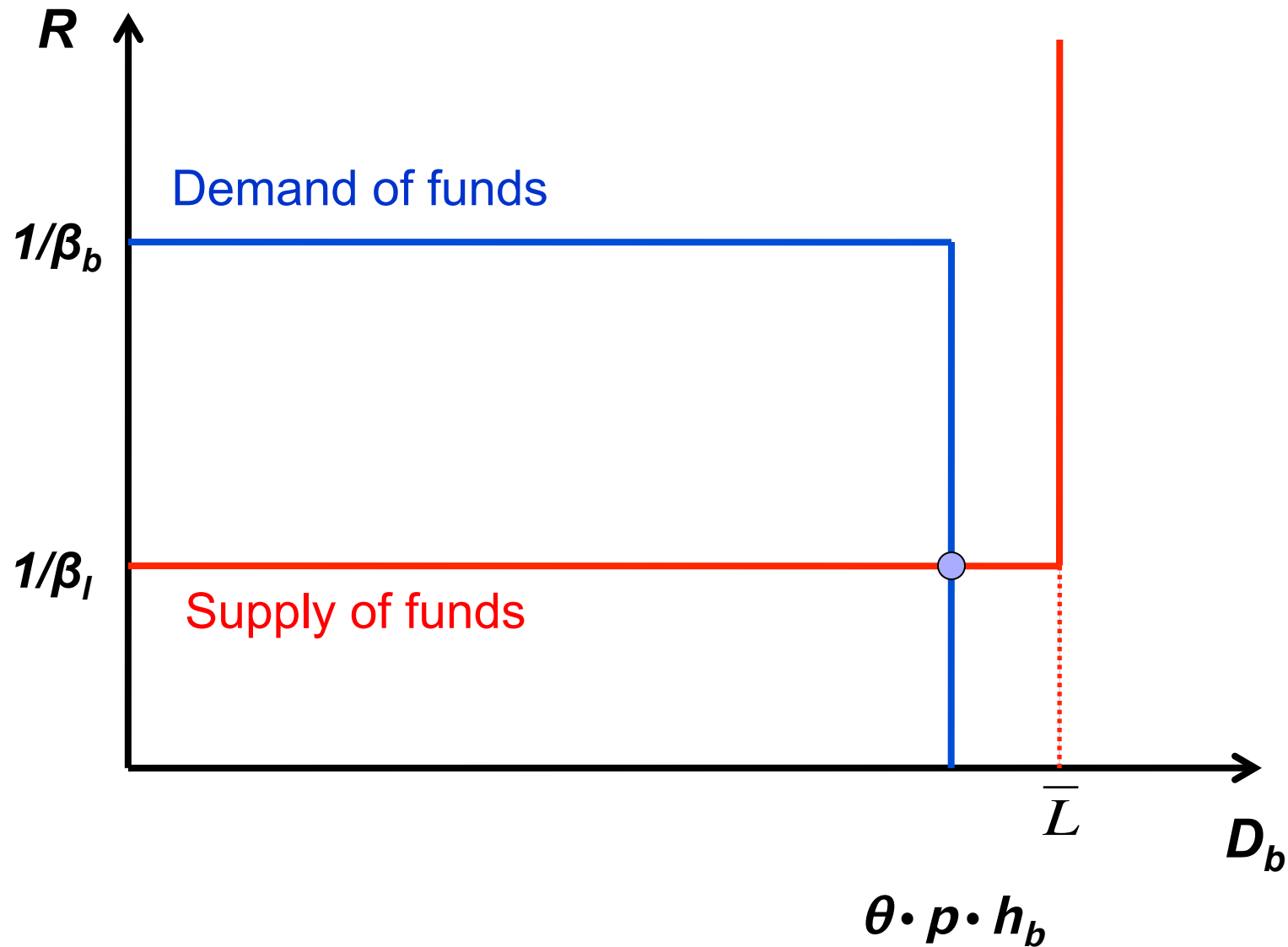
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# Relaxing the lending constraint



- 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
  - Kaplan and Violante (2012)
  
- ② Standard mortgage contracts specify accumulation of equity
  - Replace simple collateral constraint with

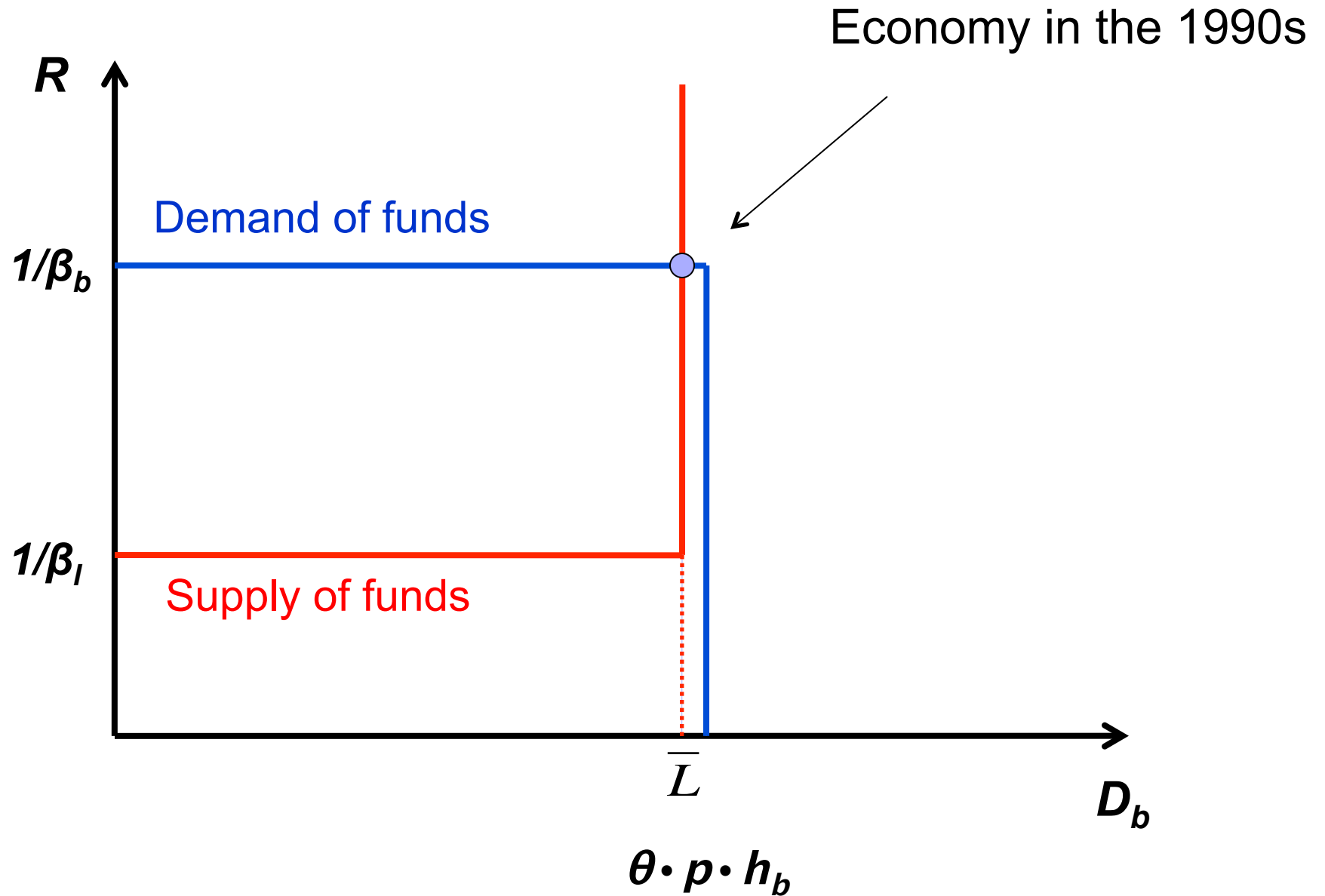
$$D_{b,t} \leq \theta p_t d_t$$

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

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

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

# Calibration



# Quarterly calibration

Parameter	Value	Source/Target
Discount factor borrower ( $\beta_b$ )	<b>0.9879</b>	5% real mortgage rate
Discount factor lender ( $\beta_l$ )	<b>0.9938</b>	<ul style="list-style-type: none"><li>• 2.5% decline in real mortgage rates</li><li>• ~ Krusell and Smith (1998)</li><li>• ~ Carroll et al. (2013)</li></ul>
Depreciation ( $\delta$ )	<b>0.003</b>	Fixed Asset Tables
Maximum LTV ( $\theta$ )	<b>0.80</b>	<ul style="list-style-type: none"><li>• Median LTV of new or recently refinanced mortgages of liquidity constrained HHs in the SCF</li><li>• Evidence from Duca et al. (2012)</li></ul>
Amortization ( $\rho$ )	<b>0.0056</b>	<ul style="list-style-type: none"><li>• Collateral constraint close to binding</li><li>• Mortgage-to-RE ratio of liquidity constrained HHs in the SCF (43%)</li></ul>



- Model
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- Quantitative results
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  - Loosening of collateral requirements

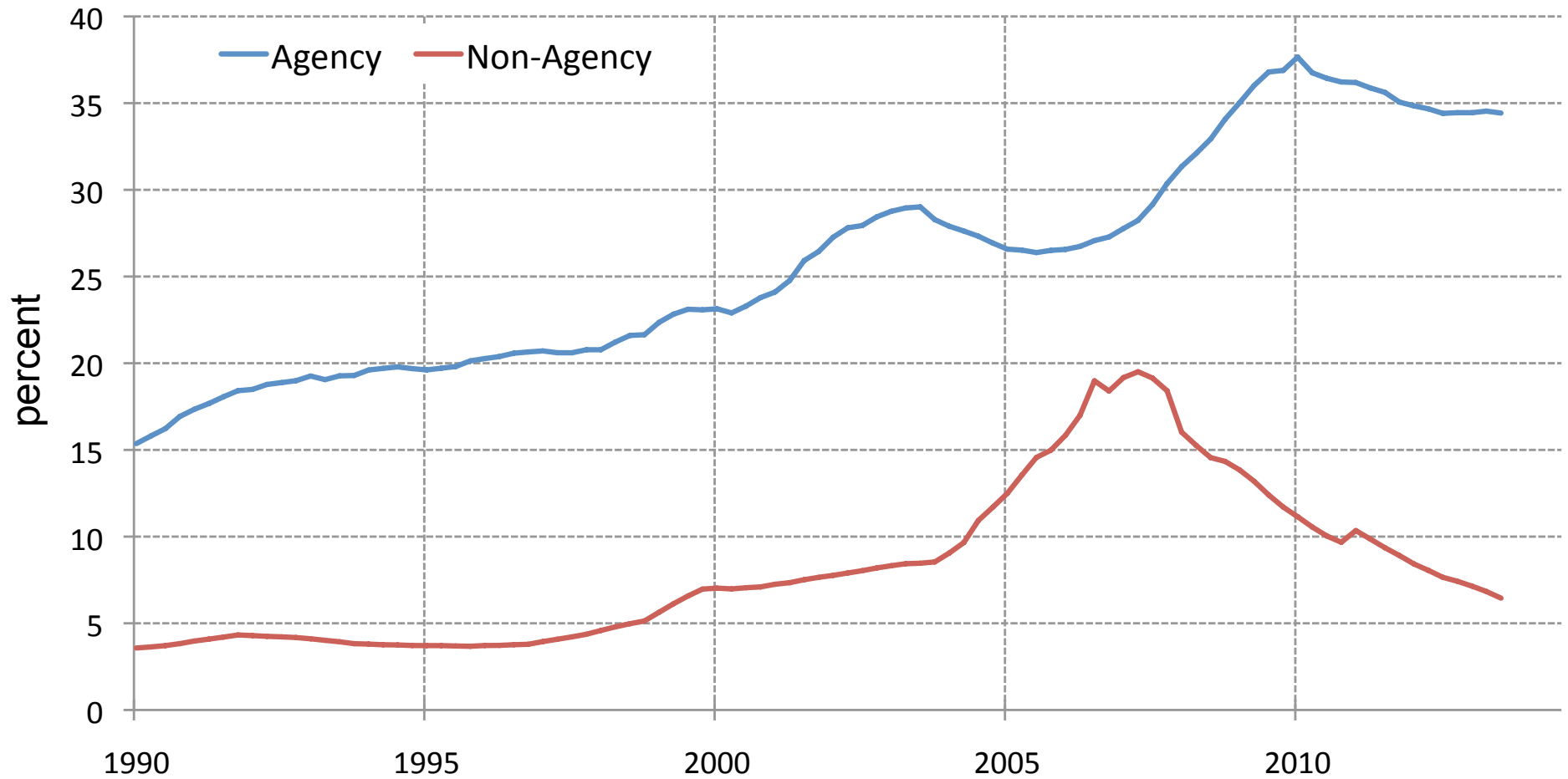
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## Value of outstanding RMBSs relative to GDP



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    - 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 (Acharya and Schnabel, 2009)

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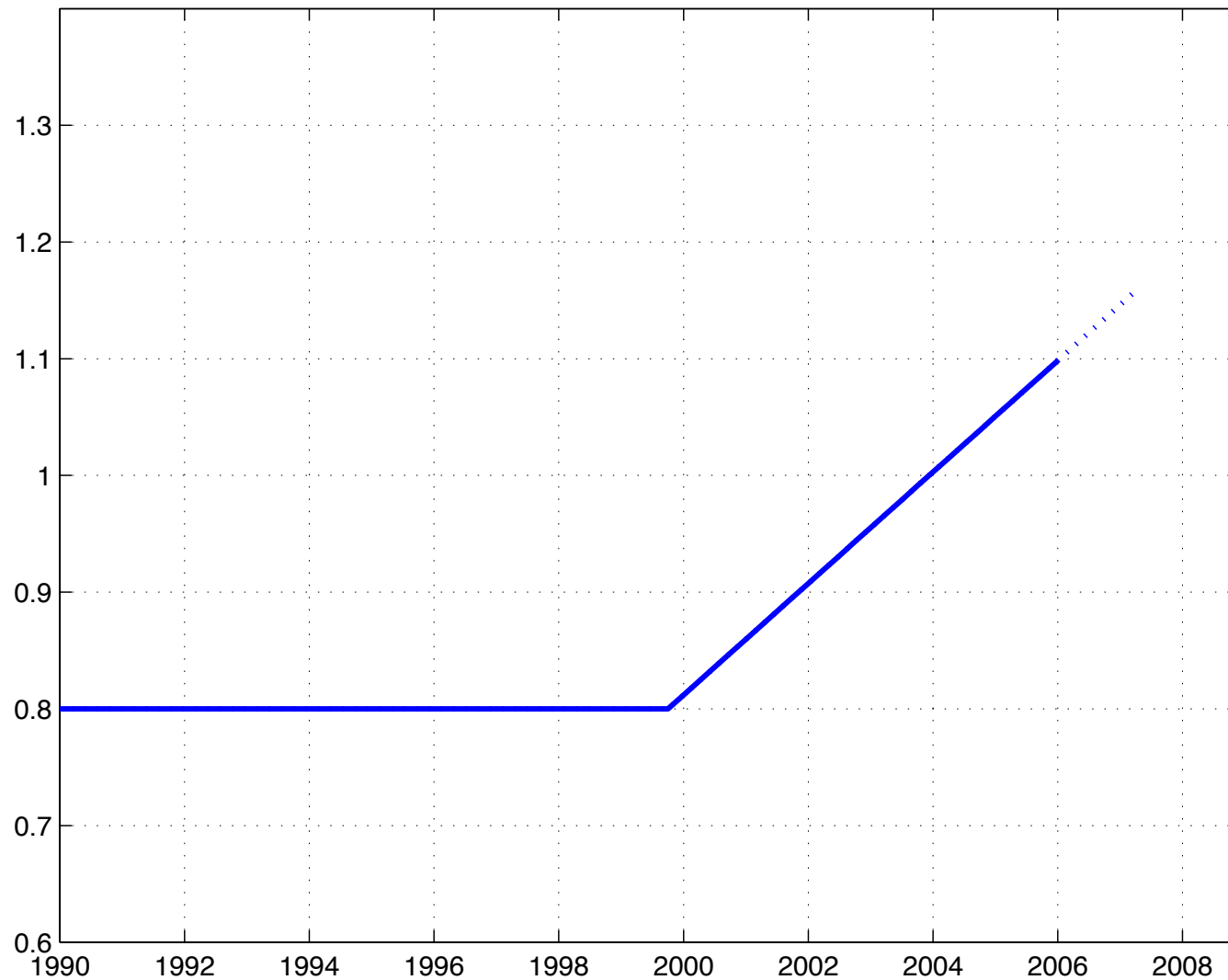
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- Experiment timed to “complete” the transition in 2006

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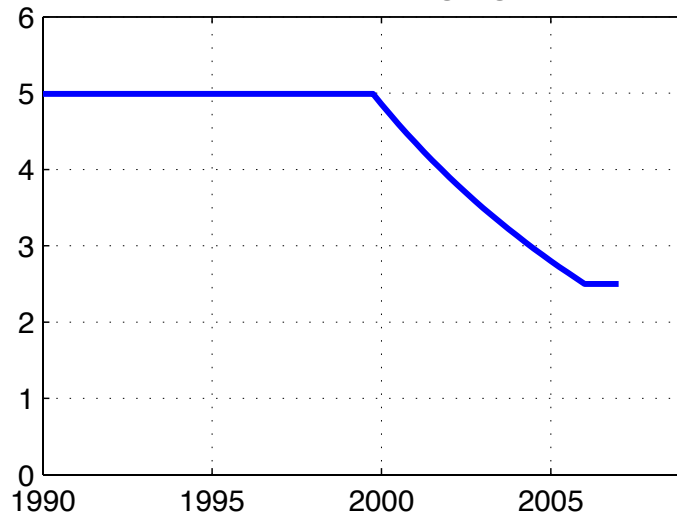
$\bar{L}$  relative to income



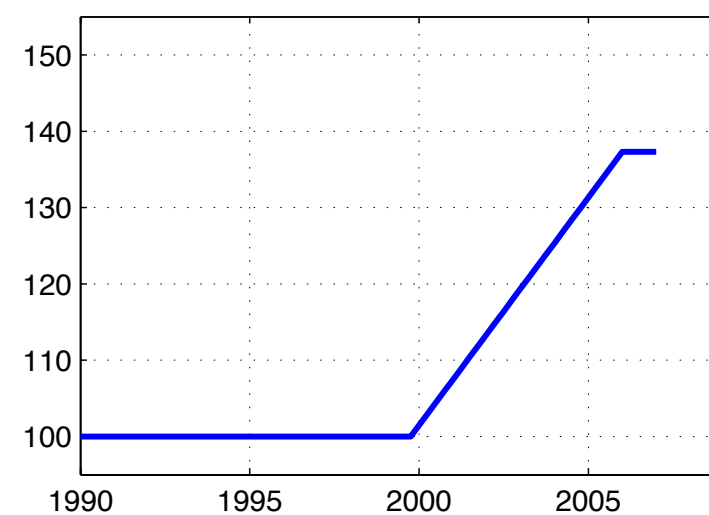


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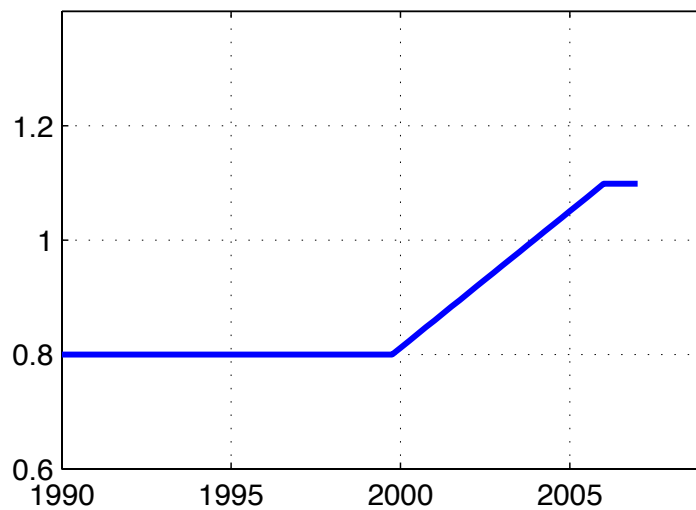
## Annualized mortgage rate



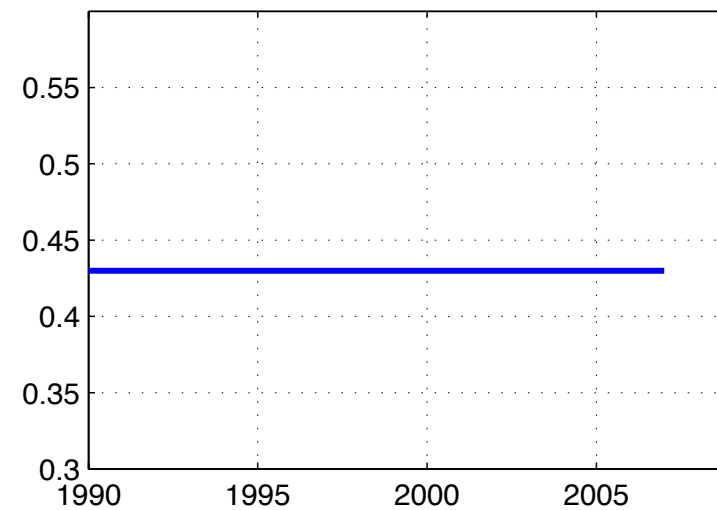
## House prices



## Debt-to-GDP ratio



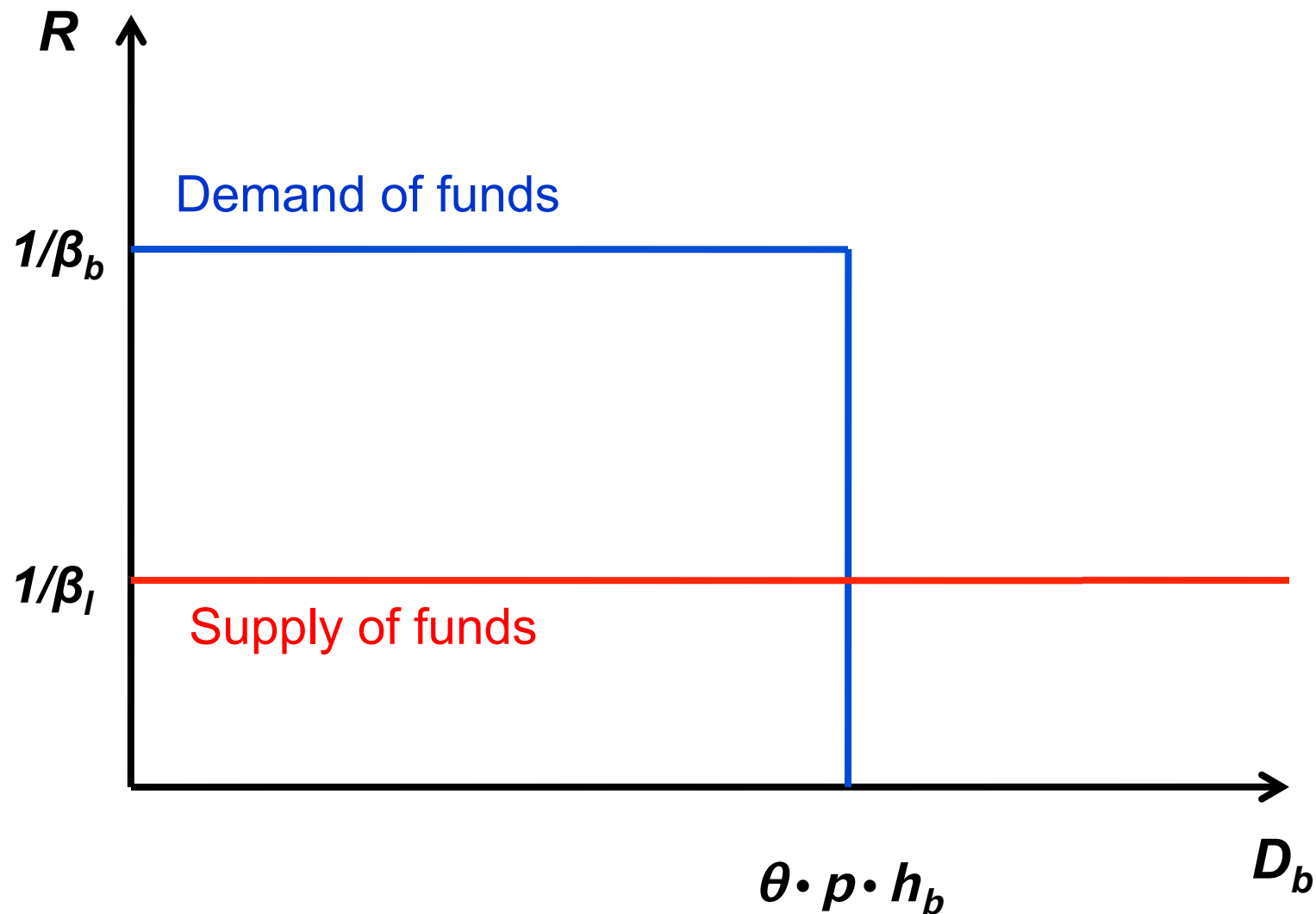
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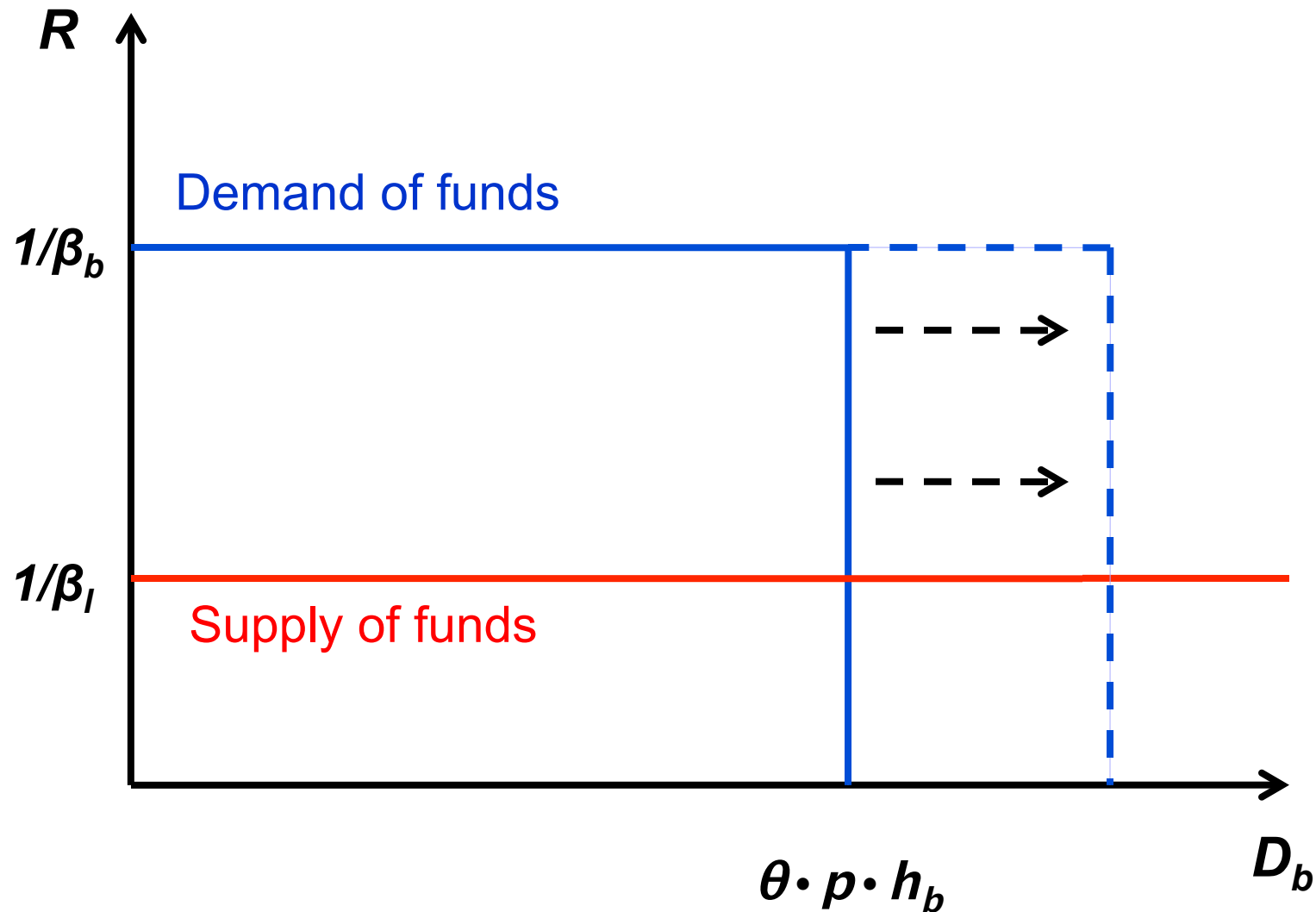
# Experiment 2: Loosening of collateral requirements

- Standard model without lending constraints
- Simulate the effects of a gradual relaxation of collateral requirements

# Standard model without lending constraint



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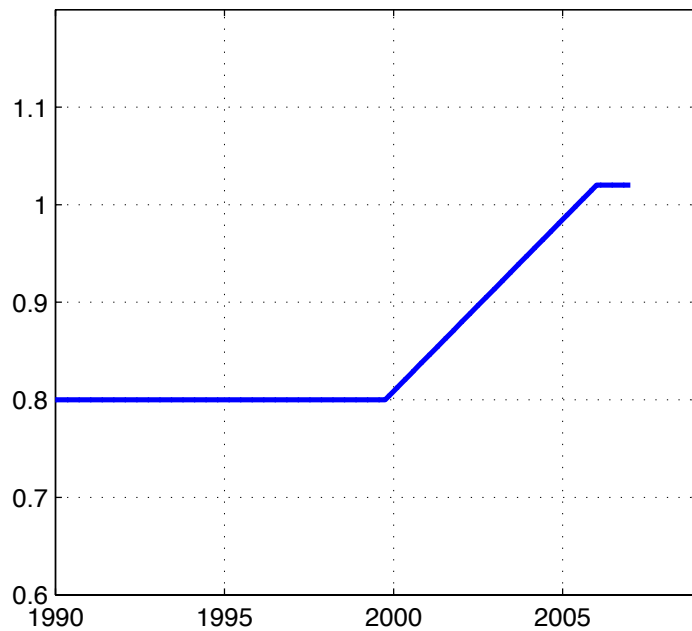


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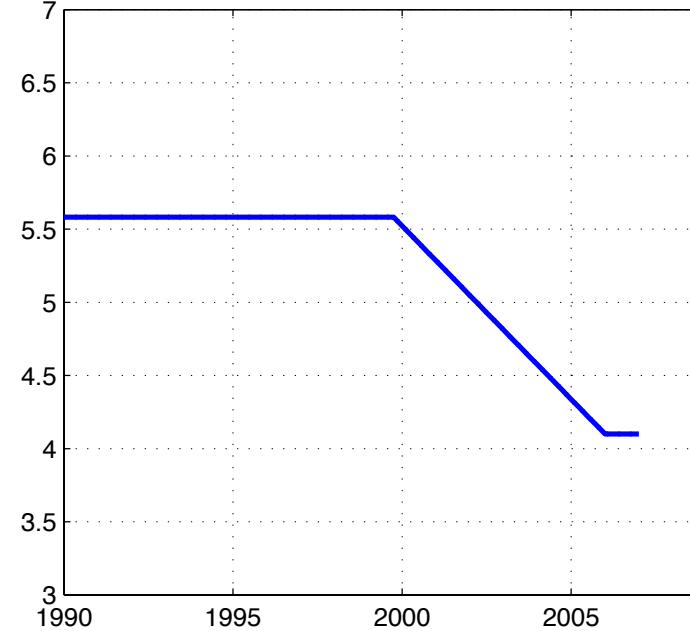
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  - $\theta$  from 0.8 to 1.02, to match the increase in HH debt of experiment 1

# Experiment 2: Loosening of collateral requirements

(a): Maximum LTV

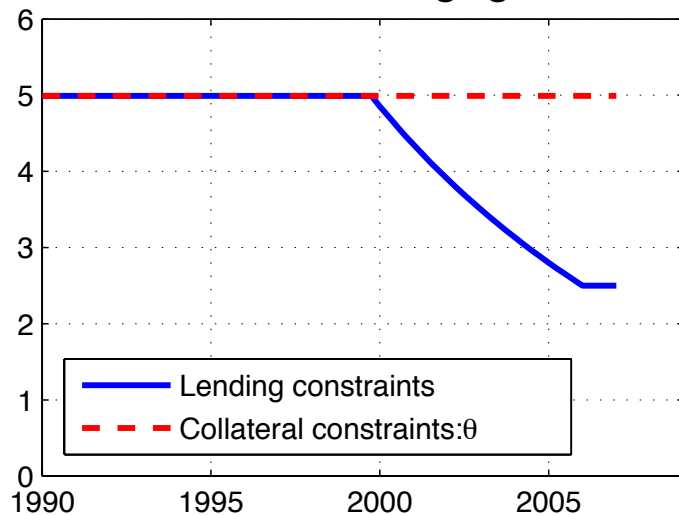


(b): Speed of repayment  $\times 10^{-3}$

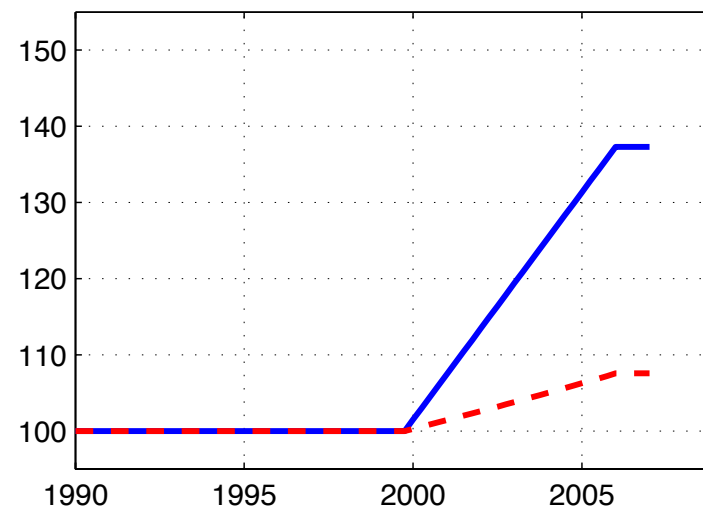


# Experiment 2: Loosening of collateral requirements ( $\theta$ )

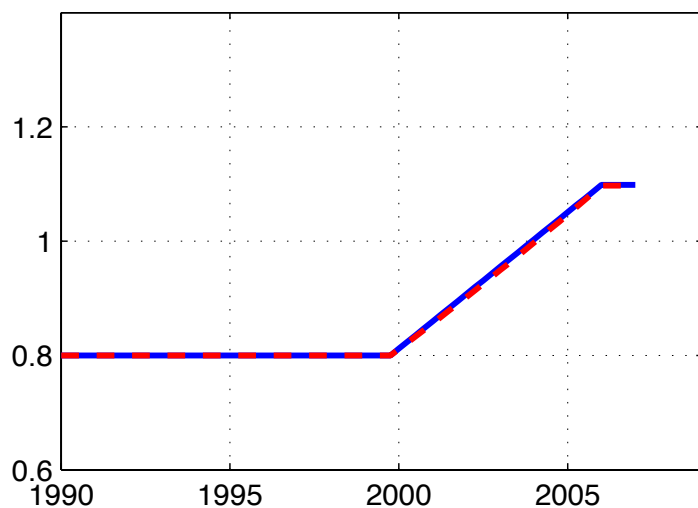
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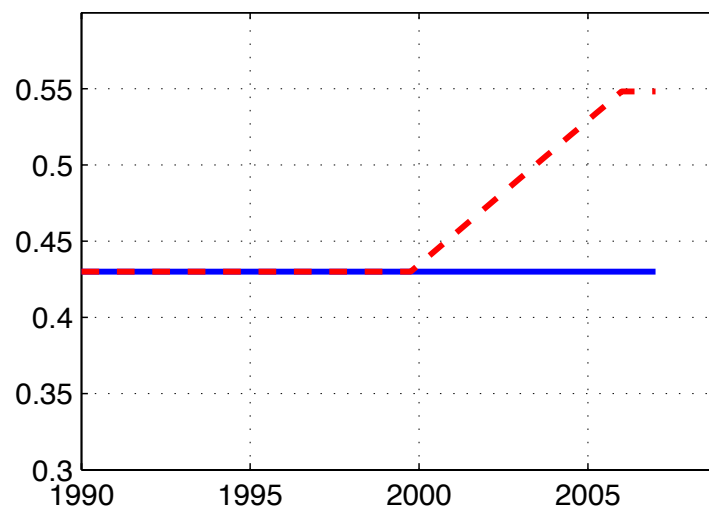
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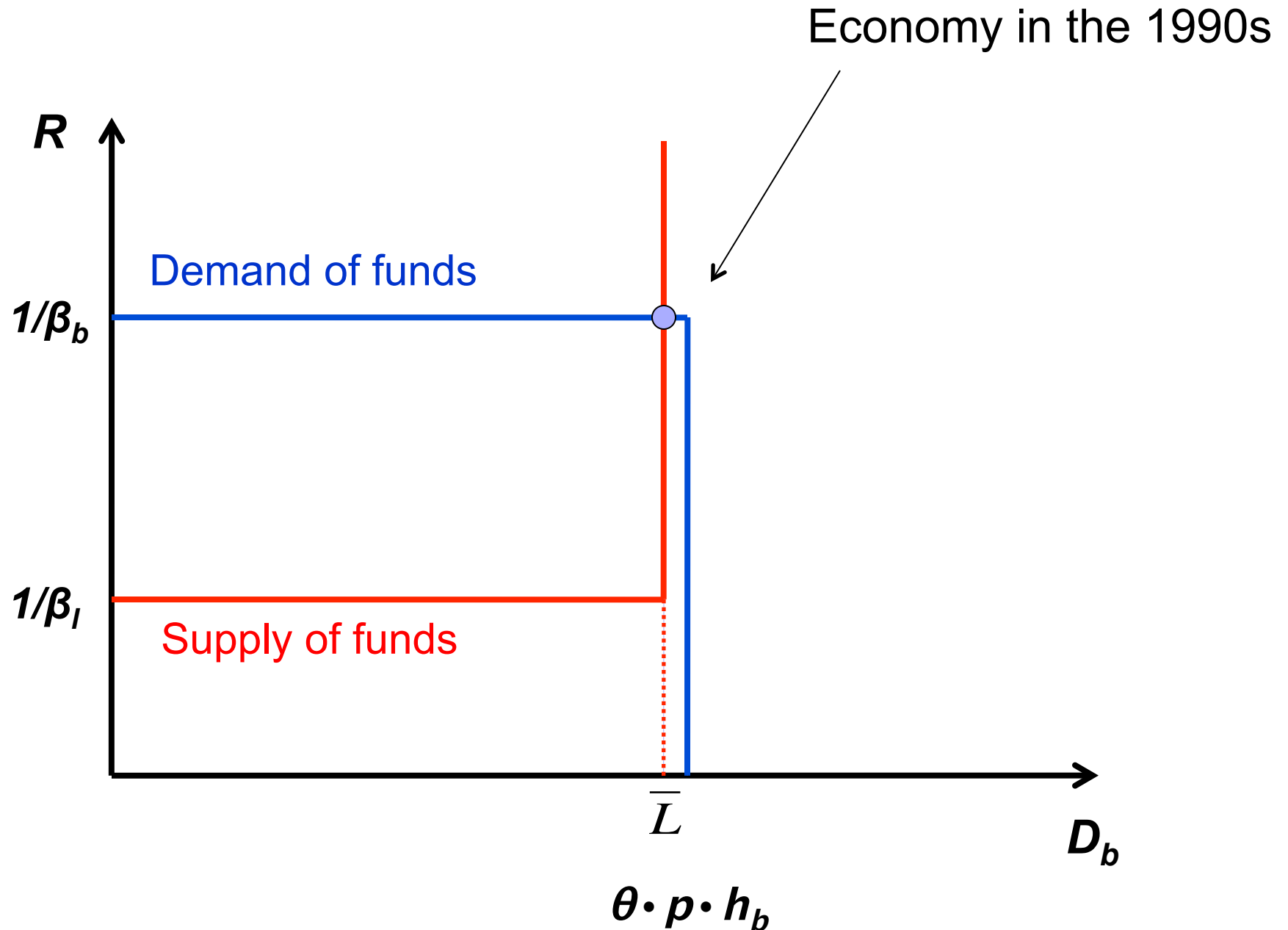
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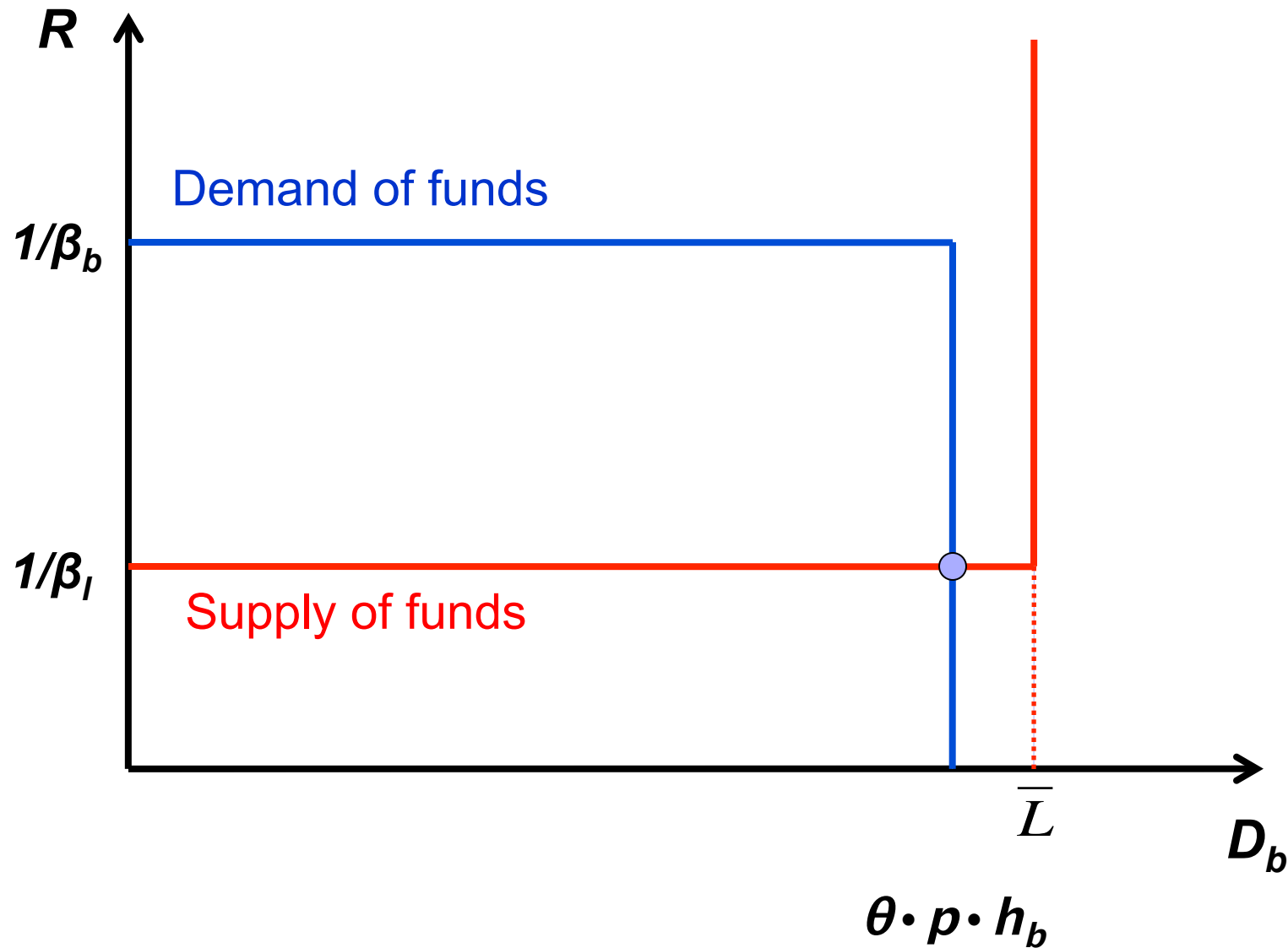
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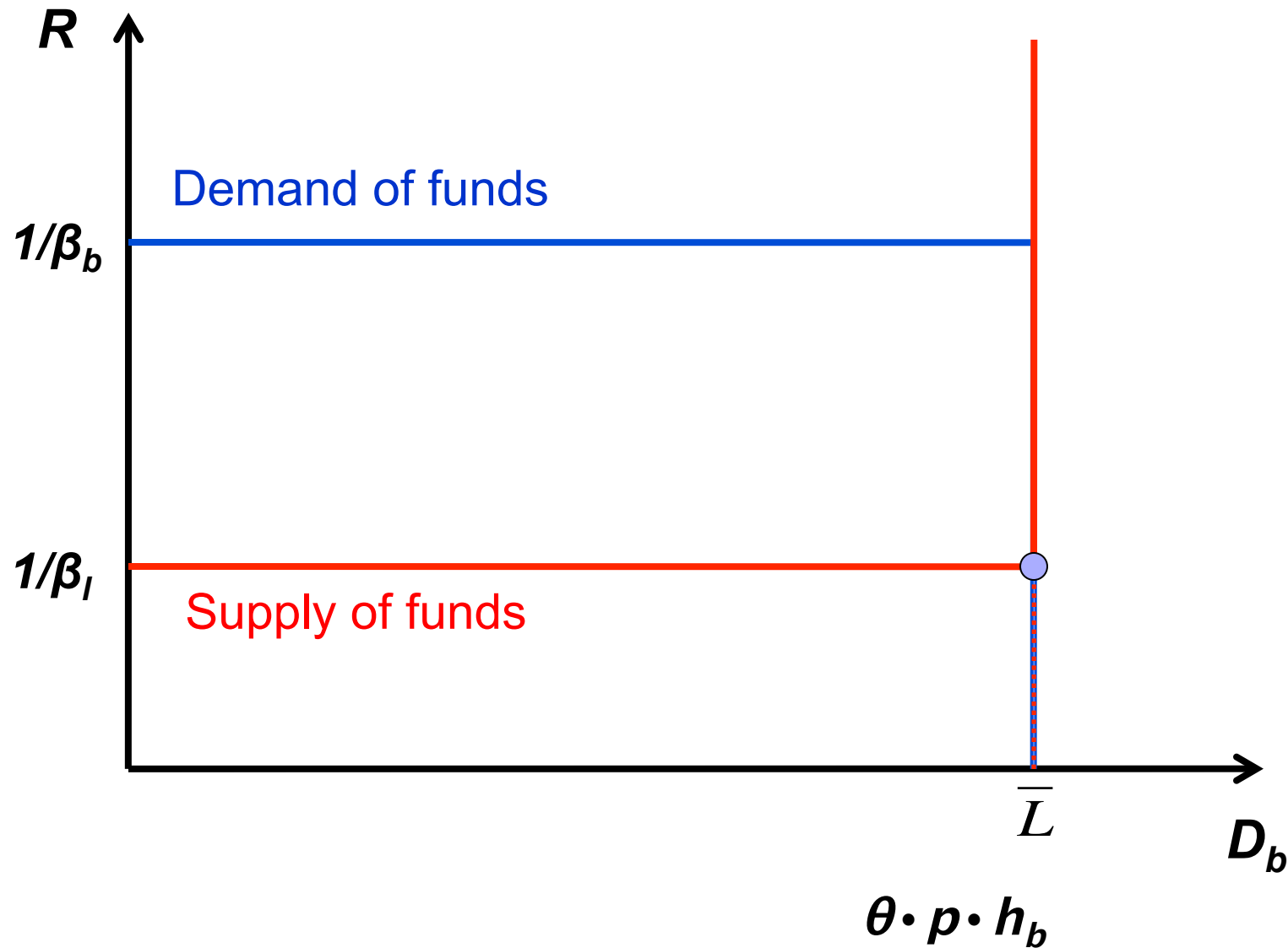
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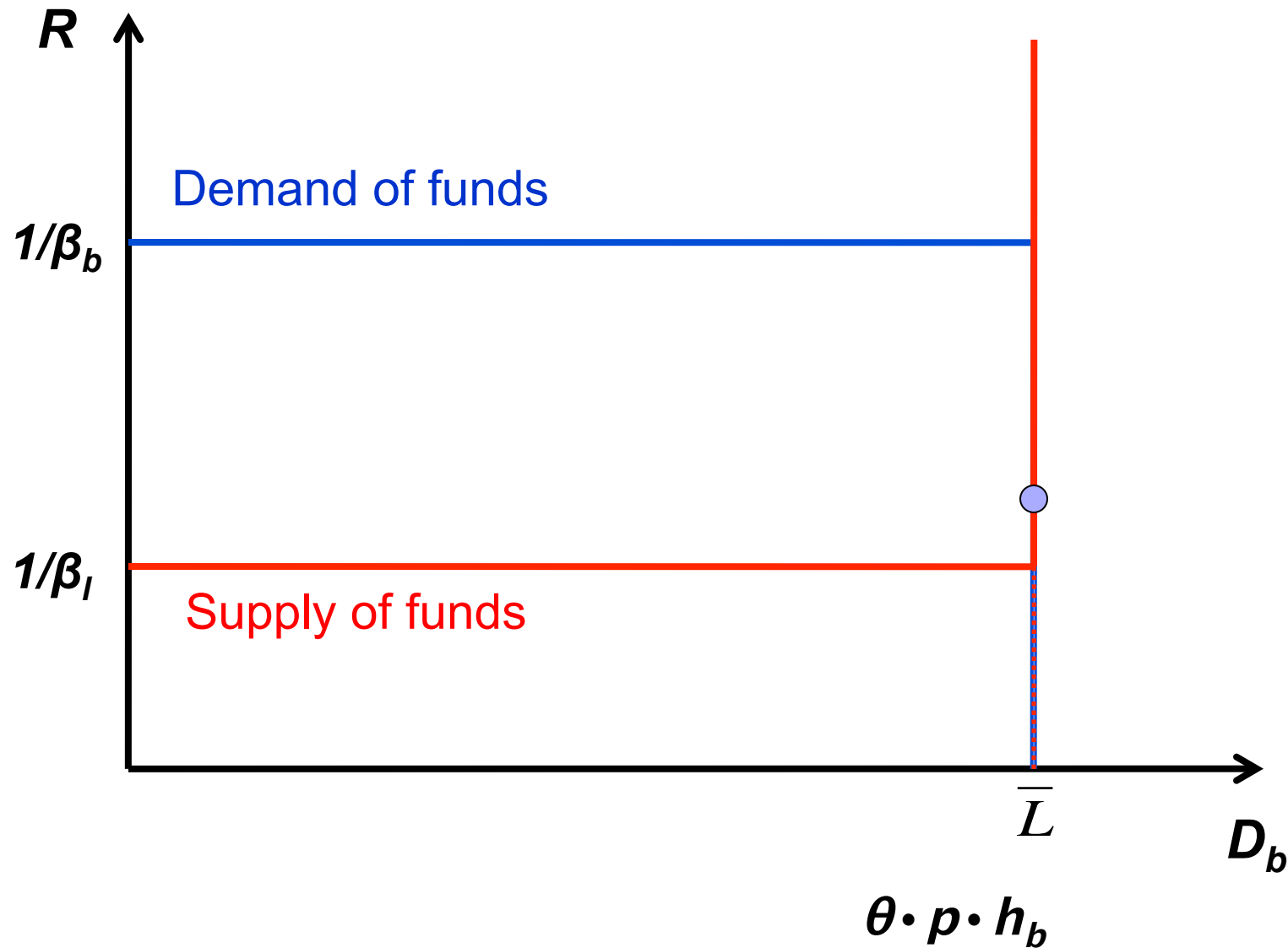
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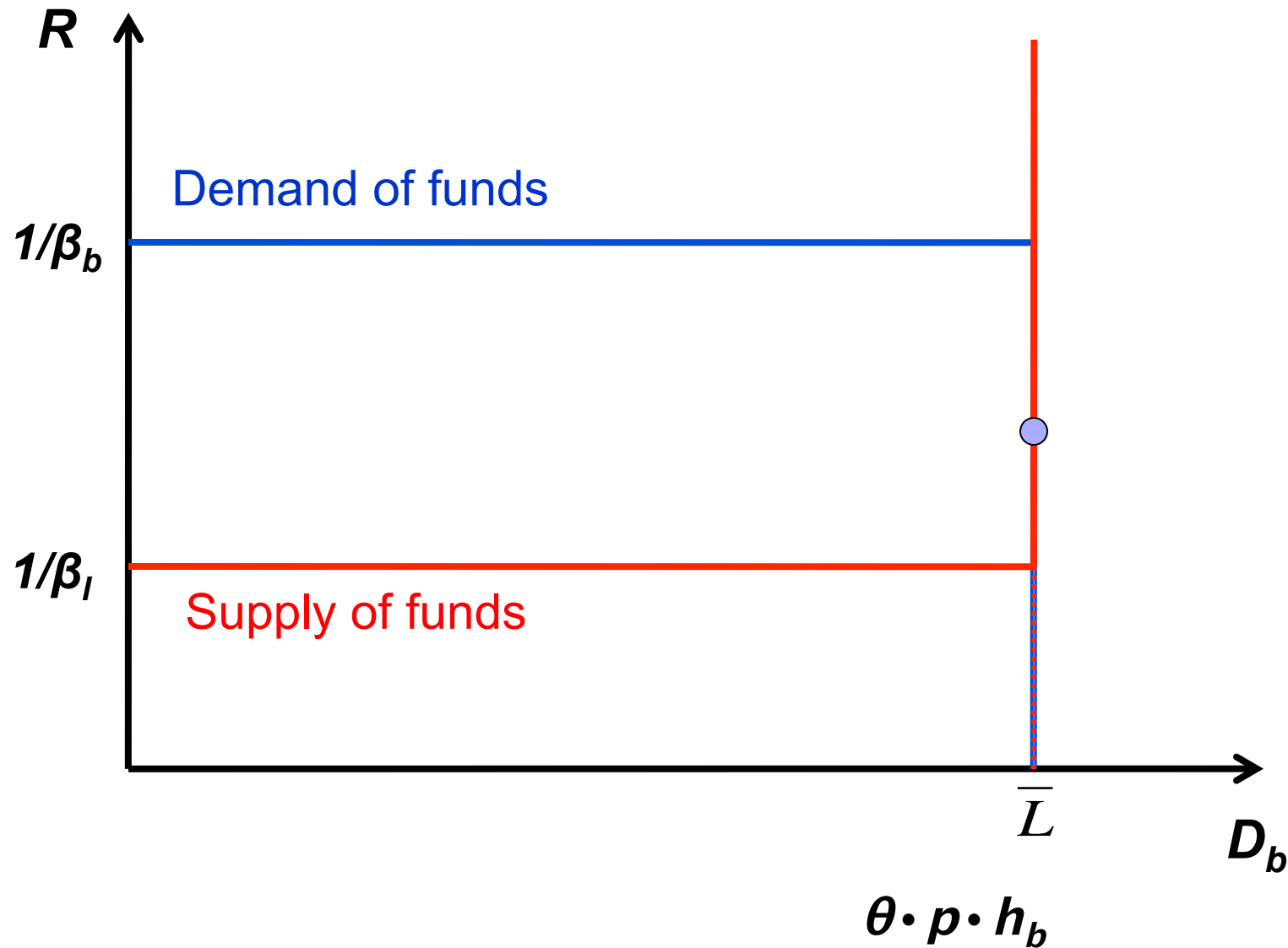
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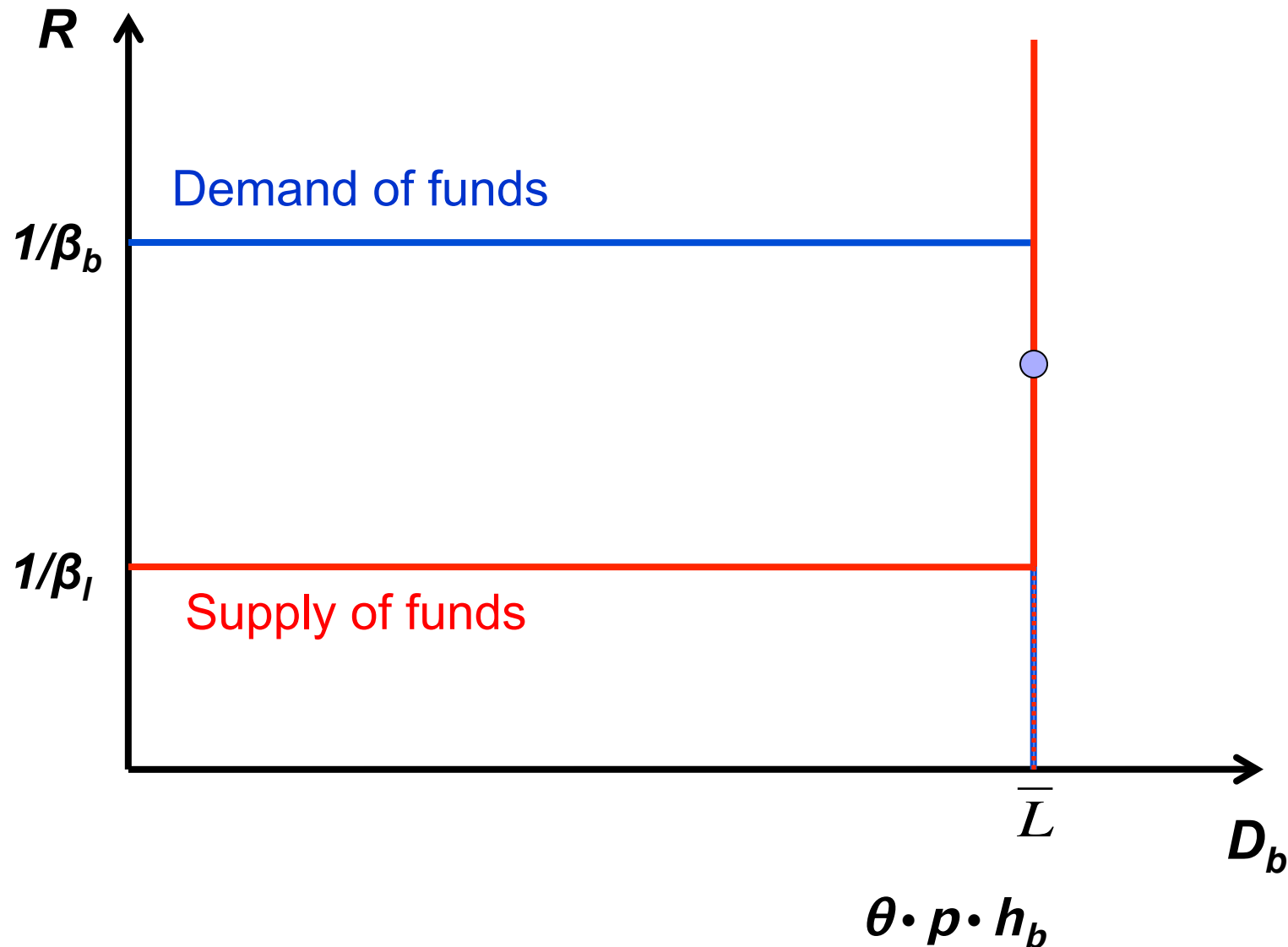
# Experiment 3: Loosening of collateral requirements ( $\theta$ ) in a model **with** lending constraints



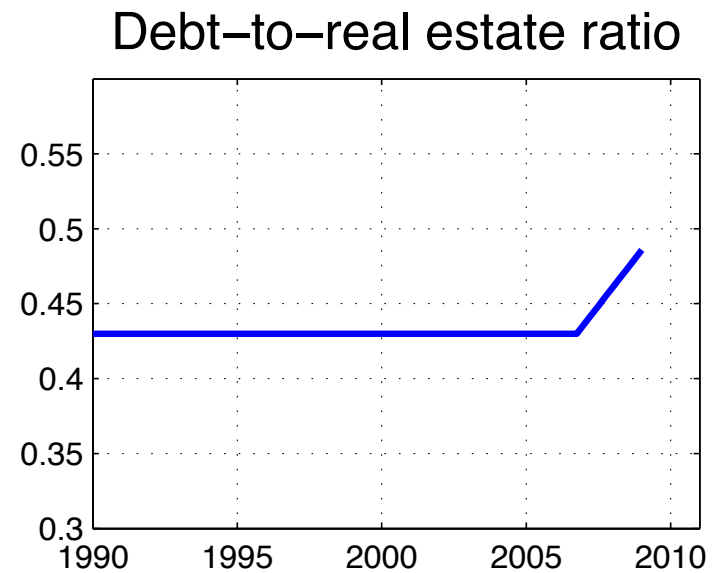
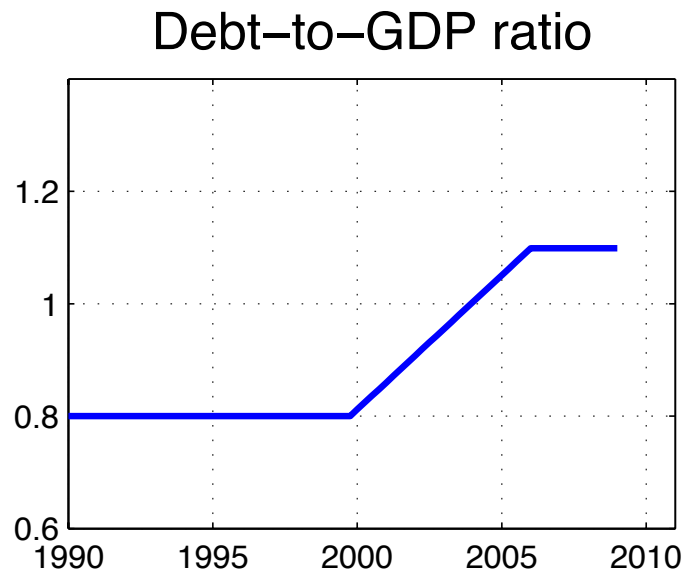
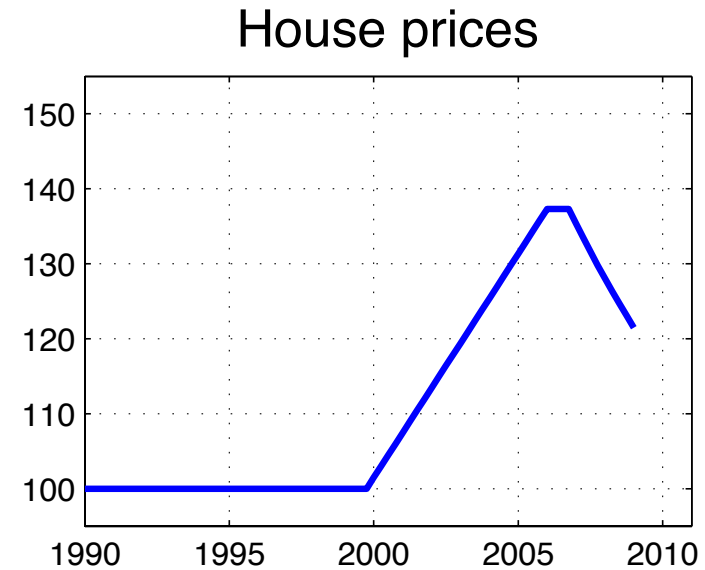
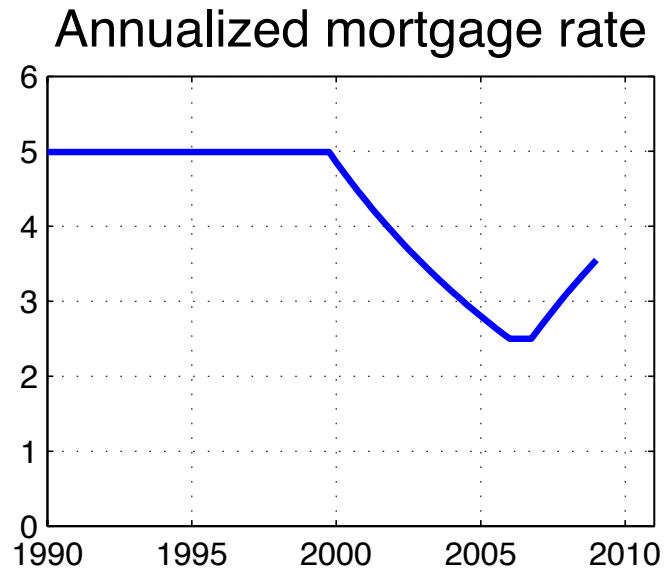
# Experiment 3: Loosening of collateral requirements ( $\theta$ ) in a model **with** lending constraints



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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