Financial Disintermediation and Financial Fragility

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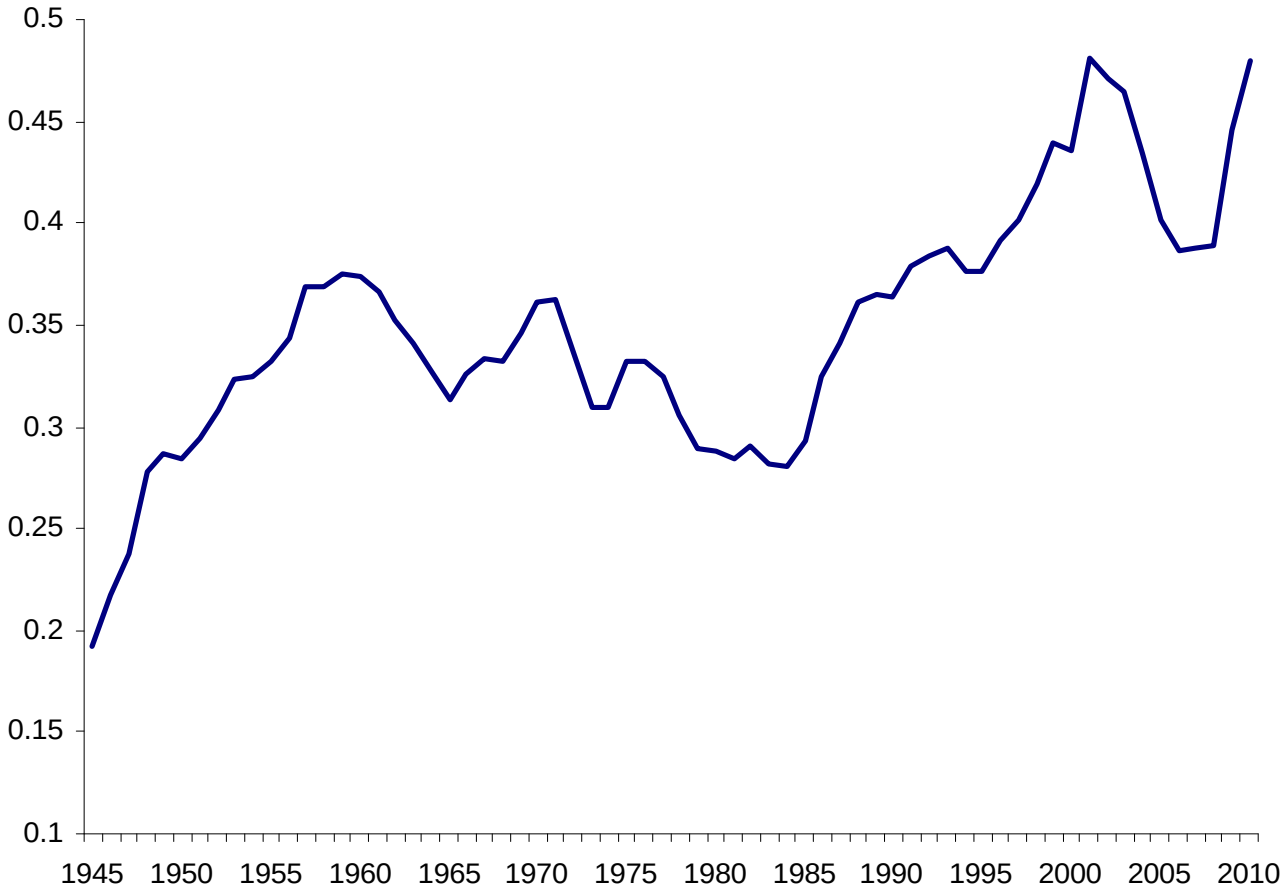
Motivation

- Markets for debt securities have grown rapidly in the past 20 years
  - corporate bond markets
  - securitisations
- Aim of the paper: build a limited commitment economy in which banks and markets co-exist
- Main question: what is the effect of larger debt markets on the likelihood and real economy impact of banking crises in our model economy?

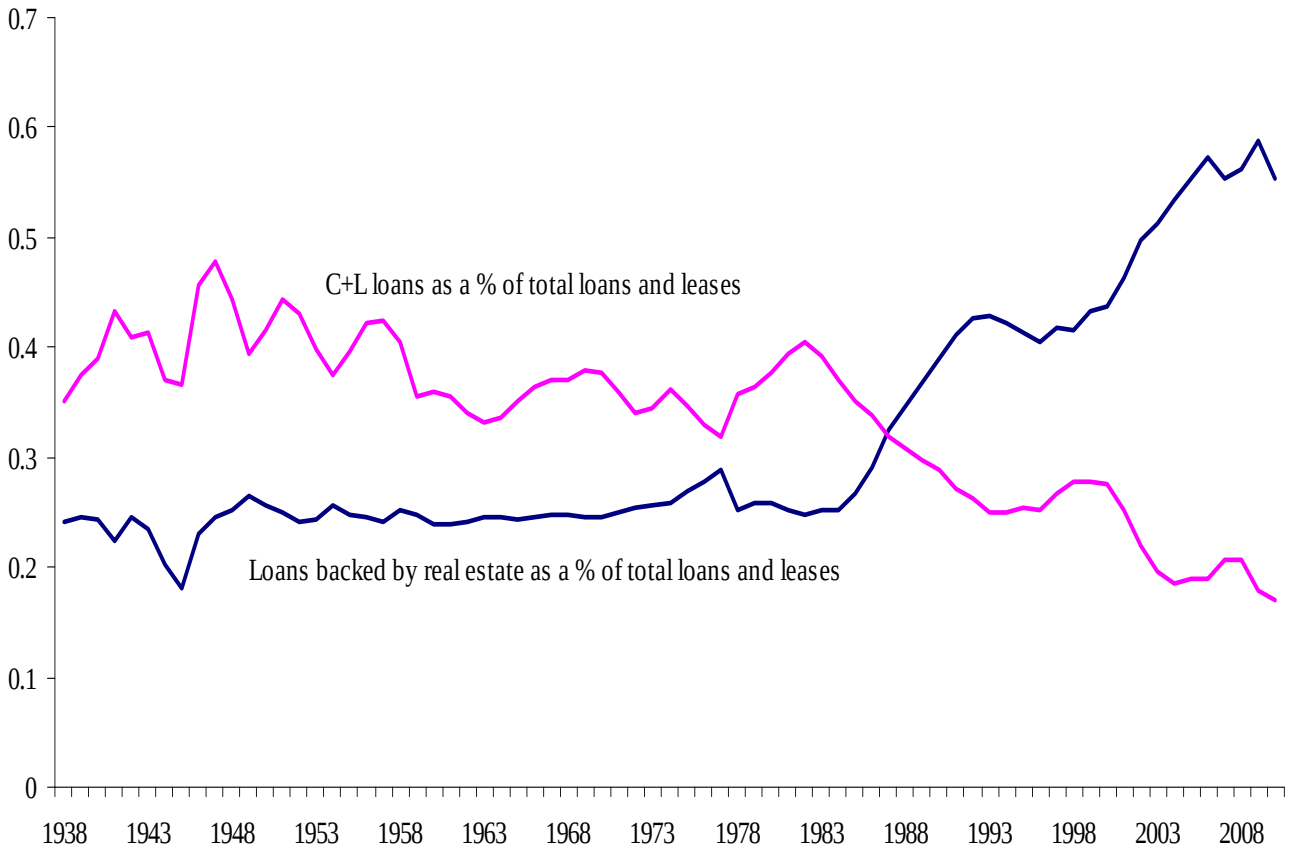
Corporate bond markets have grown

Corporate bond stock as a fraction of commercial bank loans in the US
(Source: FDIC, Flow of Funds)



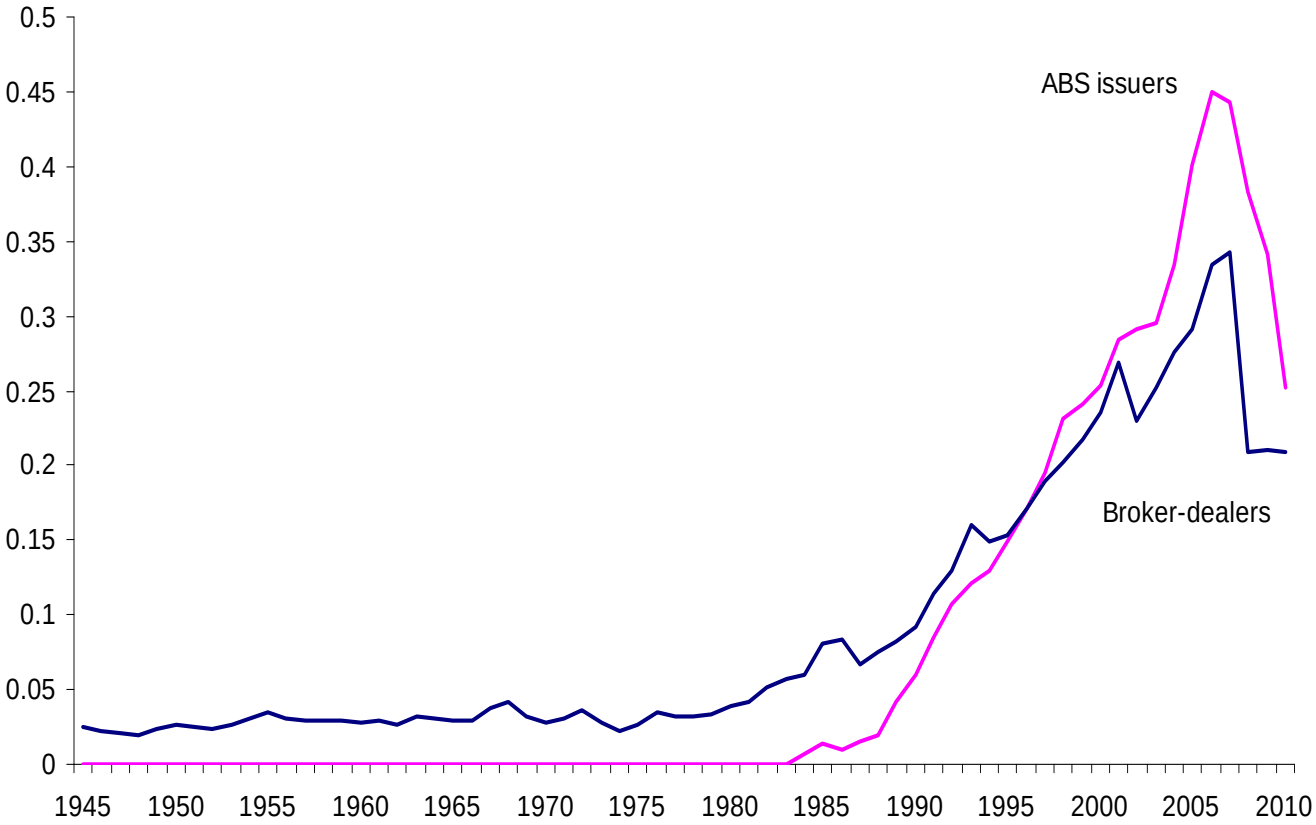
...banks moved to housing finance

Commercial & Industrial and Real Estate loans as a fraction of total loans in the US (Source: FDIC)



...but faced competition from ABS markets there too

Assets of ABS issuers and Broker-Dealers as a fraction of commercial bank loans in the US (Source: FDIC, Flow of Funds)



Question and Approach

- Main question of the paper:
  - What effect has the growth of markets had on the likelihood and severity of banking crises?
- Paper is part of our work on understanding the role of asset price bubbles in financial crises.
- Aoki and Nikolov (2012):
  - bubble collapses have much larger effects if banks exposed ('Dot Com' vs 'Subprime')
  - But what explains banks' high exposure in 2007?
- This paper: the type of financial innovation that occurred in the 2000s

Preview of Results

- We build a limited commitment economy with two types of markets
  - Ones that operate independently of banks: corporate bond markets (1980s and 1990s)
  - Ones that need bank guarantees to work: 'Shadow banking' (1990s and 2000s)
- The growth of both types of financial markets stimulates bank risk-taking in the model.
  - Markets compete with banks and errode their profitability.
  - They increase their exposure to risky assets

  $\Longrightarrow$ risk of banking losses increases
- But: different markets have a different impact on systemic risk
  - Dot Com vs Subprime

Preview of Results (cont'd)

- Corporate bond market growth more benign
  - corporate bond market expands at the expense of banks
  - lending-deposit rate spreads fall and risky investments grow
  - BUT: consolidated bank leverage falls

  $\Longrightarrow$ small banking losses
- 'Shadow banking' more likely to cause a crisis
  - allows commercial banks to evade regulation (e.g. ABCP)

  $\Longrightarrow$ aggregate financial system leverage expands
  - higher leverage leads to an even larger fall in lending-deposit spreads

  $\Longrightarrow$ risky invesments grow even more

  $\Longrightarrow$ large banking losses

Related literature

- Bank and bond finance
  Holmstrom and Tirole (1997), De Fiore and Uhlig (2011), (2012), Adrian, Colla and Shin (2012), Gertler and Karadi (2012)
- Shadow banking
  Gennaioli, Shleifer and Vishny (2011, 2012), Acharya and Schnabl (2011), Goodhart et. al. (2012), Alessandri, Meeks and Nelson (2012)
- Franchise values and bank risk-taking in macro models
  Martinez-Miera and Suarez (2012), Corbae and D'Erasmo (2012)
- Asset price bubbles in macro models
  Farhi and Tirole (2011), Martin and Ventura (2012), Aoki and Nikolov (2012), Hirano and Yanagawa (2012), Miao and Wang (2012)

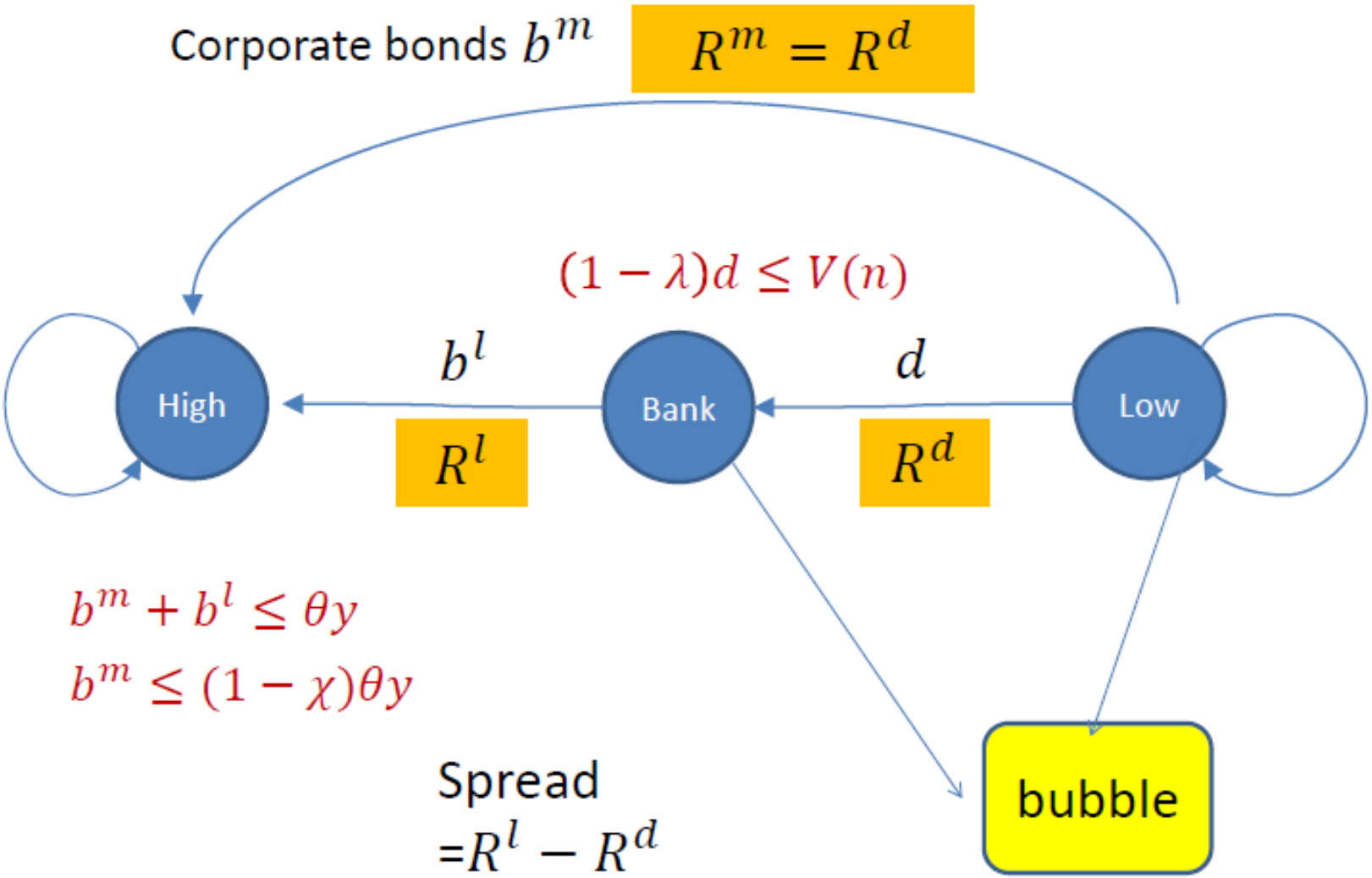
Model Overview

- Limited commitment economy with 2 main types of agents: entrepreneurs and bankers
- Only source of aggregate risk: stochastic rational bubble
  - bubble modelled as an intrinsically worthless asset
  - bubbly equilibria exist due to credit frictions
- Bubble impact:
  - large when bubble held by banks
  - small when held by savers
- This paper: does the growth of financial markets increase banks' incentives to hold the risky bubble asset?

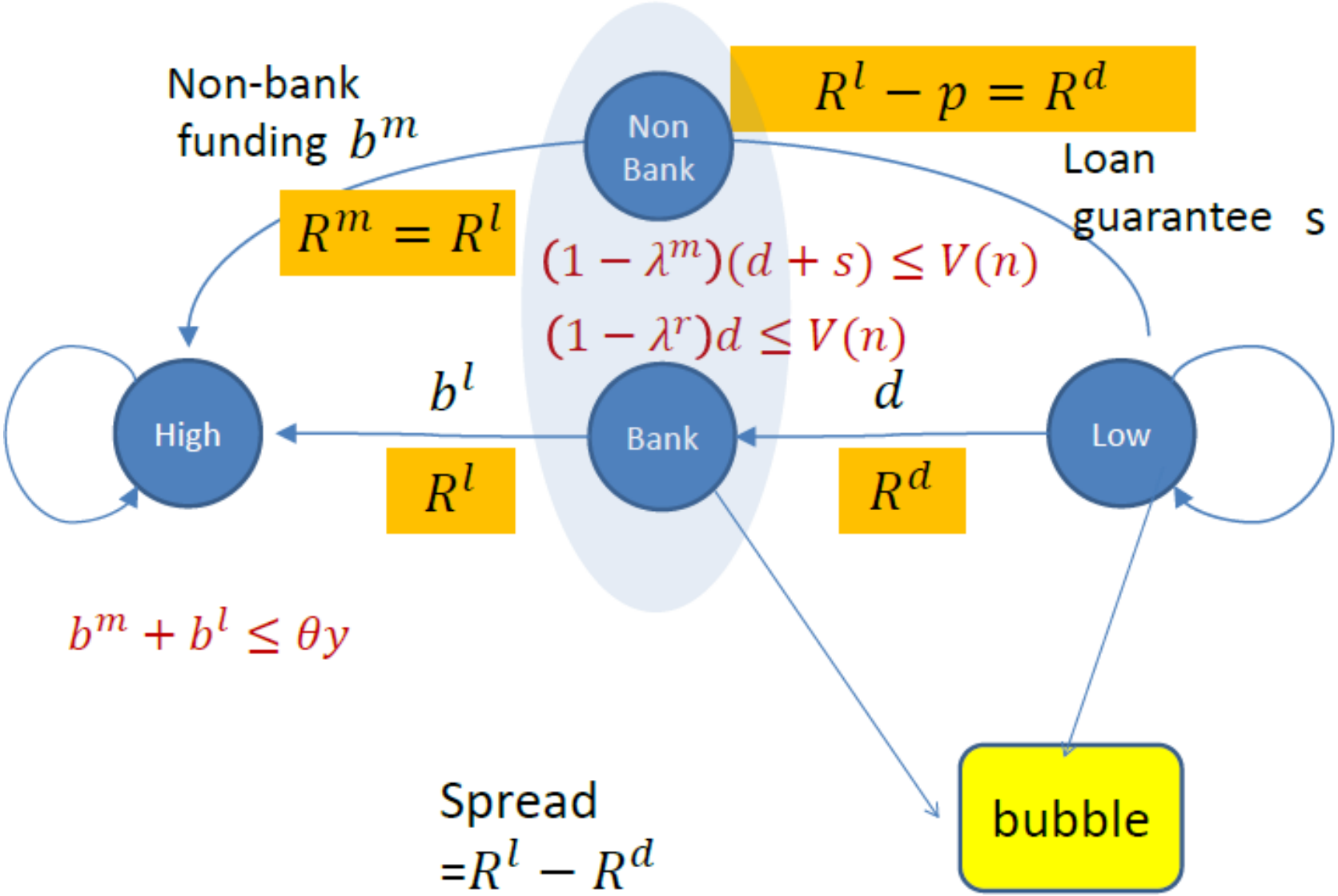
Model Overview (cont'd)

- Compare the effects of the introduction of two types of financial markets into a hitherto bank-centred financial system
- 'Corporate bond market'
  - operates without bank involvement (genuine disintermediation)
- 'Shadow banking'
  - operates with the help of bank guarantees (motivated by Acharya and Schnabl (2011) evidence on the ABCP market)

Model of financial disintermediation 1: corporate bond



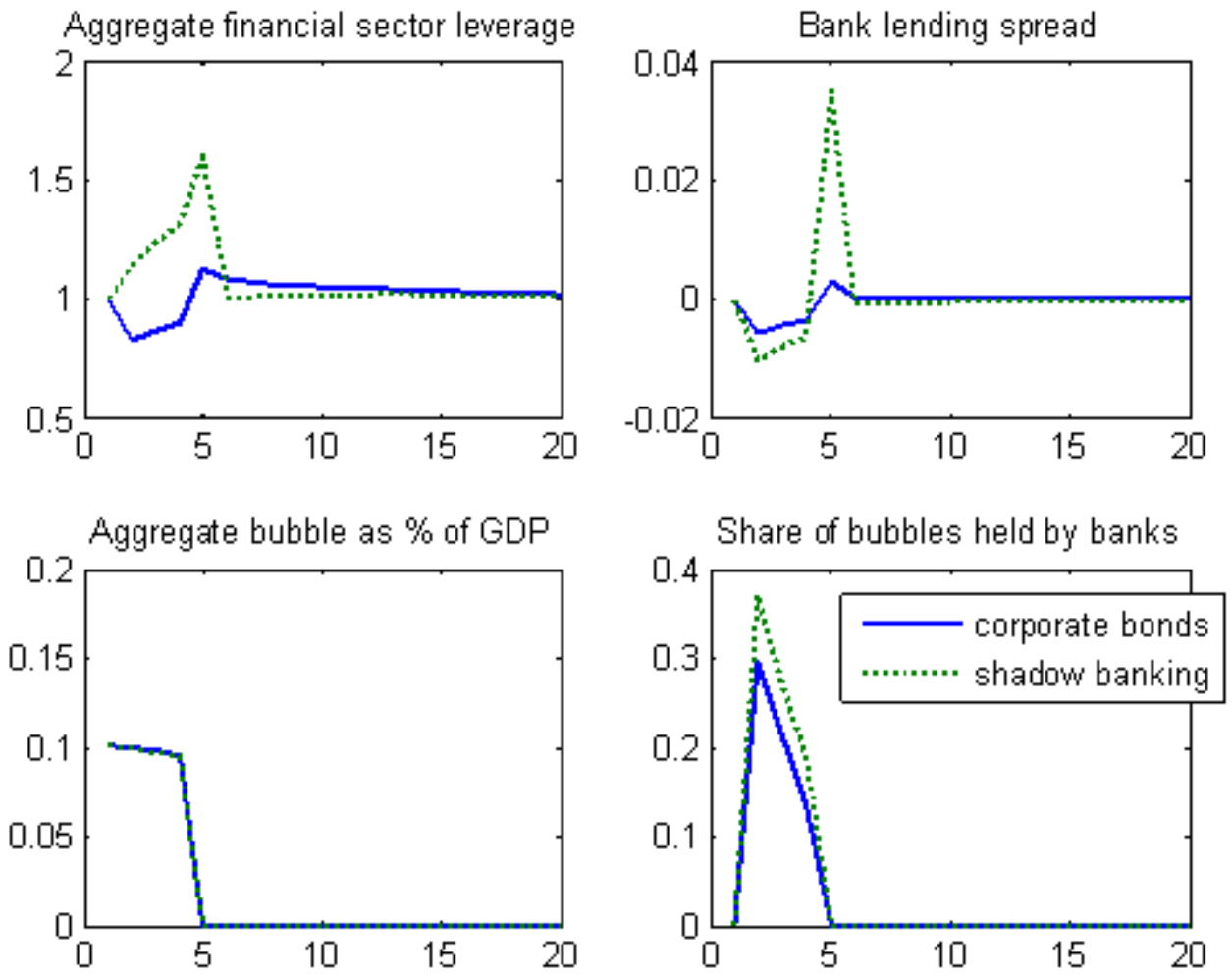
Model of financial disintermediation 2: shadow banking



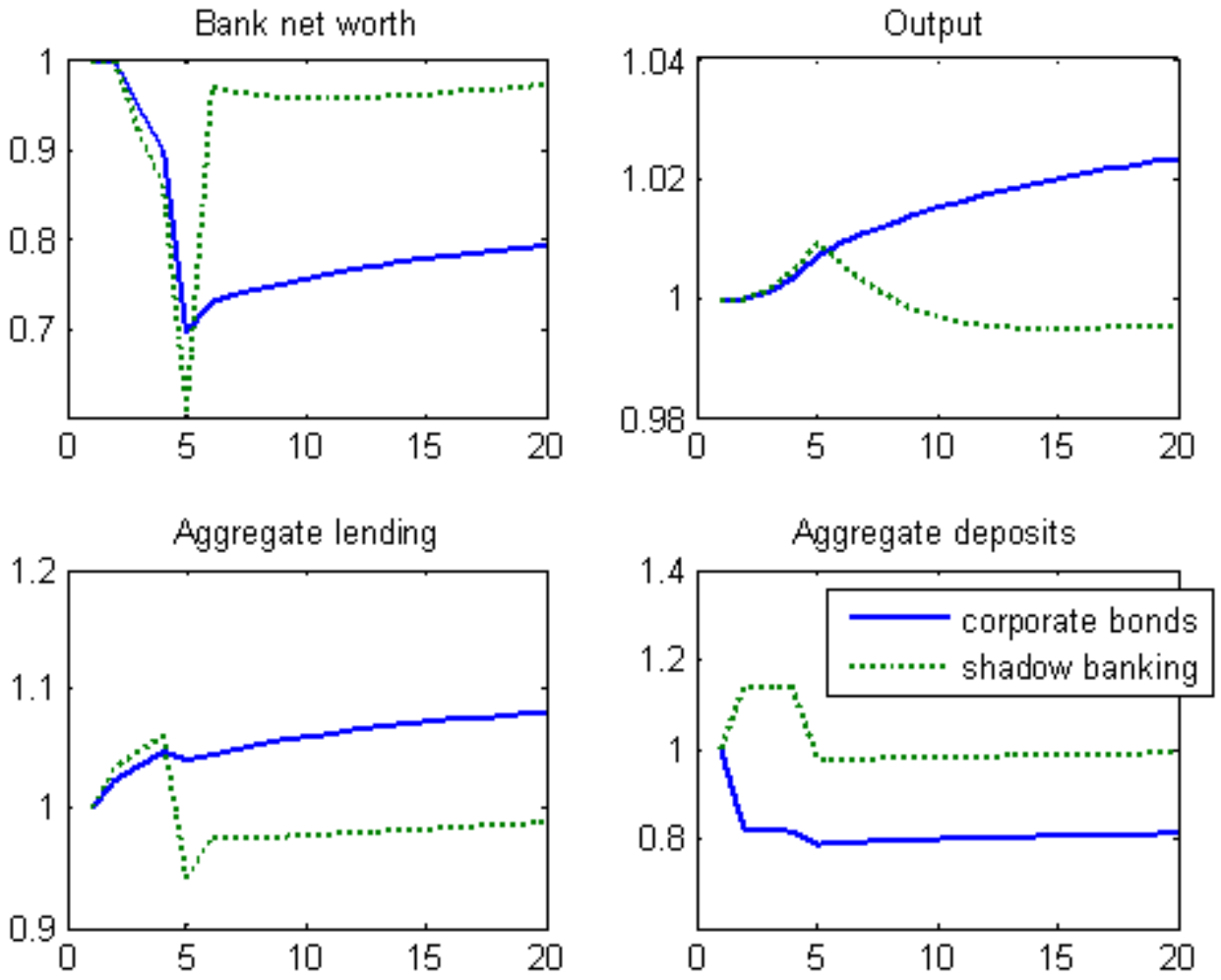
Financial markets and bank risk-taking

- Baseline economy:
  - only banks intermediate
  - economy is in a bubbly equilibrium
  - bank bubble holdings are zero due to high lending spread
- Contrast the impact on this economy of two financial innovations
  - corporate bond market expansion
  - shadow banking expansion
- Crisis: bubble collapses in period 5 of the simulation
  Shadow banking system is closed by regulators

Financial markets and bank risk-taking (cont'd)



Financial markets and bank risk-taking (cont'd)



Why does leverage depress spreads?

- Rate of return on bank equity:

$$R_t^l + \frac{\phi_t}{(1-\lambda)}\left(R_t^l - R_t^d\right)$$

- $\frac{\phi_t}{(1-\lambda)}$ is bank leverage. Consists of:
  - $\phi_t > 1$: the 'charter value' of a unit of net worth inside the bank: $\uparrow$ when $\uparrow R_t^l - R_t^d$
  - $1-\lambda$: depositors/regulators' perceived benefit from diverting funds: $\downarrow$ under shadow banking
- Holding equity returns fixed $\uparrow \lambda \Longrightarrow \downarrow R_t^l - R_t^d$

Conclusions

- We develop a model of the corporate bond market and shadow banking
- Bank risk taking impact
  - both decrease bank profitability and stimulate bank risk-taking
  - shadow banking increases financial sector leverage $\Longrightarrow \uparrow$ risk-taking compared to the corporate bond market

Entrepreneurs

- Utility

$$\Sigma_{t=0}^{\infty}\beta^t \ln c_t$$

- Production function

$$y_{t+1} = ah_t, \quad a = a^H, a^L, \quad a^H > a^L$$

- Budget constraint

$$\begin{aligned} & c_t + w_t h_t + m_t^e \mu_t - b_t^m - b_t^l \\ = \quad & a^i h_{t-1} - R_{t-1}^i b_{t-1}^l - \widetilde{R}_{t-1}^i b_{t-1}^m + m_{t-1}^e \mu_t \end{aligned}$$

- We consider two alternative credit market arrangements

The corporate bond market

- $\widetilde{R}_t^l = \widetilde{R}_t^d = R_t^m$
- Banks and savers have different enforcement ability
  - Can pledge up to θ to banks $\Longrightarrow$ total (bank + bond) debt is

$$R_t^l b_t^l + R_t^m b_t^m \leq \theta y_{t+1}, \quad 0 < \theta < 1$$

  - Can pledge up to $\theta(1-\chi)$ to savers $\Longrightarrow$ total bond debt

$$R_t^m b_t^m \leq \theta(1-\chi) y_{t+1}, \quad 0 < \theta < 1, \quad 0 < \chi < 1$$

- Consistent with several different micro-foundations
  - Different enforcement ability of banks and savers (our assumption)
  - 'Skin-in-the-game' constraint in 'plain vanilla' securitisations (Shleifer and Vishny (2010))

Shadow banking

- Savers cannot enforce loan repayment: need a guarantee from banks

$$\begin{aligned} \widetilde{R}_t^l &= R_t^m && \text{if borrower} \\ \widetilde{R}_t^d &= R_t^m - p_t && \text{if saver} \end{aligned}$$

  p_t is the unit price of the bank guarantee
- Motivated by evidence in Acharya and Schnabl (2011) suggests that ABCP market in particular grew due to regulatory arbitrage
- $\Longrightarrow$ firms face only one constrained determined by banks' ability to enforce

$$R_t^l b_t^l + R_t^m b_t^m \leq \theta y_{t+1}, \quad 0 < \theta < 1$$

- In the banking section we show that a market may nevertheless arise due to regulatory arbitrage

Banks

- Linear utility (exogenous exit rate $1-\gamma$)

$$\Sigma_{t=0}^{\infty}\left(\beta\gamma\right)^{t}c_{t}^{B}$$

- Budget constraints and state evolution

$$c_{t}^{B}+b_{t}^{l}+\mu_{t}m_{t}^{b}=n_{t}+d_{t}$$

$$n_{t+1}=R_{t}^{l}b_{t}^{l}+\mu_{t+1}m_{t}^{b}-R_{t}^{d}d_{t}+p_{t}s_{t}$$

$p_t s_t$ is the bank's non-interest income

Banks (cont'd)

- Banks are subject to a market imposed no diversion constraint

$$(1-\lambda^m)(d_t+s_t) \leqslant V(n_t)$$

  Takes into account all liabilities (on- and off-balance-sheet)
- Regulatory borrowing constraint (only on-balance-sheet liabilities)

$$(1-\lambda^r)d_t \leqslant V(n_t)$$

- Scope for establishing a bank-guarantee-backed debt market in order to evade regulation

Banks' behaviour

- Borrowing constraint binds whenever $R_t^l - R_t^d > 0$
- Corporate bond economy: $s_t = 0$, regulatory constraint binds

$$d_t = \frac{1}{1-\lambda^r} V(n_t)$$

- Shadow bank economy: $s_t > 0$, regulation ineffective

  - On-balance sheet liabilities set to satisfy regulation

$$d_t = \frac{1}{1-\lambda^r} V(n_t)$$

  - Off-balance sheet liabilities expand as far as the market borrowing constraint allows

$$s_t = \left(\frac{1}{1-\lambda^m} - \frac{1}{1-\lambda^r} \right) V(n_t)$$

  - Arbitrage between on and off balance sheet lending

$$p_t = R_t^l - R_t^d$$

Who holds the bubble asset?

- For unproductives choice between deposits and bubbles governed by FOC

$$E_t\left[\frac{1}{c_{t+1}^L}\frac{\mu_{t+1}}{\mu_t}\right] = E_t\left[\frac{1}{c_{t+1}^L}\right] R_t^d$$

or

$$E_t\left[\frac{\mu_{t+1}}{\mu_t}\right] = R_t^d + \varkappa_t^L$$

where $\varkappa_t^L$ is the risk premium demanded by savers

- Banks start to hold the bubble asset approximately when

$$E_t\left[\frac{\mu_{t+1}}{\mu_t}\right] = R_t^l$$

Who holds the bubble asset? (cont'd)

- Bank lending spread is crucial:

$$\varkappa_t^L = R_t^l - R_t^d$$

- - Bank risk-taking $\uparrow$ when bank profitability/franchise value is low: $\downarrow R_t^l - R_t^d$

Baseline Calibration

Model and Data Moments

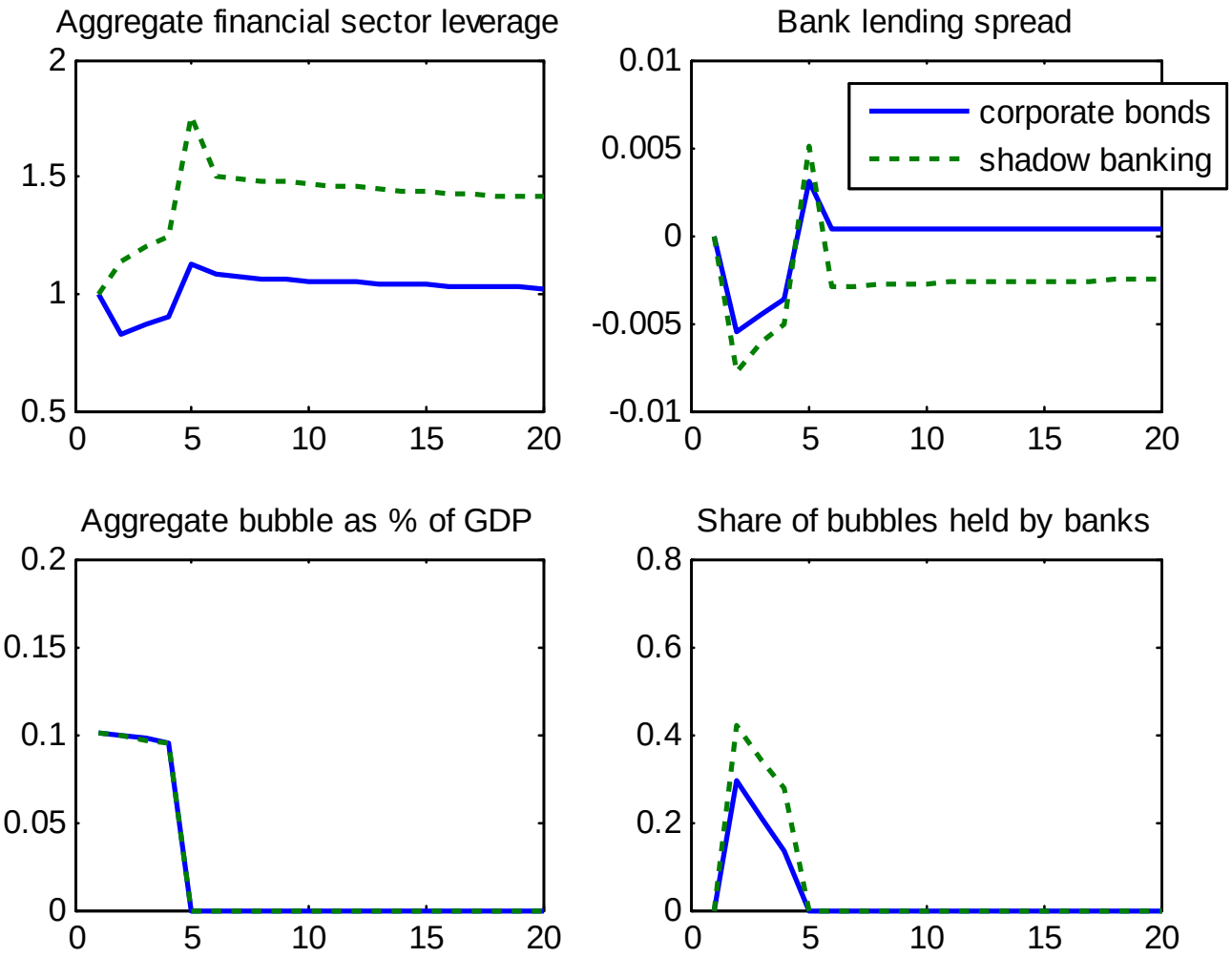
Moment (Model concept)	Data	Model
Real deposit rate - real GDP growth (R^d)	0.950	0.971
Real loan rate - real GDP growth - costs/Assets (R^l)	0.982	0.982
Ratio of M2 to GDP (D/Y)	0.500	0.464
Bank leverage (D/N)	10.00	10.00
Average corporate leverage (L/Z)	0.500	0.530
Leverage of indebted corporates ($L/(sZ)$)	2.000	2.000
Bank rate of return on equity ($R^l_t + \frac{\phi_t\left(R^l_t - R^d_t\right)}{(1-\lambda)}$)	1.100	1.103

Baseline Calibration

Baseline Parameters

Parameter	Value
δ	0.167
n	0.011
a^H / a^L	1.100
η	5.000
θ	0.622
χ	1.000
λ	0.788
γ	0.907
β	0.958

Financial markets and bank risk-taking (cont'd)



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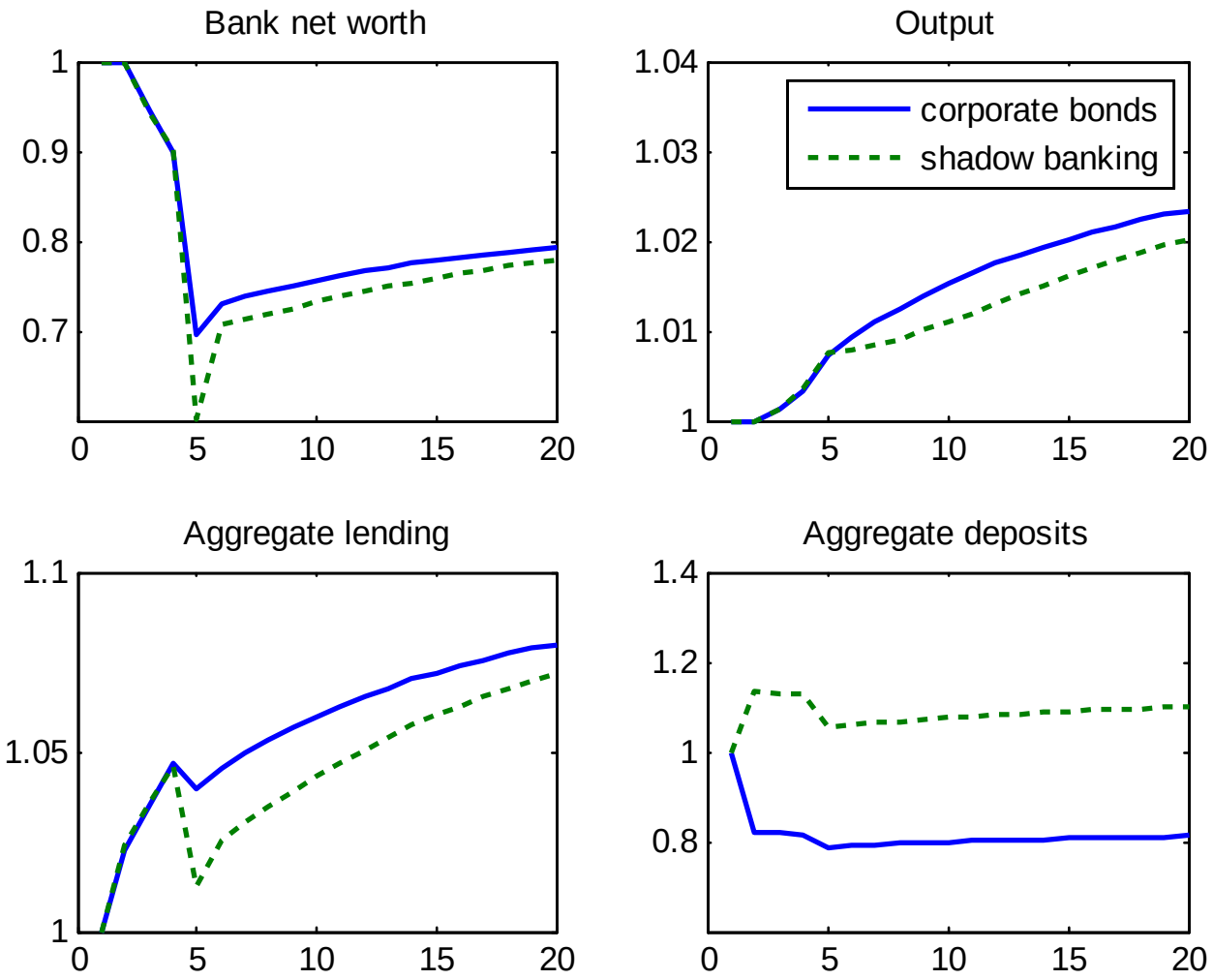

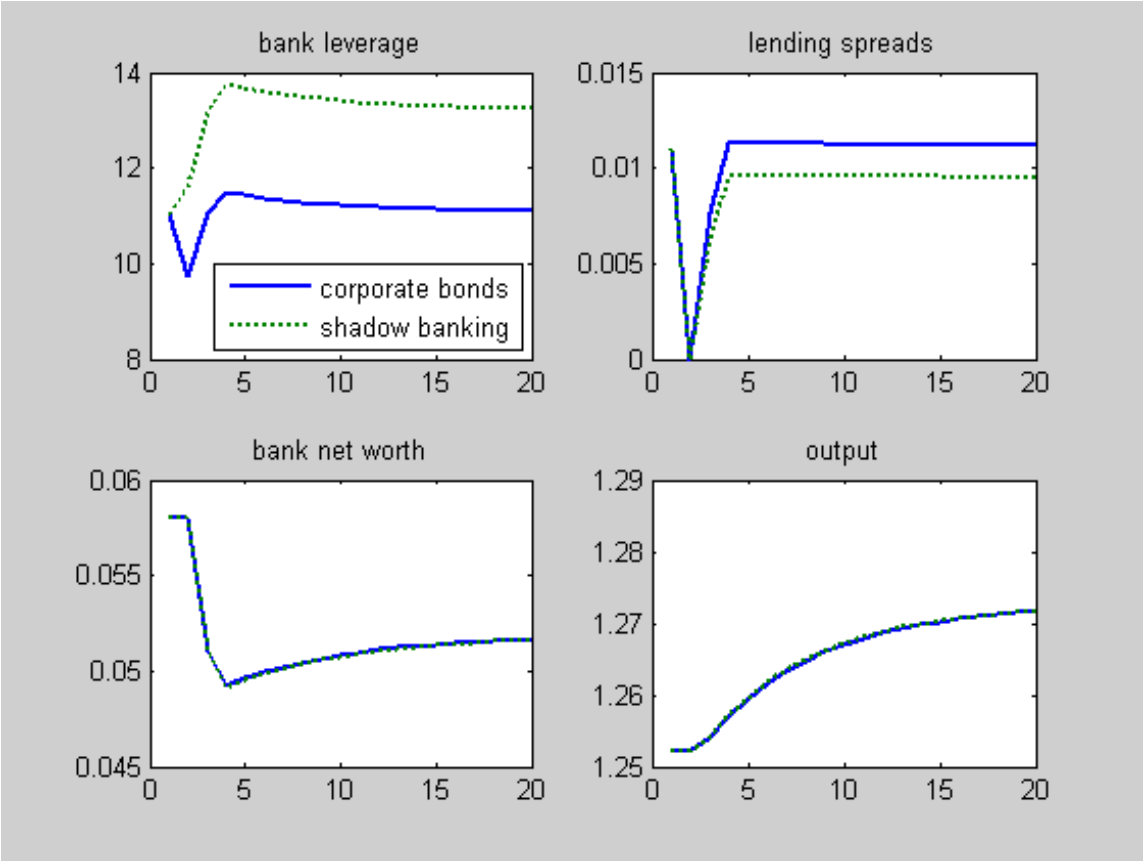
bank leverage
14
12
10
8
0
5
10
15
20
corporate bonds
shadow banking
lending spreads
0.015
0.01
0.005
0
bank net worth
0.06
0.055
0.05
0.045
output
1.29
1.28
1.27
1.26
1.25