Banks Collateral, Asymmetric Information and Aggregate Fluctuations

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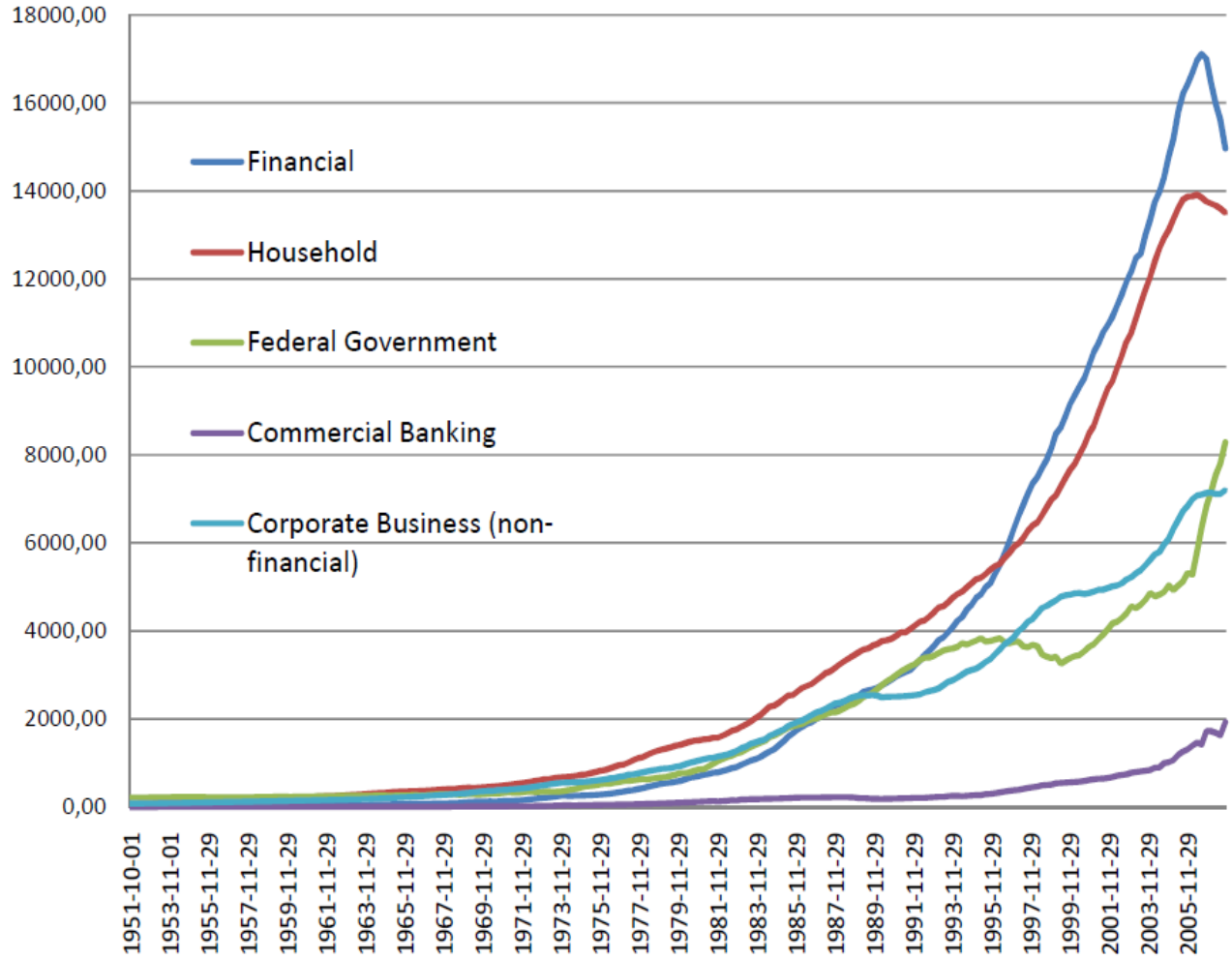
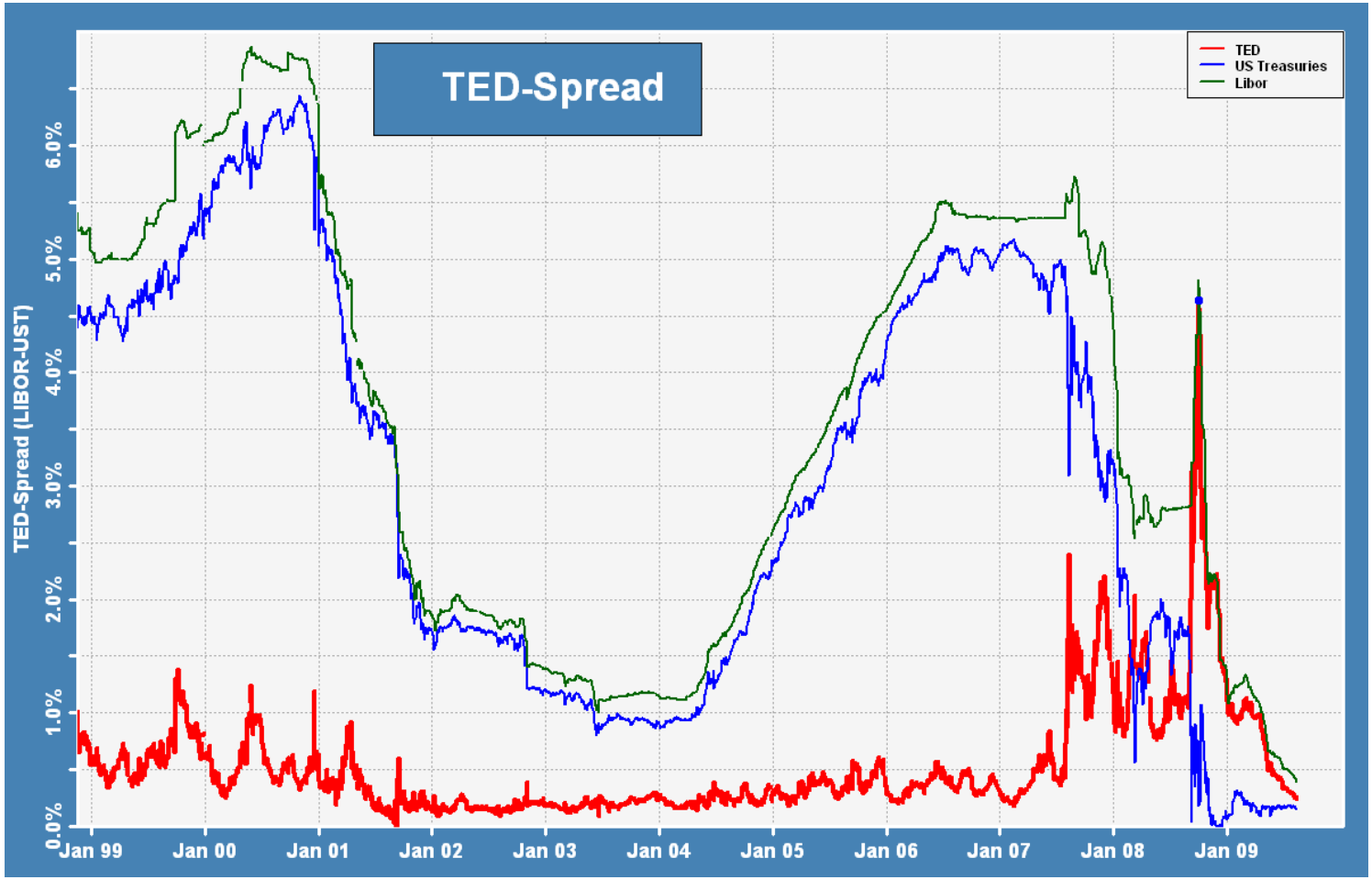
August 2010

Debt overhang



Total credit market debt owed by different sectors (US, billions of. $)

Debt markets subject to spirals



TED spread and its components (source Bloomberg).

Liquidity and cost of finance

- Spirals involve feedback effects between cost of finance and **liquidity** in the interbank market
- Liquidity = **perceived safety** of the assets traded in the market.
- Holmstrom (2008): necessary condition for asset to be **liquid** is that market participants **know its value**.

Amplification

- Bad news hit $\longrightarrow$ informational asymmetries become more acute $\longrightarrow$ Market participants cast doubts on the value of the assets
- **Two effects**

1. Asset prices fall
2. Asset liquidity shrinks

Liquidity shocks

- **Shifts in confidence** about riskiness of assets held by financial institutions..

or alternatively...

- Variations in the degree of **opacity** of balance sheets

This paper

1. Model **liquidity shocks** as variations in uncertainty about value of assets held by (investment) banks
2. Characterize effects on **interbank** market and **credit** markets
3. Characterize effects on **aggregate economic activity**

Households

(home production)

Commercial banks

save in riskless deposits

Loans to entrepreneurs

Interbank market with asymmetric information problem

Entrepreneurs

(market production)

Investment banks

Investment banks purchase entrepreneurial loans

Model

- **Asymmetric information** problem in the interbank market
- Two types of banks

1. Commercial banks (lenders, perfectly competitive)
2. Investment banks

Model (con't)

- Investment banks **borrow** in interbank market to finance purchase of assets
- Asset return subject to **idiosyncratic** uncertainty
- This is **private information** to investment bank

Investment banks balance sheet

assets		**liabilities**	
loans	$a_t^{(+)}$	short-term debt	b_t

- Investment banks borrow in excess of internal funds nw_t

$$\underbrace{b_t}_{\text{debt}} = \underbrace{q_t a_t^{(+)}}_{\text{asset purchase}} - nw_t$$

Model (con't)

- **Commercial banks** balance sheet

assets		**liabilities**	
banks loans	b_t	h.h deposits	d_t

Financial Technology

- Asset return subject to **idiosyncratic uncertainty**

$$\underbrace{\text{purchase portfolio } q_t a_t^{(+)}}_{\text{end of t}} \quad \rightarrow \quad \underbrace{\eta_{t+1}\Delta_{t+1}\ q_t a_t^{(+)}}_{\substack{\text{end of t+1} \\ \text{total gross return}}}$$

$$\Delta_{t+1} = \mathbb{E}_t \left\{ q_{t+1} / q_t \right\}$$

- Shock η_t

$$\begin{aligned} &\Phi(\eta_t, \sigma_{\eta,t}) \quad \text{cdf} \\ &\phi(\eta_t, \sigma_{\eta,t}) \quad \text{pdf} \end{aligned}$$

- Time-varying **riskiness of assets**

$$\log \sigma_{\eta,t} = (1 - \rho_\sigma) \log \sigma_\eta + \rho_\sigma \log \sigma_{\eta,t-1} + \varepsilon_{\sigma,t},$$

Asset default

- Threshold value $\overline{\eta}_{t+1}$

$$\underbrace{\overline{\eta}_{t+1}\Delta_{t+1}\ q_t a_t^{(+)}}_{\substack{\text{return from} \\ \text{holding asset}}} = \underbrace{R^b_{t+1}\ b_t}_{\substack{\text{service} \\ \text{cos}\,t \text{ of debt}}}$$

Lender's participation constraint

- In case of default, the lender recovers a fraction $1-\xi$ of the realized asset return

$$\overbrace{\underbrace{\left[1-\Phi(\overline{\eta}_{t+1})\right] R^{b}_{t+1}\ b_t}_{\text{no default}} + \underbrace{(1-\xi)\, M\left(\overline{\eta}_{t+1}\right) \Delta_{t+1}\ q_t a_t^{(+)}}_{\text{default}}}^{\text{lender's exp. income}} \geq \underbrace{R^{d}_{t}\ b_t}_{\substack{\text{opport. cost} \\ \text{of funds}}}$$

$$M\left(\overline{\eta}_{t+1}\right) \equiv \int_0^{\overline{\eta}_{t+1}} \eta\, d\Phi(\eta)$$

Optimal Financial Contract (CSV setting)

- Specifies a pair $\left\{a_t^{(+)}, \overline{\eta}_{t+1}\right\}$ to maximize the **bank's expected income** (taking asset price q_t as given)

$$\max \quad \left[1 - \Gamma(\overline{\eta}_{t+1})\right] \Delta_{t+1} q_t a_t^{(+)}$$

subject to lender's participation constraint

Return premium

$$\underbrace{\mathbb{E}_t\left\{\frac{\Delta_{t+1}}{R_t^d}\right\}}_{\substack{\text{return}\\ \text{premium}}} = \theta(\overline{\eta}_{t+1})$$

$\Uparrow \overline{\eta}_{t+1} \longrightarrow \Uparrow$probability of asset default $\longrightarrow \Uparrow$return premium

- Also direct function of **leverage**

$$\begin{aligned}\mathbb{E}_t\left\{\theta(\overline{\eta}_{t+1})\right\} &= h(\overline{\eta}_{t+1})\left(1-\frac{nw_t}{q_t a_t^{(+)}}\right)\\ &= h(\overline{\eta}_{t+1})\left(1-\frac{1}{LV_t}\right)\end{aligned}$$

Asset demand and net worth

$$q_t a_t^{(+)} = \frac{nw_t}{1 - \mathbb{E}_t \left\{ \theta(\overline{\eta}_{t+1}) \left[\Gamma(\overline{\eta}_{t+1}) - \xi M \left(\overline{\eta}_{t+1} \right) \right] \right\}}$$

Aggregate net worth and interbank finance premium (ifp)

$$nw_t = \zeta \left[\underbrace{\Delta_t q_{t-1} a_{t-1}^{(+)}}_{\text{ex-post asset return}} - \underbrace{\left(R_{t-1}^d + \varphi_t \right) b_{t-1}}_{\text{effective cost of borrowing}} \right]$$

$$\underbrace{\varphi_t}_{\text{ifp}} \equiv \frac{\xi M(\overline{\eta}_t) \Delta_t q_{t-1} a_{t-1}^{(+)}}{q_{t-1} a_{t-1} - nw_{t-1}}$$

Households (unproductive)

- Purchase fixed asset (capital) and use it in home production

$$\max \mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta_h^t \mathbb{U}(c_{h,t}) \right\}$$

$$c_{h,t} + \underbrace{z_t \left(k_{h,t} - k_{h,t-1}\right)}_{\substack{\text{purchase} \\ \text{capital}}} + \underbrace{d_t}_{\text{deposits}} = R_{t-1}^d d_{t-1} + \underbrace{G\left(k_{h,t-1}\right)}_{\text{home production}}$$

Entrepreneurs (productive)

$$\max \mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta_e^t \mathbb{U}(c_{e,t}) \right\} \quad \beta_e < \beta_h$$

budget constraint

$$c_{e,t} + z_t \left(k_{e,t} - k_{e,t-1} \right) + q_{t-1}^{-1} a_{t-1}^{(-)} = a_t^{(-)} + y_t$$

collateral constraint on the issue of bonds

$$\underbrace{a_t^{(-)}}_{\substack{\text{borrowing} \\ \text{at time t}}} \leq \underbrace{(1-\gamma_t)\mathbb{E}_t \left\{ k_{e,t} \; z_{t+1} \right\}}_{\substack{\text{expected future} \\ \text{value of K stock}}}$$

Credit finance premium (cfp)

- **Effective** real interest rate faced by entrepreneurs

$$m_{e,t} \equiv \frac{\lambda_{e,t}}{\beta_e \lambda_{e,t+1}}$$

- **Cfp** proportional to shadow value of borrowing ψ_t

$$\begin{aligned} f_t &\equiv \mathbb{E}_t \left\{ m_{e,t} - R_t^a \right\} \\ &= R_t^a \frac{\psi_t}{1 - \psi_t} \end{aligned}$$

$$R_t^a = q_t^{-1}$$

Calibration (baseline)

$$\Phi(\cdot) = 0.04/4 \quad \text{quarterly frequency of asset default}$$

$$\xi = 0.1 \quad \text{bankruptcy cost share}$$

$$V = \frac{b}{qa^{(+)}} = 0.5 \quad \text{debt-asset ratio}$$

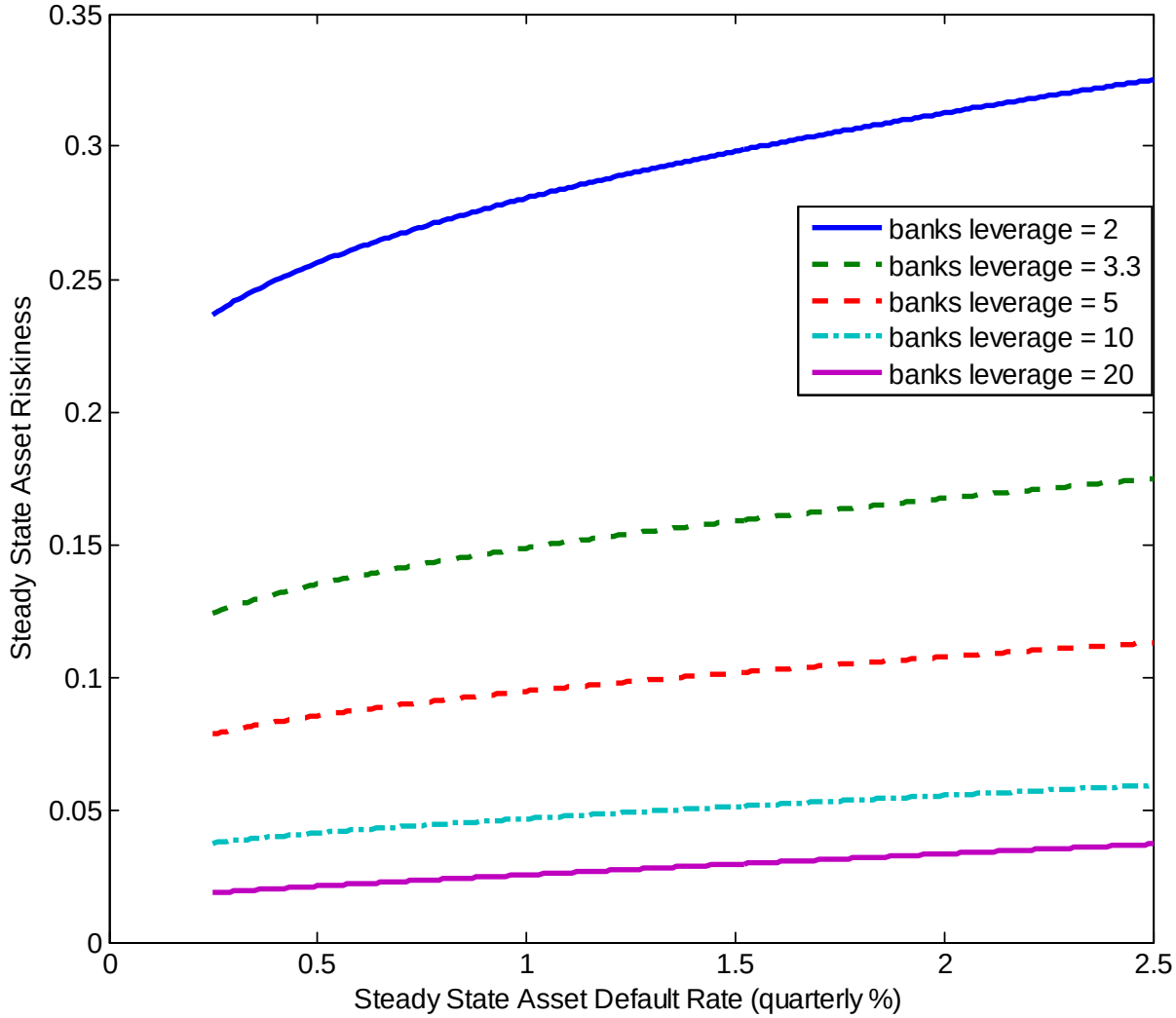
$\Longrightarrow$ Leverage

$$LV = \frac{1}{1-V} = 2$$

- Solve for $\{\Delta, \overline{\eta}, \sigma_\eta\}$

Default rate rises with asset riskiness

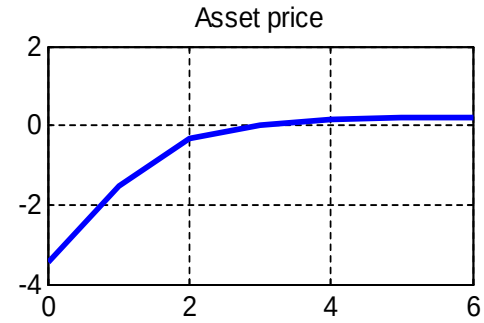
σ_η

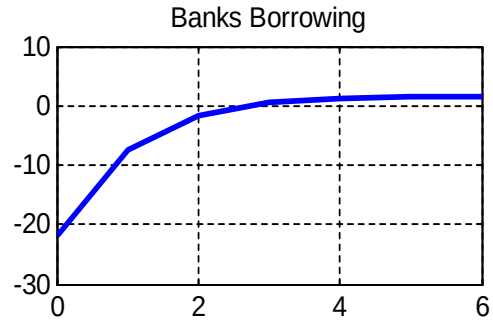


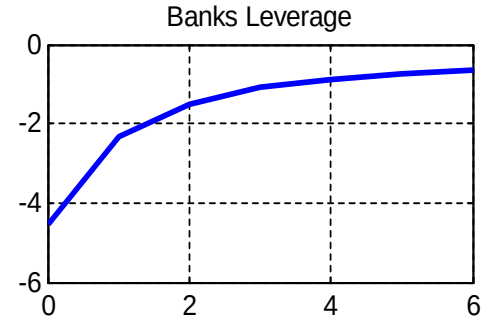
Dynamics

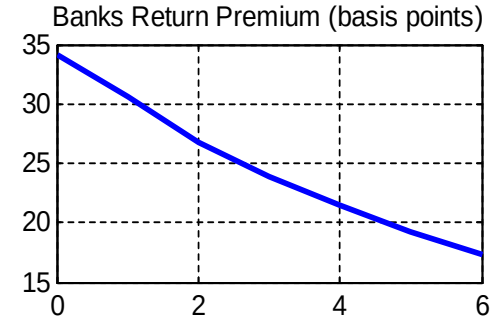
- Sudden rise in **asset riskiness** σ_η: 10% above steady state value

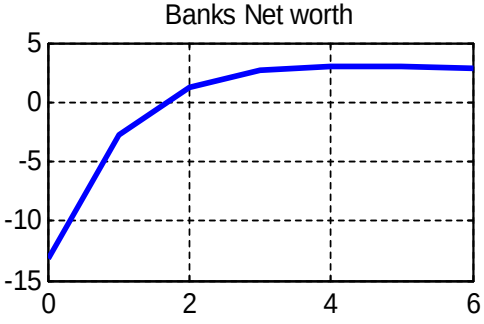
Interbank market



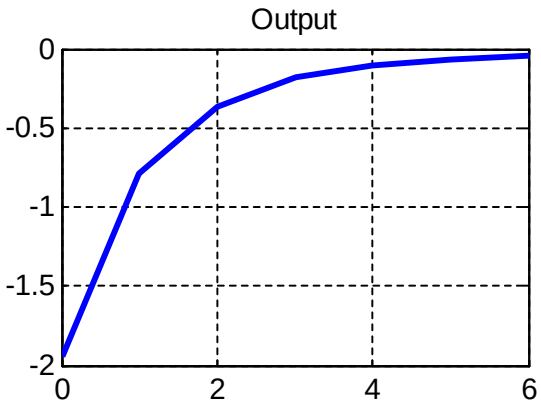


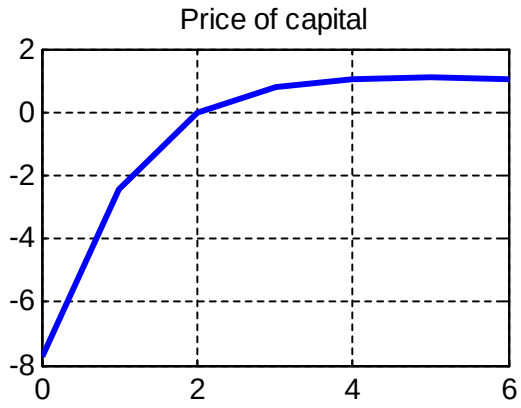


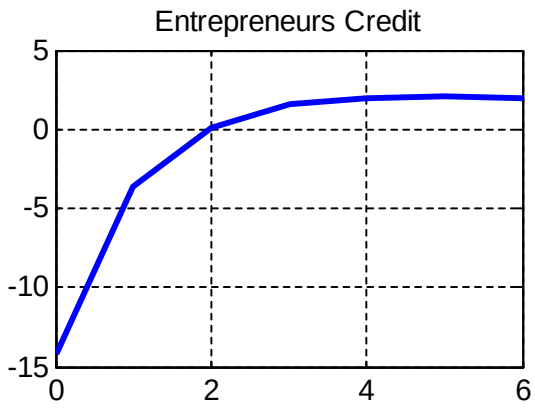




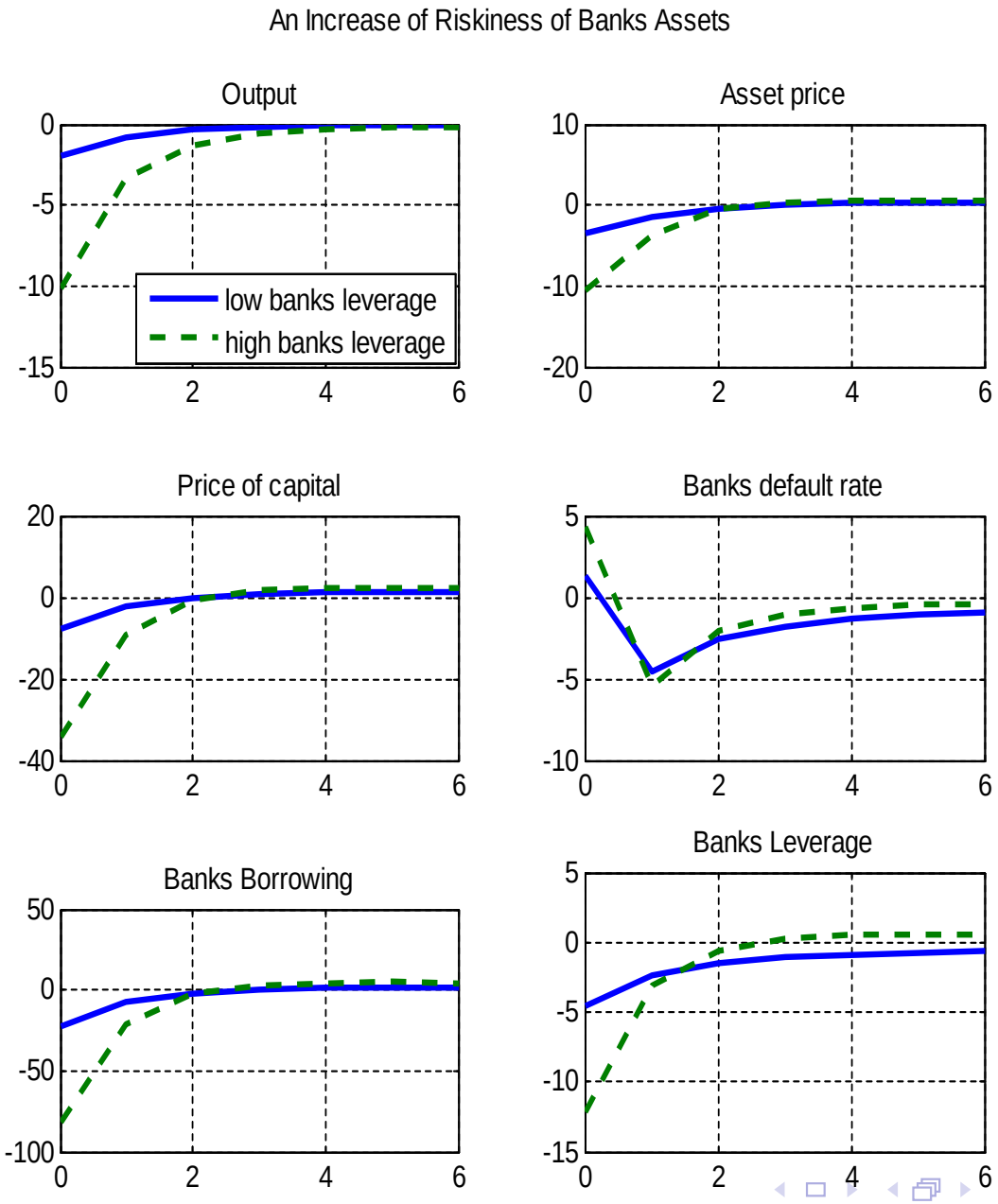
Output and Credit Market







Amplification with high leverage



Conclusions

- Model **liquidity shocks** as sudden variations in asset riskiness
- Intensity of asymmetric information problem in interbank market **can vary** suddenly
- Effects on interbank market, credit market and real activity can be large

Extensions

- DSGE structure
- Role of monetary policy
- Securitization