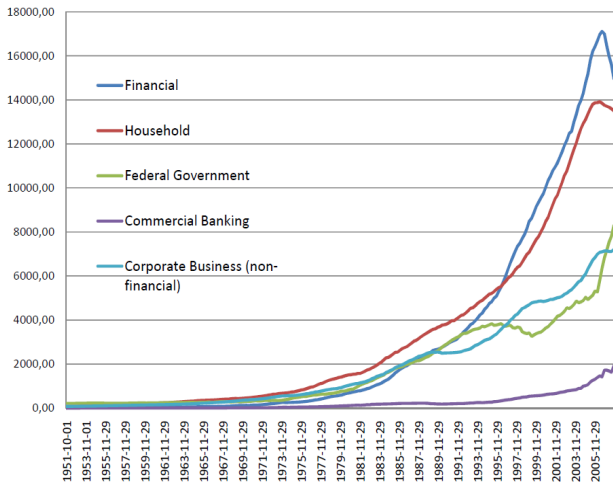


# Banks Collateral, Asymmetric Information and Aggregate Fluctuations

Tommaso Monacelli (Bocconi, Iger and CEPR)<sup>1</sup>,

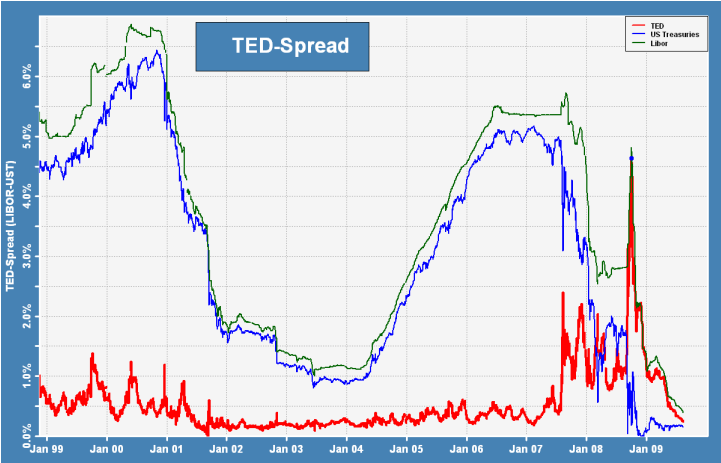
August 2010

# 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 → informational asymmetries become more acute → 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)



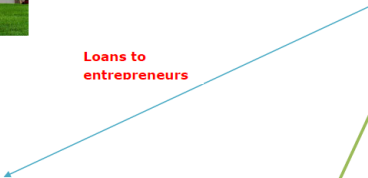
## Commercial banks



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

<b>assets</b>		<b>liabilities</b>	
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

<b>assets</b>		<b>liabilities</b>	
banks loans	$b_t$	h.h deposits	$d_t$

- ▶ Asset return subject to **idiosyncratic uncertainty**

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

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

- ▶ Shock  $\eta_t$

$\Phi(\eta_t, \sigma_{\eta,t})$  cdf

$\phi(\eta_t, \sigma_{\eta,t})$  pdf

► 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  $\bar{\eta}_{t+1}$

$$\underbrace{\bar{\eta}_{t+1} \Delta_{t+1} q_t a_t^{(+)}}_{\text{return from holding asset}} = \underbrace{R_{t+1}^b b_t}_{\text{service cost of debt}}$$

## Lender's participation constraint

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

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

$$M(\bar{\eta}_{t+1}) \equiv \int_0^{\bar{\eta}_{t+1}} \eta d\Phi(\eta)$$

## Optimal Financial Contract (CSV setting)

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

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

subject to lender's participation constraint

## Return premium

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

$\uparrow \bar{\eta}_{t+1} \rightarrow \uparrow$ probability of asset default  $\rightarrow \uparrow$ return premium

► Also direct function of **leverage**

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

## Asset demand and net worth

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

# Aggregate net worth and interbank finance premium (ifp)

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

# Households (unproductive)

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

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

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

# Entrepreneurs (productive)

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

budget constraint

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

collateral constraint on the issue of bonds

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

## 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  $\psi_t$

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

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

## Calibration (baseline)

$\Phi(\cdot) = 0.04/4$  quarterly frequency of asset default

$\zeta = 0.1$  bankruptcy cost share

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

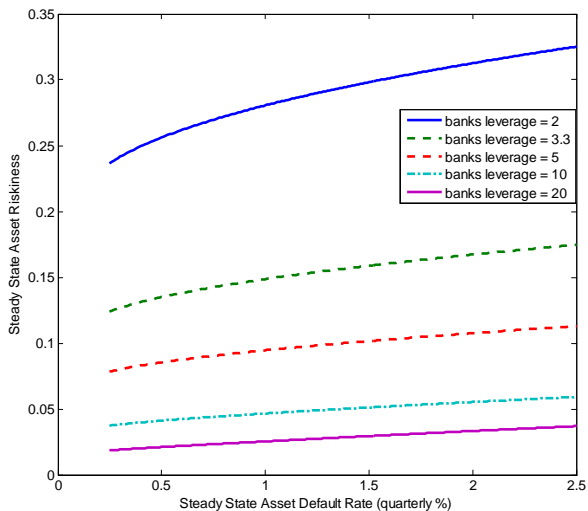
$\implies$  Leverage

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

► Solve for  $\{\Delta, \bar{\eta}, \sigma_{\eta}\}$

# Default rate rises with asset riskiness

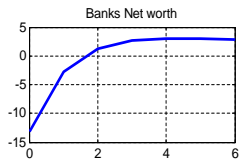
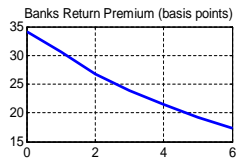
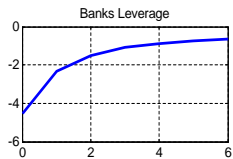
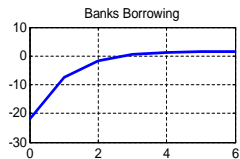
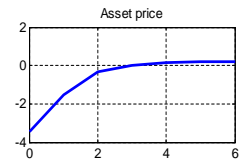
$\sigma_\eta$



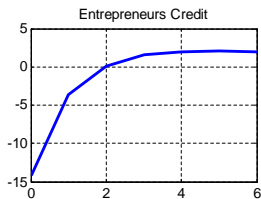
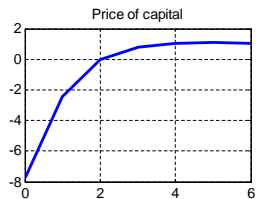
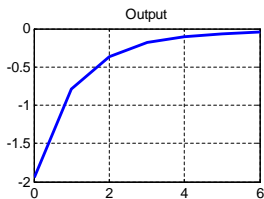
# Dynamics

- ▶ Sudden rise in **asset riskiness**  $\sigma_{\eta}$ : 10% above steady state value

# Interbank market

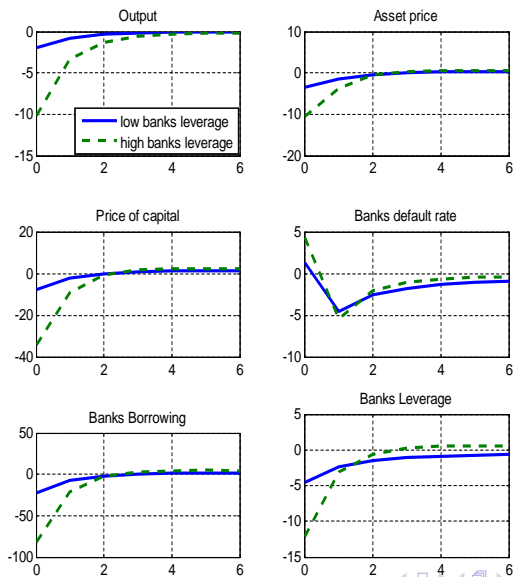


# Output and Credit Market



# Amplification with high leverage

An Increase of Riskiness of Banks Assets



# 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