Market Confidence and Liquidity Hoarding

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Motivation

- Credit crunch and central banks policy
- No agreement about the policy effect in the literature:
  - Curdia and Woodford (2011) and Taylor and Williams (2009): was not efficient or irrelevant
  - Del Negro et al. (2011) and Christensen et al. (2014), Gertler and Karadi (2011): helped avoid more severe recession
- Liquidity hoarding
- Change in sentiment
Motivation
Liquidity hoarding
Motivation

Impact on bank’s lending standards
Motivation
Paper contribution

- Counterparty risk in the interbank market
- Liquidity hoarding
- Policy exercises:
  - liquidity provision, targeted liquidity provision, declining policy rate, relaxing collateral constraints
Model
Overview

- DSGE framework (Gertler and Karadi (2011))
- Continuum of banks, indexed by $i$, lend to the real sector and to each other
- Two types of assets:
  - safe (reserves), pays $R_t^{res}$
  - risky, pays $R_{t+1}^k$
- Banks differ by their beliefs about risky asset return,
  $\hat{E}_t R_t^k \sim N(\bar{R}_t^k, K_F^t, P_t^{K_F})$
Model
Overview

- Assumption 1:

\[ R_t^k = \frac{\alpha \frac{P_t Y_t}{K_t} + (1 - \delta) Q_t \zeta_t}{Q_{t-1}} \]
Model
Overview

- **Assumption 1:**
  \[ R_t^k = \frac{\alpha \frac{P_t}{K_t} Y_t + (1 - \delta) Q_t \zeta_t}{Q_{t-1}} \]

- **Assumption 2:**
  \[ \zeta_t = \rho \zeta_{t-1} + \mu_t + \varepsilon_{\zeta,t} \quad (1) \]
Model
Overview

- Assumption 1:
  \[ R_t^k = \frac{\alpha P_t Y_t}{K_t} + (1 - \delta) \frac{Q_t \zeta_t}{Q_{t-1}} \]
- Assumption 2:
  \[ \zeta_t = \rho \zeta_{t-1} + \mu_t + \varepsilon_{\zeta,t} \quad (1) \]
- \( \mu_t \) is a persistent shock
  \[ \mu_t = \rho \mu_{t-1} + \nu_t \]
Assumption 1:

\[ R_t^k = \frac{\alpha \frac{P_t Y_t}{K_t} + (1 - \delta) Q_t \zeta_t}{Q_{t-1}} \]

Assumption 2:

\[ \zeta_t = \rho_\zeta \zeta_{t-1} + \mu_t + \varepsilon_{\zeta,t} \quad (1) \]

- \( \mu_t \) is a persistent shock

\[ \mu_t = \rho_\mu \mu_{t-1} + \nu_t \]

Experts’ opinions

\[ \mu^i_t = \mu_t + \theta^i_t \quad (2) \]
## Model

Bank's balance sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturers' claims</td>
<td>Deposits</td>
</tr>
<tr>
<td>Reserves</td>
<td>Interbank borrowing</td>
</tr>
<tr>
<td>Interbank lending</td>
<td>Net worth</td>
</tr>
</tbody>
</table>
Model
Bank’s problem

- Each bank maximizes expected return, choosing $\alpha^i_t, h^i_t$: 

  \[
  r^i_t \hat{E} R^i_t + 1 \\
  h^i_t R_{\text{res}} \\
  p^i_t 1 \alpha^i_t h^i_t R_{\text{ib}} \\
  \hat{E} R^i_t + 1 R_{\text{ib}} L_i \text{ for lenders, } \lambda_b (\text{net worth}) \text{ for borrowers}
  \]
Model
Bank’s problem

• Each bank maximizes expected return, choosing $\alpha^i_t$, $h^i_t$:
  
  • risky asset:
    
    \[ \alpha^i_t \star \hat{E}^i_t R^k_{t+1} \]
Model
Bank’s problem

- Each bank maximizes expected return, choosing $\alpha^i_t$, $h^i_t$:
  - risky asset:
    \[ \alpha^i_t \cdot \hat{E}^i_t R^k_{t+1} \]
  - reserves:
    \[ h^i_t \cdot R^\text{res}_t \]
Model

Bank’s problem

- Each bank maximizes expected return, choosing $\alpha_t^i, h_t^i$:
  - risky asset:
    $$\alpha_t^i \times \hat{E}_t^i R^k_{t+1}$$
  - reserves:
    $$h_t^i \times R^{res}_t$$
  - interbank market lending:
    $$p_t^i \left(1 - \alpha_t^i - h_t^i\right) \times R^{ib}_t$$
Model
Bank’s problem

- Each bank maximizes expected return, choosing $\alpha_t^i, h_t^i$:
  - risky asset:
    \[ \alpha_t^i \cdot \hat{E}_t^i R_{t+1}^k \]
  - reserves:
    \[ h_t^i \cdot R_{t}^{res} \]
  - interbank market lending:
    \[ p_t^i \left( 1 - \alpha_t^i - h_t^i \right) \cdot R_{t}^{ib} \]
  - or interbank market borrowing:
    \[ \left( \hat{E}_t^i R_{t+1}^k - R_{t}^{ib} \right) \cdot L_t^i \]
Model

Bank’s problem

- Each bank maximizes expected return, choosing $\alpha^i_t$, $h^i_t$:
  - risky asset:
    \[ \alpha^i_t \cdot \hat{E}^i_t R^k_{t+1} \]
  - reserves:
    \[ h^i_t \cdot R^{res}_t \]
  - interbank market lending:
    \[ p^i_t \left( 1 - \alpha^i_t - h^i_t \right) \cdot R^{ib}_t \]
  - or interbank market borrowing:
    \[ \left( \hat{E}^i_t R^k_{t+1} - R^{ib}_t \right) \cdot L^i_t \]

- $L^i_t$ interbank loan
  \[ L^i_t = \begin{cases} 0, & \text{for lenders} \\ \lambda_b \cdot \text{(net worth)}, & \text{for borrowers} \end{cases} \]
Model
Bank's problem continued

- Collecting the terms by $\alpha_t^i$:

$$\alpha_t^i \left( \hat{E}_t R_{t+1}^k - p_t^i R_{t}^{ib} \right)$$

- $\alpha_t^i = 1$ for $\hat{E}_t R_{t+1}^k \geq p_t^i R_{t}^{ib}$, $\alpha_t^i = 0$ for $\hat{E}_t R_{t+1}^k < p_t^i R_{t}^{ib}$

- Note: for each lender all borrowers are identical
- $p_t^i = \text{Prob} \left( \hat{E}_t R_{t+1}^k (1 + \lambda_b) > R_t d_t + \lambda_b R_{t}^{ib} \right)$

- A lender lends if $p_t^i * R_{t}^{ib} > R_{t}^{res}$, hoards otherwise
- A borrower borrows if $\hat{E}_t R_{t+1}^k \geq R_{t}^{ib}$
Model

Interbank market and beliefs

Hoard

Lend

Borrow

\( p^i R^{ib} = R^{res} \)

\( E^k R^k = p^i R^{ib} \)

\( E^k R^k = R^{ib} \)

Lenders and hoarders

Investors
Model

Crisis and policy responses

- "Fundamental" shock: \( \zeta_t = \rho \zeta_{t-1} + \mu_t + \varepsilon_{\zeta,t} \)
- Sentiment shock: \( \hat{\mu}_t^i = \mu_t + \eta^i_t \)
- Policy: \( \nabla^p_t = \kappa^p \left( R^k_{t+1} - R_t - (Rk - R) \right) \)
  - untargeted \( Q_t K_{t+1} + \text{Rest} = D_t + \psi_t (Q_t K_{t+1} + \text{Rest}) \)
  - targeted \( Q_t K_{t+1} + \text{Rest} = D_t + \psi^\text{targ}_t Q_t K_{t+1} \)
  - interest rate \( R^\text{res}_t - \nabla^p_t \)
  - collateral constraint \( \lambda_b - \nabla^\lambda_t \)
- Policy costs: \( \tau \psi_t (Q_t S_t + \text{Rest}) \) or \( \tau \psi^\text{targ}_t (Q_t S_t + \text{Rest}) \)
Results

Impulse Responses to Sentiment (5%) and Fundamental Shock (5%)
Results

Role of the interbank market

![Graphs showing policy response, prem, Y, C, Res, K, L, N, R, Rres, interbank lending, and share of borrowers.]
Results

Policy effects
Results
Policy effects continued
Conclusion

- Investors’ expectations generate long and large responses in model variables
- Banks hoard some liquidity provided by central bank due to their low sentiment
- Liquidity provision mitigates crisis slightly, but does not stop it, nor decreases its duration

Future Work

- ?
Motivation

Investor Sentiment

Market Volatility Index (VIX)