Bank Heterogeneity and Financial Stability

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Overview

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- **Ex-post heterogeneity in asset quality + common liquidation market**
  - Standard strategic complementarities within banks
  - Cross-bank strategic complementarities through asset liquidations
  - Global games to deal with multiplicity

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- **Main results:** Increasing bank heterogeneity may decrease the probability of runs
  1. Strategic complementarities increase in weak banks, decrease in strong banks
  2. Fire sale pressure decreases for weak banks, increases for strong banks
     - weak banks are more sensitive to fire sales $\Rightarrow$overall fire sale pressure decreases

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  - For low heterogeneity, fire sale effect dominates and heterogeneity improves stability

The model

- Continuum of banks with deposits and assets with random payoff

$$\theta_i = \theta + \eta_i,$$

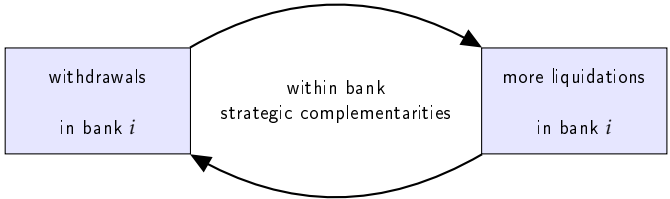
  where $\eta_i \in \left\{-\frac{\omega}{1-\omega}\Delta, \Delta\right\}$ and η_i is iid across banks

- Fraction of early withdrawers $m_i \leq \overline{m}$ if

$$\Delta\pi\left(\theta_i, m_i, p_i\right) = \frac{\theta_i\left(1 - \frac{m}{p_i}\right)}{1 - m_i} - 1 < 0$$

- Banks can liquidate assets to meet redemptions at price $p_i\left(\theta_i, \int m_i di\right)$
  - Costly liquidation $p_i < 1 \Rightarrow$ strategic complementarities within bank
  - Fire sales $\partial p_i / \partial(\int m_i di) < 0 \Rightarrow$ strategic complementarities across banks

Reinforcing complementarities



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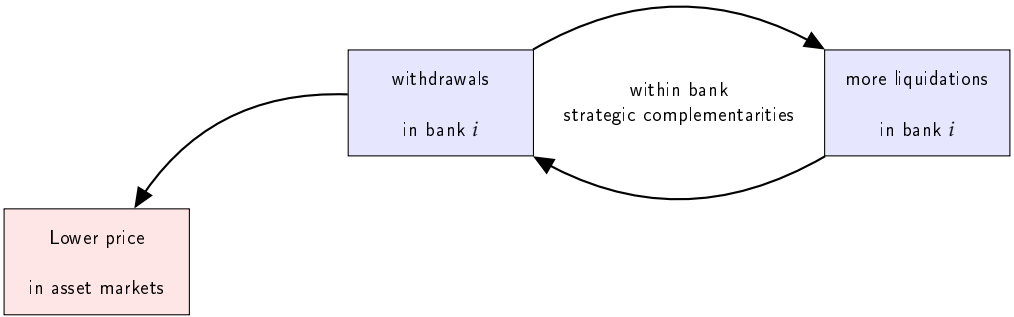

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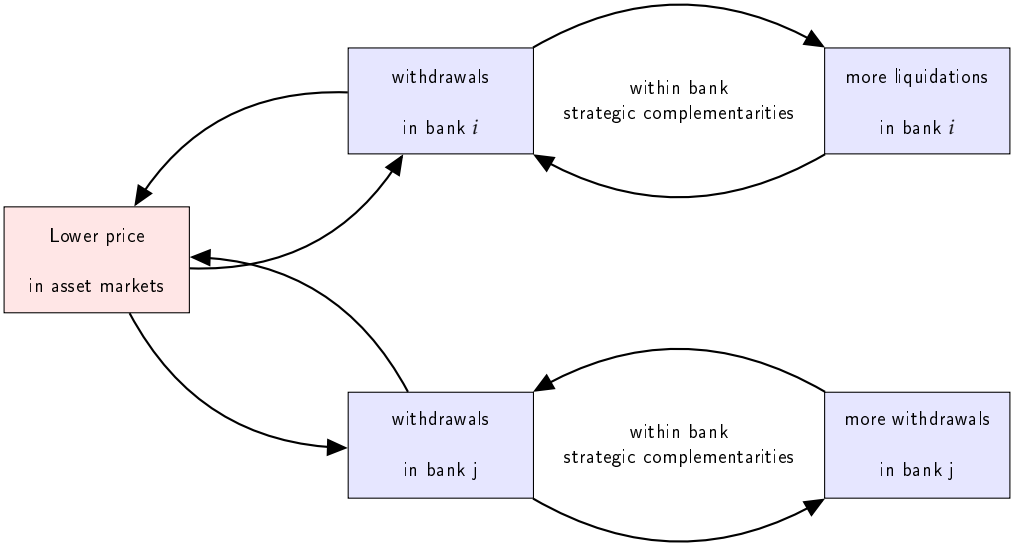

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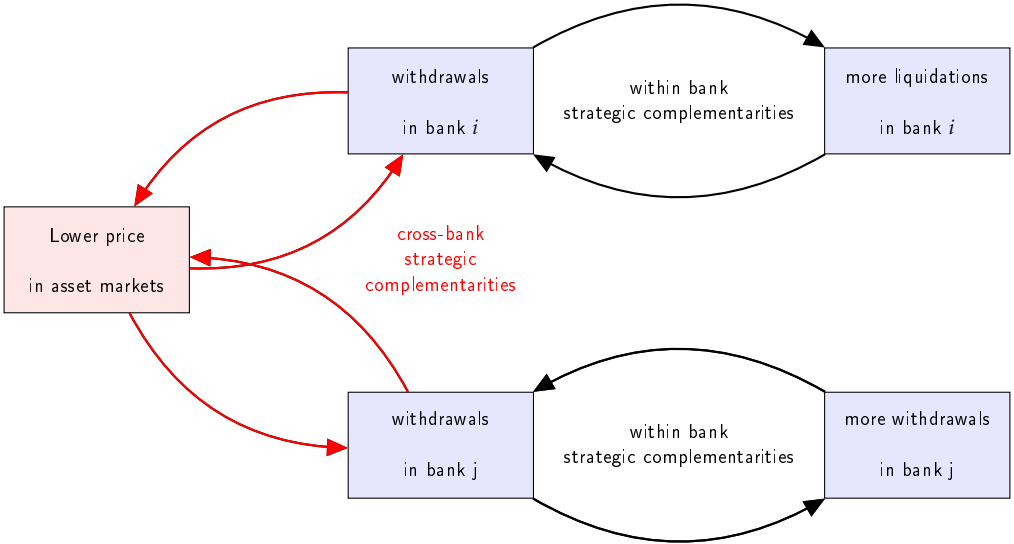

Financial Fragility

- **Global Games:** Depositors receive private signal

$$s_{ij} = \theta + \sigma\varepsilon_{ij}, \quad \sigma \to 0$$

- Threshold strategies: Depositor j in bank i runs if $s_{ij} < \theta_i^*$

$$\theta_w^*\left(\underset{+}{\Delta}, \underset{+}{m}\right) \quad \text{and} \quad \theta_s^*\left(\underset{-}{\Delta}, \underset{+}{m}\right)$$

where m is the total number of withdrawers

$$m = \overline{m}\left(\omega F\left(\theta_s^*\right) + (1-\omega) F\left(\theta_w^*\right)\right)$$

- Increasing heterogeneity has ambiguous effects on fragility
  - Makes weak banks weaker and strong banks stronger$\Rightarrow \uparrow \theta_w^*, \downarrow \theta_s^*$
  - Overall effect on fire sales is unclear: weak banks increase fire sale pressure, strong banks decrease it
  - For Δ low enough, $\theta_w^* = \theta_s^* = \theta^*$ and m decreases enough with Δ such that $\downarrow \theta^*$

$\Rightarrow$Homogeneity is never optimal

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1. Ex-ante homogeneity, Ex-post heterogeneity
   - idiosyncratic shocks are perfectly negatively correlated
   - can inter bank market eliminate all idiosyncratic risk?
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3. Liquidity Buffers
   - With a liquidity buffers, heterogeneity is less costly
   - Can homogeneity lead to stability?

Liquidity Buffers

- Banks have $\hat{m} < \overline{m}$ in liquid safe assets and $(1 - \hat{m})$ in risky assets.
- Benefit from withdrawing early

$$\Delta\pi\left(\theta_i, m_i, p_i\right) = \frac{\max \hat{m} - m_i + \theta_i \left(1 - \hat{m} - \max \frac{m_i - \hat{m}}{p_i}, 0\right)}{1 - m_i} - 1$$

  - if $m < \hat{m}$ there are str. complementarities if $\theta_i < 1$, i.e., $sgn \frac{\partial \Delta\pi}{\partial m_i} = sgn(\theta_i - 1)$
  - if $m > \hat{m}$ there are str. complementarities, i.e., $\frac{\partial \Delta\pi}{\partial m_i} < 0$
- Liquidity buffers decrease the incentives to withdraw when runs happen

$$\frac{\partial \Delta\pi\left(\theta_i, m_i, p_i\right)}{\partial \hat{m}} < 0$$

  $\Rightarrow$ lower fire sale pressure (asymmetrically)
- Cost: lower expected return/lower credit supply

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3. Liquidity Buffers
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4. Pricing function is key to get results (convexity assumptions)
   - Cash-in-the market pricing
   - Banks on both sides of the market
   - Insurance vs. contagion

Cash-in-the-market-pricing

- Outside investors have limited funds to purchase assets ℓ
- Both assets are purchased if the benefit of purchasing is the same

$$\theta_i - p_i = \theta_j - p_j$$

- All funds are exhausted if there are fire sales

$$p_i m_i + p_j m_j = \ell$$

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- Equilibrium prices

$$p_j = \frac{\ell - (\theta_i - \theta_j) m_i}{m_i + m_j}$$

- Complementarities
  - within banks $\frac{\partial p_j}{\partial m_j} = -\frac{p_j}{m_i + m_j} < 0$
  - across banks $\frac{\partial p_i}{\partial m_j} = -\frac{p_i}{m_i + m_j} < 0$

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- However, does not satisfy specific assumptions in the paper. Do results hold?