Imperfect Competition in the Inter-bank Market for Liquidity as a Rationale for Central Banking

Viral Acharya
London Business School and CEPR

Denis Gromb
London Business School and CEPR

Tanju Yorulmazer
Federal Reserve Bank of New York

Basel
30 May 2008

Opinions expressed here do not necessarily represent the views of the Federal Reserve Bank of New York or the Federal Reserve System.
Motivation

- Central Banking as a response to market failure in provision of liquidity arising from asymmetric information, lack of coordination etc.

- This paper examines one such source of market failure: Market power of liquidity rich banks in the interbank market.

- Surplus banks exploit their market power to extract rents
  - Inefficient liquidity transfers such as excessive liquidation of banking assets
  - Misallocation cost

- Central bank acting as a lender can improve liquidity transfers.
Cooperation among Banks

- **Inter-bank Market:**

- Banks borrow and lend to each other

- Mutual insurance
Cooperation among Banks

- **Clearing Houses**: Before the establishment of Federal Reserve

- Private arrangements by banks during crises for co-insurance

- Started in New York in 1853.

- Acted as LOLR during crises

- Suspended convertibility and issued joint claims to protect member banks.
Competition among Banks

• Banks may benefit from peers’ failures:
  – Slovin, Sushka and Polonchek (1999) and Schumacher (2000)

• Flight to quality, gain failed banks’ customers.

• Buy distressed banks’ assets at fire-sale prices.
  – JP Morgan Chase acquires Bear Stearns
  – JP Morgan stock price up 10% next day.
Failure of Private Arrangements

- In practice, clearing houses have not been organized quickly.

- Anecdotal evidence

- The role of competition and the strategic behaviour in the failure of private arrangements.
Failure of Private Arrangements

• **Episodes from England**

• BoE orchestrated an insurance fund for Baring Brothers in 1890.

• However, BoE was unwilling to support Overend Gurney in 1866.

• Goodhart-Shoenmaker attribute this to a **commercial rivalry** between the two banks.
Failure of Private Arrangements

- Episode from Australia

- Crisis in 1893: 11 banks failed, others experienced runs.

- Associated banks of Victoria coalition of private banks.

- Banks agreed and announced they will help each other.

- Pope (1989): Failure of private arrangements due to healthy banks seeking to increase their market share.
Failure of Private Arrangements

- **Episode from France**

- **Crisis in 1867:**
  - Banque de France threatened by competition from other banks.
  - Credit Mobilier experienced difficulties after unsuccessful real estate speculation.
  - Banque de France forced its liquidation.
Failure of Private Arrangements

• Kindleberger (1989):

“… the optimum may be a small number of actors, closely attuned to one another in an oligarchic relation, like-minded, applying strong pressure to keep down the chiselers and free-riders, prepared ultimately to accept responsibility.”
Failure of Private Arrangements

• Goodhart-Schoenmaker (1995):

“Although rescues financed on an implicit central bank-commercial banks basis may seem desirable, it is doubtful how far it will be sustainable much longer. These rescues depend on the cohesion of a well-defined group of banks, which are prepared to finance a self-supporting regime under the leadership, usually, of a central bank.”

“…Greater competition has made commercial banks less willing to participate (in such cartels and coalitions), and reduced the clout of the central bank in dragooning unwilling volunteers.”
Failure of Private Arrangements

• 1907 Crisis in New York:
  
  • Commercial-bank clearing houses assisted Mercantile National Bank.
  
  • Trust companies did not receive assistance, some were solvent.
    – Some argue that commercial banks were threatened by the growth of trust companies.
    – JP Morgan started an attack on trust companies.
  
  • Only after 2 weeks, JP Morgan organized a rescue plan.
  
  • During this period, strong banks gained deposits.
Failure of Private Arrangements

• **1907 Crisis in New York:**

  • Morgan says he has done enough and wants a quit pro quo.

  • Morgan’s US Steel would acquire Tennessee Coal’s assets (from Moore and Schley, a trust company) estimated to be worth $1 billion for $45 million.

• **Creation of the Federal Reserve:**

  • Senator Aldrich: “We may not always have Pierpont Morgan with us to meet a banking crisis”.
Strategic Behaviour

• Donaldson (1992):

• US data for the period 1873-1993

• Banks with excess liquidity exert market power and charge high interest rates to exploit other banks.

• Interest rates during panics higher than competitive rates
  – Evidence for the strategic behavior of banks with excess liquidity.

• LOLR can prevent cash rich banks from exploiting other banks.
Strategic Behaviour

- National City Bank (1893, 1907):
  - National City had higher reserve and capital ratios.
  - During the panic it gained deposits and loans relative to its competitors.
  - Vanderlip's (Vice President) complaint in early 1907 that National City's low leverage and high reserve ratio was depressing profitability.
  - Stillman (President): “What impresses me most important is to go into next Autumn (usually a time of financial stringency) **ridiculously strong and liquid**, and now is the time to begin and shape for it...If by able and judicious management we have money to help our dealers when trust companies have suspended, **we will have all the business we want for many years.**”
Related Literature

• Goodfriend and King (1988):
  – Efficient inter-bank market, solvent bank can always get liquidity.
  – No need for LOLR
  – Provide liquidity to the market, inter-bank market takes care of the rest.

• **Fed introduced 5 new facilities:**
  
  • Extended maturities
  
  • Extended the range of collateral
  
  • Extended the safety net to investment banks.
Related Literature

• **Frictions:**

  • Asymmetric information:
    – Flannery (1996)

  • Coordination failure:

  • Banks may free ride on liquidity:
    – Gale and Bhattarcharya (1987), Repullo (2003), Gonzales-Eiras (2003)…

• **Strategic Behaviour**
Main Focus

• Strategic behaviour and market power can prevent efficient transfer of liquidity.

• Enough liquidity in aggregate but concentrated among a few players.

• Central bank as a LOLR

• Credible option for liquidity

• Supervisory and LOLR role of central banks.
Model

• Similar to Holmstrom and Tirole (1998)

• There are 3 dates: $t = 0, 1, 2$.

• **Banks:**
  
  – 2 banks: Bank $A$ and Bank $B$.

  – Bank $B$ always have some cash (cash-rich bank).

  – Bank $A$ can be hit by a liquidity shock so that it may need the cash.

  – Bank $A$ invests in risky assets at $t = 0$. 
Model (cont.)

- **Risky Asset:**

  - Invest 1 unit at $t = 0$.

  - Return realized at $t = 2$.

  - Risky assets return $R_t$ (*Success*) or 0 (*Failure*).

  - At $t = 1$, there may be a liquidity shock.

  - Bank needs to put liquidity of $\rho$ into the project. Otherwise the return at $t = 2$ is 0.
Model (cont.)

Risky Asset:

- If the original bank (A) chooses the good project, the probability is $p_H$.
- If the original bank chooses the bad project, the probability is $p_L$.
- The other bank (B) has the probability $\overline{p}$, where $p_L < \overline{p} < p_H$.
- Loss of value if assets change hands.
Banks and moral hazard

Banks cannot fully pledge their future returns due to moral hazard (HT-98).

- Non-pecuniary benefit of $b$ from choosing bad projects.

$$p_H(R - r) \geq p_L(R - r) + b$$

$$R - r \geq \frac{b}{\Delta p} \Rightarrow r \leq R - \frac{b}{\Delta p}$$

- Some of the profit has to go stay with banks \( R_b = \frac{b}{\Delta p} \)

- Maximum interest satisfies: \( r \leq (R - R_b) \)
Lending vs. Acquisition

- The other bank (B) has the probability $\bar{p}$, where $p_L < \overline{p} < p_H$

- Maximum interest satisfies: $r \leq (R - R_b)$

- Purchase can be more profitable than lending:

$$\overline{p}R > p_H r$$
Market Power

• Bank $B$ has liquidity at $t = 1$.

• Bank $A$ needs liquidity at $t = 1$.

• If Bank $A$’s options are limited, this gives Bank $B$ some market power.

• We model this using a two-stage bargaining game.
Bargaining Game

Stage 1:

• Bank $A$ makes an offer to Bank $B$.

• If Bank $B$ accepts, the offer is implemented.

• If Bank $B$ rejects:
  
  – With probability $\beta$, Bank B gets the chance to make a take-it-or-leave-it offer.
  
  – With probability $(1 - \beta)$, game is over. Banks get their outside options ($X_A$ and $X_B$).
Barganing Game

Stage 2:

• Bank $B$ makes an offer to Bank $A$.

• If Bank $A$ accepts, the offer is implemented.

• If Bank $A$ rejects, banks get their outside options ($X_A$ and $X_B$).
Bargaining Game

Stage 2:

- Bank $B$ makes a take-it-or-leave-it offer to Bank $A$.

- **Offer has:**
  
  - $\alpha$ of Bank $A$’s assets sold to Bank $B$ at price $P$.
  
  - Bank $B$ lends Bank $A$ $L$ units at the rate of $r$ (per unit of asset left at $A$).
  
  - Total liquidity transfer: $T = \alpha P + (1 - \alpha)L$
Stage 2

• Bank B’s problem:

\[
\max_{\alpha, r, T} \quad (1 - \alpha)p_H r + \alpha \bar{p}R - \alpha \rho - T \\
\text{s.t.} \quad r \leq (R - R_b) \\
T \geq (1 - \alpha) \rho \\
(1 - \alpha)p_H (R - r) - (1 - \alpha) \rho + T \geq X_A
\]
Stage 2 outcomes

• Offer:

\[ r = (R - R_b), \]
\[ \alpha = \left( 1 - \left( \frac{X_A}{p_H R_b} \right) \right), \]
\[ T = \left( \frac{X_A}{p_H R_b} \right) \rho. \]

• Bank B’s payoff:

\[ \pi_B = (\bar{p}R - \rho) - X_A \left[ 1 - \frac{(p_H - \bar{p}) R}{p_H R_b} \right]. \]
Stage 1

• Bank A’s problem:

$$\max_{\alpha,r,T} \ (1 - \alpha)p_H (R - r) - (1 - \alpha)\rho + T$$

s.t.  
$$r \leq (R - R_b)$$
$$T \geq (1 - \alpha)\rho$$
$$(1 - \alpha)p_Hr + \alpha\bar{p}R - \alpha\rho - T \geq E(\pi_B).$$
Bargaining game

- Solution:
  
  \[
  r^* = (R - R_b)
  \]
  
  \[
  \alpha^* = \max \left\{ 0 ; \left( \frac{E(\pi_B) + \rho - p_H(R - R_b)}{\bar{p}R - p_H(R - R_b)} \right) \right\}
  \]
  
  \[
  T^* = (1 - \alpha^*) \rho.
  \]

  \[
  E(\pi_B) = \beta \pi_B + (1 - \beta) X_B
  \]

- As \( E(\pi_B) \) increases, \( \alpha^* \) increases.

- As \( X_B \) increases, \( E(\pi_B) \) increases.

- As \( X_A \) increases, \( E(\pi_B) \) increases.
Main Result

• If Bank $B$ lends, it needs to leave some of the profits ($R_b$) to Bank $A$.

• There is a limit to how much it can earn by lending: $r \leq (R - R_b)$

• However, it may force Bank $A$ to sell some of its assets at low prices.

• Bank $B$ may be able to earn more this way.

• Best user of assets is the original bank. So (excessive) sales result in welfare losses.
Main Result

- Fraction of Bank A’s assets sold to Bank B and the associated inefficiency:
  - Increase with Bank B’s market power
  - Increase with Bank B’s outside option
  - Decrease with Bank A’s outside option
  - Decrease with Bank B’s effectiveness at running Bank A’s assets
Ex-ante Liquidity Insurance (in progress)

- Bank A can arrange a line of credit with Bank B.
- As long as insurance is not full, results go through.
- Reasons for less than full insurance:
  - Bank B can have own projects that it needs the liquidity for.
  - Bank B’s cost of liquidity can increase (non-verifiable).
  - If non-verifiable, not full insurance.
Central Bank and Outside Options

- Bank $A$ gets liquidity from “outsiders”.

- Outsiders are not as efficient as Bank $B$ in running assets and monitoring Bank $A$.

- Outsiders worse than Bank $B$: $p^s_o < \bar{p}$

- Bank $B$ better monitor than outsiders when lending: $R_b < R_b^o$

- Bank $A$ can get a smaller amount of liquidity from outsiders.
Central Bank

- A Central Bank can alleviate the inefficiency if it can improve upon Bank A’s outside options

- If it can do so, then it can play a “virtual and virtuous” role:
  - CB does not have to lend in equilibrium

- Under what conditions can a Central Bank (or cannot) improve upon the market outcome?
Central Bank

• No loss-making loans and no supervision:
  – CB no better than outsiders
  – CB cannot improve upon the market outcome

• Some loss-making loans, but no supervision:
  – Akin to lowering collateral quality for lending
  – CB can reduce Bank B’s market power
  – Credible? Moral hazard?

• Supervision:
  – Again, CB can reduce Bank B’s market power
  – Commitment to the LOLR role, no moral hazard
Central Bank

- Suppose that the CB can better monitor banks than outsiders:

\[ b \leq b^{CB} < b^o \]

\[ R_b \leq R_b^{CB} < R_b^o. \]

- As the Central Bank's monitoring advantage over outsiders increases, the equilibrium outcome is more efficient: Bank A borrows more from and sells less assets to Bank B.

  - Bank A’s outside option \( X_A \) increases
Central Bank

- Central Banking effective at little cost as in equilibrium Central Bank does not lend to Bank $A$.

- But, there may be commitment issues…

- The Central Bank must be prepared to lend against collateral that outsiders will not lend against.

- Either suffer loss on loans ex post OR Invest in better supervision ex ante.

- Bank supervision thus naturally coincident with the liquidity provision role of Central Bank.
Further Questions

• Can Bank $B$ exert power on the Central Bank?

• Fed wanted to resolve Bear Stearns before markets open.

• Only credible offer came from JP Morgan Chase.

• Coordination role of the CB

• Use of public funds

• Use of CB liquidity? Stigma?