Directed Search in the Interbank Money Market

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structural changes in money markets

Introduction

- Unconventional monetary policies have challenged our understanding of the way money markets work.

Introduction

"Where to exit to? Monetary policy implementation after the crisis"

Speech by Benoit Coeure (2013a)

"Several members raised the possibility that the federal funds rate might not, in the future, be the best indicator of the general level of short-term interest rates, and supported further staff study of potential alternative approaches to implementing monetary policy in the longer term and of possible new tools to improve control over short-term interest rates"

Minutes of the May 2013 FOMC meeting

"A consequence of the financial crisis may be a move from unsecured to secured transactions in the interbank money market and this may trigger a similar move by central banks in terms of policy target"

Speech by Jurgen Stark (2011)

Introduction

- ▶ Major central banks now implement monetary policy using some version of a corridor system.

- ▶ Missing: A "good" model to guide monetary implementation.

- ▶ "Good" means (at least):

  - • combining several infrastructures of the money market: auctions, interbank market, and facilities.

  - • matching money market facts (usual and unconventional).

  - • soft / tractable.

Some Stylized Facts

1. With neutral liquidity provision, the overnight rate tends to be at the mid-point of the corridor, large liquidity surplus drives the rate to the floor of the corridor. ▸ Fact 1

2. The ON rate *volatility* decreases with excess reserves. ▸ Fact 2

3. The market *volume* decreases with excess reserves. ▸ Fact 3

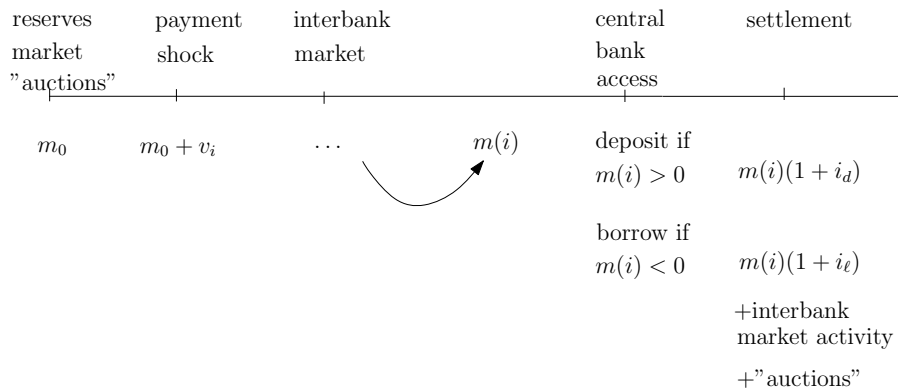4. The ON rate is increasing with rising counterparty risk. ▸ Fact 4

Introduction

- We review current models in Bech and Monnet (2013)

    - Poole (1968) type models focus on level of the ov. rate
    - Afonso and Lagos (2012) Fed realistic, but hard
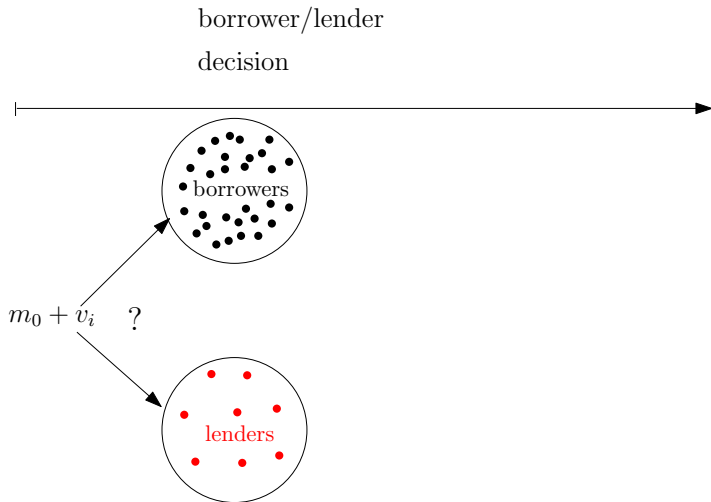
- We propose another model based on directed search

The model

- One maintenance period

- A $[0,1]$ continuum of risk neutral, profit maximizing, banks

- 0 reserve requirement

- A central bank offering lending (i_ℓ) and deposit (i_d) facility

- A reserve market (auction)

- A liquidity shock $v \sim F(.)$ where $F(.)$ is symmetric around its mean 0 and has full support on $[-\bar{v}, \bar{v}]$
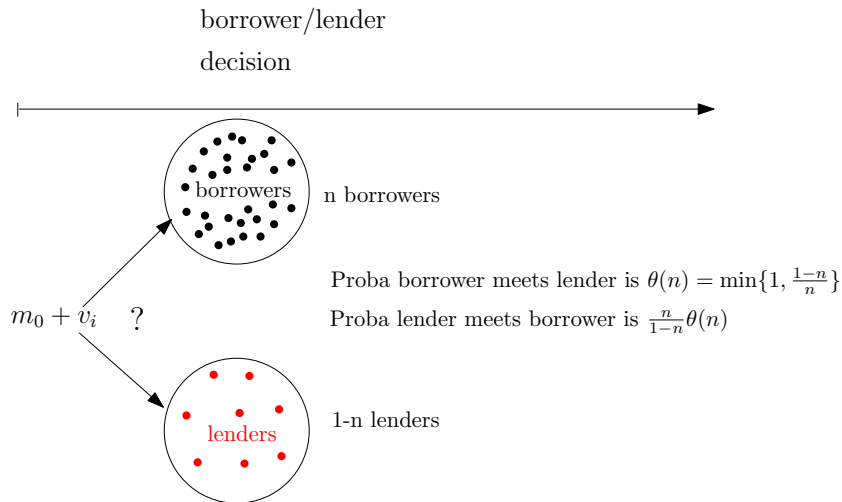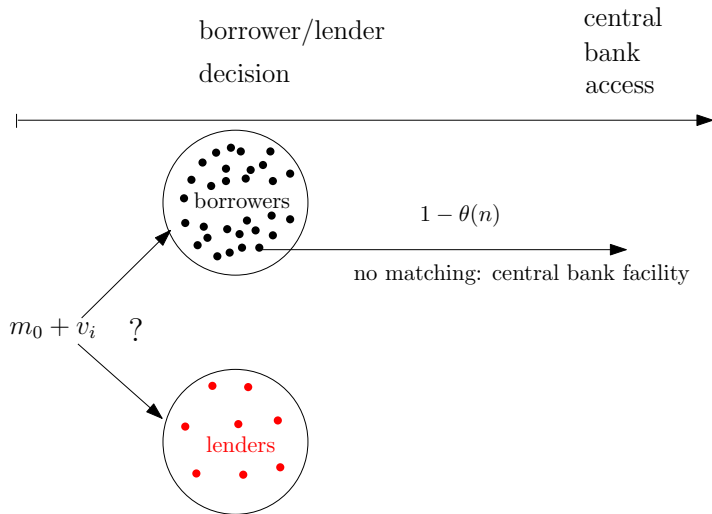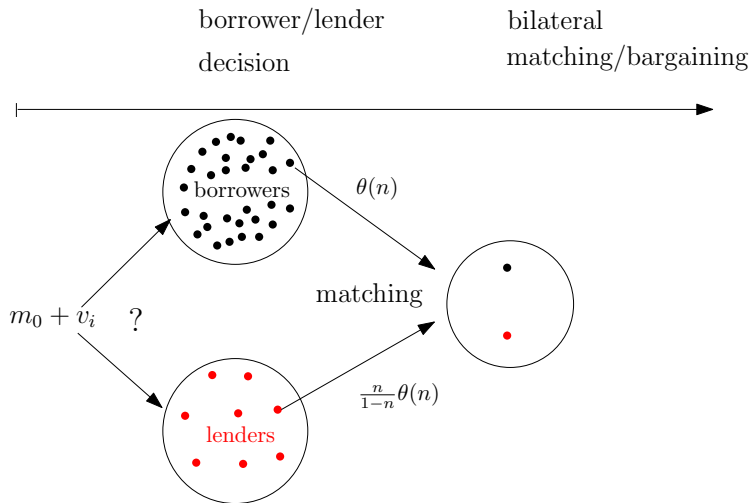
- An interbank market

The timeline

reserves market "auctions"	payment shock	interbank market		central bank access	settlement
m_0	$m_0 + v_i$	$\cdots$	$m(i)$	deposit if $m(i) > 0$	$m(i)(1 + i_d)$
				borrow if $m(i) < 0$	$m(i)(1 + i_\ell)$
					+interbank market activity
					+"auctions"

An OTC market with directed search

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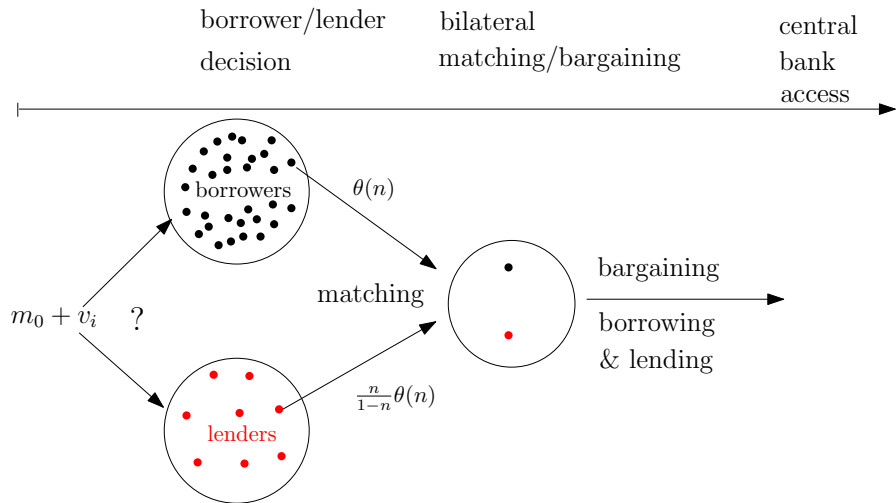
Bargaining

- Banks split the surplus from trade

- Profit maximization and linear payoff implies an indeterminacy (see Tapking, 2006)

- We assume

$$q(m_b, m_\ell) = \frac{m_\ell - m_b}{2}$$

- Interest rate is then given by

$$i_m = \begin{cases} i_d & \text{if } m_\ell > m_b > 0 \\ \frac{m_\ell}{m_\ell - m_b} i_d + \frac{-m_b}{m_\ell - m_b} i_\ell & \text{if } m_b < 0 < m_\ell \\ i_\ell & \text{if } m_b < m_\ell < 0 \end{cases} \tag{1}$$

Borrower or lender?

Proposition

All banks with negative reserves choose to become borrowers, while banks with positive reserves choose to become lenders.

The number of borrowers is $n = F(-m)$, where m is aggregate reserves.

Borrower or lender?
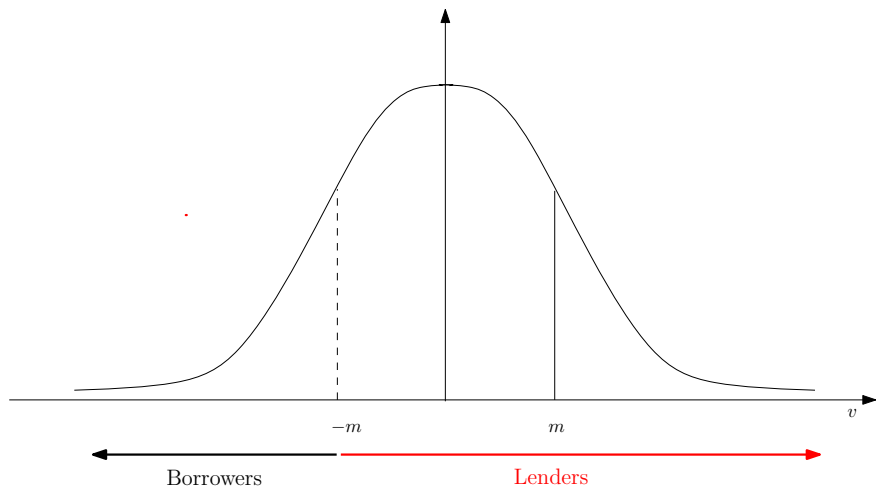
Borrower or lender?

The marginal value of reserves is

$$
\frac{\partial V^b(\tilde{m})}{\partial \tilde{m}} = 1 + i_\ell - \theta(n) \frac{(i_\ell - i_d)}{2} \frac{1 - F(-m - \tilde{m})}{1 - F(-m)} \text{ for any } \tilde{m} < 0
$$

$$
\frac{\partial V^\ell(\tilde{m})}{\partial \tilde{m}} = 1 + i_d + \frac{n}{1 - n} \theta(n) \frac{(i_\ell - i_d)}{2} \frac{F(-m - \tilde{m})}{F(-m)} \text{ for any } \tilde{m} \geq 0
$$

Willingness to pay for reserves at the "auction"

- Value of existing the auction with m units of reserves:

$$W(m) = \int_{-\bar{v}}^{\bar{v}} \max\left[V^b(m+v), V^{\ell}(m+v)\right] dF(v)$$

- Willingness to pay at the auction is

$$\begin{aligned}
W'(m) = {} & n(1+i_{\ell})+(1-n)(1+i_d) \\
& -\frac{\theta(n)}{1-n}(i_{\ell}-i_d)\left[\int_{-\bar{v}}^{\bar{v}} F(2m+v)dF(v)-F(m)\right]
\end{aligned}$$

where $n = F(-m)$.

- Excess reserves : Bid-shading relative to Poole (1968)

Willingness to pay for reserves at the "auction"
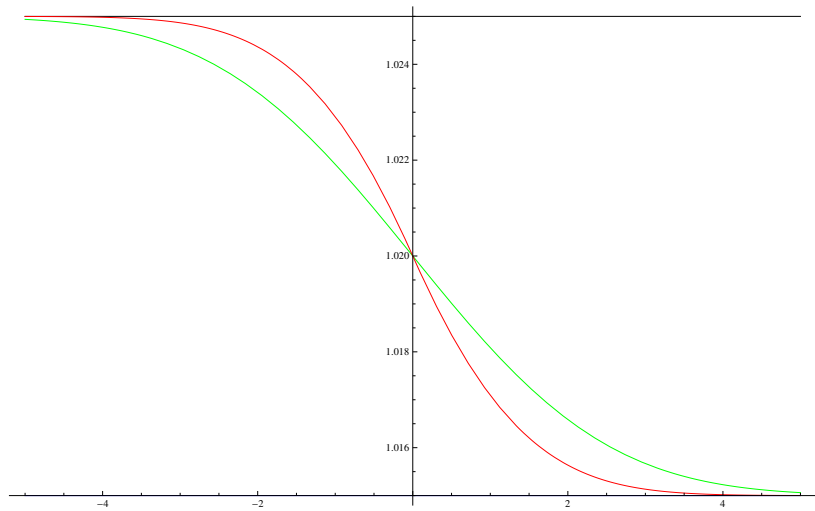
Volume OTC market

$$Q(m) = \frac{\theta(m)}{2} \int_{-m}^{\bar{v}} v \frac{dF(v)}{[1 - F(-m)]}$$
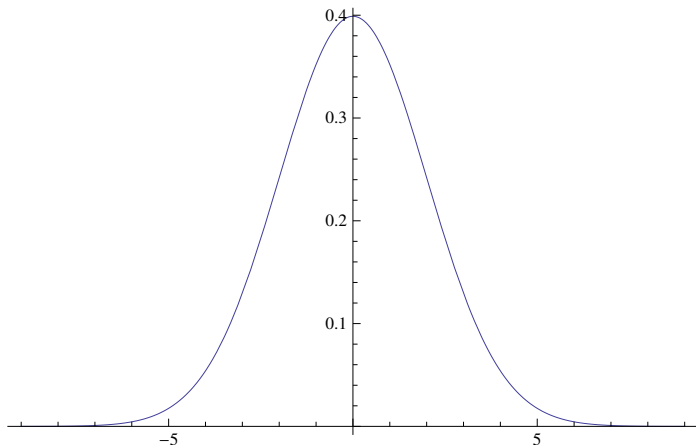
Independent of the size of the corridor (by assumption).

Indexed Average OTC Rate
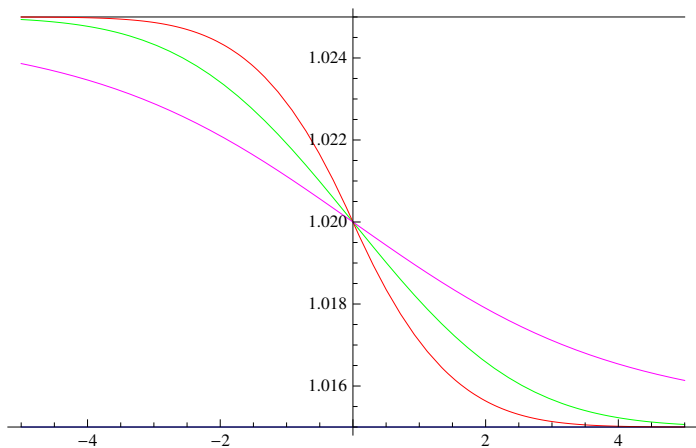
Volatility Indexed Average OTC Rate (weighted variance)
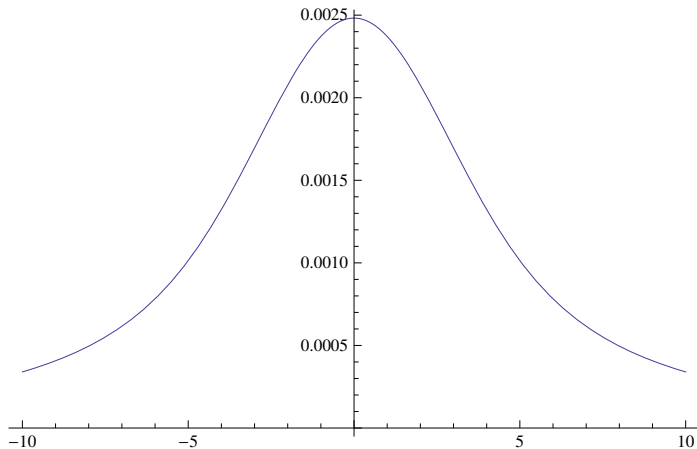
Counterparty Risk

- We assume that banks can go bust with probability $\delta \in (0,1)$

- There is a risk premium

$$i_m^\delta(m_\ell, m_b) = i_m(m_\ell, m_b) + \frac{\delta}{(2-\delta)}\left[1 + i_m(m_\ell, m_b)\right]$$

Lemma
There is no trade on the interbank market if $\delta \geq \frac{2(i_\ell - i_d)}{1 + i_\ell}$.

Proposition
With counterparty risk, all banks with negative reserves choose to become borrowers, while banks with positive reserves choose to become lenders. The number of borrowers is $n = F(-m)$.

Counterparty Risk

- Volume is decreasing with counterparty risk.

- Volume is now a function of the size of the corridor (volume increases with the corridor).

- Indexed average can increase with risk, depends on the distribution.

Effect of Counterparty Risk On Volume

Increasing δ from 0 to 0.01.
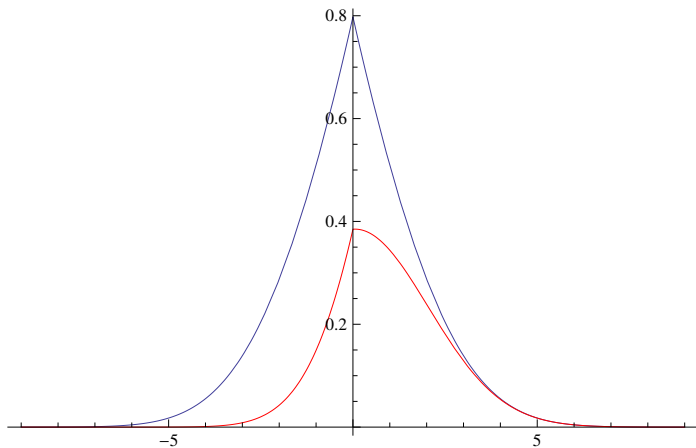
Simulation With Counterparty Risk
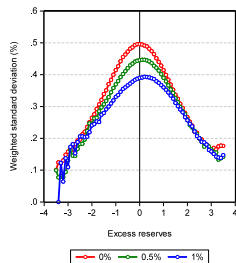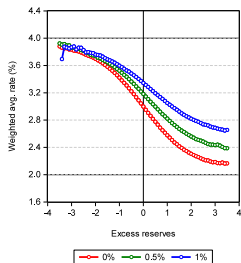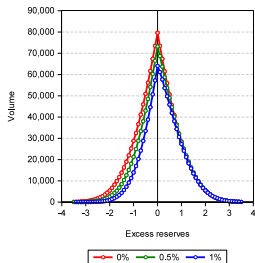
Conclusion

- Model of the interbank market with directed search.

- Framework is able to replicate basic statistics of the interbank market, both in normal and exceptional circumstances.

- Taken at face value: the unsecured interbank market should re-emerge once the unconventional policies and market stresses are reversed.
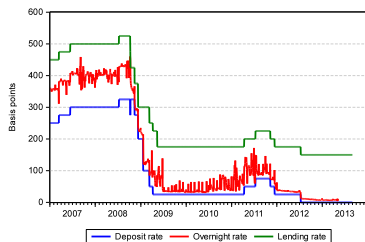
- but... many caveats.

Work in progress:
- Estimation
- Access to standing facilities
- Brokered trades

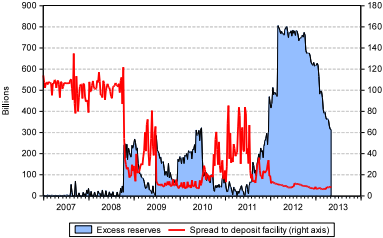# Fact I: Corridor mid-point and the floor
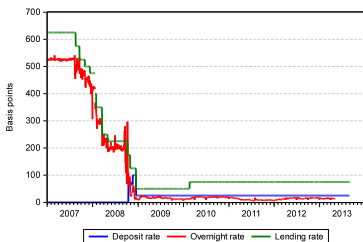
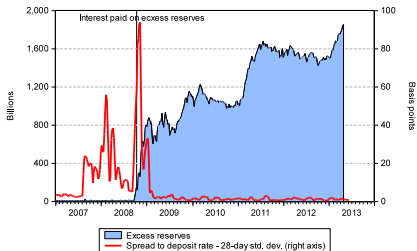(b) Fed funds rate

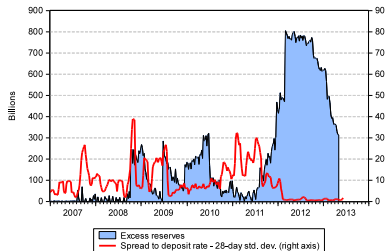(c) Eonia

Excess reserves and rates
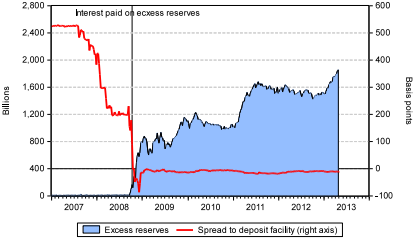
(d) Federal Reserve

(e) Eurosystem
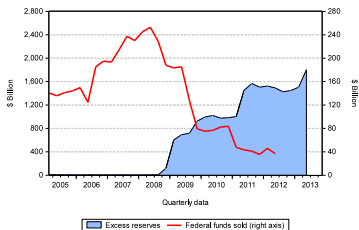
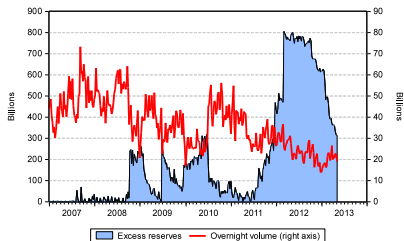# Fact 2: Volatility is decreasing with reserves

(f) Federal Reserve

(g) Eurosystem

Fact 3: Volume is decreasing with reserves

(h) Federal Reserve

(i) Eurosystem

Fact 4: Counterparty risk increases rates