

# Can the US Interbank Market be Revived?

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11/05/2019

\* Expressed views are solely those of the authors, not those of the Federal Reserve System or any Federal Reserve Bank.

- Before QE: Close-to-zero excess reserves. Active interbank market.
- After QE: Excess reserves are abundant  $\Rightarrow$  Tiny interbank market.
- **Can the US interbank market be revived if excess reserves are drained?**
  - If not, better to avoid relying on measuring interbank activity.
  - Reviving interbank market might require more than just draining reserves.
  - Valid question even for 'ample' reserves, not necessarily 'scarce'.
  - Changes in the reserve management policy or regulations affecting reserve demand will keep bringing back this question.
- What has changed between pre-crisis and now? Changes in regulations increasing balance sheet cost.

# Regulations Increasing Balance Sheet Cost

- Balance sheet cost: Regulatory cost to expanding a bank's balance sheet, including interbank lending.
- Examples of regulatory changes:
  - FDIC assessment fee.
  - Changes in leverage ratio calculation.
  - GSIB surcharges in the past. May become relevant again in the future.

# Can the Interbank Market be Revived?

- Balance sheet cost reduces interbank volume (when reserves are not abundant): Two channels.
- 1. Interbank lending generates extra balance sheet cost  $\Rightarrow$  Reduce volume.
- 2. Interbank funding costly to a borrower relative to non-bank-to-bank funding ('deposit')  $\Rightarrow$  **Incentive for non-bank funding to replace interbank funding.**
  - Non-bank lenders bear some cost in replacing interbank trading.
  - Can drastically reduce interbank volume if the cost is small.

# Our Theory and Conjecture

- What happens if non-bank lending replaces interbank lending?
  - With smaller interbank volume, supports the idea of measuring bank funding rate using a broader set of transactions.

Interbank funds  $\subset$  Federal funds  $\subset$  Overnight bank funds.

- More generally rate differential between non-bank-to-bank and interbank lending could be a cause of rate volatility.

# Our Approach

- Stylized model supported by observations on pre-crisis and current money markets.
- Roughly, model takes **reserve supply** and **marginal balance sheet cost** as parameters.
  - Pre-crisis parameters: Zero excess reserves and zero balance sheet cost.
    - ⇒ Active interbank market. Interbank rate (fed funds) = non-bank deposit rate (eurodollar).
  - Current parameters (as of late 2017): Large excess reserves and increased balance sheet cost.
    - ⇒ Tiny interbank market. FF ( $\approx$  deposit) rate below IOER. Interbank rate above IOER.
  - Current parameters (today; not in the paper): FF rate above IOER. No news of interbank market coming back yet, even after rate volatility in September  $\Rightarrow$  balance sheet cost matters.

# Model Description

- Model in the tradition of Poole (1968).
- **Two identical banks and an investor** placing deposits on them — all competitive.
- Model represents overnight trades happening during a day.
- Two markets: **Early (deposit) and late (interbank)**.

# Model Summary

P1. Banks borrow **deposits** / initial dist. of reserves:  $r_D$ .  
(Non-bank lender puts aside some funds to lend in P2)



' $\eta$ ' shock: Move reserves between the banks.



P2. Banks can offset  $\eta$  in the late market with  
**interbank and late non-bank lending**:  $r_R$ .



' $v$ ' shock: Uniform shocks on reserves.



P3. (Mechanical) Banks borrow from DW or earn IOER.  
(Linear MV in P2. Poole (1968).)



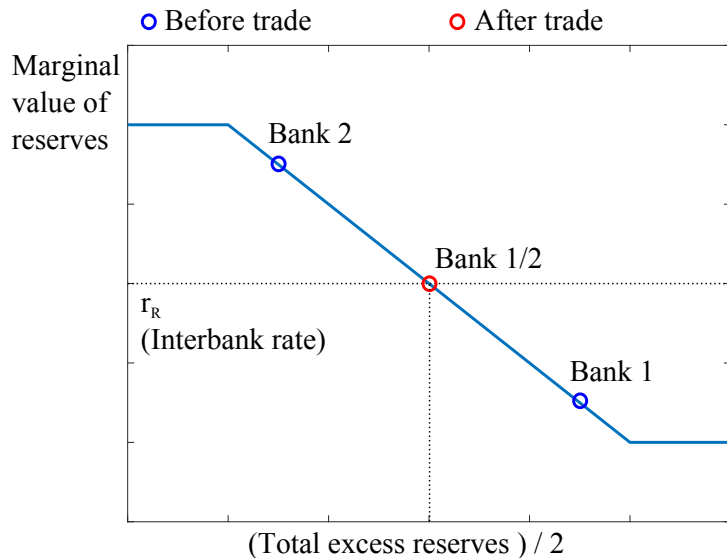
## Model Summary (cont'd)

- Three additions to the simple money market model of Poole (1968):
  1. **Balance sheet cost** borne by banks: Without this the following additions are meaningless.
  2. Intraday payment shocks and late/interbank market to offset the shocks.
  3. Market fragmentation/friction: Non-bank faces some cost in setting aside funds to lend in the late market.

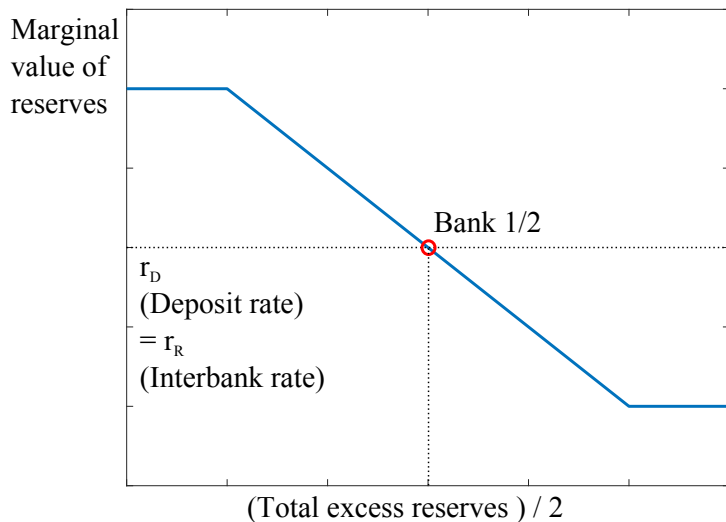
# Benchmark Model

- Benchmark model representing the pre-crisis period:
  - Zero balance sheet cost.
  - Scarce reserves: Zero excess reserves.  
(More generally: Positive probabilities of having both enough (excess) and not enough (DW borrowing) reserves  $\Rightarrow$  Rates sensitive to  $\Delta$  in reserve supply. 'Steep' reserve demand.)

# Benchmark: Interbank Market



# Benchmark: Deposit Market



Note: **No incentive** for the non-bank lender to enter the late market.

# Introducing Balance Sheet Cost

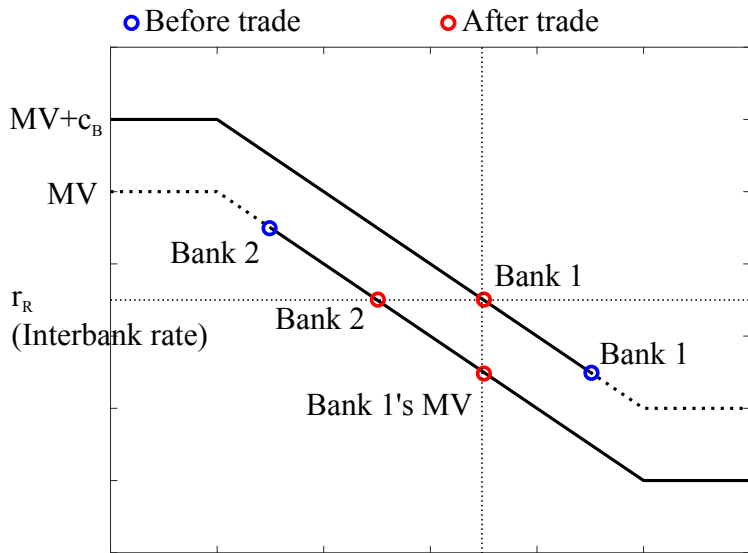
- Add positive balance sheet cost to the benchmark model.
- Introduce linear balance sheet cost:  $c_B \times (\text{Total BS})$ .  
(Total BS) = (Reserves) + (Interbank Lending)
- For simplicity, non-banks cannot enter the late/interbank market by assumption.
- The future of the interbank market if non-bank lending **does not replace** interbank lending.

# Interbank Trade under BS Cost

	<b>Bank 1</b>		<b>Bank 2</b>	
	Assets	Liabilities	Assets	Liabilities
After deposit (P1)	<hr/> 3 Reserves	<hr/> 3 Deposits	<hr/> 3 Reserves	<hr/> 3 Deposits
After payment shock	<hr/> 5 Reserves	<hr/> 5 Deposits	<hr/> 1 Reserves	<hr/> 1 Deposits
After interbank lending (P2)	<hr/> 4 Reserves 1 Interbank	<hr/> 5 Deposits	<hr/> 2 Reserves 1 Deposits 1 Interbank	

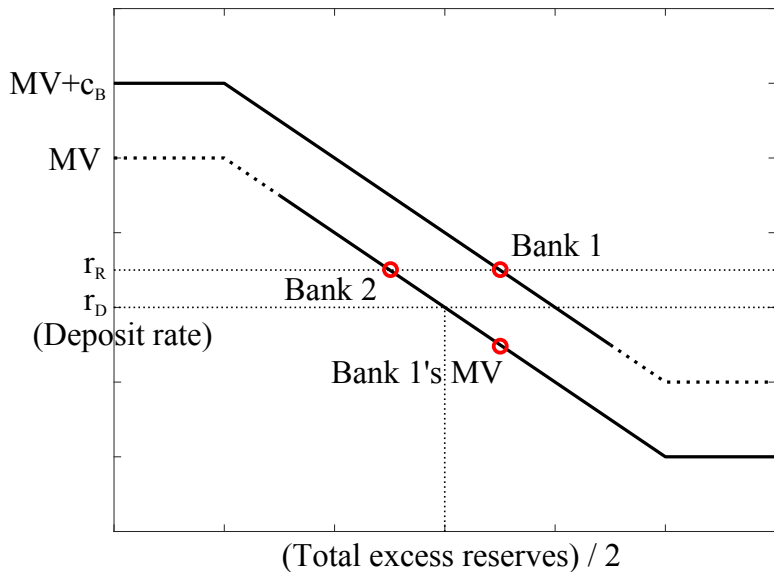
- Extra balance sheet of 1 stays with the lender, bank 1.

# Interbank Trade Diagram



\* It looks as if the lending bank 'bears' the BS cost because lending out reserves does not reduce its BS.

# Deposit Market under BS Cost





# Rate Differential: An Example

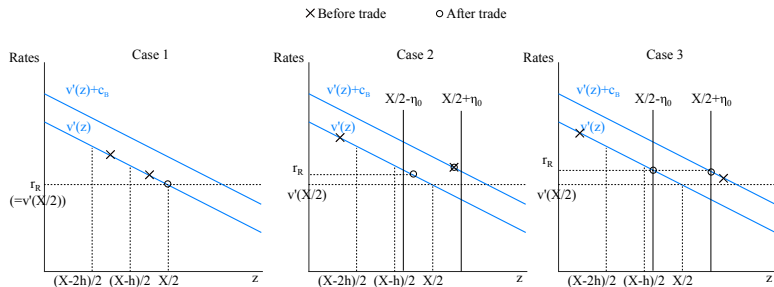
- Banks cannot take advantage of the rate differential  $r_R - r_D$ :  
Extra deposit may get lent out later  $\Rightarrow$  BS cost.
  - Imagine getting 1 extra deposit, paying  $r_D$ .
  - Can reduce borrowing/increase lending by 1 in the interbank market, earning  $r_R$ .
  - When lending, lends 1 more, incurring extra BS cost  $c_B$ .

	<b>Bank 1</b>		<b>Bank 2</b>	
	Assets	Liabilities	Assets	Liabilities
After interbank lending (P2)	4 Reserves 1 Interbank	5 Deposits	2 Reserves	1 Deposits 1 Interbank

# Non-Bank Lending

- Non-banks can take advantage of the rate differential  $r_R - r_D$ : just lending either way; no borrowing and then lending out.
- The non-bank lender can set aside some deposits,  $L$ , for late trading.
  - For simplicity, it parks the money at either bank (does not matter which bank).
  - Cost:  $L \times c_L$ .
- Cost for operational readiness / legal template. Can also be the risk of not being able to place money (outside model).
- Non-bank lending will largely replace interbank lending if the cost of late trading  $c_L$  is much smaller than the BS cost  $c_B$ .

# Illustration of Non-Bank Lending

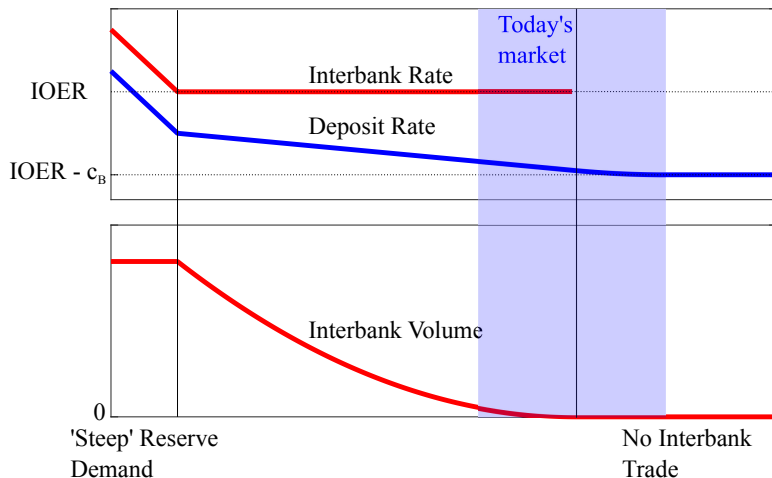


Only with large shocks interbank lending happens (case 3; right).  
Case 3 becomes less likely as the supply of late deposit increases.

# Future of the Interbank Market

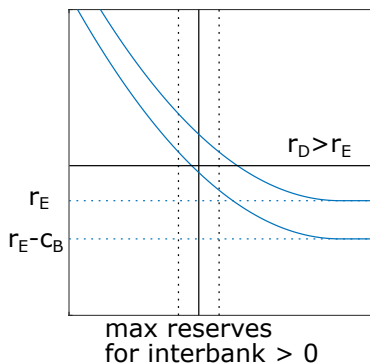
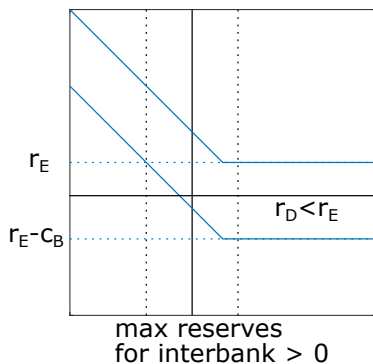
- What will happen to interbank market or money markets more generally if reserves are drained sufficiently?
- Simple exercise: Look at the equilibrium as a function of excess reserves  $R$ .
- Note that in the following slides 'today' means late 2017: The FF rate is below IOER. (This discussion is not in the paper.)
  - Today (as of now) the FF rate is above IOER.
  - However the FF rate is still very flat as a function of excess reserves.
  - Thus the market is qualitatively very close to what it looked like at the floor (with FF rate below IOER): The slope of rate is key to market functioning, not the level of rate.
  - Can reconcile FF rate above IOER by assuming a flat extra value (LCR benefits, etc.) or a smooth  $v'$ .

# Reserve Drain without Late Non-bank Lending



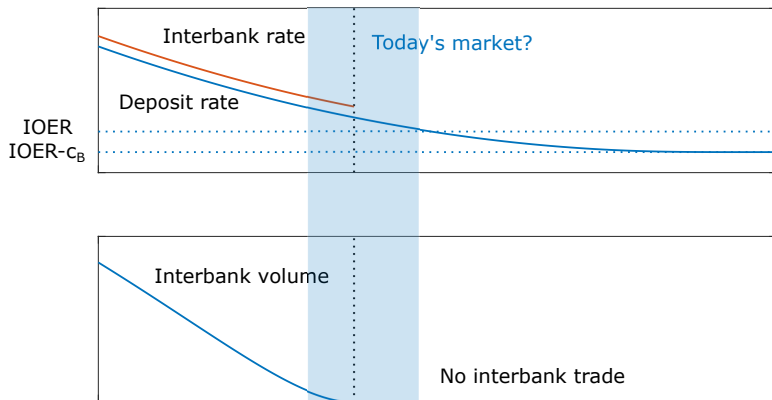
Conventional setup: No late non-bank lending replacing interbank lending.

# Reconciling with FF rate above IOER

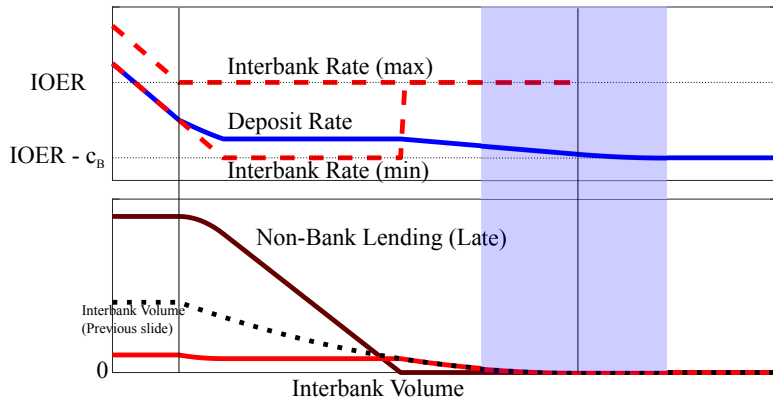


No intrinsic relationship between FF rate greater than IOER and interbank volume.

# Reserve Drain with Smooth Reserve Demand



# Reserve Drain with Late Non-bank Lending

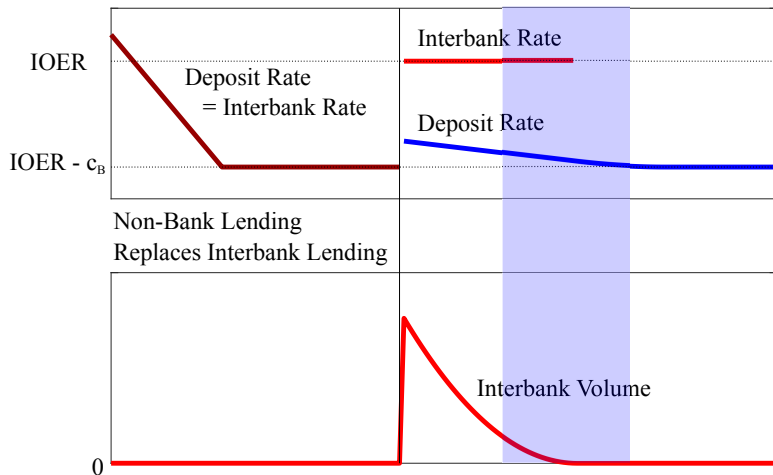




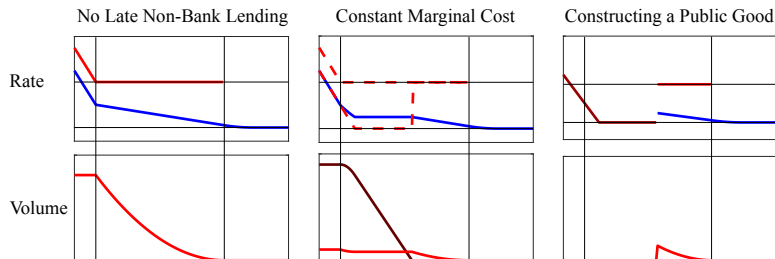
# Late Trading as a Public Good

- Non-bank can freely lend in the late market if a public good is made at some cost  $C$ .
  - Interpretation: Trading platform / legal template that can be shared.
- Simple setup: The public good is made if the total private surplus (non-bank investor and two banks) exceeds  $C$ . Abstract from coordination.
  - Roughly, compare  $C$  with  $(\text{Interbank Volume}) \times c_B$ .
- As reserves are drained, interbank volume increases at the beginning, but can drastically decrease as drain continues.
  - Hard to predict the future of interbank market just based on its initial response to reserve drain.

# Reserve Drain with Late Trading as a Public Good



# Different Future Paths



- \* Different scenarios are possible.
- \* Open market operations still effective, but needs to define the rate in the right way.

# Conclusion

- Stylized model of money markets with market fragmentation and balance sheet cost.
  - Equilibrium in the model consistent with pre-crisis and current money markets.
- Can the US interbank market be revived?
  - Non-bank-to-bank lending can replace interbank lending.
  - The magnitude of the balance sheet cost vs. the cost to non-bank investor determines its future.
- Case for monetary policy implementation based on non-bank-to-bank lending.
  - Interbank volume can be small.
  - Late market rate can be different from and more uncertain than early market rate. Case for using more early market trades as a basis for policy.
    - In practice a broader set of non-bank-to-bank funding.
  - Changing reserve supply still effective.