Federal Reserve Tools for Managing Rates and Reserves

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1 The views expressed are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System.

2 Federal Reserve Bank of New York

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The Federal Reserve’s supply of bank reserves

- The Fed has begun reducing its balance sheet size
- But, the “new normal” supply of reserves has not been decided yet
Overnight RRP

- The Fed’s policy rates:
  - The Fed pays interest on excess reserves (IOER)
  - The Fed pays the overnight RRP rate set at 20-25 bps below IOER

- Overnight reverse repurchases (RRP)
  - Non-banks such as money market funds can do collateralized lending to the Fed

- The Fed plans to phase out using RRP's
Our paper

- **Research questions**
  - What is the optimal supply of reserves, and how is that measured?
  - What is the optimal role of the overnight RRP?

- **Approach**
  - The direct impact of reserves is on the banking system
  - General equilibrium model of banks with liquidity and balance sheet costs

- **Main results**
  - Bank deposit rates reflect liquidity and balance sheet costs
  - Reserves should be reduced until deposit rates rise to IOER.
  - The overnight RRP rate should be raised to IOER
The debate

Advocates for very large reserves

Advocates for very large overnight RRP quantity

Small Fed balance sheet
- (Sims, 2016), some FOMC members

Scarce reserves
- Stein (2012), Kashyap and Stein (2012)

Moderate reserves
- (Williamson, 2016)
Model of reserves

- Dates \( t = 0, 1, 2 \)
- Two ex-ante identical sectors with banks, households, and firms
  - Banks issue:
    - Deposits \((D_0, D_1)\) and equity \((E_0, E_1)\) to households
    - Loans to firms
    - Interbank loans \((I)\)

- Households
  - Sell endowment goods at date 0
  - Acquire bank deposits and equity, and govt bonds
  - Buy production goods for consumption at date 2

- Firms
  - Buy goods at date 0 and sell production goods at date 2

- Government sells bonds \((B)\)
- Central bank (CB) issues reserves \((M)\) to buy govt bonds
Bank liquidity and equity costs

- Equity is costly relative to deposits
  - Households receive a liquidity benefit on deposits
- Bank risk-shifting moral hazard necessitates capital requirements
  - Government cannot ex-ante commit against depositor bailouts, which protects household liquidity benefits of deposits
  - Government requires bank equity, which is increasing in the size of a bank’s balance sheet size at dates 0 and 1
- Bank liquidity shocks
  - At date 1, one sector has a liquidity shock
  - Depositors in shocked sector withdraw deposits to buy additional bonds
  - If the bank does not have sufficient reserves, interbank borrowing is costly
Bank balance sheet cost

- Bank balance sheet cost: $K(A)$

$$\quad K(A) = (R^E - R^D) \frac{dE}{dA} + \frac{1}{2} (R^{E_1} - R^{D_1}) \frac{dE_1}{dA}.$$  

- $K(A)$ is a bank’s expected marginal capital requirement cost for a marginal increase in assets ($A$)

- Balance sheet costs broadly interpreted to include:
  - Shadow cost of Basel III bank leverage ratio
  - FDIC fees on all non-equity bank liabilities, which increases with a bank’s balance sheet size

- Empirical evidence that balance sheet costs increase in reserves and (Armenter and Lester, 2017)
Bank liquidity cost

- Interbank borrowing has marginal cost \( Y(I) \)
  - \( I \) is the amount of interbank borrowing for a bank with a liquidity shock

Bank liquidity cost: \( \frac{1}{2} Y(I) \frac{d(-I)}{dM} \)

- A marginal increase in reserves reduces a bank's expected marginal interbank borrowing cost by \( \frac{1}{2} Y(I) \frac{d(-I)}{dM} \)
The net cost of reserves, \( C(M) \), is defined as the IOER-deposit rate spread:

\[
C(M) \equiv R^M - R^D
\]

- \( R^M \) is IOER
- \( R^D \) is the deposit rate

In equilibrium, \( C(M) \) equals the bank’s balance sheet cost minus the bank’s liquidity cost:

\[
C(M) = K(A) - \frac{1}{2} Y(I) \frac{d(-I)}{dM}
\]

An increase in reserves:
- increases balance sheet costs
- decreases liquidity costs
Bank borrowing rates and reserves

- With overabundant reserves since 2009, no interbank borrowing
- Deposit rates decrease below IOER as reserves increase:

\[ R^D = R^{M^2} - K(A) \]
Optimal Supply of Reserves

- The central bank’s optimal supply of reserves ($M^*$) maximizes welfare.
  - Higher reserves trades off higher balance sheet costs with lower liquidity costs.

- $M^*$ equates banks’ liquidity cost and balance sheet cost:

  \[
  \frac{1}{2} Y(I) \frac{d(-I)}{dM} = K(A).
  \]

  - Implies a moderate amount of interbank borrowing.

- Bank’s net cost of reserves is zero: $C(M^*) = 0$.

- The equilibrium deposit rate equals IOER:

  \[
  R^D(M^*) = R^{M^2}.
  \]
The overnight RRP is added to the model:

- The central bank offers RRPs to households (e.g., through MMFs)
- One-period RRP quantity $Q_t$ offered at dates $t = 0, 1$ with return $R^{Q_t}$

Central bank balance sheet:

$$B^{CB} = M_t + Q_t$$

RRP takeup by households reduces reserves one-for-one
Optimal RRP rate

- Equilibrium
  - The RRP rate sets a floor on deposit rates: $R^D = R^{Q0} R^{Q1}$

- The optimal overnight RRP rate is equal to IOER:
  $$R^{Qt} = R^M$$

- Raising the RRP rate to IOER has three benefits:
  1. Reduces overabundant reserves
  2. Increases the optimal quantity of reserves
  3. Stabilizes overnight rates
(1) Reduces overabundant reserves

- Raising the RRP rate to IOER efficiently reduces the overabundance of reserves to their optimal supply
  - More expedient alternative for reducing reserves
  - The Fed’s current normalization strategy is to reduce reserves by waiting for its assets to mature and roll off its balance sheet

- Central bank balance sheet:

\[ B_{CB} = M_t + Q_t \]
(2) Increases the optimal quantity of reserves

- The optimal supply of reserves increases to $M^{**} > M^*$
  - Because RRPs absorb bank liquidity shocks at date 1
    - Eliminates additional capital requirements at date 1
  - Hence, the bank balance sheet cost $K(A)$ is lower
    - Reserves are less costly to hold
  - Also lowers the bank liquidity cost, since $\frac{1}{2} Y(I) \frac{d(-I)}{dM} = K(A)$ at $M^{**}$
- Deposit rate equal to IOER is maintained: $R^D = R^{M^2}$
(3) Stabilizes overnight rates

- Extension: Volatile liquidity shocks
  - The size of the bank liquidity shock is random with a high or low realization at date 1
  - Without the RRP: volatile overnight deposit rate at date 1

- The RRP, with its rate set at IOER
  - Absorbs the bank liquidity shock
  - Optimal for welfare, with optimal reserves of $M^{**}$ maintained
  - Overnight deposit rate is constant and equal to IOER
The overnight RRP reduced volatility and put a floor on overnight bank borrowing rates

- Financial CP rate is the lowest and most volatile of bank borrowing rates
Conclusion

- Reserves lower bank liquidity costs but increase balance sheet costs
- A moderate supply of reserves is optimal
- Signified by when deposit rates equal IOER
  - Slightly fewer reserves than the quantity at which the prototypical downward-sloping bank demand curve for reserves “kinks”
  - Partially active federal funds market
- The overnight RRP rate should be raised to IOER
  - Reduces the overabundance of reserves more quickly
  - Enables a higher optimal supply of reserves
    - Decreases bank balance sheet costs by absorbing bank liquidity shocks
    - Decreases bank liquidity costs
  - Stabilizes the volatility of overnight rates