Federal Reserve Tools for Managing Rates and Reserves[1]

David Skeie
Texas A&M

With Antoine Martin,[2] James McAndrews[3] and Ali Palida[4]

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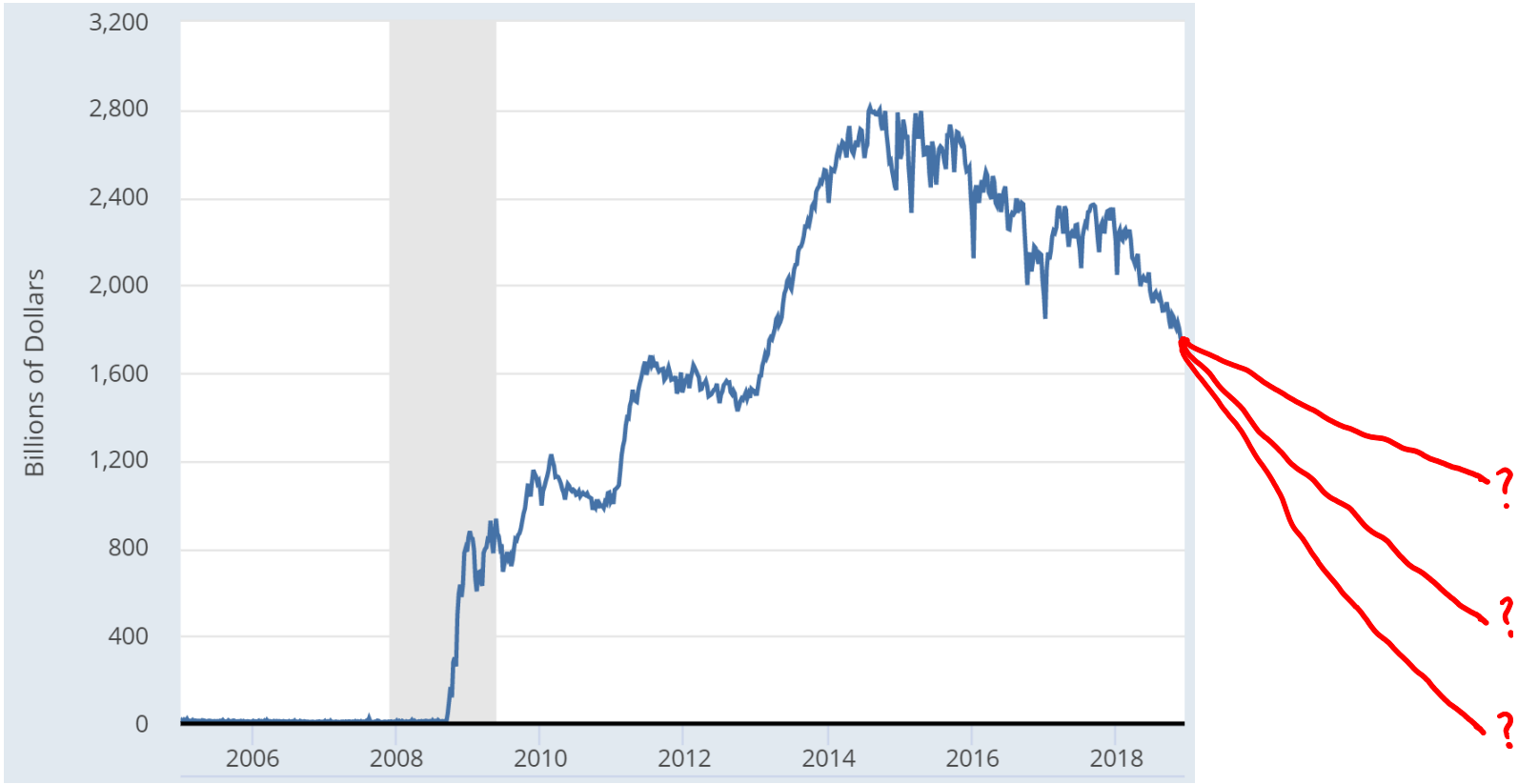
[1] The views expressed are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System.

[2] Federal Reserve Bank of New York
[3] Wharton Financial Institutions Center
[4] MIT

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 RRPs

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
  - Cochrane (2014), Curdia and Woodford (2011), Goodfriend (2002)
- Advocates for very large overnight RRP quantity
  - Duffie and Krishnamurthy (2016), (Reis, 2016), Greenwood, Hansen, and Stein (2016), Cochrane (2014)
- 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: $K(A)$

$$K(A) = (R^E - R^D)\frac{dE}{dA} + \frac{1}{2}(R^{E1} - R^{D1})\frac{dE_1}{dA}.$$

  - $K(A)$ 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, whihc 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 $\frac{1}{2} Y(I) \frac{d(-I)}{dM}$

Net Cost of Reserves

- The net cost of reserves, $C(M)$, is defined as the IOER-deposit rate spread:

$$C(M) \equiv R^{M^2} - R^D$$

  - 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:

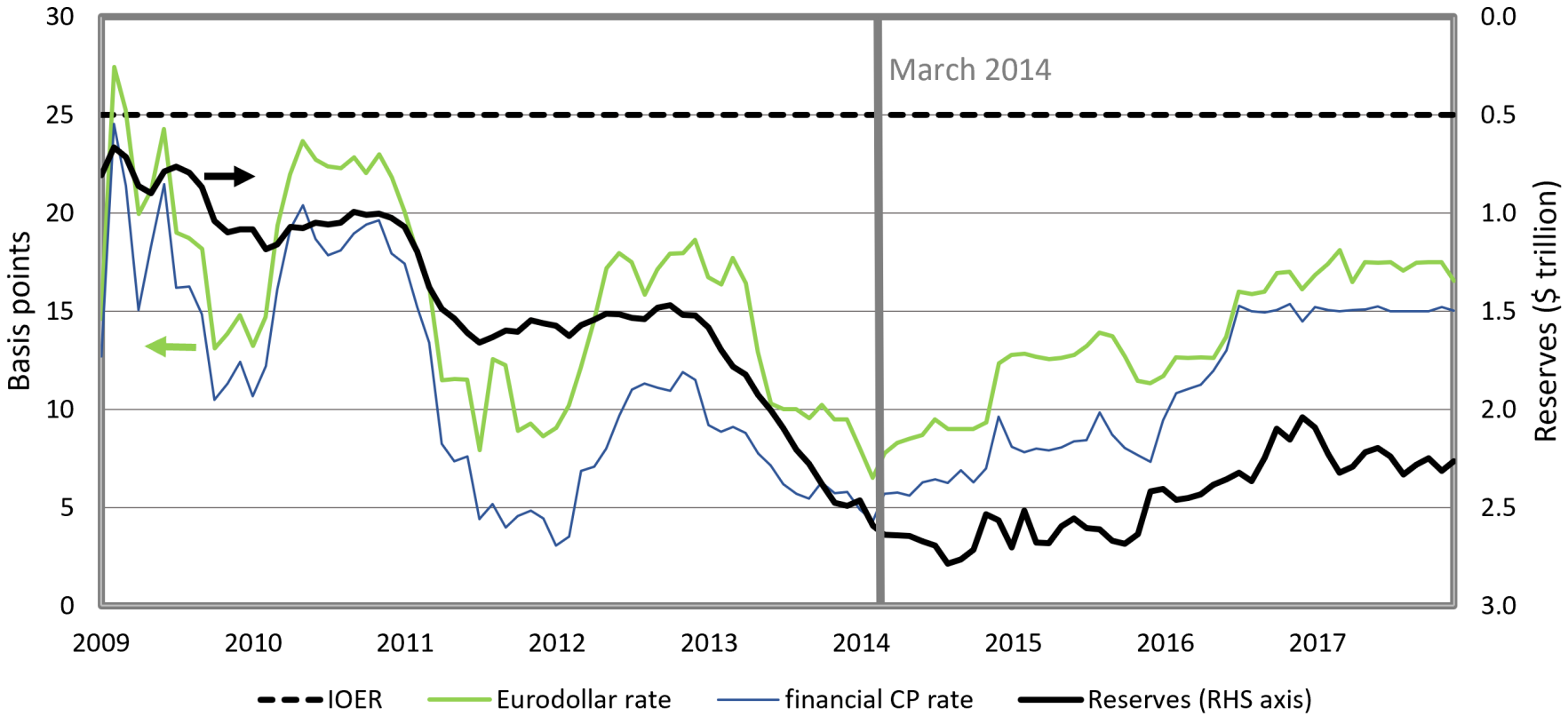
$$C(M) = K(A) - \frac{1}{2} Y(I) \frac{d(-I)}{dM}$$

- 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:

$$R^D(M^*) = R^{M^2}$$

Overnight RRP

- 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^{Qt}
- 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

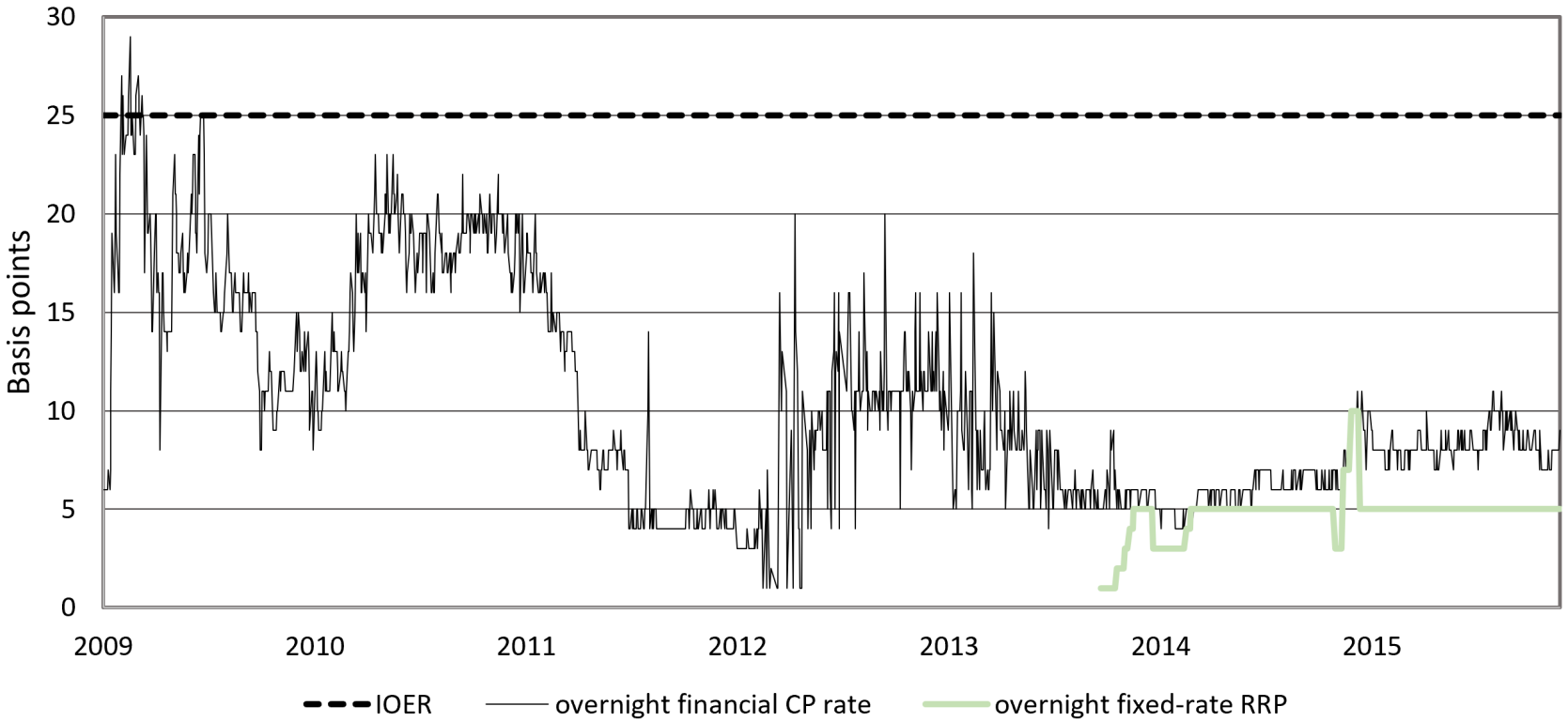
- The optimal supply of reserves increases to $M^{**} > M^{*}$
  - Because RRPs absorb bank liquidity shocks at date 1
    - Eliminates additional capital requirements at date 1
  - Hence, the bank balance sheet cost $K(A)$ is lower
    - Reserves are less costly to hold
  - Also lowers the bank liquidity 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

Overnight financial CP rate and RRP rate

- 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