Federal Reserve Tools for Managing Rates and Reserves

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Large Quantity of Reserves

How can the Fed manage interest rates in this environment of large reserves?
How Can the Fed Manage Rates?

- Interest on excess reserves (IOER) rate has not created a floor for short term rates
  - What determines rates once IOER is raised to 100bps? 500bps?
  - Historically, scarcity of reserves creates demand, allowing for control of the fed funds rate
New Federal Reserve Tools

• New Fed tools have been developed to manage:
  o Short term rates
  o Quantity of reserves
  o Composition of the Fed’s liabilities away from reserves alone

• Fixed-rate or fixed-quantity auction facilities for a variety of maturities
  o TDF
    • Term Deposit Facility
    • Banks can deposit reserves with the Fed for a term maturity
  o RRP
    • Reverse Repurchase agreement
    • Banks and non-banks, such as money market mutual funds (MMFs), can do collateralized lending to the Fed
  o FRFA ON RRP
    • Fixed-rate, full-allocation overnight RRP
Outline

1. Model
2. Benchmark market equilibrium without tools
3. Equilibrium using tools
4. Conclusion
Model

• Dates $t = 0, 1, 2$

• Two sectors each with representative:
  o Bank (B), household (H) and firm
  o Banks issue:
    • Deposits ($D^0$ and $D^1$) and preferred equity ($E$) to households, loans ($L$) to firms, and interbank loans ($I$)

• Government issues bonds ($B$)

• Central bank (CB) issues reserves ($M$), TDF, term RRPs and overnight RRPs
Model Assumptions

- Banks face frictions in supplying “money” in the form of:
  - Deposits to households
    - Bank has convex risk-shifting opportunities
  - Interbank loans to other banks
    - Convex interbank monitoring cost
Date $t=0$: Bonds, deposits, preferred equity and loans
   o Yield return at $t=2$
     • Deposits can be withdrawn early at $t=1$
   o Banks can risk-shift on assets obtained in $t=0$

Date $t=1$: One sector has a liquidity shock
   o Probability of shock is half for each sector
   o Portfolio shock:
     • Depositors in shocked sector demand additional bonds equal to a fraction ($\lambda$) of their bank assets
   o Depositors can make new (one-period) overnight deposits
   o Banks can borrow and lend on the interbank market
   o Banks can risk-shift on assets obtained in $t=1$ and issue new preferred equity

Date $t=2$: Assets mature and consumption occurs
Real Economy

• Households
  o Sell endowment $W$ at $P_0$ (normalized to 1) at $t=0$
  o Buy production goods for consumption at price $P_2$ at $t=2$
    • Goods prices (inflation) is determined according to fiscal theory of the price level as $\Pi = \frac{P_2}{P_0}$
  o Households obtain a liquidity benefit of $\theta$ on liquid assets

• Firms
  o Buy household endowment at $t=0$ and sell production goods at $t=2$
Optimizations
Firms and Households

Firms maximize profits:

\[ \max U^F \equiv \Pi \int_0^L r(L) d\hat{L} - R^L L \]

- \( r(L) \) is a firm's marginal real return on production

Households maximize expected utility:

\[ \max U^H \equiv \frac{1}{2n} \{(R^B + \theta)B^{H0} + R^E E^0 + (R^D^0 + \theta)D^0 + (R^D^1 + \theta)(B^{H1} P^B_1 - E^1) + R^E_1 E^1 \]
\[ - (R^B + \theta)B^{H1} - \tau + U^B + U^F \}
\[ + \frac{1}{2n} \{(R^B + \theta)B^{H0} + R^E E^0 + (R^D^0 + \theta)[D^0 - \lambda(D^0 + E^0)] + (R^B + \theta) \left( \frac{\lambda(D^0 + E^0)R^W}{pB_1} \right) \]
\[ - \tau + U^B + U^F \} \]

s.t. \( D^0 + E^0 + B^{H0} \leq W \)
\[ B^{H1} \leq B^{H0} \]
Banks maximize expected profits:

$$\max UB \equiv \frac{1}{2} \left[ RL + RM^2 - RE^0E^0 - R^D_0D_0 + RM A^1 - R^D_1D_1 - RE^1E^1 \right. \\
+ (RI - RM)I - \Pi \int_0^I f(\hat I)d\hat I] \\
+ \frac{1}{2} \left[ RL - RE^0E^0 + RM \max\{RM M - \lambda A^0 R^W, 0\} \\
- RI \max\{\lambda A^0 R^W - RM M, 0\} - R^D_0 (1 - \lambda) D_0 \right]$$

s.t. $A^0 \equiv L^0 + M \leq E^0 + D_0$ \\
$A^1 \leq E^1 + D^1$ \\
$UB,RS \leq UB$ \hspace{1cm} (No Risk Shifting Constraint)

- $f(I)$ is bank’s marginal interbank monitoring cost, with $f'(I) \geq 0$
Risk-Shifting
Banks

- Date $t=0,1$ risk shifting pays on new date $t$ bank assets an additional return as a function of the balance sheet size at date $t$
  - With prob $\frac{1}{2}$, bank receives $\alpha(\cdot) > 0$, where $\alpha'(\cdot) \geq 0$
  - With prob $\frac{1}{2}$, bank loses $\beta(\cdot) > 0$, where $\beta'(\cdot) \geq 0$ and $\beta(\cdot) > \alpha(\cdot)$
    - $\beta(\cdot) > U_B + E^0 R^{E0} + E^1 R^{E1}$

- $U^{B,RS} \equiv U_B + \frac{1}{2} \left[ \frac{1}{2} \alpha(A^0)A^0 + \frac{1}{2} \alpha(A^0 + A^1)A^1 - E^0 R^{E0} - \frac{1}{2} E^1 R^{E1} \right]$

- Constraint for no risk shifting at $t=0,1$:
  - $U^{B,RS} \leq U_B$

- Constraint satisfied by two conditions:
  $$E^0 \geq \frac{\alpha(A^0)A^0}{R^{E0}}, \quad E^1 \geq \frac{\alpha(A^0 + A^1)A^1}{R^{E1}}$$
Equilibrium

- $C(.)$ is a bank’s balance sheet cost

\[
C(A^0) \equiv (R^L - R^{D0})
\]

\[
C(A^0 + A^1) \equiv (R^M - R^{D1})
\]

- $C(.)$ increases (and deposit rates decrease) with $A^t$
  - Reflects costly bank equity

\[
R^{E0} = R^{D0} + \theta
\]

\[
R^{E1} = R^{D1} + \theta
\]
Equilibrium (t=0)  
Small Reserves ($M<M$)

**Bond Market**

**Deposit Market**

**Loan Market**
Equilibrium (t=0)
Large Reserves (\(M>\bar{M}\))

Bond Market

Deposit Market

Loan Market
Federal Reserve Tools

• Term (two-period) RRP and/or TDF offered by the central bank at $t=0$
  o Either fixed-quantity or fixed-rate
  o The equilibrium quantity is $RRP^M (TDF)$ and the rate is $R^M (R^{TDF})$

• Overnight (one-period) RRP offered by the central bank at $t=1$
  o Fixed-quantity RRP
    • Auctions the quantity $RRP^FQ$ with equilibrium stop-out rate $R^{FQ}$
  o Fixed-rate, full-allotment RRP
    • Sets rate $R^{FR}$ with equilibrium quantity is $RRP^{FR}$

• Which tool is most effective for raising rates? For stabilizing rates?
Balance Sheet Channel
RRPs vs. TDF

RRPs (but not TDF) increase rates through the balance sheet channel by reducing balance sheet size

• RRP are held by non-banks
  • Attract bank depositors, reducing banks’ balance sheet size and equity cost
  • Raises overnight & term deposit rates
  • Provides a floor on the date-0 term deposit rate

• TDF is held by banks and replaces reserves
  o Balance sheet size and deposit rates are unchanged
  o No reduction in equity
• TDF raises bank asset rates and deposit rates by more than RRP through the scarcity channel
  • TDF reduces reserves and increases interbank lending
  • RRP additionally reduces bank size and liquidity needs, reducing interbank borrowing needs
To maximize the fed funds rate and deposit rate:

- When $M$ is large, the balance sheet channel is stronger than the scarcity channel
  - Start by using the RRP

- When eventually $M$ becomes small, the scarcity channel is stronger
  - Then use the TDF

- Result: both the TDF and RRP used together most increases rates
Term vs. Overnight RRP

- Term RRP are not available for date $t=1$ liquidity-shock needs

- Overnight RRP provides a stronger floor by absorbing short-term liquidity shocks
  - Directly increases date-$1$ overnight rates, the lowest of rates

- Overnight RRP reduces balance sheet size and cost at date $t=1$ through the balance sheet channel
Extension: information constraints

• $\lambda$ is random with a high or low realization at $t=1$

• The central bank chooses either a fixed-rate or fixed-quantity ON RRP to target the date-1 rate before observing the shock size ($\lambda$)

• Fixed-quantity RRP sets a rate floor with upward rate volatility
  o Cannot implement the same rate in all states

• Fixed-rate RRP implements the same rate floor rate in all states
  o Fully dampens volatility for overnight rates
Conclusion

- Reserves alleviate interbank lending costs but increase balance sheet costs, which requires costly equity.

- With RRPs, the Fed can provide public money to households without intermediation by banks.

- RRPs and TDF together can increase rates the most through the balance sheet and scarcity channels, respectively.

- Fixed-rate overnight RRPs provide a floor on the lowest (overnight) rates with the least rate volatility.

- Normative: The optimal provision is ON RRPs to absorb shock and moderate reserves less than but close to $\overline{M}$. 