

Chapter 15: The Fed-Funds Market
(mostly Fed Funds – plus other policy tools)

- Market between banks = Buying and selling reserve balances held at the Fed.
  - Overnight loans, unsecured, OTC. Symbol: $i_{ff} =$ Fed Funds rate.
  - Key point: Trading does not change total reserves.

Supply of Reserves

- Regular components (Textbook treatment):
  - Supply through open market operations: $NBR =$ Non-borrowed.
  - Supply through regular discount loans: $BR =$ borrowed at interest rate $i_d$,
    expire automatically, provided to banks on demand.
    Write as supply function $BR = BR(i_{ff} - i_d)$.
    Elastic supply function for $i_{ff} \geq i_d$. Zero for $i_{ff} < i_d$.

- Regular reserve supply as function of the Fed Funds rate:
  \[ R^s(i_{ff}) = NBR + BR(i_{ff} - i_d) \]
  - Vertical for $i_{ff} < i_d$. Kink at $i_{ff} = i_d$. Flat for $i_{ff} \geq i_d$. 

[Notes on Mishkin Ch.15 - P.1]
**Demand for Reserves**

- Two components, each with multiple determinants:
  - Required reserves: \( RR = rr \cdot D \)
  - Excess reserves: \( ER = e \cdot D \)

\[ R^d = RR + ER = rr \cdot D + ER \]

1. Fed controls required reserve ratio (rr); may offer interest on reserves (i_{or}).
2. Banks make decisions about excess reserves (e).
3. Bank customers determine the deposit volume (D).

- **Claim:** Total reserve demand depends negatively on the Fed Funds rate
- Several arguments …
• Argument #1: The Fed funds rate determines banks’ incentives to attract deposits and make loans => D depends on \( i_{ff} \).
  - Deposits are part of money demand: Deposit volume depends on opportunity cost (consumer interest rates) and transaction needs. Needs: Real transactions (Y), their price (P); Shifting when payment habits changing.
  - Fed funds rate is the opportunity cost of funds for banks
    Changes in \( i_{ff} \) triggers changes in retail interest rates (loans, deposits)
    \[
    D = D(i_{ff}, Y, P, \ldots) \quad \text{downward sloping function of } i_{ff}
    \]
    - Desired deposits depends on real output and prices (like money demand)
    - Desired deposits also shift when C/D changes (at given money demand)

• Argument #2: Reserves are normally proportional to deposits
  - Required reserves are proportional to deposits (by definition)
    \[
    RR = rr \cdot D(i_{ff}, Y, P, \ldots) \quad \text{downward sloping function of } i_{ff}
    \]
  - Excess reserves are small and proportional to deposits, provided \( i_{ff} > i_{or} \):
    \[
    R = (rr + e) \cdot D(i_{ff}, Y, P, \ldots) \quad \text{downward sloping function of } i_{ff}
    \]
• Conclude: Reserve demand is declining in the Fed funds rate; curve shifts whenever money demand shifts
• Special short-run argument:
  - Banks are obliged to hold sufficient reserves over a *reserve maintenance period* of 14 days => Reserve holdings are more interest-elastic than deposits within each reserve maintenance period.

• Special argument with interest on reserves (IOR; introduced Oct.2008):
  - If $i_{ff} < i_{or}$, banks could earn arbitrage profits $i_{or} - i_{ff}$ by borrowing Fed funds and holding them as excess reserves => Rules out $i_{ff} < i_{or}$
    => Reserve demand should be horizontal at $i_{ff} = i_{or}$ (Textbook graph)
  - Technical Caveat: Some institutions not eligible to receive interest on reserves
    => Find that $i_{ff} \geq i_{or} - \Delta$ with $\Delta =$ small profit margin for intermediaries
    (Simplify theoretical exposition: assume $\Delta \approx 0$ so $i_{ff} \geq i_{or}$.)
  - Main result: *IOR provides a lower bound for the Fed Funds rate.*

• Conclude: Reserve demand function has two parts:
  - Reserve demand is decreasing function of the Fed funds rate for $i_{ff} > i_{or}$
  - Reserve demand is horizontal at the lower bound $i_{ff} = i_{or}$; at zero until 2008.
**Market Equilibrium**

- Equilibrium Fed Funds rate matches demand and supply:
  \[ R^s = NBR + BR(i_{ff} - i_d) = R^d(i_{ff}, i_{or}, Y, P, rr, \ldots) \]

- Several cases for relationship between \( i_{ff}, i_d, \) and \( i_{or} \)
  - Before 2003: Discount rate below the Fed funds target; administrative restrictions on discount loans to discourage opportunistic borrowing by banks.
  - Since Dec.2008: Abundant excess reserves and \( i_{ff} \approx i_{or} \).
Mishkin’s Diagrams
1. Market Equilibrium

[Notes on Mishkin Ch.15 - P.6]
2. Impact of an Open Market Operations
3. Impact of a reduced discount rate

- Discount rate usually changes with the Fed Funds target ⇒ No separate role.
- Reserve requirements change = Shift in reserve demand. Rarely used.
4. Impact of higher reserve requirements

(Detail: $R^d = rr \cdot D \Rightarrow$ Reserve demand should “rotate” outwards—similar answers)
5. Impact of a higher interest rate on reserve balances
Fluctuations in the Demand for Reserves

- Deserves attention: Reserve demand is volatile, subject to shocks.
  - Macro disturbances: changes in Y, P => shifts in $M^d$ => shifts in D and $R^d$
  - Financial disturbances: seasonal changes (holiday cash needs), banking competition causing shifts between D and other deposits (not subject to rr)

- Result: $i_{ff}$ varies with $R^d$. No Fed involvement => Loss of control over $i_{ff}$.

[Notes on Mishkin Ch.15 - P.11]
Coping with Fluctuating Reserve Demand

- Challenges for the Fed: Avoid interest rate volatility while maintaining control over the money supply. Monetary history = search for solutions.

1. Fed procedures before 2003: set the discount rate below the Fed funds rate target, use administrative controls to restrict discount loans:

- Reserve supply is elastic because banks can take out discount loans.
- Elastic supply reduces the interest rate effect of shifts in reserve demand.
- Restrictions on discount loans allow Fed to make $R^S$ flat or more steep.
- Banks influence BR. Motivates writing $M1 = m * (MB_n + BR)$ in ch.14

- Problem: Administrative controls are opaque and create moral hazard: setup induces banks to claim emergencies to obtain “cheap” discount loans.

[Notes on Mishkin Ch.15 - P.12]
2. Fed procedures 2003-2008:
- Set the discount rate above the Fed funds rate target (penalty rate)
- Rely on open market operations to offset fluctuations in reserve demand.

- Banks use BR only in true emergencies.
  Normal procedure:
  - FOMC sets a Fed funds rate target
  - Open market desk is instructed to stabilize $i_{ff}$ between meetings.
  - FOMC reviews $i_{ff}$ the target as needed.

- Concern: Open market operations that stabilize $i_{ff}$ imply that money supply is perfectly elastic when demand shifts: Higher $M^d$ => higher $R^d$ => higher NBR to keep $i_{ff}$ constant => increase in $M1 = m \times MB_n$.
- Procedures rely on FOMC to adjust the target to avoid excessive $M1$ growth.
  Note: Shifts in $R^d$ are observed => gives FOMC information about $M^d$
3. Fed procedures since 2008:

- Set the IOR at or slightly above the Fed funds rate target. Supply sufficient reserves so that $i_{ff} \approx i_{or}$. Set the discount rate at penalty level.

- No need for open market operations to stabilize $i_{ff}$ between FOMC meetings
- Banks use BR only in true emergencies.
- FOMC reviews the $i_{ff}$-target as needed.

*What could possibly go wrong?*

• Concern: Shifts in $R^d$ are unobserved $\Rightarrow$ No information about banks’ desired reserves to support deposit taking vs. excess reserves held as investments
  - Graphical interpretation: Downward sloping segment of $R^d$ includes excess reserves for deposit taking. Flat segment = Reserves held as investment
• Problem: Excess reserves held as investments are unrelated to deposit volume.
  $\Rightarrow$ Cannot treat e=ER/D as exogenous $\Rightarrow$ No meaningful money multiplier.
  - Liquidity preference diagram: M1 determined by $M^d$ at $i_{ff}$. Elastic/flat “supply”.

[Notes on Mishkin Ch.15 - P.14]
• Implications for the market for money:

Liquidity preference diagram

- M1 determined by \( M^d \) at given interest rate;
- Term structure theory \( \Rightarrow i^* \) influenced by current and expected \( i_f \);
- Money “supply” undefined - may be drawn as flat/perfectly elastic at \( i^* \);
- Conclude: Procedures rely heavily on the FOMC’s vigilance to adjust the Fed funds rate as needed to limit money growth

4. Alternative suggested by ECB procedures (pre-crisis):

- Set tight upper and lower bounds and accept fluctuations between them