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: \( RR = \rho r \cdot D \)
  - Excess reserves: \( ER = e \cdot D \)

=> Total reserve demand: \( R^d = RR + ER = \rho r \cdot D + ER \)

1. Fed controls required reserve ratio (\( \rho r \)); 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 ⇒ RR 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)
  
  \[ D = D(i_{ff}, Y, P, ...) \]

  downward sloping function of \( i_{ff} \)

- Required reserves are proportional to deposits

  \[ RR = rr \cdot D(i_{ff}, Y, P, ...) \]

  downward sloping function of \( i_{ff} \)

  Shifts in money demand or in C/D will shift the demand for reserves.

• Argument #2: Banks have incentives to hold excess reserves when the interest rate on excess reserves is greater then the Fed funds rate

  - If \( i_{ff} > i_{or} \), banks keep \( ER \approx 0 \). Then \( R^d = RR = rr \cdot D(i_{ff}, ...) \)

  - If \( i_{ff} < i_{or} \), banks earn arbitrage profits \( i_{or} - i_{ff} \) by borrowing Fed funds and holding them as excess reserves ⇒ \( R^d = rr \cdot D(i_{ff}, ...) + ER \) with \( ER > 0 \).

  Graph: \( R^d \) is elastic (flat) at \( i_{ff} \approx i_{or} \) - profit margin.
Market Equilibrium

- Equilibrium Fed Funds rate matches demand and supply:

\[ R^s = NBR + BR(i_{ff} - i_d) = R^d(i_{ff}, i_{or}, Y, P, rr, ...) \]

- Several cases for relationship between \( i_{ff} \), \( i_d \), and \( i_{or} \)
  - 2003 – Oct. 2008: \( i_{ff} < i_d \) (~1% penalty) and \( i_{ff} > i_{or} = 0 \).
  - Zero interest period starting Dec. 2008: \( i_{ff} \leq i_{or} = 0.25\% \).
Mishkin’s Diagrams
1. Market Equilibrium

[Notes on Mishkin Ch.15 - P.5]
2. Impact of an Open Market Operations

[Notes on Mishkin Ch.15 - P.6]
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: $R_d^d \approx rr \cdot D \Rightarrow$ Reserve demand should “rotate” outwards—similar answers)
5. Impact of a higher interest rate on reserve balances
6. How the discount rate and interest on reserves limit fluctuations in the Fed-funds rate

Step 1. A rightward shift of the demand curve raises the federal funds rate to a maximum of the discount rate.

Step 2. A leftward shift of the demand curve lowers the federal funds rate to a minimum of the interest rate on reserves.

[Notes on Mishkin Ch.15 - P.10]
What About Private Sector Changes?

- Deserves attention: Reserve demand is volatile, subject to shocks.
  - Examples: Output Y, prices P, competitive shifts between banks a/o intermediaries, seasonal shifts, holiday cash needs, etc
  => Fed faces a choice:
    (a) Do nothing => \( i_{ff} \) varies, NBR remain unchanged.
    (b) Do defensive open market operations to stabilize \( i_{ff} \) => R fluctuates

- Normal situation (current U.S. practice):
  - Stabilize \( i_{ff} \) between FOMC meetings.
  - Review \( i_{ff} \)-target as FOMC meets.

- Foreign central banks operate similarly: Target a money market rate, choice between stabilizing an interest rate or stabilizing bank reserves.
Step 1. A rightward or leftward shift in the demand curve for reserves…

Step 2. Lead the central bank to shift the supply curve of reserves so that the federal rate does not change…

Step 3. With the result that non-borrowed reserves fluctuate between $NBR'_{fr}$ and $NBR''_{fr}$.
Choice: Interest Rate versus Quantity Target

• If the Fed systematically stabilizes NBR, the supply curve for Fed Funds is effectively vertical in the range between $i_{or}$ and $i_d$.
• If the Fed systematically stabilizes the Fed funds rate, the supply curve for Fed Funds is effectively horizontal at the target rate.