Chapter 11

CB, Money, and Credit

Money Stock Determination

The money supply consists mostly of deposits at banks, which the CB does not control directly. In this section we develop the details of the process by which the money supply is determined, and particularly the role of the CB.

The key concept to understand is fractional reserve banking. In a world in which only gold coins were money and in which the king reserved to himself the right to mint coins, the money supply would equal the number of coins minted.

Contrast this with a futuristic cashless society in which all payments are made by electronic transfers through banks and in which the law requires (here's where the "fractional reserve" part comes in) banks to hold gold coins equal to 20 percent of their outstanding deposits.

In this latter case, the money available to the public would be 5 times the number of gold coins (coins/.20). The coins would not be used as money. Rather, the coins would form a "base" supporting deposits available through the banking system.

The real money supply is determined by a combination of these two fantastic systems.

High-powered money **(or the monetary base)** consists of currency (notes and coins) and banks' deposits at the CB.

The part of the currency held by the public forms part of the money supply. The currency in bank vaults and the banks' deposits at the CB are used as reserves backing individual and business deposits at banks.
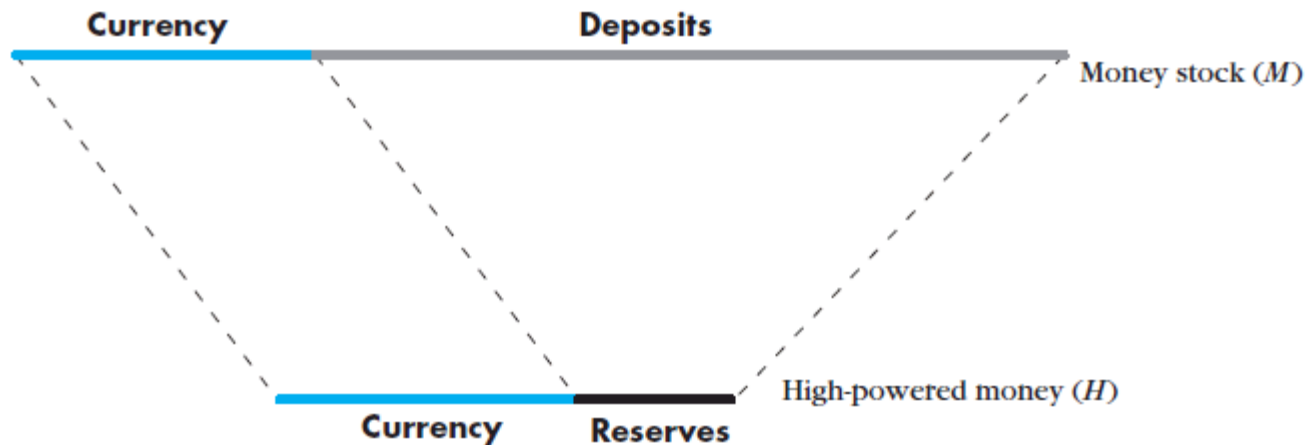
The CB's control over the monetary base is the main way through which it determines the money supply.

The CB has direct control over high-powered money, H. We are interested in the supply of money, M. The two are linked by the money multiplier, mm .

Before going into details, we want to think briefly about the relationship between the money stock and the stock of high-powered money. **As we said, money and high-powered money are related by the money multiplier.**

- The money multiplier is the ratio of the stock of money to the stock of high-powered money.

- The money multiplier is larger than 1.

- The larger deposits are as a fraction of the money stock, the larger the multiplier is.

- That is true because currency uses up a dollar of high-powered money per dollar of money. Deposits, by contrast, use up only a fraction of a dollar of high-powered money (in reserves) per dollar of money stock. For instance, if the reserve ratio is 10 percent, every dollar of the money stock in the form of deposits uses up only 10 cents of high-powered money. Equivalently, each dollar of high-powered money held as bank reserves can support $10 of deposits.

- The Fed has direct control over high powered money (H)
- Money supply (M) is linked to H via the money multiplier, mm
  - Top of figure 17-2 is the money stock
  - Bottom of figure is the stock of high-powered money = *monetary base*
- Money multiplier (mm) is the ratio of the stock of money to the stock of high powered money → mm > 1
  - The larger deposits are, as a fraction of M, the larger the multiplier

Money Stock Determination

Money supply consists of currency, CU, plus deposits: $\qquad M = CU + D \qquad$ (1)

High powered money consists of currency plus reserves: $H = CU + reserves$ (2)

Summarize the behavior of the public, the banks, and the CB in the money supply process by three variables:

- Currency-deposit ratio: $cu \equiv CU/D$

- Reserve ratio: $re \equiv reserves/D$

- Stock of high powered money: H

- We can rewrite equations (1) and (2) as:

$$M = (cu + 1)D \qquad \text{and} \qquad H = (cu + re)D$$

→ This allows us to express the money supply in terms of its principal determinants, re, cu, and H:

$$M = \frac{1 + cu}{re + cu} H \equiv mm \times H \qquad (3)$$

where mm is the money multiplier, given by:

$$mm \equiv \frac{1 + cu}{re + cu}$$

- Some observations of the money multiplier:

$$mm \equiv \frac{1 + cu}{re + cu}$$

➢ The money multiplier is larger the smaller the reserve ratio, re
➢ The money multiplier is larger the smaller the currency-deposit ratio, cu

The Currency Deposit Ratio

- The payment habits of the public determine how much currency is held relative to deposits
  - The currency deposit ratio is affected by the cost and convenience of obtaining cash
  - Currency deposit ratio falls with shoe leather costs
    - $\rightarrow$ Ex. If there is a cash machine nearby, individuals will on average carry less cash with them because the costs of running out are lower
  - The currency deposit ratio has a strong seasonal pattern (highest around Christmas)

The Reserve Ratio

- Bank reserves = <u>deposits</u> banks hold at the CB and "<u>vault cash</u>" (notes and coins held by banks)

- In the absence of regulation, banks would hold reserves to meet:

    1. The demands of their customers for cash

    2. Payments their customers make by checks that are deposited in other banks

- In the banks hold reserves primarily because the CB requires them to (*required reserves*)

    - In addition to required reserves, banks hold *excess reserves* to meet unexpected withdrawals
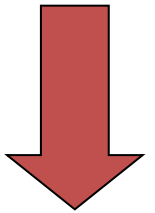
The Instruments of Monetary Control

- The CB has three instruments for controlling money supply
    1. Open market operations
        - Buying and selling of government bonds
    2. Discount rate
        - Interest rate Federal Reserve "charges" commercial banks for borrowing money
        - Federal Reserve is often the lender of last resort for commercial banks
    3. Required-reserve ratio
        - Portion of deposits commercial banks are required to keep on hand, and not loan out

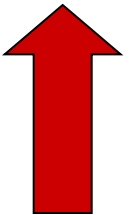# How does this affect the money supply? (OMO)

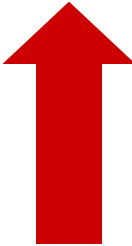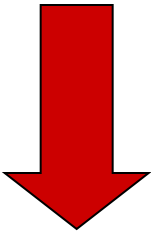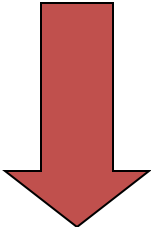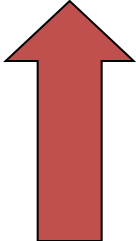Selling Bonds   Money Supply ⬇

Buying Bonds   Money Supply ⬆

Loans and Discounts

- A bank that runs short on reserves can borrow to make up the difference
  - Borrow from either the CB or other commercial banks
- The cost of borrowing from the CB is the *discount rate*
  - Discount rate also serves as a <u>signal</u> of the CB's intentions
  - The discount rate is the interest rate the central bank charges for those loans it makes to banks
  - An increase in the discount rate makes it more expensive to borrow from the CB and may decrease the money supply
  - A decrease in the discount rate makes it less expensive to borrow from the CB and may increase the money supply

How does this affect the money supply?

- Discount Rate ⬆   Money Supply ⬇

- Discount Rate ⬇   Money Supply ⬆

The Reserve Ratio

- The CB sets the required reserve ratio: the portion of each deposit commercial banks must keep on hand

- Looking at the money multiplier shown in equation (3), it is easy to see that the CB can increase the money supply by reducing the required reserve ratio:

$$M = \frac{1 + cu}{re + cu} H \equiv mm \times H$$

The reserve requirement is the percentage the central bank (CB) sets as the minimum amount of reserves a bank must have.

- Raising the reserve requirement lowers the money supply

- Lowering the reserve requirement raises the money supply

Which Targets for the CB?

Three key points:

1. There is a distinction is between <u>ultimate targets</u> and <u>intermediate targets</u>.

   – Ultimate targets are variables such as the inflation rate and unemployment rate whose behavior matters.

   – Intermediate targets, including the interest rate, are targets the CB aims at in order to hit the ultimate targets more accurately

   – The discount rate, RRR, and OMO are the instruments CB has to hit the targets

2. It matters how often the intermediate targets are rearranged.

- If the CB were to commit itself to a 5.5% money growth over a period of several years, it would have to be sure that the velocity of money was not going to change unpredictably

  $\rightarrow$ else the actual level of GDP would be far different from the targeted level

- If the money target were reset more often, as velocity changed, the CB could come closer to hitting its ultimate targets

3. The need for targeting arises from a lack of knowledge
   – If the CB had the right ultimate goals and knew exactly how the economy worked, it could do whatever was needed to keep the economy as close to its ultimate targets as possible

     $\rightarrow$ b ut the CB does not have a crystal ball or perfect foresight

- Intermediate targets give the CB something concrete and specific to aim for in the next year
  - Enables the CB itself to focus on what it should be doing
  - Helps the private sector know what to expect
- Specifying targets also makes it possible to hold the CB *accountable* for its actions
- Ideal target is a variable that:
  1. The CB can control exactly
  2. Has exact relationship with the ultimate target

Q. Derive money multiplier by using related formulas.

$$M = C + D$$

↓ money stock

↓ currency

→ deposits

$$H = C + R$$

↓ High-powered money

↘ currency

→ reserves

$$cu \equiv \frac{CU}{D} \quad \rightarrow \text{currency - deposit ratio} \quad \Rightarrow CU \equiv cu \cdot D$$

$$re \equiv \frac{\text{reserves}}{D} \quad \rightarrow \text{Reserve Ratio} \quad \Rightarrow \text{Reserves} \equiv re \cdot D$$

$$M = cu \cdot D + D = D(cu + 1)$$

$$H = cu \cdot D + re \cdot D = D(cu + re) \implies D \equiv \frac{H}{cu + re}$$

$$M \equiv \frac{H}{cu + re} \cdot (cu + 1)$$

$$M \equiv \left(\frac{cu + 1}{cu + re} \right) \cdot H$$

mm : money multiplier

$$re \downarrow \implies mm \uparrow$$

$$cu \downarrow \implies mm \uparrow$$

Q: Derive money multiplier by using related formulas

MONEY MULTIPLIER

1) $\underline{\text{Total Reserve}}$ = Required Reserve + Excess Reserve

$$R = RR + ER$$

2) $\underline{\text{Required Reserve}}$ = Required Reserve Ratio × Demand Deposits

$$RR = r_D \times D$$

3) $R = (r_D \times D) + ER$

$$R + C = (r_D \times D) + ER + C$$

total
reserve   currency

$\underbrace{\hspace{3cm}}$
monetary base (parasal taban)

$$M_0 = C + R$$

$$M_0 = (r_D \times D) + ER + C$$

$$M_0 = (r_D \times D) + \left(\frac{ER \times D}{D}\right) + \left(\frac{C + D}{D}\right)$$

$$M_0 = D\left[r_D + \frac{ER}{D} + \frac{C}{D}\right]$$

$$D = \frac{M_0}{r_D + \frac{ER}{D} + \frac{C}{D}}$$

$$M_1 = \underset{\text{currency}}{C} + \underset{\text{deposit}}{D}$$

$$M_1 = M = D\left[\frac{C}{D} + 1\right]$$

$$\boxed{D = \frac{M}{1 + \frac{C}{D}}}$$

$$\frac{M}{1 + \frac{C}{D}} = \frac{M_0}{r_D + \frac{ER}{D} + \frac{C}{D}}$$

$$\boxed{M = \frac{\left[1 + \frac{C}{D}\right]}{\left[r_D + \frac{C}{D} + \frac{ER}{D}\right]} \cdot M_0}$$

→ monetary-base multiplier, money multiplier, mm.

$\rightarrow$ money supply

$$M = mm \cdot M_0$$

$\hookrightarrow$ monetary base or high powered money

$$mm = \frac{M}{M_0} = \frac{1 + \frac{C}{D}}{\frac{RR}{D} + \frac{ER}{D} + \frac{C}{D}}$$

$\downarrow$

money
multiplier

$$r_D = \frac{RR}{D}$$

The Determinants of money supply: (What are the determinants of
money supply? Explain each of them
briefly)

1) $M = M(\overset{+}{mm}, \overset{+}{M_o})$

Currency in circulation $\uparrow \Rightarrow M_o \uparrow \Rightarrow M \uparrow$

Total Reserves $\qquad \uparrow \Rightarrow M_o \uparrow \Rightarrow M \uparrow$

2) $M = M(\overset{+}{mm}, \overset{+}{C}, \overset{+}{R})$

3) $M = M\left(\overline{\dfrac{C}{D}}, \overline{\dfrac{RR}{D}}, \overline{\dfrac{ER}{D}}, C, R\right)$

$\dfrac{C}{D}$: currency - deposit Ratio

$\left(\dfrac{C}{D}\right) \uparrow \Rightarrow M \downarrow$ (ceteris paribus)

$\dfrac{ER}{D}$: Excess Reserve - Deposit Ratio

$\left(\dfrac{ER}{D}\right) \uparrow \Rightarrow M \downarrow$ (ceteris paribus)

$\dfrac{RR}{D}$: Required Reserve - Deposit Ratio, r_D (Required Reserve Ratio)

$\left(\dfrac{RR}{D}\right) \uparrow \Rightarrow M \downarrow$ (ceteris paribus)

$$M = M\left(\overset{-}{\frac{C}{D}},\ \overset{-}{\frac{ER}{D}},\ \overset{-}{\frac{RR}{D}},\ \overset{+}{C},\ \overset{+}{R} \right)$$

Balance sheet of A Bank

Asset	Liabilities
vault Cash: 200 000	Deposits 1.200.000
Deposit in CB: 400 000	
Loans: 600 000	
Total Asset. 1.200.000	Total Liabilities: 1.200.000

$r = 20\%$

a. Fill in the blanks

b. legal Reserve = ?

c. Required Reserve = ?

d. Excess Resene = ?

e. Expand in money supply OR Max. increase in deposit ?

b. $LR = $ Vault Cash + Deposit in CB

$= 200\,000 + 400\,000 = 600\,000$

c. $RR = r_D \times D$

$= \dfrac{20}{100} \times 1\,200\,000 = 240\,000$

d. $ER = LR - RR$

$= 600\,000 - 240\,000 = 360\,000$

e. Max ↑ in deposit $= \dfrac{1}{r} \times ER = \dfrac{1}{0.2} \times 360\,000 = 1\,800\,000$

* If Reserve requirement ratio r_D ↑

$\Rightarrow r_D ↑ \Rightarrow RR ↑ \Rightarrow ER ↓ \Rightarrow$ Max ↑ in deposit ↓

LR, r_D ↑ $\Rightarrow$ Deposit exp. multiplier $= \dfrac{1}{r}$ ↓