Unit 5
Money, the Central Bank and interest rate

Instructor: Nguyen Tai Vuong
School of Economics and Management
Hanoi University of Science and Technology

Learning Objectives

- Define money and discuss its functions;
- Explain how banks create money;
- Discuss the role of a nation's banking system in determining the amount of money in the economy;
- Describe the determinants of money demand;
- Analyze nation's Central Bank measures to control the banking system, the money supply and interest.
- Define interest and discuss the relationship between interest rates and security prices;

Contents

An overview of Money

Money is the stock of assets that can be readily used to make transactions.

Money: Functions

- medium of exchange
  we use it to buy stuff

- store of value
  transfers purchasing power from the present to the future

- unit of account
  the common unit by which everyone measures prices and values

Money: Types

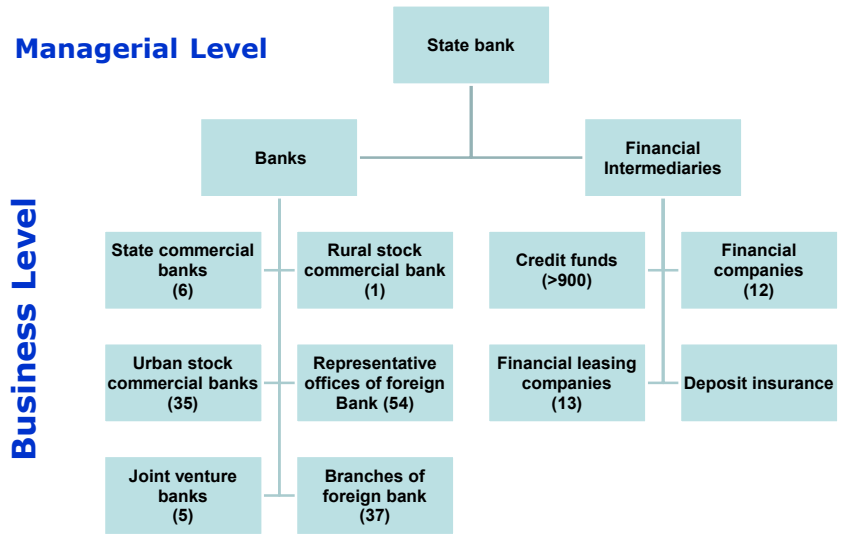
1. **fiat money**
   - has no intrinsic value
   - example: the paper currency we use
2. **commodity money**
   - has intrinsic value
   - examples:
     gold coins,
     cigarettes in P.O.W. camps
3. ***virtual money***
   - cryptocurrency is a digital currency designed to work as a medium of exchange through a computer network that is not reliant on any central authority
   - example: bitcoin, ethereum …

Discussion Question

Which of these are money?

a. Currency
b. Checks (Cheques)
c. Deposits in checking accounts ("demand deposits")
d. Credit cards
e. Certificates of deposit ("time deposits")

Banking System



Managerial Level: The Central Bank

- Monetary policy is conducted by a country's **Central Bank**.
- In the U.S., the Central Bank is called the **Federal Reserve** ("the Fed").
- Viet Nam: **State Bank of Viet nam** (the SBV)

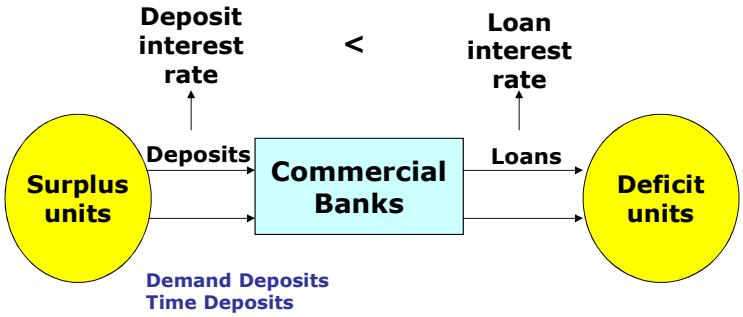
Functions of Central Bank

- **Govern the monetary (financial) market**
  - Issue notes and coins
  - Control money supply and implement monetary policy
  - Manage exchange rates and the nation's foreign exchange reserves
- **Acts as a banker to commercial banks**
  - Clearing interbank payments, regulating the banking system, and assisting banks in a difficult financial position.
  - Perform as a lender of last resort: It provides funds to troubled banks that cannot find any other sources of funds.
- **Acts as financial consultant for the government**
  - Transaction with State Treasury
  - Consultation for government securities issuance
  - Involve in intercountry negotiations on international economic issues

Business Level in Banking System

- **Financial intermediary**
  - specialize in bringing lenders and borrows together.
    - insurance companies, pension funds,...
- **Commercial banks**
  - are financial intermediaries licensed to make loans and issue deposits, including deposits against which cheques can be written

Commercial Bank Operation



- **Interest rate spread =** Loan interest rate – Deposit interest rate

Commercial bank

- **Reserves** (***R***): the portion of deposits that banks have not lent.
  - to meet possible withdrawals by depositors.
- The **reserve ratio** is the ratio of reserves to deposits

Balance Sheet

Assets	Liabilities
Reserves: $10 Outstanding loans: $90	Deposits: $100

The money supply and monetary policy definitions

- The **money supply** is the quantity of money available in the economy.
- **Monetary policy** is the control over the money supply.
  - Implemented by Central Bank

Money supply measures

Amount of

symbol	assets included	amount ($ billions)
C	Currency	$739
M1	**C** + demand deposits, travelers' checks, other checkable deposits	$1391
M2	**M1** + small time deposits, savings deposits, money market mutual funds, money market deposit accounts	$6799

Liquidity

Banks' role in the monetary system

- The money supply (M1)

  equals currency plus demand (checking account) deposits:

$$M = C + D$$

➢ Since the money supply includes demand deposits, the (commercial) banking system plays an important role.

A few preliminaries

- **Reserves** (***R***): the portion of deposits that banks have not lent.
- A bank's
  - liabilities include deposits;
  - assets include reserves and outstanding loans.
- **100-percent-reserve banking**:
  - a system in which banks hold all deposits as reserves.
- **Fractional-reserve banking**:
  - a system in which banks hold a fraction of their deposits as reserves.

SCENARIO 1: No banks

1. Central Bank issues a currency amount of $1000.

2. Households in the society receive $1000 from Central Bank.

With no (commercial) banks,

D = 0 and ***M*** = ***C*** = $1000.

SCENARIO 2: 100-percent reserve banking

- Initially ***C*** = $1000, ***D*** = $0, ***M*** = $1,000.
- Now suppose households deposit the $1,000 at "Firstbank."
- Bank offers check to households for payment goods

FIRSTBANK'S balance sheet

Assets	Liabilities
reserves $1,000	deposits $1,000

- After the deposit,
  C = $0,
  D = $1,000,
  M = $1,000.
- 100%-reserve banking has no impact on size of money supply.

SCENARIO 3: Fractional-reserve banking

- Suppose banks hold 20% of deposits in reserve, making loans with the rest.
- Firstbank will make $800 in loans.

FIRSTBANK'S balance sheet

Assets	Liabilities
reserves $200 loans $800	deposits $1,000

The money supply now equals $1,800:

- Depositor has $1,000 in demand deposits.
- Borrower (from the Firstbank) holds $800 in currency.

SCENARIO 3: Fractional-reserve banking

Thus, in a fractional-reserve banking system, (commercial) banks create money.

FIRSTBANK'S balance sheet

Assets	Liabilities
reserves $200	deposits $1,000
loans $800	

The money supply now equals $1,800:

- Depositor has $1,000 (Checks) in demand deposits.
- Borrower holds $800 in currency.

SCENARIO 3: Fractional-reserve banking

- Suppose the borrower deposits the $800 in Secondbank.
- Initially, Secondbank's balance sheet is:

Note: banks hold 20% of deposits in reserve, making loans with the rest.

SECONDBANK'S balance sheet

Assets	Liabilities
reserves $160	deposits $800
loans $640	

- Secondbank will loan 80% of this deposit.

SCENARIO 3: Fractional-reserve banking

- If this $640 is eventually deposited in Thirdbank,
- then Thirdbank will keep 20% of it in reserve, and loan the rest out:

THIRDBANK'S balance sheet

Assets		Liabilities	
reserves	$128	deposits	$640
loans	$512		

Finding the total amount of money:

	Original deposit	= $1000
+	Firstbank lending	= $ 800
+	Secondbank lending	= $ 640
+	Thirdbank lending	= $ 512
+	other lending…	

Total money supply = $(1/rr) \times \$1{,}000$
where ***rr*** = ratio of reserves to deposits

In our example, ***rr*** = 0.2, so ***M*** = $5,000

Money creation in the banking system

A fractional reserve banking system creates money, but it doesn't create wealth:

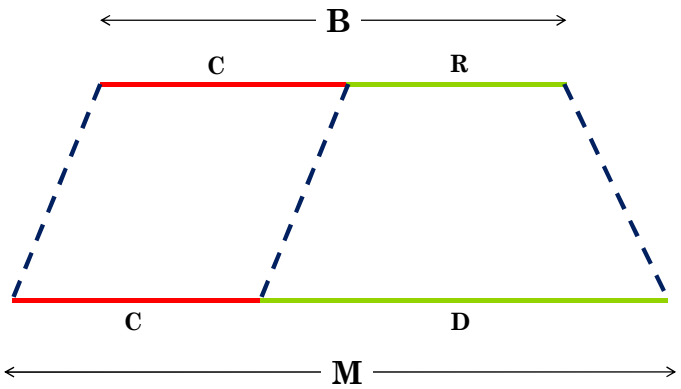
Bank loans give borrowers some new money and an equal amount of new debt.

A model of the money supply

exogenous variables

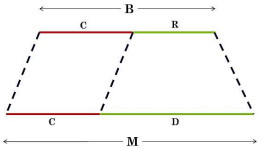
- **Monetary base**, ***B*** = ***C*** + ***R***
  controlled by the central bank
- **Reserve-deposit ratio**, ***rr*** = ***R/D***
  depends on regulations & bank policies
- **Currency-deposit ratio**, ***cr*** = ***C/D***
  depends on households' preferences

A model of Money Supply



$$M = m * B$$

Solving for the money supply



$$M = C + D = \frac{C + D}{B} \times B = m \times B$$

where

$$m = \frac{C + D}{B}$$

$$= \frac{C + D}{C + R} = \frac{(C/D) + (D/D)}{(C/D) + (R/D)} = \frac{cr + 1}{cr + rr}$$

The money multiplier

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- If $rr < 1$, then $m > 1$
- If monetary base changes by ΔB, then $\Delta M = m \times \Delta B$
- m is the **money multiplier**, the increase in the money supply resulting from a one-dollar increase in the monetary base.

Exercise

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

Suppose households decide to hold more of their money as currency and less in the form of demand deposits.

1. Determine impact on money supply.
2. Explain the intuition for your result.

Solution to exercise

Impact of an increase in the currency-deposit ratio $\Delta cr > 0$.

1. An increase in ***cr*** increases the denominator of ***m*** proportionally more than the numerator. So ***m*** falls, causing ***M*** to fall.
2. If households deposit less of their money, then banks can't make as many loans, so the banking system won't be able to "create" as much money.

Three instruments of monetary policy

Central Bank could use the following instruments to adjust the money supply (M)

1. Open-market operations
2. Reserve requirements
3. The discount rate

Open-market operations

- *definition:*
  The purchase or sale of government bonds by the Central Bank.
- *how it works:*
  If Central Bank buys bonds from the public,
  it pays with new dollars, increasing ***B*** and therefore ***M***.

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

Reserve requirements

- *definition:*
  Central Bank regulations that require banks to hold a minimum reserve-deposit ratio.
- *how it works:*
  Reserve requirements affect ***rr*** and ***m***:
  If Central Bank reduces reserve requirements,
  then banks can make more loans and
  "create" more money from each deposit.

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

The discount rate

- *definition:*
  The interest rate that the Central Bank charges on loans it makes to banks.
- *how it works:*
  When banks borrow from the Central Bank, their reserves increase, allowing them to make more loans and "create" more money.

  The Central Bank can increase ***B*** by lowering the discount rate to induce banks to borrow more reserves from the Central Bank.

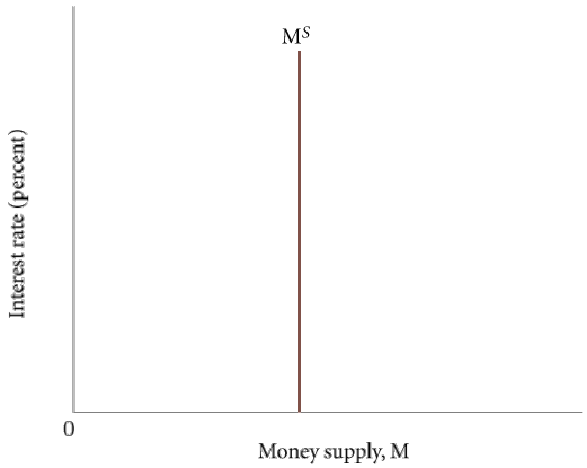
Which instrument is used most often?

- Open-market operations:
  most frequently used.
- Changes in reserve requirements:
  least frequently used.
- Changes in the discount rate:
  largely symbolic.
  The Central Bank is a "lender of last resort,"
  does not usually make loans to banks
  on demand.

Supply and Demand for Money

- The supply of money
  - Through its three tools, the Central Bank is assumed to have the money supply be whatever value it wants
  - If the Central Bank's money supply behavior is not influenced by the interest rate, the money supply curve is a vertical line.
  - Note: *the Central Bank can't precisely control M*

Excess Reserves and the Supply Curve for Money



Money supply function:

$M^S = M$

$$M^S = \frac{cr + 1}{cr + rr} \times B$$

Why the Central Bank can't precisely control *M*?

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- Households can change ***cr***, causing ***m*** and ***M*** to change.
- Banks often hold **excess reserves** (reserves above the reserve requirement). If banks change their excess reserves, then ***rr***, ***m***, and ***M*** change.

The Demand for Money

- When we speak of the demand for money, we are concerned with how much of your financial assets you want to hold *in the form of money*, which does not earn interest, versus how much you want to hold in interest-bearing securities such as bonds, or deposits in the bank.
- Why do people hold money?
  - Transaction motive
  - Speculation motive

The Transaction Motive

- **transaction motive** The main reason that people hold money—to buy things.
- **nonsynchronization of income and spending** The mismatch between the timing of money inflow to the household and the timing of money outflow for household expenses.
- When interest rates are high, typically we want to deposit money in the bank to earn interests and hold/carry less (in the form of money) in our pockets or in the checking accounts. Our demand for money is low at this situation, and vice versa.

The Speculation Motive

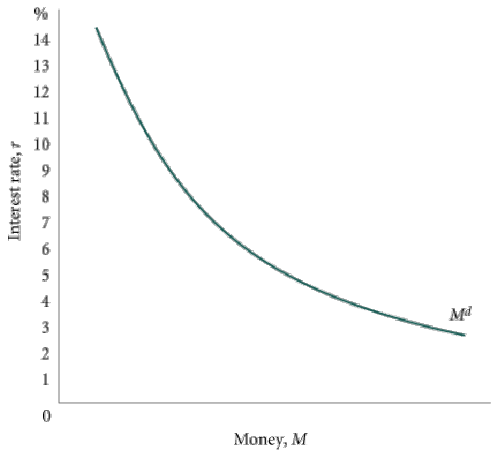
- One reason for holding bonds instead of money:
  - Because the market price of interest-bearing bonds is inversely related to the interest rate, investors may want to hold bonds when interest rates are high with the hope of selling them when interest rates fall.

The Total Demand for Money

- The total quantity of money demanded in the economy is the sum of the demand for checking account balances *and cash* by both households *and firms*.
- At any given moment, there is a demand for money—for cash and checking account balances. Although households and firms need to hold balances for everyday transactions, their demand has a limit.
- For both households and firms, the quantity of money demanded at any moment depends on the opportunity cost of holding money, a cost determined by the interest rate.

The Demand Curve for Money Balances

- The quantity of money demanded (the amount of money households and firms want to hold) is a function of the interest rate.
- Because the interest rate is the opportunity cost of holding money balances, increases in the interest rate reduce the quantity of money that firms and households want to hold and decreases in the interest rate increase the quantity of money that firms and households want to hold.



Money Demand Function

- General form: $\mathrm{M^D} = f(\mathrm{r}, \mathrm{P.Y})$
- In the short-run, price level is sticky, so
- $\mathrm{M^D} = f(\mathrm{r}, \mathrm{Y})$
- ➢ $\mathrm{M^D} = C_M - c_r r + c_Y Y$

Determinant of money demand

The demand for money depends negatively on the interest rate, *r*, and positively on real income, *Y*, and the price level, *P*.

Determinants of Money Demand

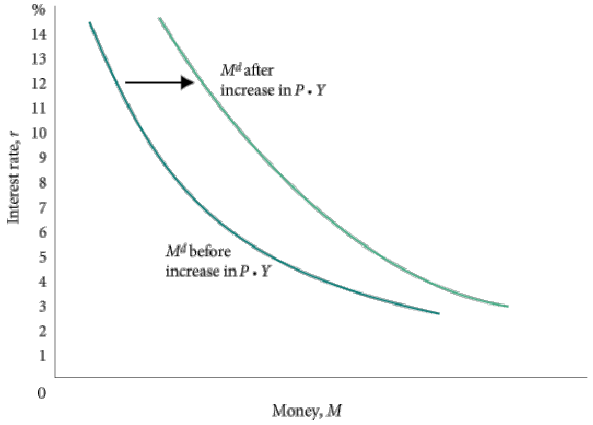
1 The interest rate: *r* (The quantity of money demanded is a negative function of the interest rate.)

2 Aggregate nominal output (income) *P* • *Y*

a. Real aggregate output (income): *Y* (An increase in *Y* shifts the money demand curve to the right.)

b. The aggregate price level: *P* (An increase in *P* shifts the money demand curve to the right.)

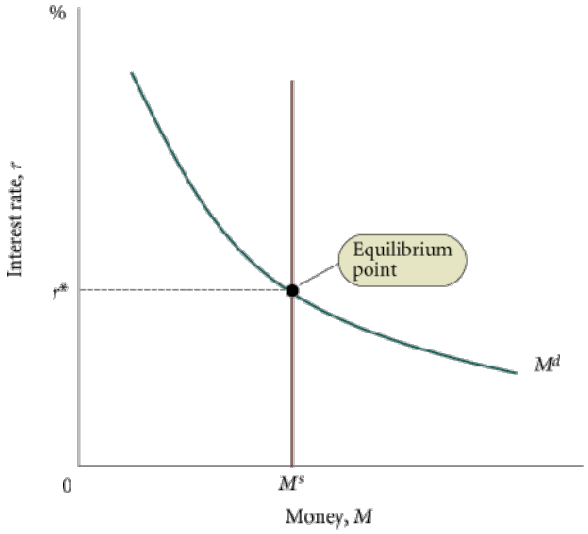
The Effect of Nominal Income on the Demand for Money



An Increase in Nominal Aggregate Output/ Income ($P \cdot Y$) Shifts the Money Demand Curve to the Right

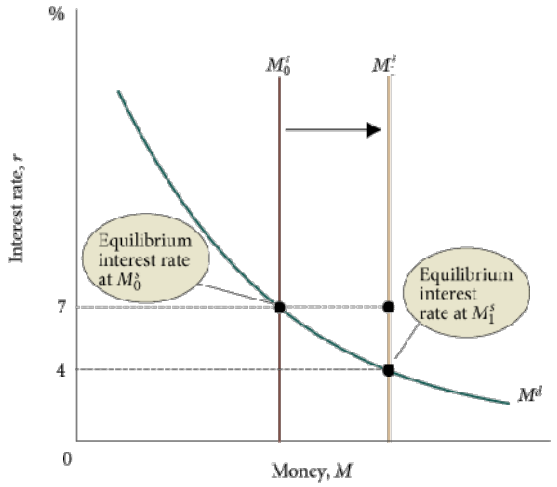
The Equilibrium Interest Rate

- The point at which the quantity of money demanded equals the quantity of money supplied determines the equilibrium interest rate in the economy.



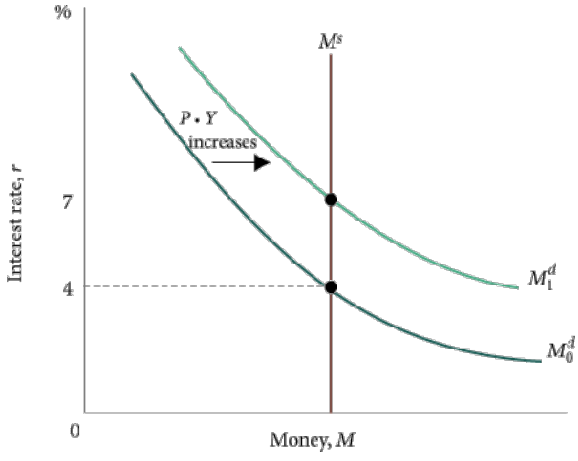
Changing the Money Supply to Affect the Interest Rate

An increase in the supply of money from M^S_0 to M^S_1 lowers the rate of interest from 7 percent to 4 percent.



Increases in nominal income

An increase in nominal income ($P \cdot Y$) shifts the money demand curve from M^d_0 to M^d_1, which raises the equilibrium interest rate from 4 percent to 7 percent.



Interest rate and securities prices

- **Households' wealth:**
  - holding money
  - holding assets in interest-bearing securities or accounts.
- Short-term securities are usually called "**bills**," and long-term securities are usually called "**bonds**."
- Both types of securities work in similar ways.
- To induce lenders to buy these securities and provide funds, borrowers promise not only to return the funds borrowed at some later date, but also to pay interest.

Interest rate and securities prices

- **interest** The fee that borrowers pay to lenders for the use of their funds.
- Firms and governments borrow funds by issuing bonds, and they pay interest to the lenders that purchase the bonds.
- Bonds are issued with a face value, typically in denominations of $1,000. They come with a maturity date—or the date when the face value of the bond is paid out. Bonds, other than the face value, often offer a fixed yearly payment, known as a coupon.

Interest rate and securities prices

- A key relationship that we will use in this unit is that market-determined prices of existing bonds and interest rates are inversely related.
- To understand why interest rates and bond prices are INVERSELY related, we need to introduce the concept of "PRESENT VALUE."
- Present Value: the value of an expected income determined as of the date of valuation.
  - What is today's value of 1,000 baht that you will get next year if the interest rate is 10%?
  - if the interest rate is instead 5%, how does your answer change?

Interest rate and securities prices

Equilibrium exists in the money market when the supply of money is equal to the demand for money and thus when the supply of bonds is equal to the demand for bonds.

At r_0 the price of bonds would be bid up (and thus the interest rate down).

At r_1 the price of bonds would be bid down (and thus the interest rate up).