

ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH  
TRƯỜNG ĐẠI HỌC KINH TẾ - LUẬT



## CHAPTER 5. MONETARY POLICY

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N. Gregory Mankiw

## Vietnam's monetary policy response to the COVID-19 pandemic



An effective management of monetary policy and banking activities enables Vietnam to control inflation, stabilize the macroeconomy, and overcome challenges posed by the COVID-19 pandemic

[https://www.tapchicongsan.org.vn/web/english/mega-story/-/-/asset\\_publisher/lc29ulxCb05g/content/an-effective-management-of-monetary-policy-and-banking-activities-enables-vietnam-to-control-inflation-stabilize-the-macroeconomy-and-overcome-challen](https://www.tapchicongsan.org.vn/web/english/mega-story/-/-/asset_publisher/lc29ulxCb05g/content/an-effective-management-of-monetary-policy-and-banking-activities-enables-vietnam-to-control-inflation-stabilize-the-macroeconomy-and-overcome-challen)



## OUTLINE

- Overview of money and banking
- Money supply
- Money demand
- Equilibrium in the money market
- Monetary policy
- Quantifying monetary policy

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**In this chapter,  
look for the answers to these questions:**



- Overview of money and banking: What assets are considered “money”? What are the functions of money? The types of money?
- What is the Federal Reserve?
- What role do banks play in the monetary system? How do banks “create money”?
- How does the Federal Reserve control the money supply?

## What Money Is and Why It's Important

- Without money, trade would require **barter**, the exchange of one good or service for another.
- Every transaction would require a **double coincidence of wants** – the unlikely occurrence that two people each have a good the other wants.
- Most people would have to spend time searching for others to trade with – a huge waste of resources.
- This searching is unnecessary with **money**, the set of assets that people regularly use to buy g&s from other people.

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## What Money Is and Why It's Important

- **The Meaning of Money**
  - money is used to mean wealth.
  - is the set of assets in the economy that people regularly use to buy goods and services from each other.



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## The 3 Functions of Money

- **Medium of exchange:** an item buyers give to sellers when they want to purchase g&s
- **Unit of account:** the yardstick people use to post prices and record debts
- **Store of value:** an item people can use to transfer purchasing power from the present to the future

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## The 3 Functions of Money



- **Liquidity** to describe the ease with which an asset can be converted into the economy's medium of exchange.



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## The 2 Kinds of Money

### Commodity money:

takes the form of a commodity with intrinsic value

*Examples: gold coins, cigarettes in POW camps*



### Fiat money:

money without intrinsic value, used as money because of govt decree

*Example: the U.S. dollar*

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## Discussion

### Cryptocurrencies: A Fad or the Future?

- a new kind of money, called cryptocurrencies
- rely on a technology called blockchain to maintain a decentralized, public ledger that records transactions.
- Bitcoins are neither commodity money nor fiat money.



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## Discussion

### Why Credit Cards Aren't Money?

- are not really a method of payment but rather a method of deferring payment.



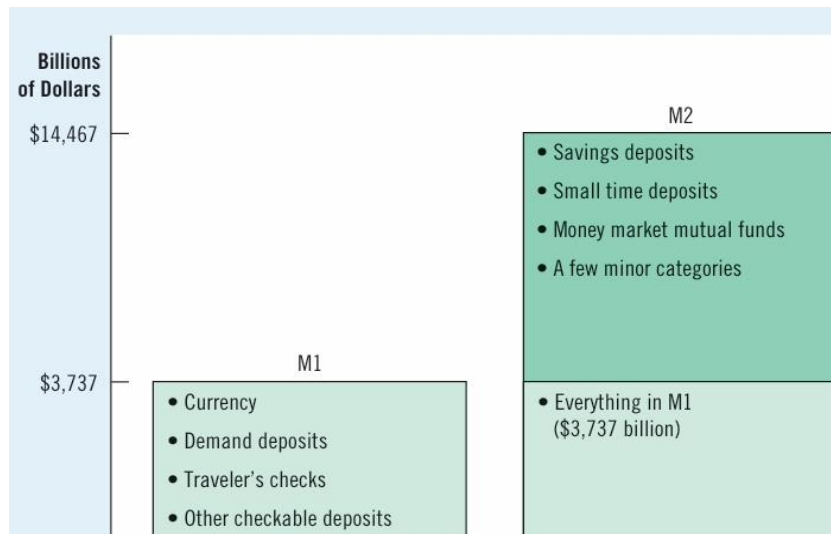
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## The Money Supply

- The **money supply** (or **money stock**): the quantity of money available in the economy
- What assets should be considered part of the money supply? Two candidates:
  - **Currency**: the paper bills and coins in the hands of the (non-bank) public
  - **Demand deposits**: balances in bank accounts that depositors can access on demand by writing a check

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## Measures of the U.S. Money Supply



Two Measures of the Money Stock for the U.S. Economy

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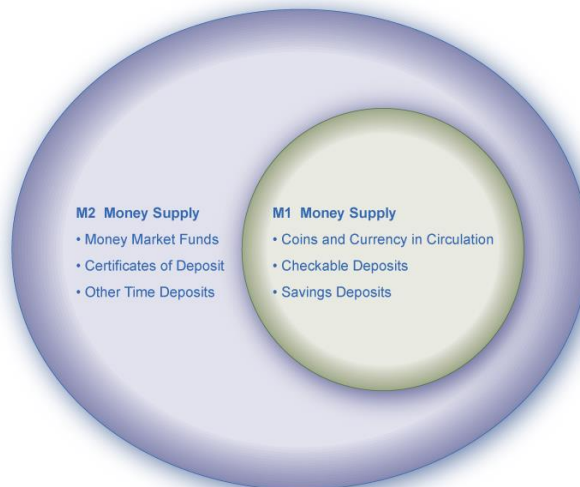
## Measures of the U.S. Money Supply

- **M1**: currency, demand deposits, traveler's checks, and other checkable deposits.  
M1 = \$1.4 trillion (June 2008)
- **M2**: everything in M1 plus savings deposits, small time deposits, money market mutual funds, and a few minor categories.  
M2 = \$7.7 trillion (June 2008)

***The distinction between M1 and M2 will usually not matter when we talk about "the money supply" in this course.***

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## Measures of the U.S. Money Supply



**The Relationship between M1 and M2 Money** M1 and M2 money have several definitions, ranging from narrow to broad. M1 = coins and currency in circulation + checkable (demand) deposit + savings deposits. M2 = M1 + money market funds + certificates of deposit + other time deposits.

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## QuickQuiz

1. Fiat money is
  - a. a type of money with intrinsic value.
  - b. a type of money set by government decree
  - c. any asset used as the medium of exchange.
  - d. any asset used as the unit of account.

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## QuickQuiz

2. The money stock includes all of the following EXCEPT

- a. metal coins.
- b. paper currency.
- c. lines of credit accessible with credit cards.
- d. bank balances accessible with debit cards.

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## Central Banks & Monetary Policy

- **Central bank:** an institution that oversees the banking system and regulates the money supply
- *Examples of central banks around the world*
- **Monetary policy:** the setting of the money supply by policymakers in the central bank
- **Federal Reserve (Fed):** the central bank of the U.S.

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## Bank Reserves

- In a **fractional reserve banking system**, banks keep a fraction of deposits as **reserves** and use the rest to make loans.
- The Central bank establishes **reserve requirements**, regulations on the minimum amount of reserves that banks must hold against deposits.
- Banks may hold more than this minimum amount if they choose.
- The **reserve ratio**,  $R$   
 = fraction of deposits that banks hold as reserves  
 = total reserves as a percentage of total deposits 18

## Bank T-account

- **T-account**: a simplified accounting statement that shows a bank's assets & liabilities.
- Example:

FIRST NATIONAL BANK			
Assets		Liabilities	
Reserves	\$ 10	Deposits	\$100
Loans	\$ 90		

- Banks' liabilities include deposits, assets include loans & reserves.
- In this example, notice that  $R = \$10/\$100 = 10\%$ .

## Banks and the Money Supply: An Example

Suppose \$100 of currency is in circulation.

To determine banks' impact on money supply, we calculate the money supply in 3 different cases:

1. No banking system
2. 100% reserve banking system:  
banks hold 100% of deposits as reserves,  
make no loans
3. Fractional reserve banking system

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## Banks and the Money Supply: An Example

### **CASE 1: No banking system**

Public holds the \$100 as currency.

Money supply = \$100.

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## Banks and the Money Supply: An Example

### CASE 2: 100% reserve banking system

Public deposits the \$100 at First National Bank (FNB).

FNB holds  
100% of  
deposit  
as reserves:

FIRST NATIONAL BANK			
Assets		Liabilities	
Reserves	\$100	Deposits	\$100
Loans	\$ 0		

Money supply

$$= \text{currency} + \text{deposits} = \$0 + \$100 = \underline{\$100}$$

***In a 100% reserve banking system,  
banks do not affect size of money supply.***

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## Banks and the Money Supply: An Example

### CASE 3: Fractional reserve banking system

Suppose  $R = 10\%$ . FNB loans all but 10% of the deposit:

FIRST NATIONAL BANK			
Assets		Liabilities	
Reserves	\$ 10	Deposits	\$100
Loans	\$ 90		

Money supply = \$190 (!!!)

Depositors have \$100 in deposits,  
Borrowers have \$90 in currency.

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## Banks and the Money Supply: An Example

### CASE 3: Fractional reserve banking system

How did the money supply suddenly grow?

When banks make loans, they create money.

The borrower gets

- \$90 in currency (an asset counted in the money supply)
- \$90 in new debt (a liability)

***A fractional reserve banking system creates money, but not wealth.***

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## Banks and the Money Supply: An Example

### CASE 3: Fractional reserve banking system

Suppose borrower deposits the \$90 at Second National Bank (SNB).

Initially, SNB's T-account looks like this:

SECOND NATIONAL BANK			
Assets		Liabilities	
Reserves	\$ 9	Deposits	\$ 90
Loans	\$ 81		

If  $R = 10\%$  for SNB, it will loan all but 10% of the deposit.

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## Banks and the Money Supply: An Example

### CASE 3: Fractional reserve banking system

The borrower deposits the \$81 at Third National Bank (TNB).

Initially, TNB's  
T-account  
looks like this:

THIRD NATIONAL BANK			
Assets		Liabilities	
Reserves	\$ 8.10	Deposits	\$ 81
Loans	\$72.90		

If  $R = 10\%$  for TNB, it will loan all but 10% of the deposit.

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## Banks and the Money Supply: An Example

### CASE 3: Fractional reserve banking system

The process continues, and money is created with each new loan.

Original deposit	=	\$ 100.00
FNB lending	=	\$ 90.00
SNB lending	=	\$ 81.00
TNB lending	=	\$ 72.90
⋮		⋮
<hr/>		
Total money supply	=	\$1000.00

***In this example, \$100 of reserves generates \$1000 of money.***

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## The Money Multiplier

Second National Bank			
Assets		Liabilities	
Reserves	\$ 9.00	Deposits	\$90.00
Loans	81.00		

Third National Bank			
Assets		Liabilities	
Reserves	\$ 8.10	Deposits	\$81.00
Loans	72.90		

Original deposit	= \$100.00
First National lending	= \$ 90.00 (= .9 × \$100.00)
Second National lending	= \$ 81.00 (= .9 × \$90.00)
Third National lending	= \$ 72.90 (= .9 × \$81.00)
•	•
•	•
•	•
<hr/>	
Total money supply	= \$1,000.00

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## The Money Multiplier

- **Money multiplier**: the amount of money the banking system generates with each dollar of reserves
- The money multiplier equals  $1/R$ .
- The higher the reserve ratio, the less of each deposit banks loan out, and the smaller the money multiplier
- In our example,
  - $R = 10\%$
  - money multiplier =  $1/R = 10$
  - \$100 of reserves creates \$1000 of money

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## QuickQuiz

3. Which of the following is NOT true about the Federal Reserve?
- a. It was established by the U.S. Constitution.
  - b. It regulates the banking system.
  - c. It lends to banks.
  - d. It conducts open-market operations.

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### ACTIVE LEARNING 1

## Banks and the money supply

While cleaning your apartment, you look under the sofa cushion find a \$50 bill (and a half-eaten taco). You deposit the bill in your checking account.

The Fed's reserve requirement is 20% of deposits.

- A. What is the maximum amount that the money supply could increase?
- B. What is the minimum amount that the money supply could increase?

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## ACTIVE LEARNING 1

### Answers

You deposit \$50 in your checking account.

- A.** What is the maximum amount that the money supply could increase?

If banks hold no excess reserves, then

$$\text{money multiplier} = 1/R = 1/0.2 = 5$$

The maximum possible increase in deposits is

$$5 \times \$50 = \$250$$

But money supply also includes currency, which falls by \$50.

Hence, max increase in money supply = \$200.

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## ACTIVE LEARNING 1

### Answers

You deposit \$50 in your checking account.

- A.** What is the maximum amount that the money supply could increase?

**Answer:** \$200

- B.** What is the minimum amount that the money supply could increase?

**Answer:** \$0

If your bank makes no loans from your deposit, currency falls by \$50, deposits increase by \$50, money supply does not change.

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## The Fed's 3 Tools of Monetary Control

1. **Open-Market Operations (OMOs)**: the purchase and sale of U.S. government bonds by the Fed.
  - To increase money supply, Fed buys govt bonds, paying with new dollars.  
...which are deposited in banks, increasing reserves  
...which banks use to make loans, causing the money supply to expand.
  - To reduce money supply, Fed sells govt bonds, taking dollars out of circulation, and the process works in reverse.

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## The Fed's 3 Tools of Monetary Control

1. **Open-Market Operations (OMOs)**: the purchase and sale of U.S. government bonds by the Fed.
  - OMOs are easy to conduct, and are the Fed's monetary policy tool of choice.

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## The Fed's 3 Tools of Monetary Control

### 2. Reserve Requirements (RR):

affect how much money banks can create by making loans.

- To increase money supply, Fed reduces RR.  
Banks make more loans from each dollar of reserves, which increases money multiplier and money supply.
- To reduce money supply, Fed raises RR, and the process works in reverse.
- Fed rarely uses reserve requirements to control money supply: Frequent changes would disrupt banking.

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## The Fed's 3 Tools of Monetary Control

### 3. The Discount Rate:

the interest rate on loans the Fed makes to banks

- When banks are running low on reserves, they may borrow reserves from the Fed.
- To increase money supply,  
Fed can lower discount rate, which encourages banks to borrow more reserves from Fed.
- Banks can then make more loans, which increases the money supply.
- To reduce money supply, Fed can raise discount rate.

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## The Fed's 3 Tools of Monetary Control

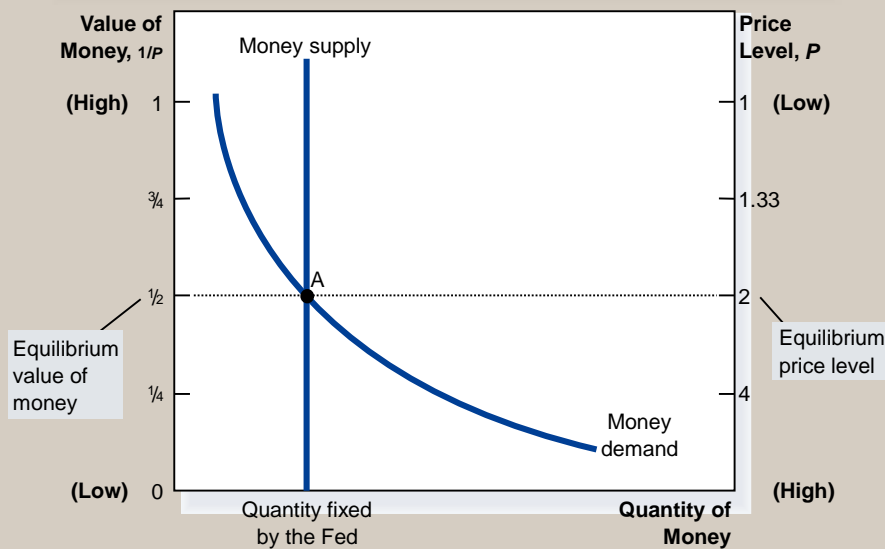
### 3. The Discount Rate:

the interest rate on loans the Fed makes to banks

- The Fed uses discount lending to provide extra liquidity when financial institutions are in trouble, e.g. after the Oct. 1987 stock market crash.
- If no crisis, Fed rarely uses discount lending – Fed is a “lender of last resort.”

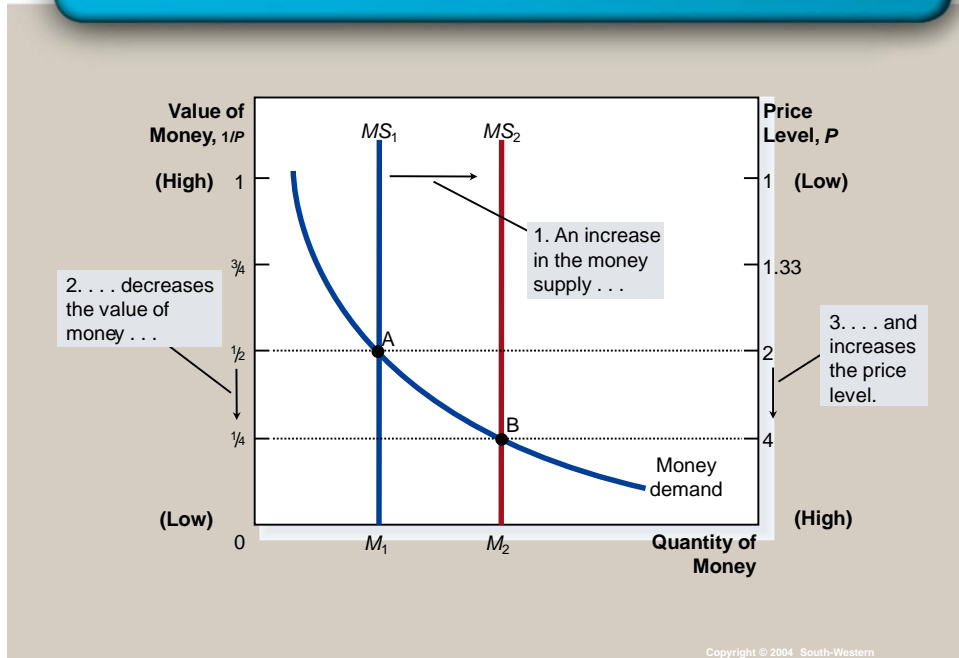
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**Figure Money Supply, Money Demand, and the Equilibrium Price Level**



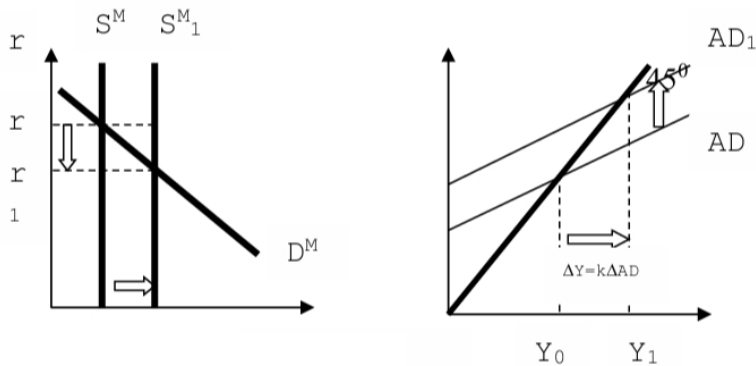
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## Figure The Effects of Monetary Injection



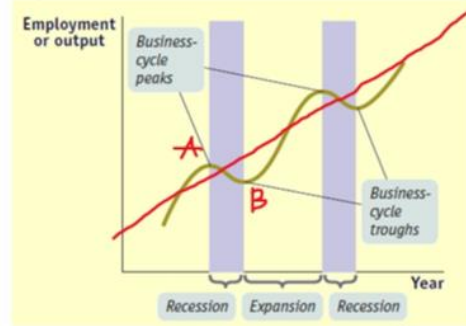
## Monetary policy

$Y_t < Y_P$ :



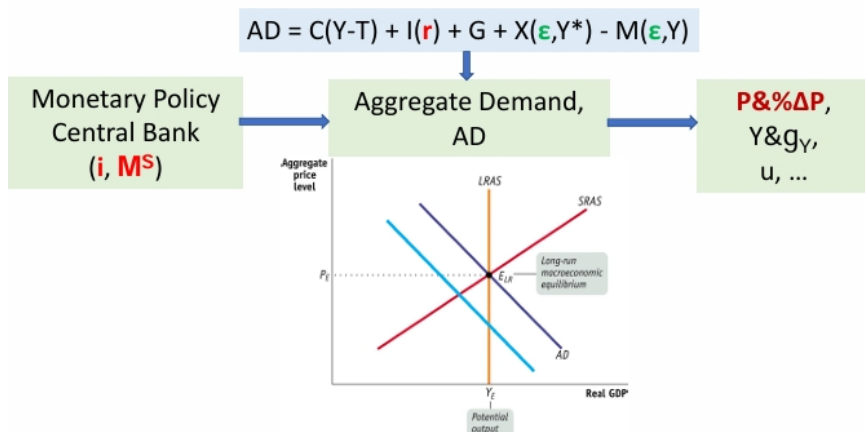
## Monetary Policy

- **Central Bank** ( $i, M^s$ )  $\Rightarrow AD \Rightarrow P \& \% \Delta P, Y \& g_Y, u, \dots$
- **Business Cycle:**
  - **Expansionary** Monetary Policy ( $i?, M^s?$ )
  - **Contractionary** Monetary Policy ( $i?, M^s?$ )
- **Liquidity Trap** [Bẫy thanh khoản]



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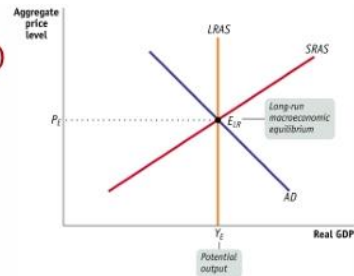
## Monetary Policy



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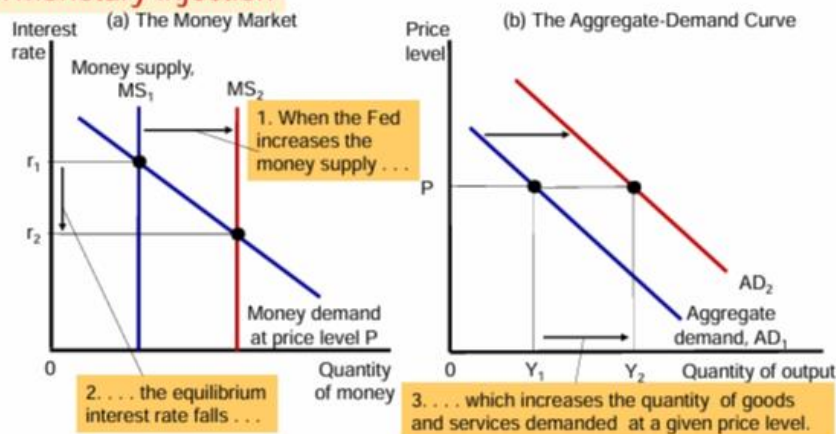
## Monetary Policy Influences AD

- Aggregate-demand curve shifts
  - Quantity of goods and services demanded changes
  - For a given price level
- Monetary policy
  - Increase in money supply
  - Decrease in money supply
  - **Shifts AD curve**
- Changes in monetary policy – **Expansionary Monetary Policy**
  - Aimed at **expanding aggregate demand**
    - Increasing the money supply
    - Lowering the interest rate
- Changes in monetary policy – **Contractionary Monetary Policy**
  - Aimed at **contracting aggregate demand**
    - Decreasing the money supply
    - Raising the interest rate



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### A Monetary Injection

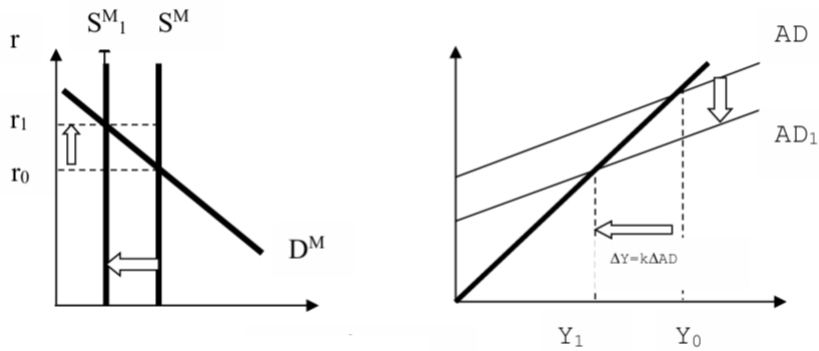


In panel (a), an increase in the money supply from  $MS_1$  to  $MS_2$  reduces the equilibrium interest rate from  $r_1$  to  $r_2$ . Because the interest rate is the cost of borrowing, the fall in the interest rate raises the quantity of goods and services demanded at a given price level from  $Y_1$  to  $Y_2$ . Thus, in panel (b), the aggregate-demand curve shifts to the right from  $AD_1$  to  $AD_2$ .

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## Monetary policy

$$Y_t > Y_P$$



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## Problems Controlling the Money Supply

- If households hold more of their money as currency, banks have fewer reserves, make fewer loans, and money supply falls.
- If banks hold more reserves than required, they make fewer loans, and money supply falls.
- Yet, Fed can compensate for household and bank behavior to retain fairly precise control over the money supply.

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## QuickQuiz

4. If the Fed wants to increase the money supply, it can
- a. raise income tax rates.
  - b. reduce income tax rates.
  - c. buy bonds in open-market operations.
  - d. sell bonds in open-market operations.

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## QuickQuiz

5. Isabella takes \$100 of currency from her wallet and deposits it into her checking account. If the bank adds the entire \$100 to reserves, the money supply \_\_\_\_\_, but if the bank lends out some of the \$100, the money supply \_\_\_\_\_.
- a. increases; increases even more
  - b. increases; increases by less
  - c. is unchanged; increases
  - d. decreases; decreases by less

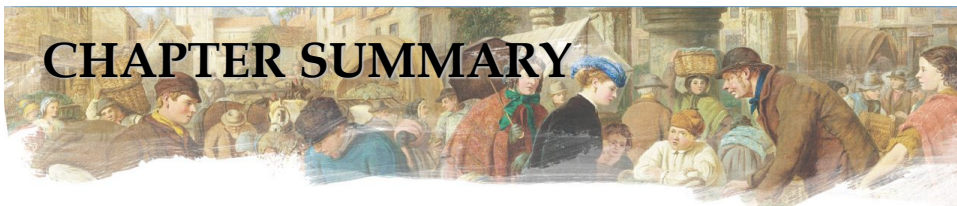
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## QuickQuiz

6. If the reserve ratio is  $\frac{1}{4}$  and the central bank increases the quantity of reserves in the banking system by \$120, the money supply increases by

- a. \$90.
- b. \$150.
- c. \$160.
- d. \$480.

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- Money includes currency and various types of bank deposits.
- The Federal Reserve is the central bank of the U.S., is responsible for regulating the monetary system.
- The Fed controls the money supply mainly through open-market operations. Purchasing govt bonds increases the money supply, selling govt bonds decreases it.

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## CHAPTER SUMMARY

- In a fractional reserve banking system, banks create money when they make loans. Bank reserves have a multiplier effect on the money supply.

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## QUESTIONS FOR REVIEW

- 1. What distinguishes money from other assets in the economy?
- 2. What is commodity money? What is fiat money? Which kind do we use?
- 3. What are demand deposits and why should they be included in the stock of money?

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## MULTIPLE CHOICE

1. Money
  - a. is more efficient than barter.
  - b. makes trades easier.
  - c. allows greater specialization.
  - d. All of the above are correct.

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## MULTIPLE CHOICE

2. Paper money
  - a. has a high intrinsic value.
  - b. is the primary medium of exchange in a barter economy.
  - c. is valuable because it is generally accepted in trade
  - d. is valuable only because of the legal tender requirement.

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## MULTIPLE CHOICE

3. Consider the following traders who meet.

Bob	has an apple	wants an orange
Ted	has an orange	wants a peach
Mary	has a pear	wants an apple
Alice	has a peach	wants an orange

Which if any pairs have a double coincidence of wants?

- a. Bob with Alice
- b. Ted with Alice
- c. Bob with Mary, Ted with Bob, and Ted with Alice
- d. None of the pairs above have a coincidence of wants with each other

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## MULTIPLE CHOICE

4. The money supply increases when the Fed

- a. lowers the discount rate. The increase will be larger the smaller the reserve ratio is.
- b. lowers the discount rate. The increase will be larger the larger the reserve ratio is.
- c. raises the discount rate. The increase will be larger the smaller the reserve ratio is.
- d. raises the discount rate. The increase will be larger the larger the reserve ratio is.

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## MULTIPLE CHOICE

5. The “yardstick” people use to post prices and record debts is called
- a. a medium of exchange.
  - b. a unit of account.
  - c. a store of value.
  - d. liquidity.

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## MULTIPLE CHOICE

6. Mia puts money into a piggy bank so she can spend it later. What function of money does this illustrate?
- a. store of value
  - b. medium of exchange
  - c. unit of account
  - d. None of the above is correct.

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## MULTIPLE CHOICE

7. Other things the same, if the Fed raises the discount rate, then banks choose to borrow
- a. more from the Fed so reserves increase.
  - b. more from the Fed so reserves decrease.
  - c. less from the Fed so reserves increase.
  - d. less from the Fed so reserves decrease.

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## MULTIPLE CHOICE

8. If the Fed sells government bonds to the public, bank reserves tend to
- a. increase and the money supply increases.
  - b. increase and the money supply decreases.
  - c. decrease and the money supply increases.
  - d. decrease and the money supply decreases.

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## MULTIPLE CHOICE

9. Which of the following functions of money is also a common function of most other financial assets?
- a. a unit of account
  - b. a store of value
  - c. medium of exchange
  - d. None of the above is correct.

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## MULTIPLE CHOICE

10. Liquidity refers to
- a. the ease with which an asset is converted to the medium of exchange.
  - b. a measurement of the intrinsic value of commodity money.
  - c. the suitability of an asset to serve as a store of value.
  - d. how many time a dollar circulates in a given year.

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## MULTIPLE CHOICE

11. Which list ranks assets from most to least liquid?
- a. currency, fine art, stocks
  - b. currency, stocks, fine art
  - c. fine art, currency, stocks
  - d. fine art, stocks, currency

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## MULTIPLE CHOICE

12. Current U.S. currency is
- a. fiat money with intrinsic value.
  - b. fiat money with no intrinsic value.
  - c. commodity money with intrinsic value.
  - d. commodity money with no intrinsic value.

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## MULTIPLE CHOICE

13. If an economy used gold as money, its money would be

- a. commodity money, but not fiat money.
- b. fiat money, but not commodity money
- c. both fiat and commodity money.
- d. neither fiat nor commodity money.

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## MULTIPLE CHOICE

14. Which of the following isn't included in either M1 or M2?

- a. U.S. Treasury bills
- b. small time deposits
- c. demand deposits
- d. money market mutual funds

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## MULTIPLE CHOICE

15. Monetary policy affects employment

- a. only in the long run.
- b. only in the short run.
- c. in both the long run and the short run.
- d. in neither the long run nor the short run.

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## MULTIPLE CHOICE

16. Other things the same if reserve requirements are decreased, the reserve ratio

- a. decreases, the money multiplier increases, and the money supply decreases.
- b. increases, the money multiplier increases, and the money supply increases.
- c. decreases, the money multiplier increases, and the money supply increases.
- d. increases, the money multiplier increases, and the money supply decreases.

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## EXERCISE

Use the balance sheet for the following questions.  
Table 29-2 First Bank of Mason City

<b>Assets</b>		<b>Liabilities</b>	
Required Reserves	\$20.00	Deposits	\$100.00
Loans	\$80.00		

- a) Refer to Table 29-2. What is the reserve ratio?
- b) Refer to Table 29-2. If \$1,000 is deposited into the First Bank of Mason City, the bank takes no other actions, how about the assets of the Bank? Will assets increase or reduce?

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## EXERCISE

Use the balance sheet for the following questions.  
Table 29-2 First Bank of Mason City

<b>Assets</b>		<b>Liabilities</b>	
Required Reserves	\$20.00	Deposits	\$100.00
Loans	\$80.00		

- c) Refer to Table 29-2. If someone deposits \$400 into the First Bank of Mason City, what are the additional loans? Does the bank have any changes in the required reserves?

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## Money: Definition

**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

## Discussion Question

Which of these are money?

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

## 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.

CHAPTER 4 *Money and Inflation*

## 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").



*The Federal Reserve Building  
Washington, DC*

CHAPTER 4 *Money and Inflation*

## Money supply measures, May 2007

symbol	assets included	amount (\$ billions)
<b>C</b>	Currency	\$755
<b>M1</b>	<b>C</b> + demand deposits, travelers' checks, other checkable deposits	\$1377
<b>M2</b>	<b>M1</b> + small time deposits, savings deposits, money market mutual funds, money market deposit accounts	\$7227

## The Quantity Theory of Money

- A simple theory linking the inflation rate to the growth rate of the money supply.
- Begins with the concept of **velocity**...



## Velocity

- basic concept: the rate at which money circulates
- definition: the number of times the average dollar bill changes hands in a given time period
- example: In 2007,
  - \$500 billion in transactions
  - money supply = \$100 billion
  - The average dollar is used in five transactions in 2007
  - So, velocity = 5

## Velocity, *cont.*

- This suggests the following definition:

$$V = \frac{T}{M}$$

where

***V*** = velocity

***T*** = value of all transactions

***M*** = money supply

## Velocity, *cont.*

- Use nominal GDP as a proxy for total transactions.

Then,

$$V = \frac{P \times Y}{M}$$

where

$P$  = price of output (GDP deflator)

$Y$  = quantity of output (real GDP)

$P \times Y$  = value of output (nominal GDP)

## The quantity equation

- The **quantity equation**

$$M \times V = P \times Y$$

follows from the preceding definition of velocity.

- It is an *identity*:  
it holds by definition of the variables.

## Money demand and the quantity equation

- $M/P$  = **real money balances**, the purchasing power of the money supply.
- A simple money demand function:  

$$(M/P)^d = kY$$
 where  
 $k$  = how much money people wish to hold for each dollar of income.  
 $(k$  is exogenous)

## Money demand and the quantity equation

- money demand:  $(M/P)^d = kY$
- quantity equation:  $M \times V = P \times Y$
- The connection between them:  $k = 1/V$
- When people hold lots of money relative to their incomes ( $k$  is high), money changes hands infrequently ( $V$  is low).

## Back to the quantity theory of money

- starts with quantity equation
- assumes  $V$  is constant & exogenous:  $V = \bar{V}$
- With this assumption, the quantity equation can be written as

$$M \times \bar{V} = P \times Y$$

## The quantity theory of money, *cont.*

$$M \times \bar{V} = P \times Y$$

How the price level is determined:

- With  $V$  constant, the money supply determines nominal GDP ( $P \times Y$ ).
- Real GDP is determined by the economy's supplies of  $K$  and  $L$  and the production function (Chap 3).
- The price level is  
 $P = (\text{nominal GDP})/(\text{real GDP}).$

## The quantity theory of money, *cont.*

- *Recall from Chapter 2:*  
The growth rate of a product equals the sum of the growth rates.
- The quantity equation in growth rates:

$$\frac{\Delta \mathbf{M}}{\mathbf{M}} + \frac{\Delta \mathbf{V}}{\mathbf{V}} = \frac{\Delta \mathbf{P}}{\mathbf{P}} + \frac{\Delta \mathbf{Y}}{\mathbf{Y}}$$

The quantity theory of money assumes  $\mathbf{V}$  is constant, so  $\frac{\Delta \mathbf{V}}{\mathbf{V}} = 0$ .

## The quantity theory of money, *cont.*

$\pi$  (Greek letter “pi”)  
denotes the inflation rate:

$$\pi = \frac{\Delta \mathbf{P}}{\mathbf{P}}$$

The result from the  
preceding slide was:

$$\frac{\Delta \mathbf{M}}{\mathbf{M}} = \frac{\Delta \mathbf{P}}{\mathbf{P}} + \frac{\Delta \mathbf{Y}}{\mathbf{Y}}$$

Solve this result  
for  $\pi$  to get

$$\pi = \frac{\Delta \mathbf{M}}{\mathbf{M}} - \frac{\Delta \mathbf{Y}}{\mathbf{Y}}$$

## The quantity theory of money, *cont.*

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

- Normal economic growth requires a certain amount of money supply growth to facilitate the growth in transactions.
- Money growth in excess of this amount leads to inflation.

## The quantity theory of money, *cont.*

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y}$$

$\Delta Y/Y$  depends on growth in the factors of production and on technological progress (all of which we take as given, for now).

***Hence, the Quantity Theory predicts a one-for-one relation between changes in the money growth rate and changes in the inflation rate.***

## Confronting the quantity theory with data

The quantity theory of money implies

1. countries with higher money growth rates should have higher inflation rates.
2. the long-run trend behavior of a country's inflation should be similar to the long-run trend in the country's money growth rate.

*Are the data consistent with these implications?*

## Money Supply and Money Demand

## In this part, you will learn...

- how the banking system “creates” money
- three ways the Fed can control the money supply, and why the Fed can’t control it precisely
- Theories of money demand
  - a portfolio theory
  - a transactions theory: the Baumol-Tobin model

## Banks’ role in the money supply

- The money supply equals currency plus demand (checking account) deposits:

$$M = C + D$$

- Since the money supply includes demand deposits, the 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

With no banks,

$$D = 0 \quad \text{and} \quad M = C = \$1000.$$

## SCENARIO 2: 100-percent reserve banking

- Initially  $C = \$1000$ ,  $D = \$0$ ,  $M = \$1,000$ .
- Now suppose households deposit the \$1,000 at "Firstbank."

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	deposits \$1,000
loans \$800	

The money supply now equals \$1,800:

- Depositor has \$1,000 in demand deposits.
- Borrower holds \$800 in currency.

### SCENARIO 3: Fractional-reserve banking

*Thus, in a fractional-reserve banking system, banks create money.*

<b>FIRSTBANK'S balance sheet</b>	
Assets	Liabilities
reserves \$200	deposits \$1,000
loans \$800	

The money supply now equals \$1,800:

- Depositor has \$1,000 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:

<b>SECONDBANK'S balance sheet</b>	
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*

## Solving for the money supply:

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

where

$$\begin{aligned} \mathbf{m} &= \frac{\mathbf{C} + \mathbf{D}}{\mathbf{B}} \\ &= \frac{\mathbf{C} + \mathbf{D}}{\mathbf{C} + \mathbf{R}} = \frac{(\mathbf{C}/\mathbf{D}) + (\mathbf{D}/\mathbf{D})}{(\mathbf{C}/\mathbf{D}) + (\mathbf{R}/\mathbf{D})} = \frac{\mathbf{cr} + 1}{\mathbf{cr} + \mathbf{rr}} \end{aligned}$$

## The money multiplier

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

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

## Exercise

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

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  
 $\Delta \mathbf{cr} > 0$ .

1. An increase in  $\mathbf{cr}$  increases the denominator of  $\mathbf{m}$  proportionally more than the numerator. So  $\mathbf{m}$  falls, causing  $\mathbf{M}$  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

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

### Open-market operations

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



## Reserve requirements

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

## The discount rate

- *definition:*  
The interest rate that the Fed charges on loans it makes to banks.
- *how it works:*  
When banks borrow from the Fed, their reserves increase, allowing them to make more loans and  
“create” more money.  
The Fed can increase ***B*** by lowering the discount rate to induce banks to borrow more reserves from the Fed.

### 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 Fed is a “lender of last resort,”  
does not usually make loans to banks  
on demand.

### Why the Fed can't precisely control $M$

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

- 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.

### CASE STUDY: Bank failures in the 1930s

- From 1929 to 1933,
  - Over 9,000 banks closed.
  - Money supply fell 28%.
- This drop in the money supply may have caused the Great Depression.

It certainly contributed to the severity of the Depression.

### CASE STUDY: Bank failures in the 1930s

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

- Loss of confidence in banks  
 $\Rightarrow \uparrow \mathbf{cr} \Rightarrow \downarrow \mathbf{m}$
- Banks became more cautious  
 $\Rightarrow \uparrow \mathbf{rr} \Rightarrow \downarrow \mathbf{m}$

### CASE STUDY: Bank failures in the 1930s

	<i>August 1929</i>	<i>March 1933</i>	<i>% change</i>
<i>M</i>	26.5	19.0	−28.3%
<i>C</i>	3.9	5.5	41.0
<i>D</i>	22.6	13.5	−40.3
<i>B</i>	7.1	8.4	18.3
<i>C</i>	3.9	5.5	41.0
<i>R</i>	3.2	2.9	−9.4
<i>m</i>	3.7	2.3	−37.8
<i>rr</i>	0.14	0.21	50.0
<i>cr</i>	0.17	0.41	141.2

### Could this happen again?

- Many policies have been implemented since the 1930s to prevent such widespread bank failures.
- *E.g.*, Federal Deposit Insurance, to prevent bank runs and large swings in the currency-deposit ratio.

## Money Demand

### Two types of theories

- Portfolio theories
  - emphasize “store of value” function
  - relevant for  $M2$ ,  $M3$
  - not relevant for  $M1$ . (As a store of value,  $M1$  is dominated by other assets.)
- Transactions theories
  - emphasize “medium of exchange” function
  - also relevant for  $M1$

### A simple portfolio theory

$$(M/P)^d = L(\underset{-}{r_s}, \underset{-}{r_b}, \underset{-}{\pi^e}, \underset{+}{W}),$$

where

$r_s$  = expected real return on stocks

$r_b$  = expected real return on bonds

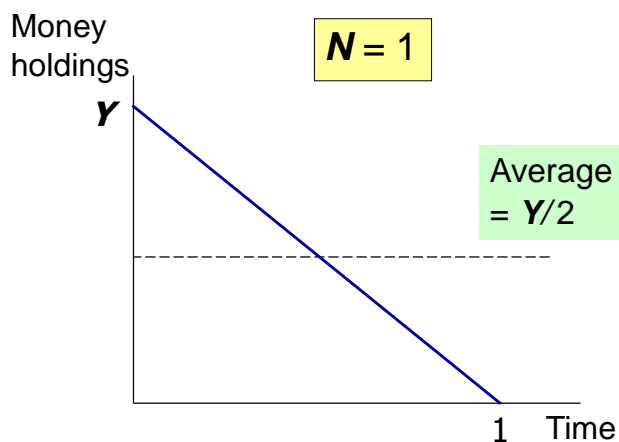
$\pi^e$  = expected inflation rate

$W$  = real wealth

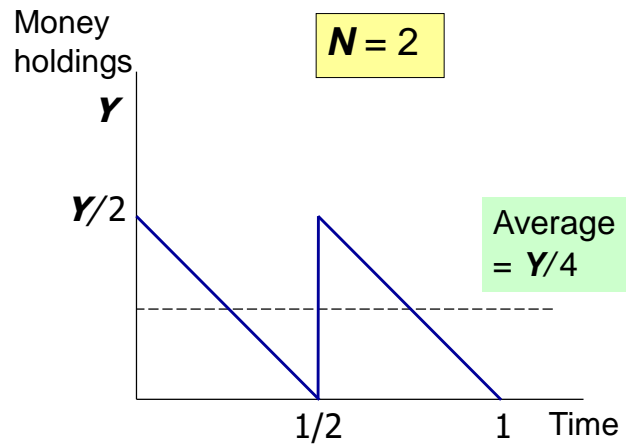
## The Baumol-Tobin Model

- a transactions theory of money demand
- notation:
  - $Y$  = total spending, done gradually over the year
  - $i$  = interest rate on savings account
  - $N$  = number of trips consumer makes to the bank to withdraw money from savings account
  - $F$  = cost of a trip to the bank  
(e.g., if a trip takes 15 minutes and consumer's wage = \$12/hour, then  $F = \$3$ )

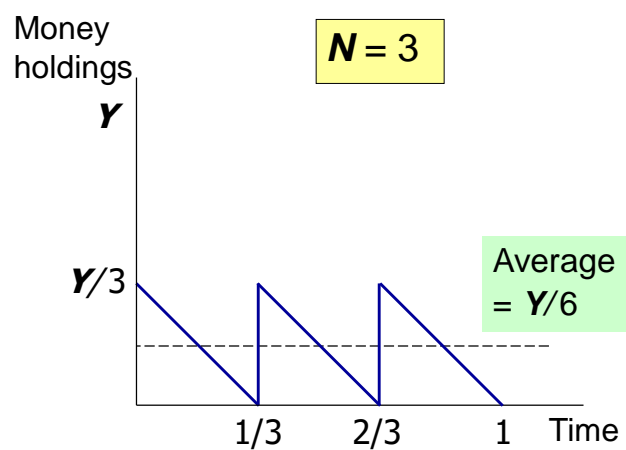
### Money holdings over the year



## Money holdings over the year



## Money holdings over the year



## The cost of holding money

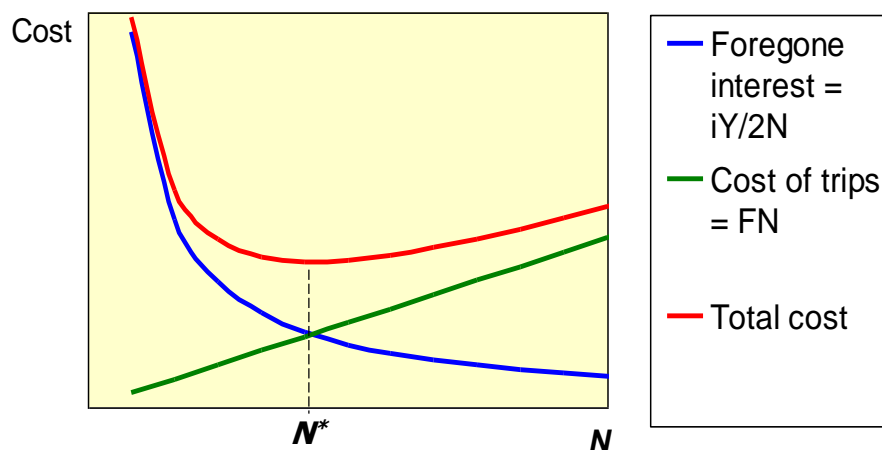
- In general, average money holdings =  $Y/2N$
- Foregone interest =  $i \times (Y/2N)$
- Cost of  $N$  trips to bank =  $F \times N$

- Thus,

$$\text{total cost} = i \times \frac{Y}{2N} + F \times N$$

- Given  $Y$ ,  $i$ , and  $F$ ,  
consumer chooses  $N$  to minimize total cost

## Finding the cost-minimizing $N$





## The money demand function

- The cost-minimizing value of  $N$ :  $N^* = \sqrt{\frac{iY}{2F}}$
- To obtain the money demand function, plug  $N^*$  into the expression for average money holdings:

$$\text{average money holding} = \sqrt{\frac{YF}{2i}}$$

- Money demand depends positively on  $Y$  and  $F$ , and negatively on  $i$ .

## The money demand function

- The Baumol-Tobin money demand function:

$$(M/P)^d = \sqrt{\frac{YF}{2i}} = L(i, Y, F)$$

How this money demand function differs from previous chapters:

- B-T shows how  $F$  affects money demand.
- B-T implies:  
income elasticity of money demand = 0.5,  
interest rate elasticity of money demand =  $-0.5$

### EXERCISE:

## The impact of ATMs on money demand



During the 1980s, automatic teller machines became widely available.

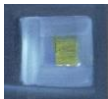
How do you think this affected  $N^*$  and money demand? Explain.

## Financial Innovation, Near Money, and the Demise of the Monetary Aggregates

- Examples of financial innovation:
  - many checking accounts now pay interest
  - very easy to buy and sell assets
  - mutual funds are baskets of stocks that are easy to redeem - just write a check
- Non-monetary assets having some of the liquidity of money are called near money.
- Money & near money are close substitutes, and switching from one to the other is easy.

## Financial Innovation, Near Money, and the Demise of the Monetary Aggregates

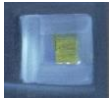
- The rise of near money makes money demand less stable and complicates monetary policy.
- 1993: the Fed switched from targeting monetary aggregates to targeting the Federal Funds rate.
- This change may help explain why the U.S. economy was so stable during the rest of the 1990s.



## Chapter Summary

1. Fractional reserve banking creates money because each dollar of reserves generates many dollars of demand deposits.
2. The money supply depends on the
  - monetary base
  - currency-deposit ratio
  - reserve ratio
3. The Fed can control the money supply with
  - open market operations
  - the reserve requirement
  - the discount rate

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## Chapter Summary

4. Portfolio theories of money demand
  - stress the store of value function
  - posit that money demand depends on risk/return of money & alternative assets
5. The Baumol-Tobin model
  - a transactions theory of money demand, stresses “medium of exchange” function
  - money demand depends positively on spending, negatively on the interest rate, and positively on the cost of converting non-monetary assets to money

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