

# Lecture 4. The Financial Markets

Reading: Blanchard, Chapter 4

# In the previous lecture...

- The Keynesian Cross:

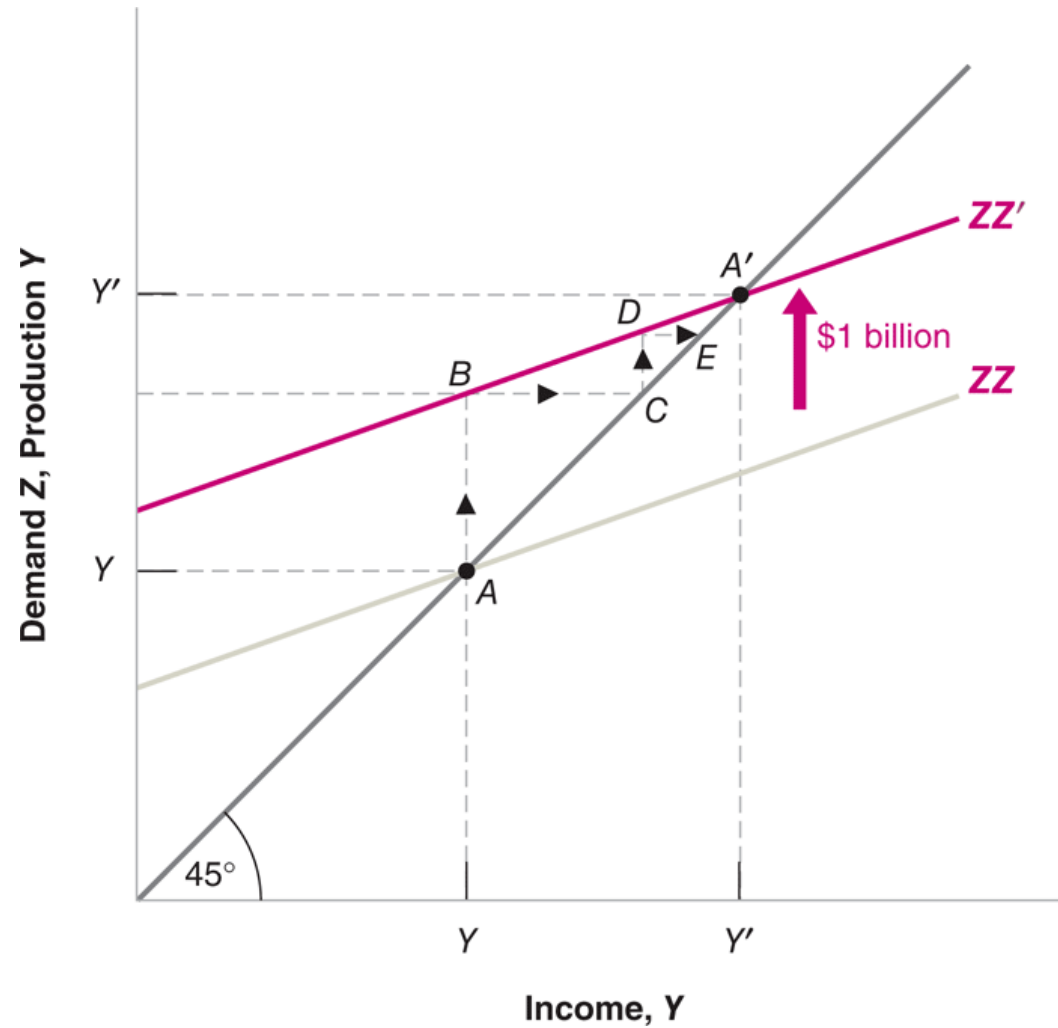
What is the equilibrium output given  $I$ ,  $T$ ,  $G$ ,  $c_0$ , and  $c_1$ ?

- What happens if either  $c_0$  or  $c_1$  changes?
- Basics of the government expenditure and taxes

# Review: What happens if firms decide to invest more?

- Demand  $Z = c_0 + c_1(Y - T) + \bar{I} + G = (c_0 + \bar{I} + G - c_1T) + c_1Y$
- Supply  $Y = Y$
- Suppose that  $\bar{I}$  increases by  $\Delta I$ .
- Remember  $Y = \frac{1}{1-c_1} (c_0 + \bar{I} + G - c_1T)$ . Thus,
$$\Delta Y = \frac{1}{1-c_1} \Delta I.$$

# Graphical illustration



# Outline

- What is Money?
- Money Demand
- Money Supply
- Determination of Interest Rate
- The Liquidity Trap

# What is Money?

- Money is the stock of financial assets that can be easily used as the medium of exchange for market transactions.

- Three functions of money:

As a **medium of exchange**,

we may also call it “liquidity”

As a **unit of account**,

to measure economic transactions

As a **store of value**,

for future transactions (but subject to inflation risk)

# What is Money?

- Money can be measured in narrow or broad terms, typically via C, M1, M2, and M3. HK has three measurements [\(M1, M2, M3\)](#)
- **C**: currency (coins and bills)
- **M1** = currency + checkable deposits (the bank deposits on which you can write checks)
- In this course, we use M1 as the definition for money.

# The Demand for Money

- The demand for money is a decision about how to allocate your financial wealth between two assets: money and bonds
- **Money**, which you can use for transactions, pays no interest.
- **Bonds** pay a positive interest rate,  $i$ , but they cannot be used for transactions.

The proportions of money and bonds you wish to hold depend mainly on two variables:

- *Your level of transactions*
- *The interest rate on bonds*



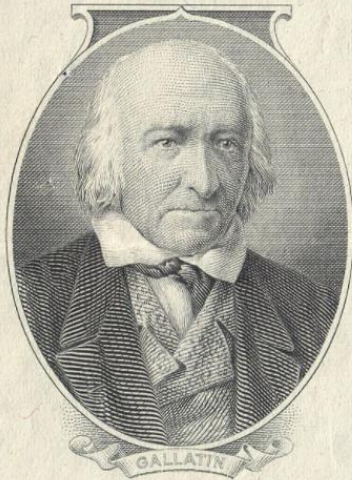
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THE  
UNITED STATES  
OF AMERICA

TREASURY BILL

100,000



TREASURY DEPARTMENT  
WASHINGTON

ON PRESENTATION OF THIS TREASURY BILL TO THE  
TREASURER OF THE UNITED STATES OR TO ANY  
FEDERAL RESERVE BANK THE UNITED STATES OF  
AMERICA WILL PAY TO THE BEARER

ONE HUNDRED THOUSAND DOLLARS

WITHOUT INTEREST ON THE DUE DATE HEREON  
SPECIFIED. THIS TREASURY BILL IS ISSUED UNDER  
AUTHORITY OF THE SECOND LIBERTY BOND ACT, AS  
AMENDED, IN ACCORDANCE WITH, AND SUBJECT TO,  
THE PROVISIONS OF TREASURY DEPARTMENT CIRCU-  
LAR NO. 418, REVISED, TO WHICH REFERENCE IS MADE  
FOR A STATEMENT OF THE RIGHTS OF HOLDERS, AS  
FULLY AND WITH THE SAME EFFECT AS THOUGH  
HEREIN SET FORTH. THIS TREASURY BILL IS ISSUED  
BY A FEDERAL RESERVE BANK OR BRANCH PURSUANT  
TO A TENDER ACCEPTED BY THE SECRETARY OF THE  
TREASURY. IT SHALL NOT BE VALID UNLESS THE  
ISSUE DATE AND THE MATURITY DATE ARE ENTERED  
HEREON.

ISSUE DATE

OCTOBER 9, 1969

DUE AND PAYABLE

APRIL 9, 1970



*David M. Kennedy*  
SECRETARY OF THE TREASURY

D  
1966-2



# One-year zero-coupon bond

- Consider a one-year zero-coupon Treasury (= risk-free) bond with a face value of \$100 and the price today, denoted by  $\$P_B$ .
- Invest  $\$P_B$  today  $\rightarrow$  \$100 in one-year
- Rate of return on holding this bond for a year:  $i = \frac{\$100 - \$P_B}{\$P_B}$ .
- Ex)  $P_B = 99 \rightarrow i = 0.01 = 1\%$ .
- What is the rate of return on holding money?

$$i = \frac{\$100 - \$P_B}{\$P_B} \Leftrightarrow \$P_B = \frac{\$100}{1 + i}$$

- The higher the price of the bond, the lower the interest rate.
- The higher the interest rate, the lower the price today.
- The bond price and the interest rate have a negative relationship.

# The Demand for Money

*The demand for money is equal to nominal income, \$Y, times a function of the interest rate,  $i$ , with the function denoted by  $L(i)$ .*

$$M^d = \$Y L(i)$$

(—)

The demand for money:

- increases in proportion to nominal income (\$Y), and
- depends negatively on the interest rate  $i$ .

# The Demand for Money

$$M^d = \$YL(i)$$

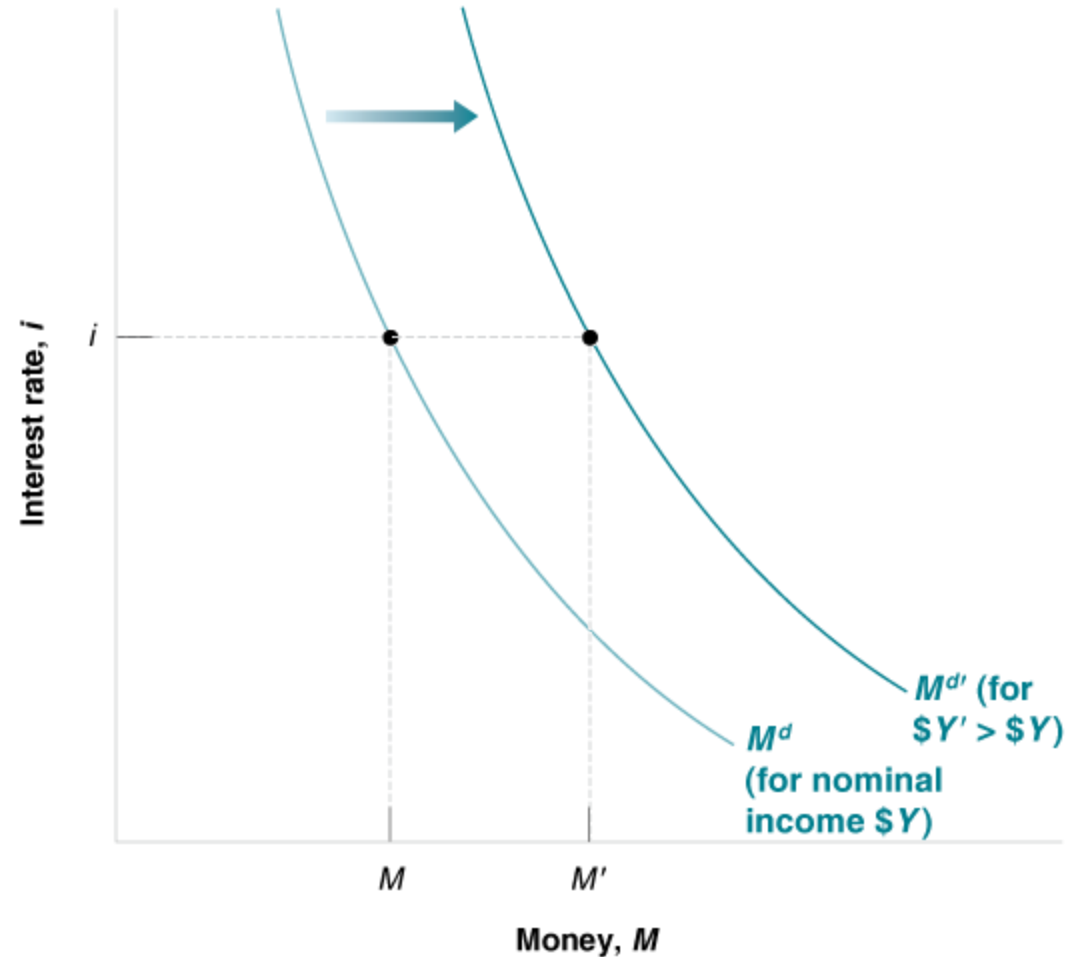
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■ **Figure 4 - 1**

## ***The Demand for Money***

For a given level of nominal income, a lower interest rate increases the demand for money.

At a given interest rate, an increase in nominal income shifts the demand for money to the right.



# The Determination of the Interest Rate, I

$$M^s = M^d = \$Y \times L(i)$$

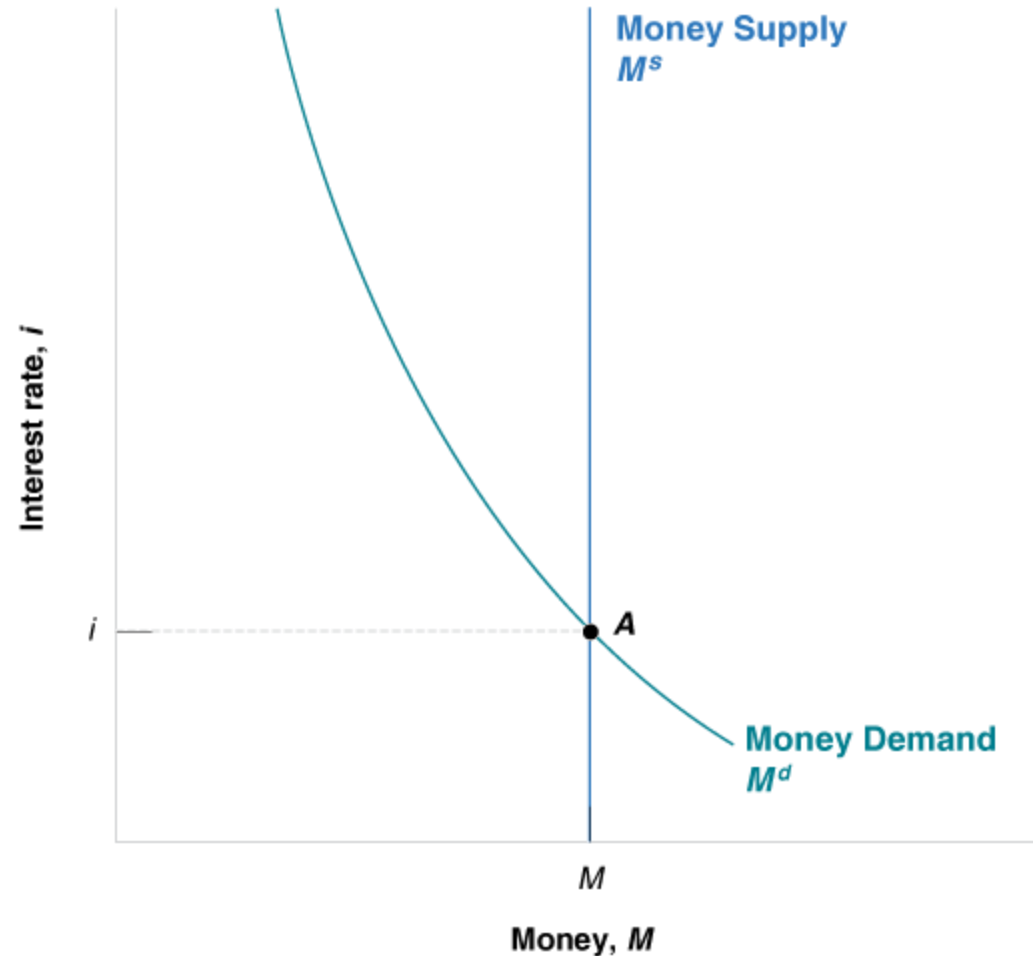
■ Figure 4 - 2

## ***The Determination of the Interest Rate***

The supply of money is independent of the interest rate.

The demand for money decreases in the interest rate.

The interest rate must be such that the supply of money is equal to the demand for money.



# Money Supply and Monetary Policy

- How is monetary policy conducted?  
Instruments of money supply.
- How is monetary policy effective?  
Determination of interest rate.

# Money Supply

- Major players:
  1. Central Bank (e.g. the Federal Reserve)
  2. Banks
  3. Depositors
  4. Borrowers from Banks
- Tools of Central Banks
  1. Open Market Operations
  2. Discount Loans
  3. Required Reserve Ratio
  4. Quantitative Easing (non-standard)



# Central Bank's Balance Sheet

Consolidated Balance Sheet of the Federal Reserve System (\$ billions, end of 2001)

Assets		Liabilities	
Securities: U.S. government and agency securities and banker's acceptances	534.0	Federal Reserve notes outstanding	580.0
Discount loans	0.1	Bank deposits (Reserves)	24.9
Gold and SDR certificate accounts	12.0	U.S. Treasury deposits	9.7
Coin	1.0	Foreign and other deposits	.6
Cash items in process of collection	6.4	Deferred-availability cash items	5.3
Other Federal Reserve assets	85.5	Other Federal Reserve liabilities and capital accounts	18.5
Total	639.0	Total	639.0

*Source: Federal Reserve Bulletin.*

# Banks' Balance Sheet

Assets (Uses of Funds)*		Liabilities (Sources of Funds)	
Reserves and Cash Items	1	Checkable deposits	10
		Nontransaction deposits	
Securities		Small-denomination time deposits	
U.S. government and agency	15	(< \$100,000) + savings deposits	48
State and local government and		Large-denomination time deposits	11
other securities	7	Borrowings	23
Loans		Bank capital	8
Commercial and industrial	18		
Real estate	35		
Consumer	6		
Interbank	11		
Other	2		
Other assets (for example,	5		
physical capital)			
Total	100	Total	100
*In order of decreasing liquidity.			
Source: Federal Reserve <i>Bulletin</i> .			

# Public's Balance Sheet

Assets (Uses of Funds)*	Liabilities (Sources of Funds)
<div><b>MONEY</b> <b>CASH (Notes + Coins)</b> <b>DEPOSITS</b></div> <b>Other Assets</b>	

# The Monetary Base

- Central bank has direct control over the **Monetary Base (Central Bank Money)**:
  - $H = \text{Monetary Base} = CU + R$
  - $CU = \text{Currency}$
  - $R = \text{Reserves} = \text{Deposits} \times \text{Reserve Ratio}$   
Reserve Ratio  $\geq$  Required reserve ratio
- The Monetary Base forms the basis for banks to create additional money through credit-creation activities.

# Open Market Operation

**Open-market operations**, which take place in the “open market” for bonds, are the standard method central banks use to change the money stock in modern economies.

If the central bank buys bonds, this operation is called an **expansionary open market operation** because the central bank increases (*expands*) the supply of money.

If the central bank sells bonds, this operation is called a **contractionary open market operation** because the central bank decreases (*contracts*) the supply of money.

### 1a. Open Market Purchase from Bank

<i>The Banking System</i>		<i>Central Bank</i>	
Assets	Liabilities	Assets	Liabilities
Securities – \$100		Securities + \$100	Reserves + \$100
Reserves + \$100			

### 1b. Open Market Purchase from Public (buyer deposits its check)

<i>Public</i>		<i>Central Bank</i>	
Assets	Liabilities	Assets	Liabilities
Securities – \$100		Securities + \$100	Reserves + \$100
Deposits + \$100			

<i>Banking System</i>	
Assets	Liabilities
Reserves +100	Checkable Deposits +100

### 1c. Open Market Purchase from Public (buyer cashes the check)

<i>Public</i>		<i>Central Bank</i>	
Assets	Liabilities	Assets	Liabilities
Securities – \$100		Securities + \$100	Currency + \$100
Currency + \$100			

Result: H ↑ \$100, R ↑ \$100 or CU ↑ \$100

# Discount Loans

The central bank can also provide reserves to the banking system by making **discount loans** to banks.

<i>Banking System</i>		<i>Central Bank</i>	
Assets	Liabilities	Assets	Liabilities
<b>Reserves</b>	<b>Discount</b>	<b>Discount</b>	<b>Reserves</b>
+ \$100	loan + \$100	loan + \$100	+ \$100

*Result:*  $R \uparrow \$100$ ,  $H \uparrow \$100$

# Credit Creation by Banks

Suppose that First National Bank obtains \$100 reserve from selling securities to the Central Bank.

First National Bank	
Assets	Liabilities
Reserves + \$100	Deposits
Securities - \$100	
Loans	

Bank A	
Assets	Liabilities
Reserves	Deposits
Loans	

Bank B	
Assets	Liabilities
Reserves	Deposits
Loans	



# Credit Creation by Banks

First National Bank then lends out \$100 to someone who deposits all \$100 to Bank A.

First National Bank	
Assets	Liabilities
Reserves	<del>XXXX</del>
Securities	
Loans	Deposits
- \$100	
+ \$100	

Bank A	
Assets	Liabilities
Reserves	Deposits
+ \$100	+ \$100
Loans	

Bank B	
Assets	Liabilities
Reserves	Deposits
Loans	

# Credit Creation by Banks

Bank A keeps \$10 as reserve and lends out \$90 to someone who then deposits it all to Bank B.

First National Bank			
Assets		Liabilities	
Reserves	<del>XXXX</del>	Deposits	
Securities	- \$100		
Loans	+ \$100		

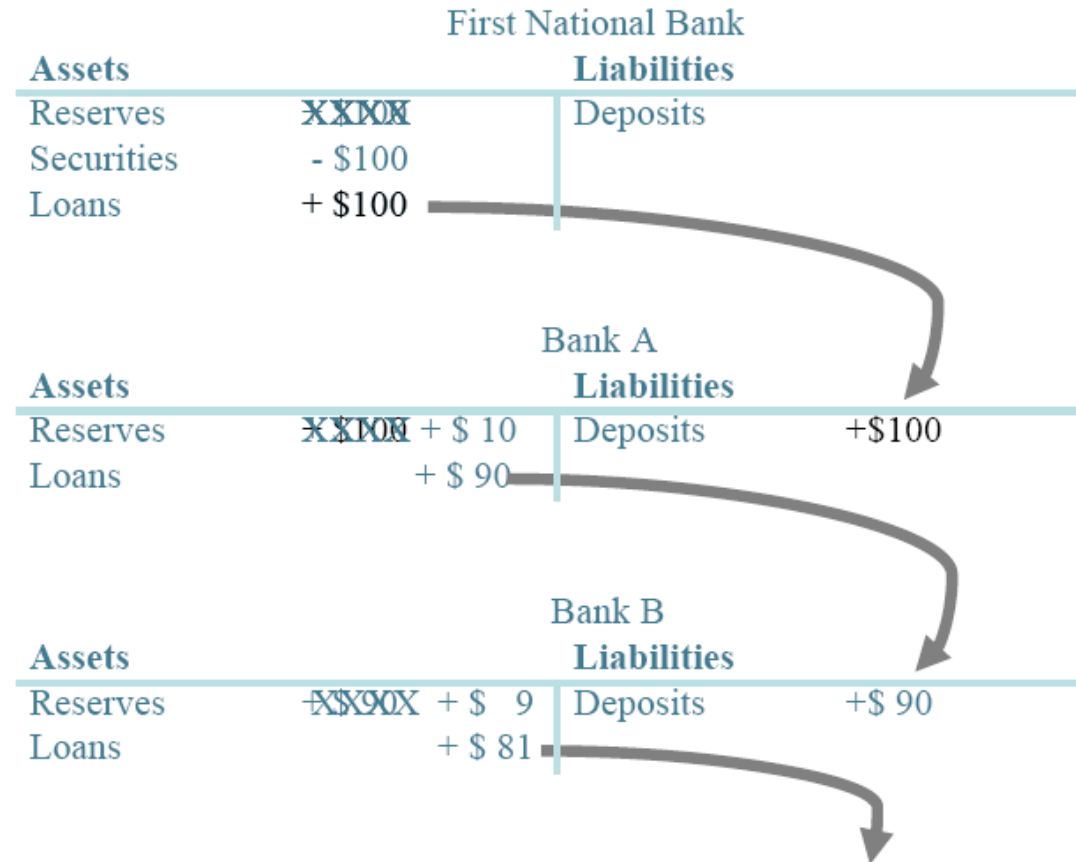
Bank A			
Assets		Liabilities	
Reserves	<del>XXXX</del> + \$ 10	Deposits	+\$100
Loans	+ \$ 90		

Bank B			
Assets		Liabilities	
Reserves	+ \$ 90	Deposits	+\$ 90
Loans			

# Credit Creation by Banks

Bank B keeps \$9 as reserve and lends out \$81 to someone who then deposits it all to Bank C. So on and so forth.



# Credit Creation by Banks

Bank	Increase in Deposits (\$)	Increase in Loans (\$)	Increase in Reserves (\$)
First National	0.00	100.00	0.00
A	100.00	90.00	10.00
B	90.00	81.00	9.00
C	81.00	72.90	8.10
D	72.90	65.61	7.29
E	65.61	59.05	6.56
F	59.05	53.14	5.91
.	.	.	.
.	.	.	.
.	.	.	.
Total for all banks	1000.00	1000.00	100.00

\$100 reserve is multiplied to be \$1000 checkable deposits.  
Here: Multiplier =  $1 / \text{Reserve Ratio}$

# Determination of Interest Rates II

- Demand for Currency and Checkable Deposits:
  - Assume an exogenous fraction of this money is held in currency. Denote the fraction by  $c$ .

Demand for currency:  $CU^d = cM^d$

Demand for checkable deposits:  $D^d = (1 - c)M^d$

# Determination of Interest Rates II

- Demand for Reserves:

- The larger the amount of checkable deposits, the larger the amount of reserves the banks must hold, both for precautionary and for legal reasons.

Relation between deposits (D) and reserves (R):  $R = \theta D$

Demand for reserves by banks:  $R^d = \theta(1 - c)M^d$

# Determination of Interest Rates II

- Demand for Central Bank Money (Monetary Base):

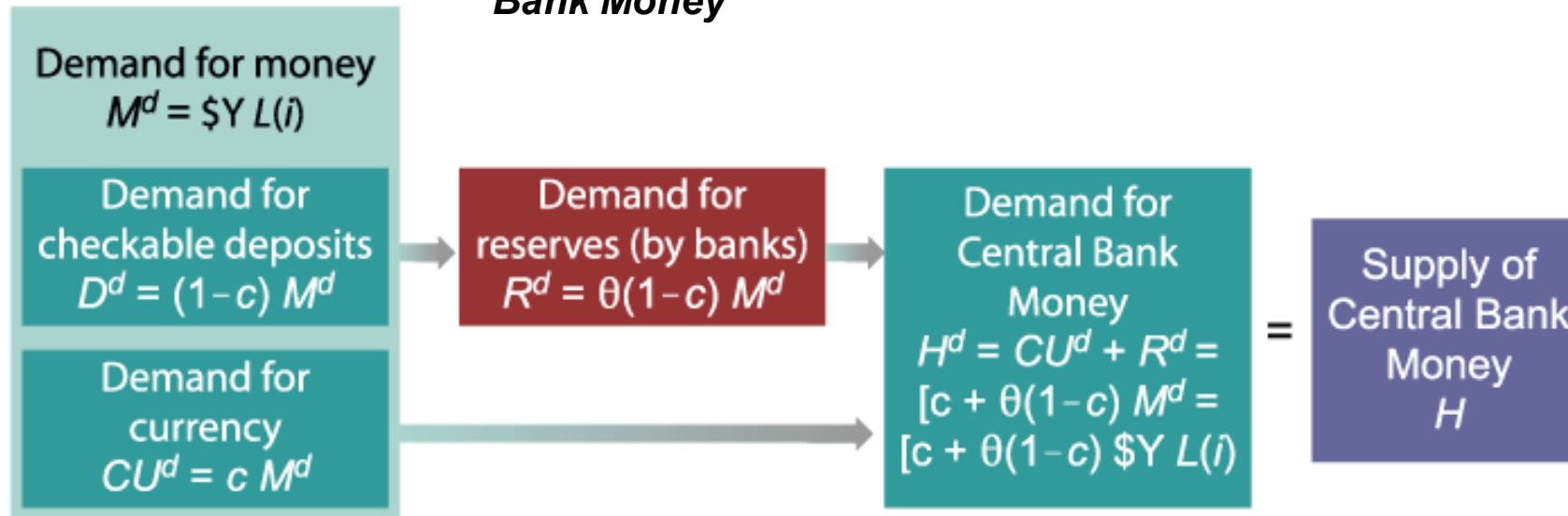
$$H^d = CU^d + R^d$$

$$\text{Then: } H^d = cM^d + \theta(1 - c)M^d = [c + \theta(1 - c)]M^d$$

$$\text{Since } M^d = \$YL(i)_{(-)} \quad \text{Then: } H^d = [c + \theta(1 - c)]\$YL(i)$$

# Determination of Interest Rates II

## *Determinants of the Demand and the Supply of Central Bank Money*





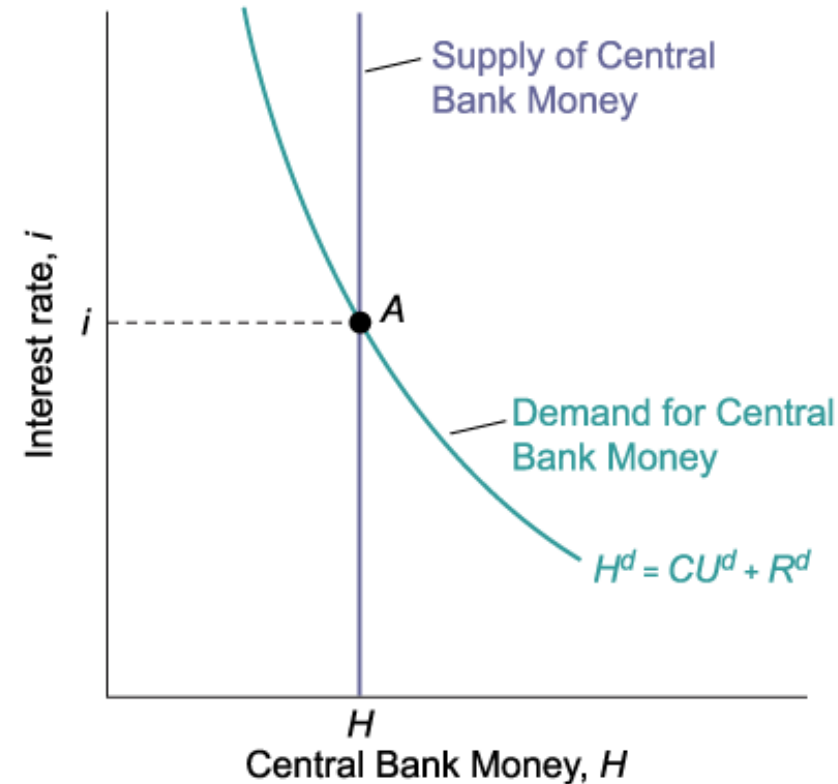
# Determination of Interest Rates II

In equilibrium, the supply of central bank money ( $H$ ) is equal to the demand for central bank money ( $H^d$ ):

$$H = H^d$$

Or restated as:

$$H = [c + \theta(1 - c)]\$YL(i)$$



# Interpreting the Equilibrium (1)

- The equality of the supply and demand of **central bank money** is equivalent to the equality of the overall supply and the overall demand for **money**.

$$H = [c + \theta(1 - c)]SYL(i)$$

Then:

$$\frac{1}{[c + \theta(1 - c)]} H = SYL(i)$$

→ **Money Multiplier**

Supply of money = Demand for money

- The overall supply of money is equal to central bank money times the **money multiplier**

# Interpreting the Equilibrium (2)

## The U.S. Institution

- The equality of the supply and demand of **central bank money** is equivalent to the equality of the supply and demand of **bank reserves**.

$$H - CU^d = R^d$$

The **federal funds market** is a market for bank reserves. In equilibrium, demand ( $R^d$ ) must equal supply ( $H - CU^d$ ). The interest rate determined in the market is called the **federal funds rate**.

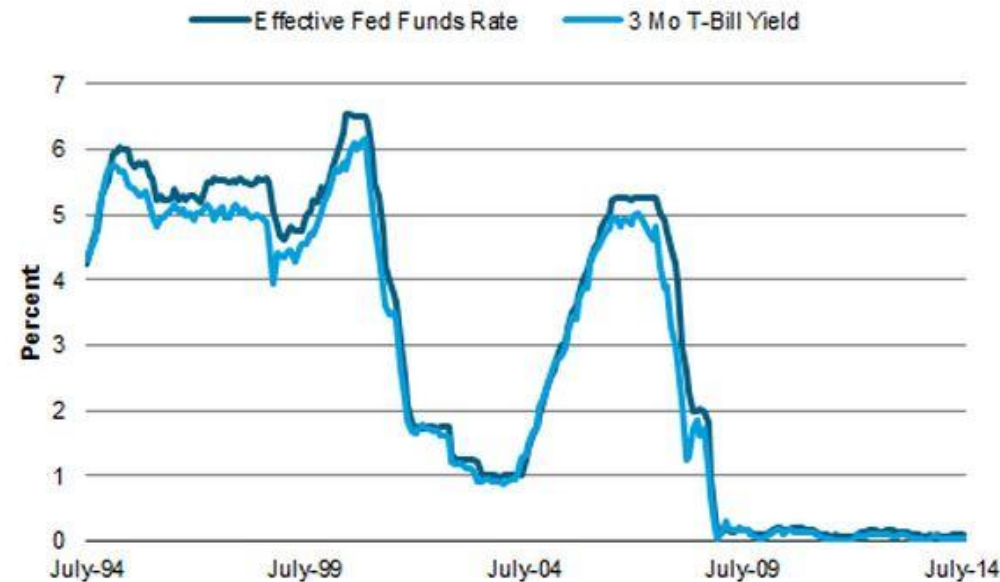
- The federal funds rate is the main indicator of U.S. monetary policy because the Fed can choose the federal funds rate it wants by changing  $H$ .

# Interpreting the Equilibrium (2)

## The U.S. Institution

The Fed supplies the central bank money majorly through open market operation. “No arbitrage condition” implies: the federal funds rate is equal to the nominal interest rate of the short-term government bond (Treasury Bill)

Effective Fed funds rate and 3-month Treasury bill yields move together



Source: Federal Reserve Bank of St. Louis, as of July 1, 2014.

# Interpreting the Equilibrium (2)

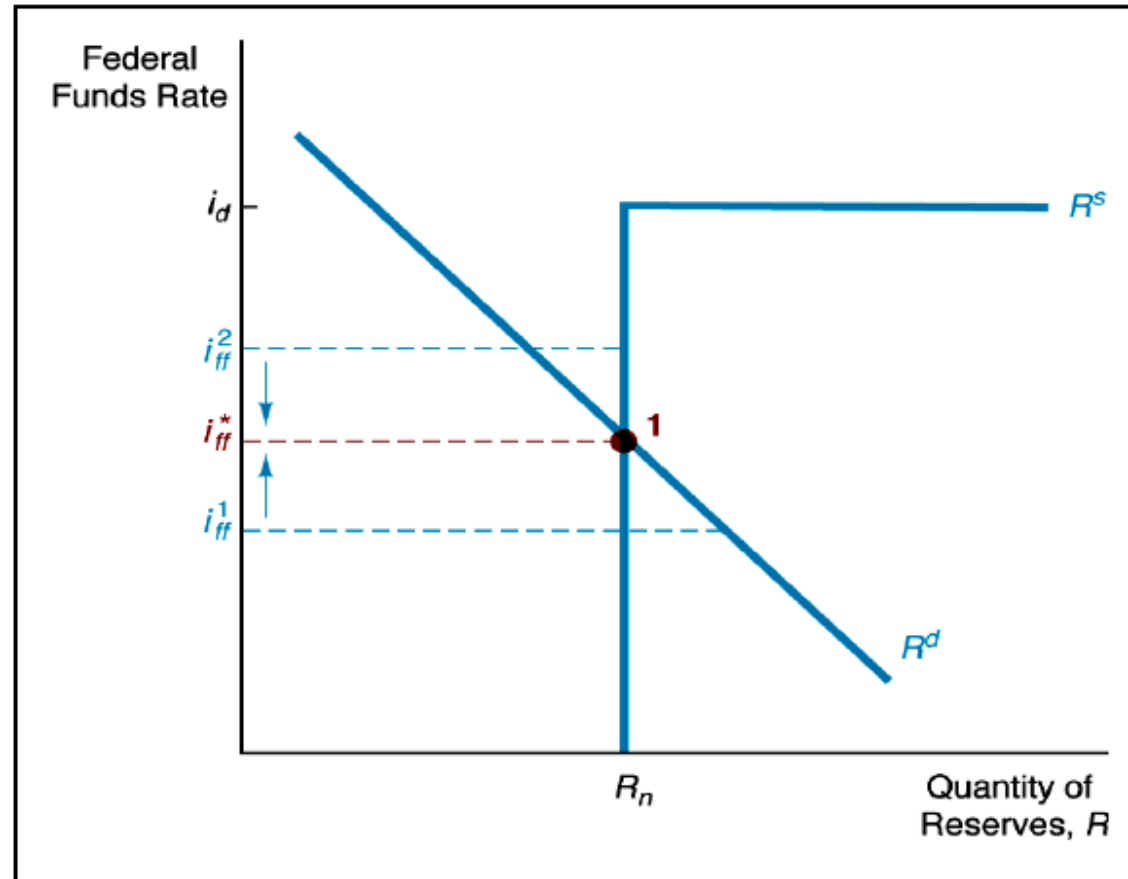
## The U.S. Institution

- The central bank can also provide reserves to the banking system by making **discount loans** to banks.
- The interest rate charged banks for these loans is called the discount rate ( $i_d$ )
- A discount loan increases H, and a discount repayment reduces H.
- In sum:
  1. discount rate ( $i_d$ ) is determined by the central bank
  2. Federal funds rate ( $i_{ff}$ ) is determined by the market

# Demand and Supply of Reserves

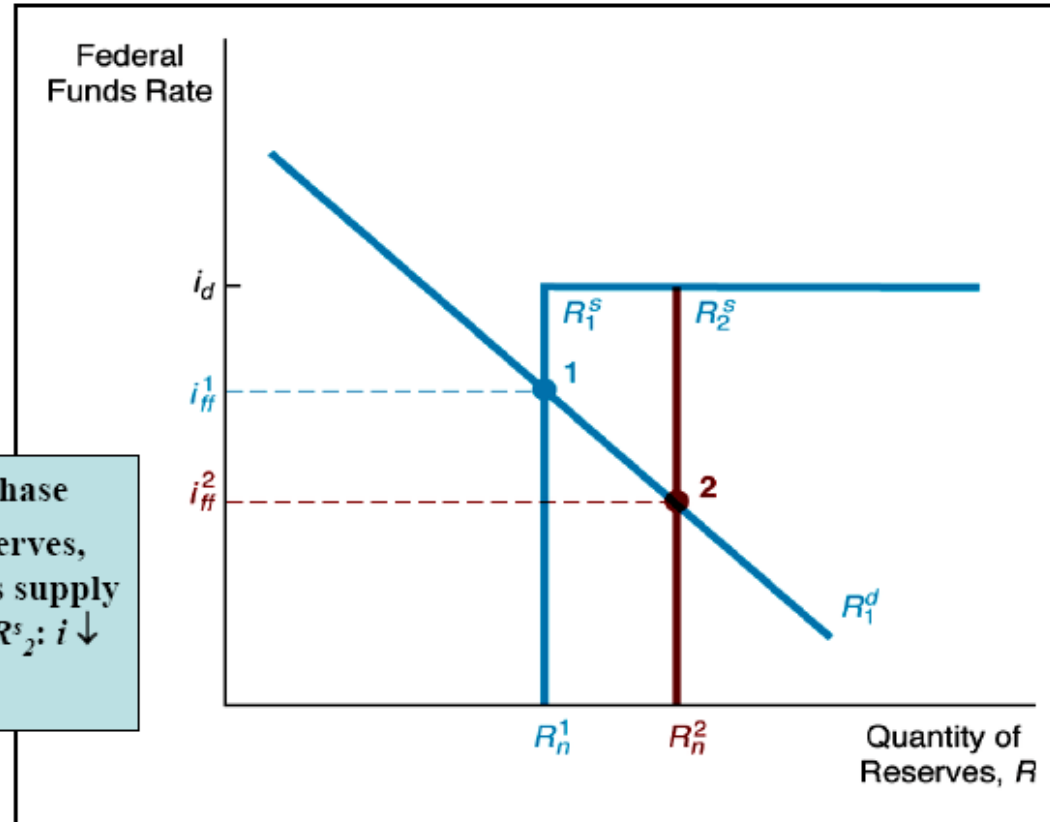
- Banks' demand for federal funds reflect the demand for bank reserves.
- This demand,  $R^d$ , increases as  $i_{ff}$  decreases.
- The supply of reserves,  $R^s$ , comprise
  - the supply of borrowed reserves (discount loans)
  - the supply of non-borrowed reserves (determined by open market operations)  
 $R_n$

# Demand and Supply of Reserves



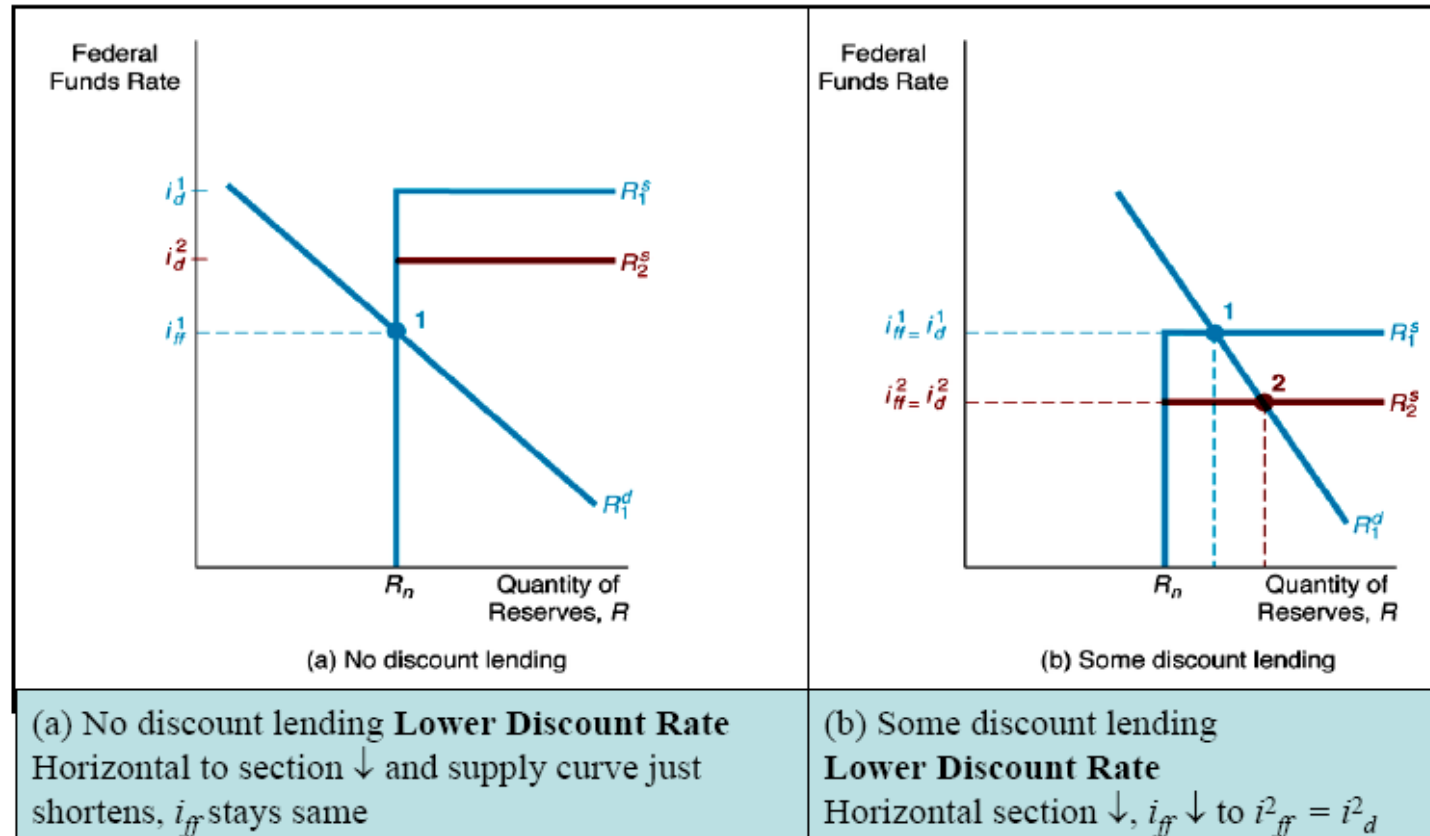
# Responses to OMO

**Open Market Purchase**  
Nonborrowed reserves,  
 $R^n$ ,  $\uparrow$  and shifts supply  
curve to right  $R^s_2$ :  $i \downarrow$   
to  $i^2_{ff}$

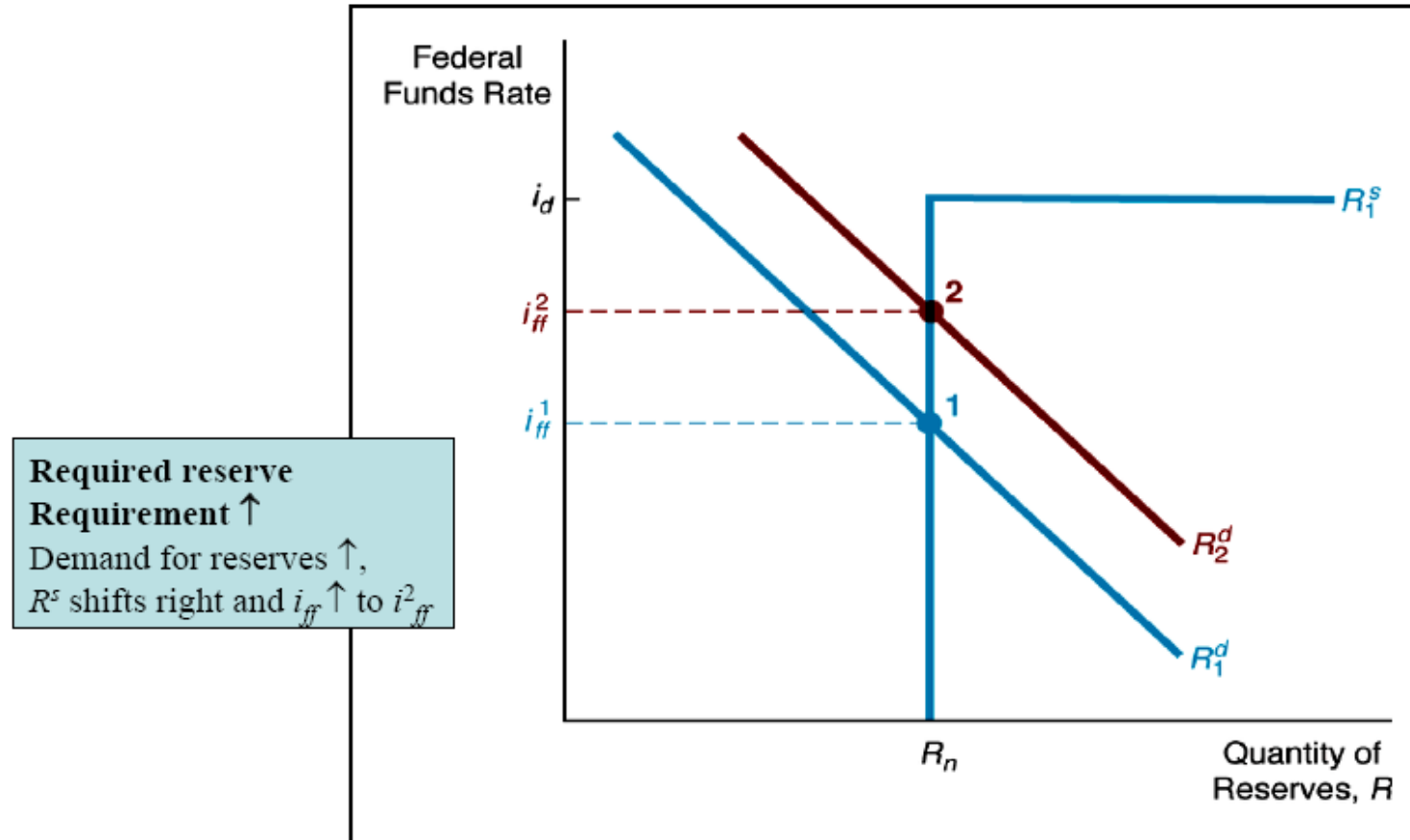




# Responses to Change in Discount Rate



# Responses to Change in RR



# Adv and Disadv of OMO

- Advantages:

1. The central bank has complete control over the volume of transactions
2. Flexible and precise
3. Easily reversed
4. Implemented quickly

- Disadvantages:

1. Zero lower bound of nominal interest rate

# Adv and Disadv of Discount Loans

- Advantages:
  1. Lender of last resort – prevent financial panics, e.g. after market crashes , 911
- Disadvantages:
  1. Confusion in interpreting discount rate changes
  2. The volume of discounted loans is not fully controlled by Fed

# Adv and Disadv of Reserves Requirement

- Advantages:

1. Powerful effect

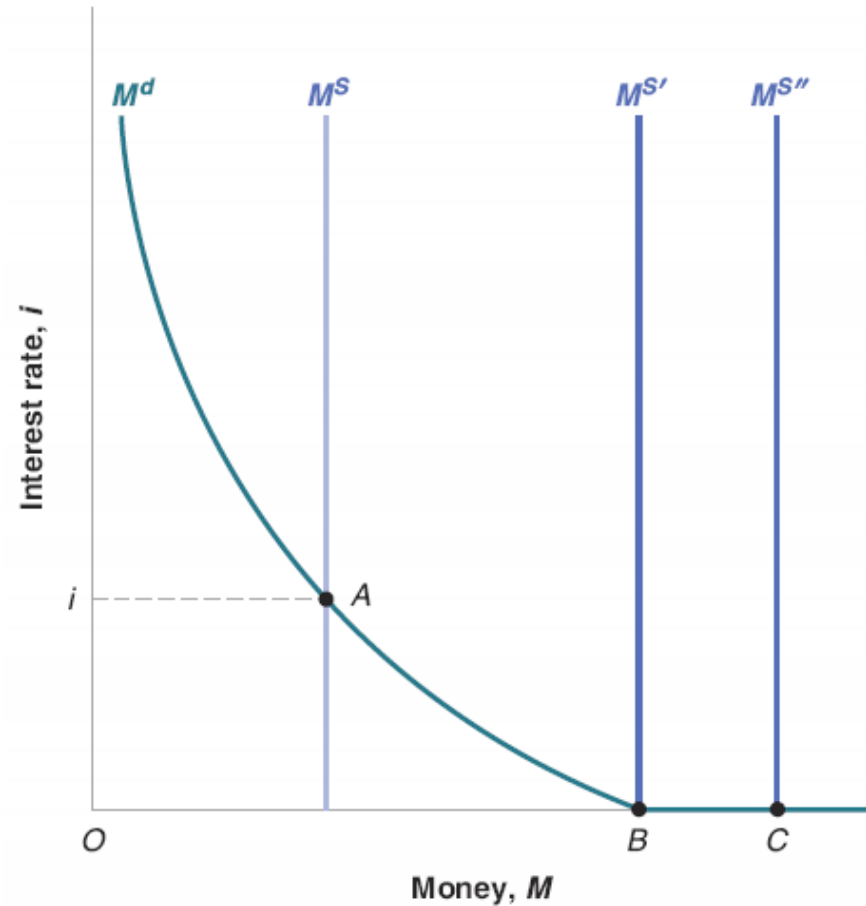
- Disadvantages:

1. May overshoot
2. Raising causes liquidity problems for banks
3. Frequent changes cause uncertainty for banks

# The Liquidity Trap

- **Zero lower bound:** The interest rate cannot go below zero.
- The economy is in a **liquidity trap** when the interest rate is down to zero, monetary policy cannot decrease it further.

**Figure 4-8** Money Demand, Money Supply, and the Liquidity Trap



# The Liquidity Trap

- ❑ When the interest rate is equal to zero,
  - People become indifferent between holding money and holding bonds, once they have enough money for transaction purposes.
  - Commercial banks become indifferent between holding reserves or buy bonds, once they have enough reserves to meet the required reserve ratio and for safety purposes.
- ❑ The demand for money becomes horizontal.
- ❑ When the interest rate is zero, further increases in the money supply have no effect on the interest rate, which remains equal to zero.

# Quantitative Easing

- The central bank creates money through purchasing financial assets that it would not usually buy in open market operations
- An unconventional tool used when short-term interest rates are close to zero
- During the recent financial crisis, the US Fed Reserve bought bank debt, mortgage-backed securities (MBS) and long-term government bonds.



# Adv and Disadv of QE

- Advantages:
  1. Flexible
  2. Not constrained by zero lower bound of nominal interest rate
- Disadvantages:
  1. Create bad incentives for the banking system
  2. Tapering may cause damage to the economy

# Summary

- $i_{ff}$  is determined by  $M^S$  and  $M^D$ , with  $i_d$  as the ceiling
- $M^S$  is supplied together by central bank and commercial banks.
- Central bank supplies monetary base
- Commercial banks multiply monetary base via credit creation
- Central bank adjusts  $M^S$  to achieve a targeted level for  $i_{ff}$

# In the next class...

- We incorporate the interest rate to the Keynesian cross and develop the IS-LM model.
- This framework is useful when we think about  $Y$ ,  $C$ ,  $I$ ,  $i$ ,  $G$ ,  $T$ , and  $M$  in the short-run.
- Blanchard, Chapter 5.