

# Financial Markets

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GRADUATE MACRO – LAB SESSION 4

ETTORE GALLO



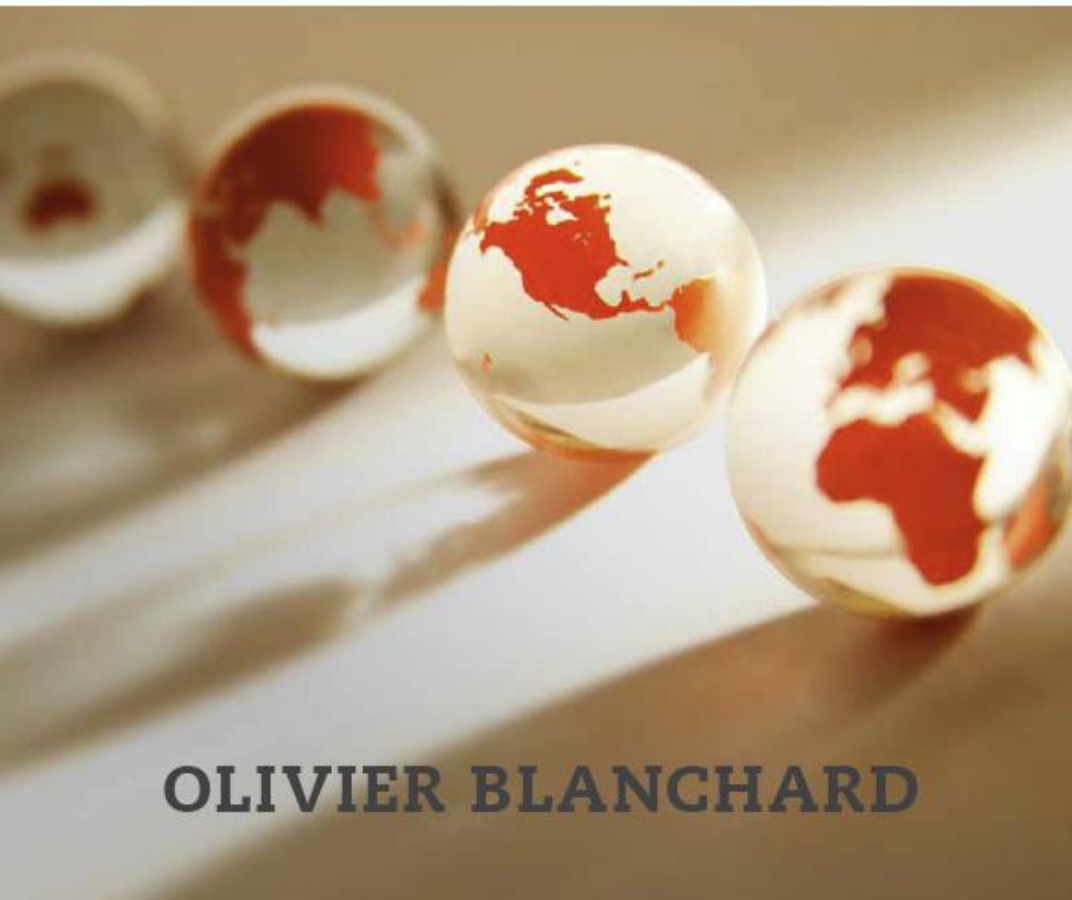
# Class Outline

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- 1            The Demand for Money
- 2            Determining the Interest Rate: I
- 3            Determining the Interest Rate: II
- 4            The Liquidity Trap
- APPENDIX   The Determination of the Interest Rate When  
                 People Hold Both Currency and Checkable  
                 Deposits

# MACROECONOMICS

SEVENTH EDITION



OLIVIER BLANCHARD

## **Financial Markets I**

### Chapter 4

# Financial Markets

- Financial markets play an essential role in the economy.
- In this chapter, we focus on the role of the central bank in affecting these interest rates.
- We learn how the interest rate on bonds is determined, and the role of the central bank (**Federal Reserve Bank**, or the **Fed**, in the United States) in this determination.

# 4-1 The Demand for Money

- Suppose you only have a choice between two assets: money and bonds.

$$FW = M + B \quad (\text{stock})$$

- **Money** is used for transactions, but it pays no interest.
  - Two types of money: **currency** and **checkable deposits**.
- **Bonds** pay a positive interest rate,  $i$  (*the* rate of interest), but cannot be used for transaction.

# 4-1 The Demand for Money

- The holding of money and bonds depends on:
  - Your level of transactions
  - The interest rate on bonds
- You can hold bonds indirectly through **money market funds**, or *money market mutual funds*.
- In the early 1980s, the interest rate on money market funds reached 14% per year, so people earned more interest by moving their wealth from checking accounts to these funds.

# FOCUS: Semantic Traps: Money, Income, and Wealth

- **Money** is what can be used to pay for transactions.
- **Income** is what you earn, and it is a flow.
- **Saving** is the part of after-tax income that you do not spend, and it is also a flow.
- **Savings** is the value of what you have accumulated over time.
- **Financial wealth**, or wealth, is the value of all your financial assets minus all your financial liabilities, and it is a stock variable
- **Investment** is what economists refer to as the purchase of new capital goods.
- **Financial investment** is the purchase of shares or other financial assets.

# 4-1 The Demand for Money

- Money is needed for transactions.
  - Reasonable to assume that the level of transactions is proportional to **nominal income**.
  - Allocating wealth to money comes at the cost of forgone interest on bonds. So, money demand should decrease with the **interest rate**.

$$M^d = \$Y L(i) \quad (4.1)$$

(–)

- Demand for money ( $M^d$ ) is equal to nominal income  $\$Y$  (a measure of level of transactions in the economy) times a decreasing function of the interest rate  $i$ :
- An increase in the interest rate decreases the demand for money, as people put more of their wealth into bonds.



# 4-1 The Demand for Money

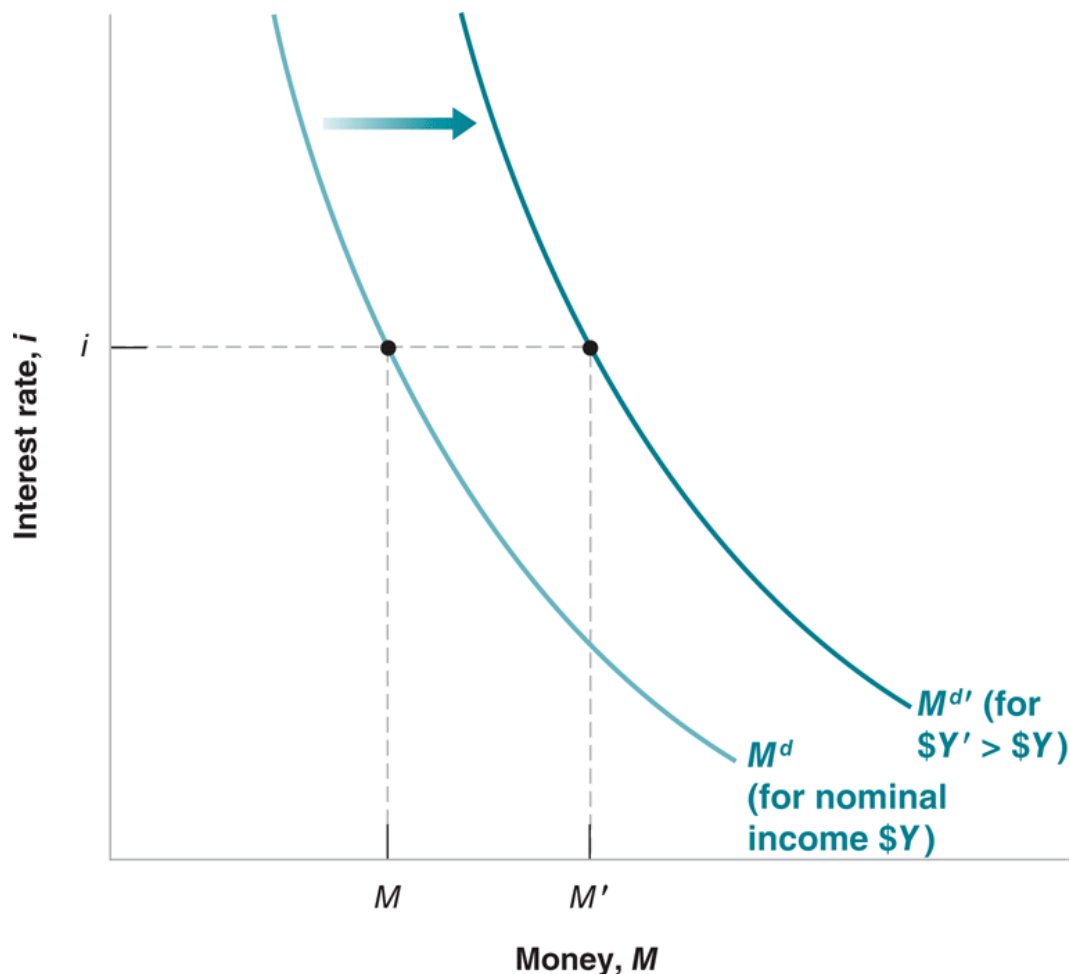
- Equation (4.1) means that the demand for money:
  - increases in proportion to nominal income, and
  - depends negatively on the interest rate.
- The relation between the demand for money and interest rate for a given level of income  $\$Y$  is represented by the  $M^d$  curve.

# 4-1 The Demand for Money

**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.



## 4-2 Determining the Interest Rate: I

- Suppose the central bank decides to supply an amount of money equal to  $M$ :

$$M^s = M$$

- Equilibrium in financial markets requires that  $M^s = M^d = M$ :

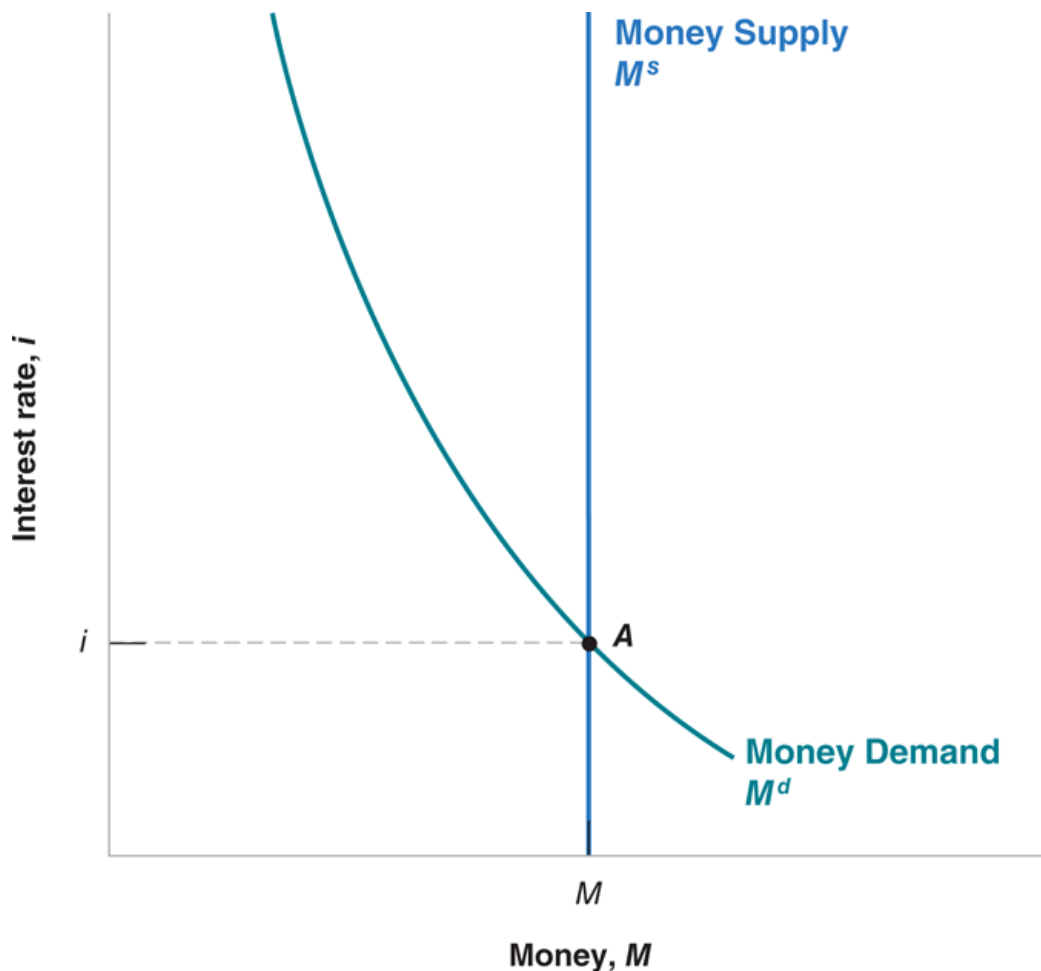
Money supply = Money demand

$$M = \$Y L(i) \tag{4.2}$$

# 4-2 Determining the Interest Rate: I

**Figure 4-2** The Determination of the Interest Rate

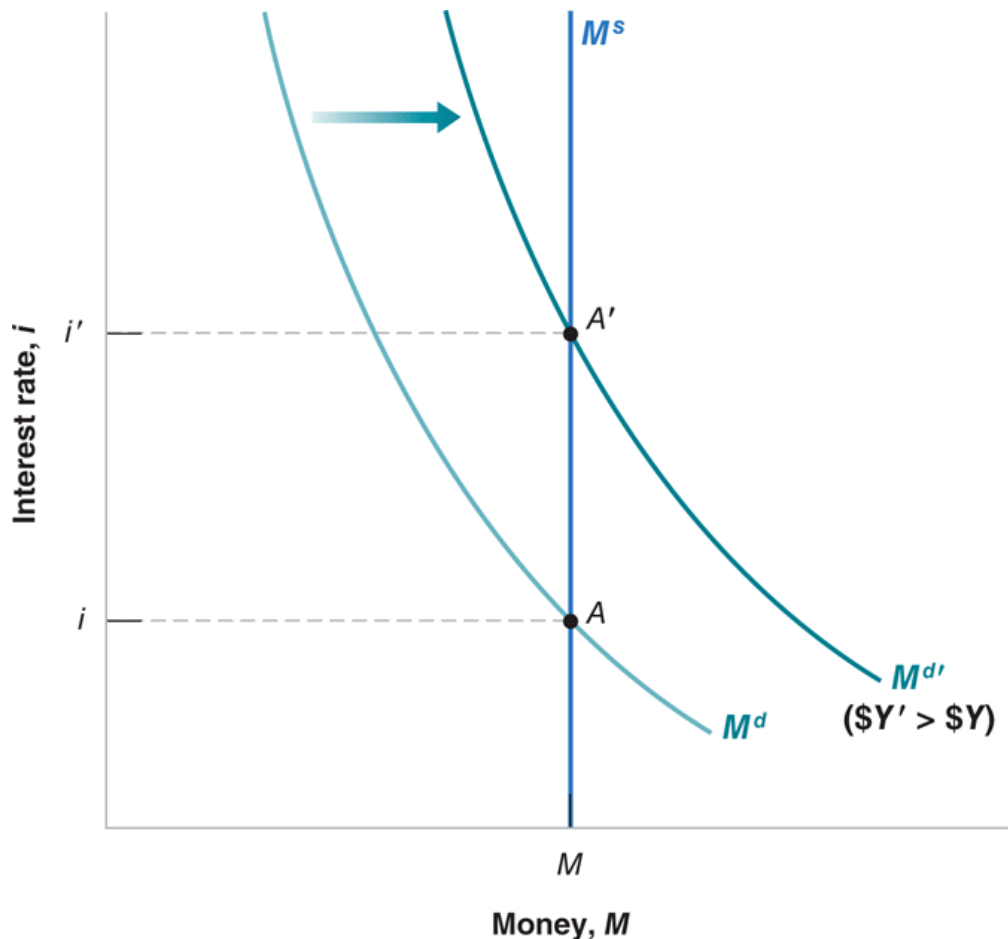
The interest rate must be such that the supply of money (which is independent of the interest rate) is equal to the demand for money (which does depend on the interest rate).



## 4-2 Determining the Interest Rate: I

**Figure 4-3** The Effects of an Increase in Nominal Income on the Interest Rate

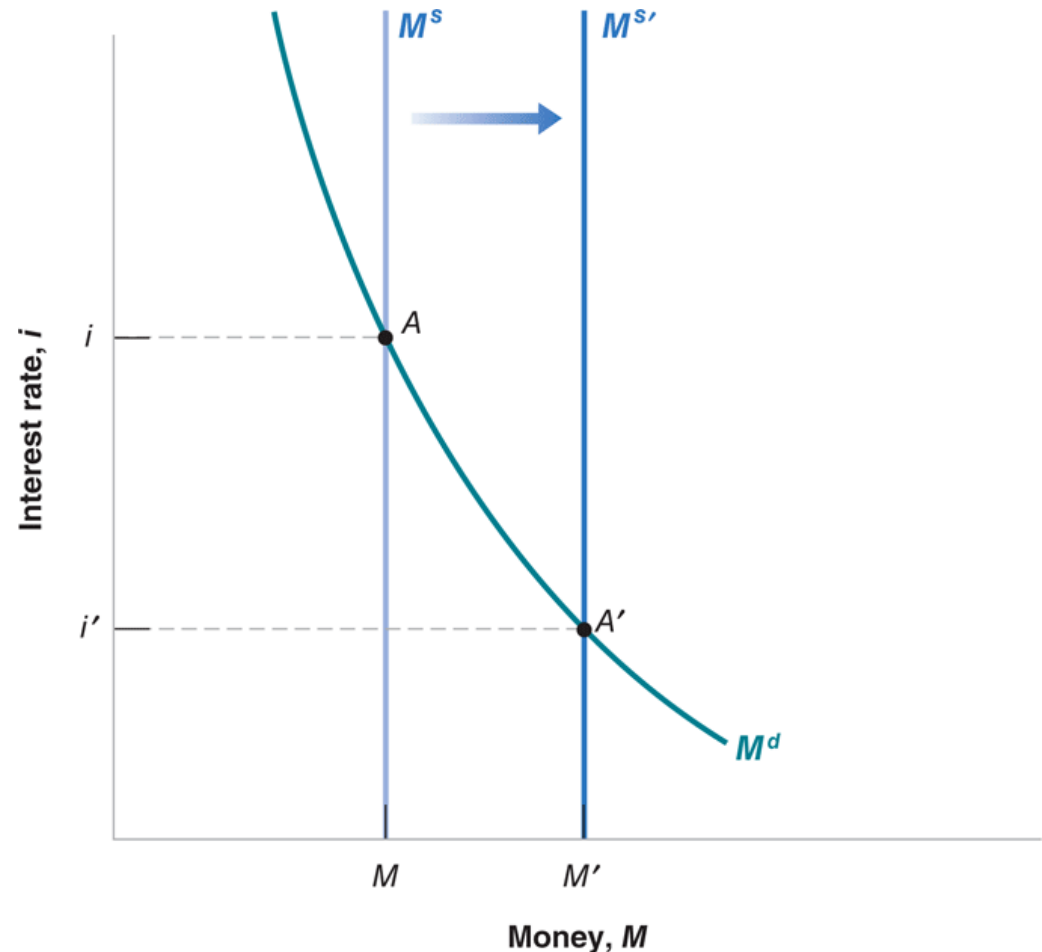
Given the money supply, an increase in nominal income leads to an increase in the interest rate.



# 4-2 Determining the Interest Rate: I

**Figure 4-4** The Effects of an Increase in the Money Supply on the Interest Rate

An increase in the supply of money leads to a decrease in the interest rate.



## 4-2 Determining the Interest Rate: I

- For a given money supply, *an increase in nominal income leads to an increase in the interest rate.*
- *An increase in the supply of money by the central bank leads to a decrease in the interest rate.*

# Exercise 4.2 – Questions and Problems

Suppose that a person's yearly income is \$60,000. Also suppose that this person's money demand function is given by

$$M_d = \$Y (.35 - i)$$

- a. What is this person's demand for money when the interest rate is 5%? 10%?
- b. Explain how the interest rate affects money demand.
- c. Suppose that the interest rate is 10%. In percentage terms, what happens to this person's demand for money if her yearly income is reduced by 50%?
- d. Suppose that the interest rate is 5%. In percentage terms, what happens to this person's demand for money if her yearly income is reduced by 50%?
- e. Summarize the effect of income on money demand. In percentage terms, how does this effect depend on the interest rate?



# Solution

- a.  $i=0.05$ : money demand = \$18,000  
 $i=0.10$ : money demand = \$15,000
- b. Money demand decreases when the interest rate increases because bonds, which pay interest, become more attractive.
- c. The demand for money falls by 50%.
- d. The demand for money falls by 50%.
- e. A 1% increase (decrease) in income leads to a 1% increase (decrease) in money demand.

## 4-2 Determining the Interest Rate: I

- Central banks typically change the supply of money by buying or selling bonds in the bond market—**open market operations**.
- **Expansionary open market operation:** the central bank *expands* the supply of money by buying bonds.
- **Contractionary open market operation:** the central bank *contracts* the supply of money by selling bonds.

# 4-2 Determining the Interest Rate: I

**Figure 4-5** The Balance Sheet of the Central Bank and the Effects of an Expansionary Open Market Operation

The assets of the central bank are the bonds it holds.

The liabilities are the stock of money in the economy.

An open market operation in which the central bank buys bonds and issues money increases both assets and liabilities by the same amount.

Balance Sheet	
Assets	Liabilities
Bonds	Money (currency)

The Effects of an Expansionary Open Market Operation	
Assets	Liabilities
Change in bond holdings: +\$1 million	Change in money stock: +\$1 million

## 4-2 Determining the Interest Rate: I

- Suppose a bond such as a **Treasury bill**, or **T-bill**, promises to pay \$100 a year from now.
- If the price of the bond today is  $\$P_B$ , then the interest rate on the bond is:

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

- *The higher the price of the bond, the lower the interest rate.*
- *The higher the interest rate, the lower the price today.*

## 4-2 Determining the Interest Rate: I

- Rather than the money supply, the central bank could have chosen the interest rate and then adjusted the money supply so as to achieve the interest rate it had chosen.
- Choosing the interest rate, instead of the money supply, is what modern central banks, including the Fed, typically do.

## Exercise 4.3 – Questions and Problems

Consider a bond that promises to pay \$100 in one year.

- a. What is the interest rate on the bond if its price today is \$75? \$85? \$95?
- b. What is the relation between the price of the bond and the interest rate?
- c. If the interest rate is 8%, what is the price of the bond today?

# Solution

a.  $i = 100/\$P_B - 1;$

- $i = 33\%;$

- $18\%;$

- $5\%$

b. When the bond price rises, the interest rate falls.

c.  $\$P_B = 100/(1.08) \approx \$93$

## 4-3 Determining the Interest Rate: II

- **Financial intermediaries:** Institutions that receive funds from people and firms and use these funds to buy financial assets or to make loans to other people and firms.
- Banks are financial intermediaries that have money, in the form of *checkable deposits*, as their liabilities.
- Banks keep as **reserves** some of the funds they receive.
- The liabilities of the central bank are the money it has issued, called **central bank money**.



# 4-3 Determining the Interest Rate: II

**Figure 4-6** The Balance Sheet of Banks, and the Balance Sheet of the Central Bank Revisited

(a) Central Bank	
Assets	Liabilities
Bonds	Central Bank Money = Reserves + Currency

(b) Banks	
Assets	Liabilities
Reserves Loans Bonds	Checkable deposits

## 4-3 Determining the Interest Rate: II

- Assume people hold no currency so the demand for money by people is the demand for checkable deposits:

$$M^d = \$Y L(i) \quad (4.3)$$

(—)

- The demand for reserves by banks depends on the amount of checkable deposits:

$$H^d = \theta M^d = \theta \$Y L(i) \quad (4.4)$$

- $\theta$  is the reserve ratio, and  $H^d$  is demand for high-power money or the monetary base.

## 4-3 Determining the Interest Rate: II

- Let  $H$  denote the supply of central bank money, then the equilibrium condition:

$$H = H^d \quad (4.5)$$

- Or using equation (4.4):

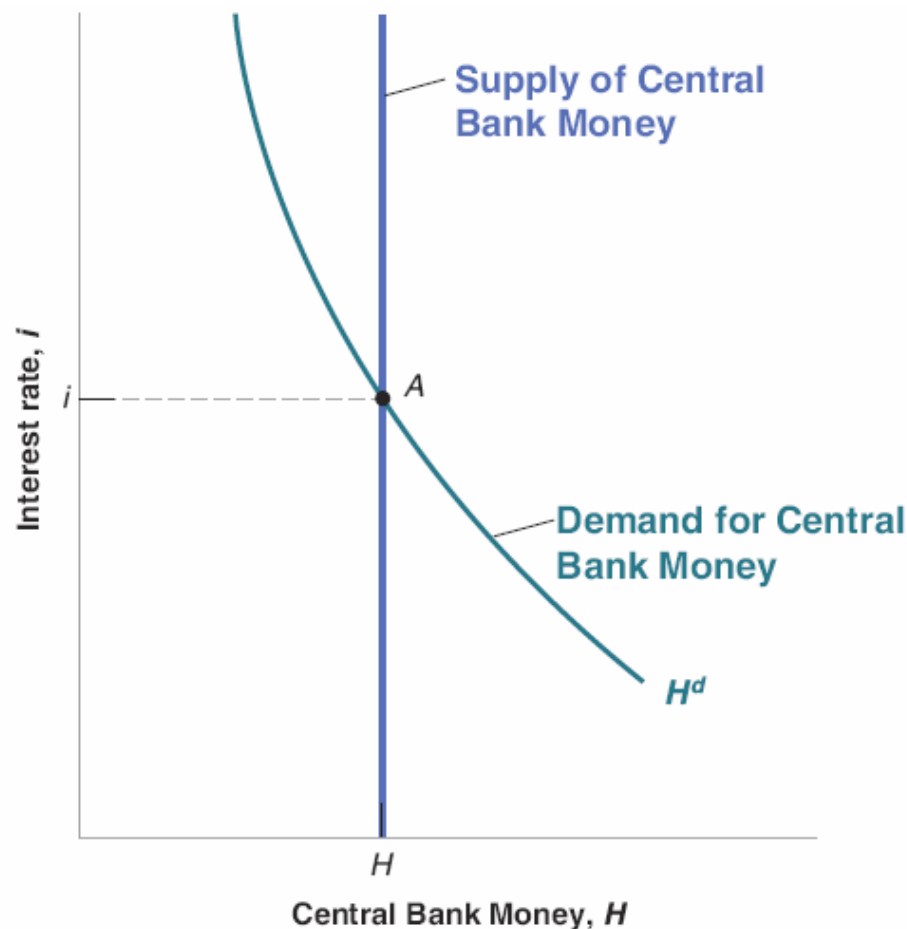
$$H = \theta \$Y L(i) \quad (4.6)$$

- An increase in  $H$  leads to a decrease in the interest rate, and a decrease in  $H$  leads to an increase in the interest rate.

# 4-3 Determining the Interest Rate: II

**Figure 4-8** Equilibrium in the Market for Central Bank Money and the Determination of the Interest Rate

The equilibrium interest rate is such that the supply of central bank money is equal to the demand for central bank money.



## 4-3 Determining the Interest Rate: II

- The **federal funds market** is an actual market for bank reserves.
- The **federal funds rate** is the interest rate determined in the federal funds market.
- 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  $H$ .

# Alternative Ways of Looking at Equilibrium

- use equilibrium condition that overall supply and overall demand for money (currency and checkable deposits) be equal:

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

to determine: 
$$\frac{1}{[c + \theta(1 - c)]} H = \$Y L(i)$$

Supply of money = Demand for money

- overall supply of money given by central bank money (H) times the **money multiplier**

$$1/(c + \theta(1 - c))$$

## ➤ high-powered money

- term used to reflect the fact that the overall supply of money depends in the end on the amount of central bank money (H), or **monetary base**.

# Exercise 4.3 – Questions and Problems

Assume the following:

- i. The public holds no currency.
- ii. The ratio of reserves to deposits is 0.1.
- iii. The demand for money is given by  $M_d = \$Y(.8 - 4i)$

Initially, the monetary base is \$100 billion, and nominal income is \$5 trillion.

- a. What is the demand for central bank money?
- b. Find the equilibrium interest rate by setting the demand for central bank money equal to the supply of central bank money.
- c. What is the overall supply of money? Is it equal to the overall demand for money at the interest rate you found in part (b)?
- d. What is the impact on the interest rate if central bank money is increased to \$300 billion?
- e. If the overall money supply increases to \$3,000 billion, what will be the impact on  $i$ ? [Hint: Use what you learned in part (c)]

# Solution

- a. All money is in checking accounts, so demand for central bank money equals demand for reserves. Therefore, demand for central bank money =  $0.1(\$Y)(.8-4i)$ .
- b.  $\$100B = 0.1(\$5,000B)(.8-4i)$   
 $i = 15\%$
- c. Since the public holds no currency, money multiplier =  $1/\text{reserve ratio} = 1/.1 = 10$ .  
 $M = (10)\$100B = \$1,000B$   
 $M = M_d$  at the interest derived in part (b).
- d. If H increases to  $\$300B$  the interest rate falls to 5%.
- e. The interest rate falls to 5%, since when H equals  $\$300B$ ,  
 $M = (10)\$300B = \$3,000B$ .



## 4-4 The Liquidity Trap

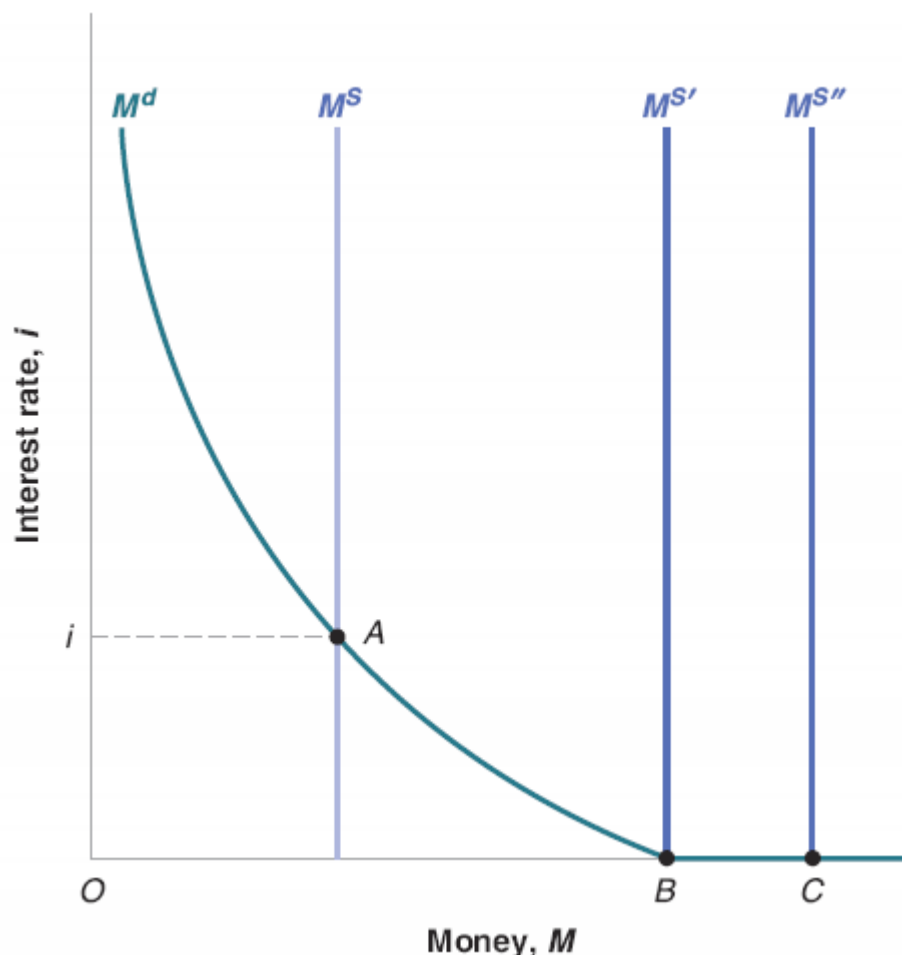
- **Zero lower bound:** The interest rate cannot go below zero.
- The economy is in a **liquidity trap** when the interest rate is down to zero, monetary policy cannot decrease it further.

# 4-4 The Liquidity Trap

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

When the interest rate is equal to zero, and once people have enough money for transaction purposes, they become indifferent between holding money and holding bonds. The demand for money becomes horizontal.

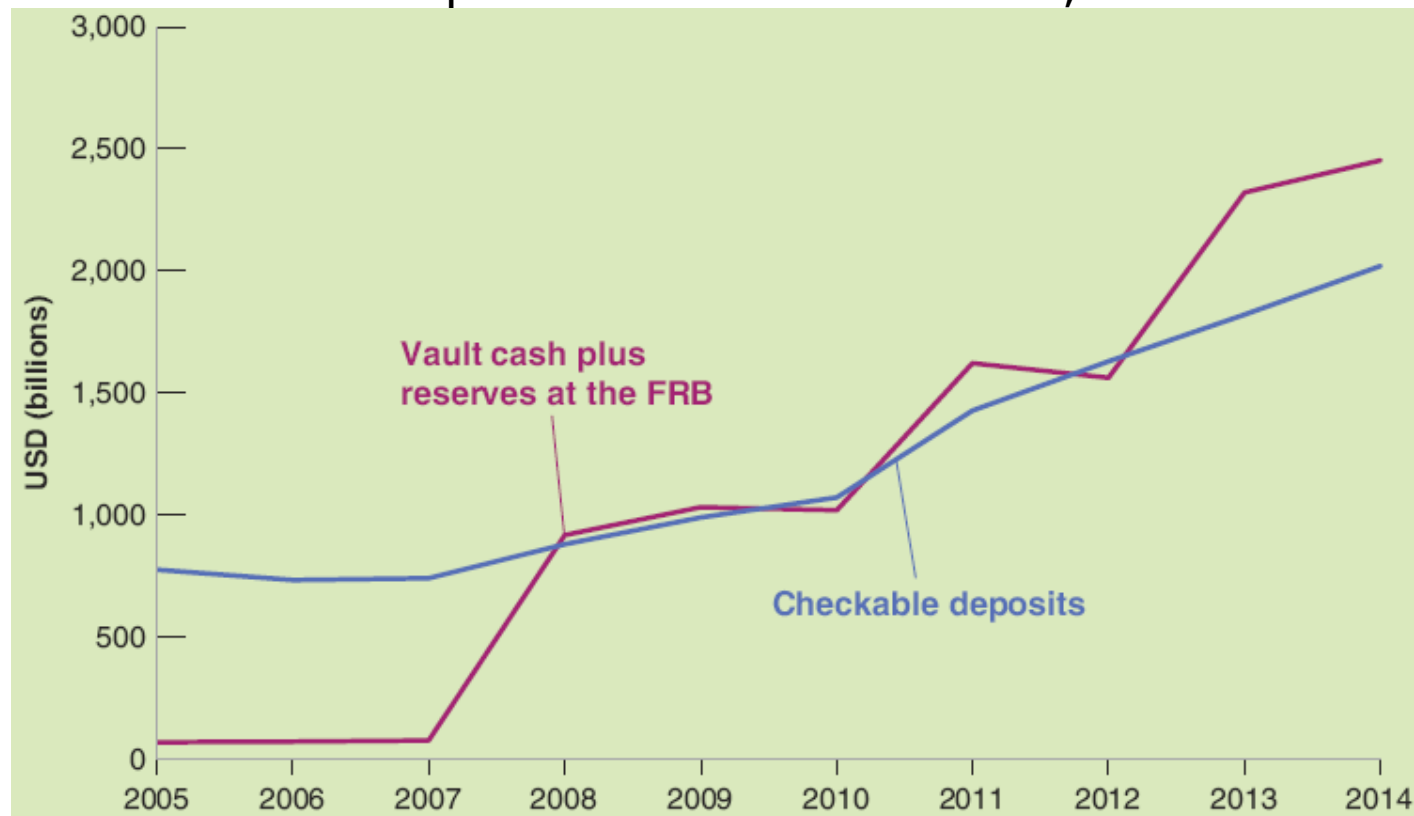
This implies that, when the interest rate is equal to zero, further increases in the money supply have no effect on the interest rate, which remains equal to zero.



# FOCUS: The Liquidity Trap in Action

- The large increase in the supply of central bank money between 2007 and 2014 was absorbed by households and banks.

**Figure 1** Checkable Deposits and Bank Reserves, 2005–2014.



Source: Flow of Funds.

# APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

- Assume that overall money demand is:

$$M^d = \$Y L(i) \quad (4.A1)$$

(—)

- Also assume that people hold a fixed proportion of their money in currency  $c$ , and  $(1-c)$  in checkable deposits, so the demand for currency and the demand for checkable deposits are respectively:

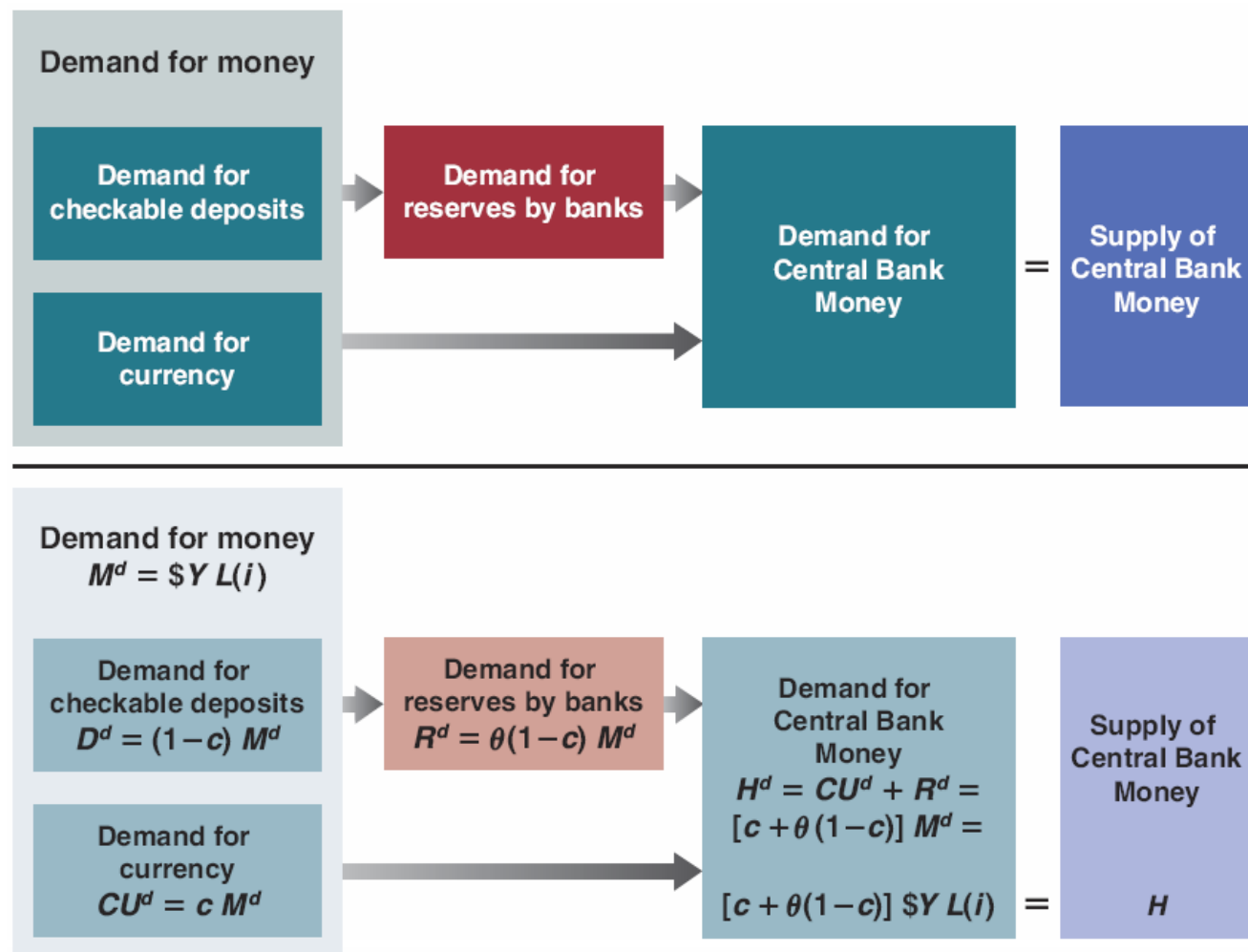
$$CU^d = cM^d \quad (4.A2)$$

$$D^d = (1 - c)M^d \quad (4.A3)$$

# APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

**Figure 4-A1**

Determinants of the Demand and the Supply of Central Bank Money.



## APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

- Let  $R$  be the reserves of banks,  $D$  be the dollar amount checkable deposits, and  $\theta$  be the reserve ratio:

$$R = \theta D \quad (4.A4)$$

- Combining (4.A2) and (4.A4) gives the demand for reserves by banks:

$$R^d = \theta(1 - c)M^d \quad (4.A5)$$

# APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

- Demand for central bank money is:

$$H^d = CU^d + R^d \quad (4.A6)$$

so that:

$$H^d = cM^d + \theta(1 - c)M^d = [c + \theta(1 - c)]M^d$$

which gives the demand for central bank money:

$$H^d = [c + \theta(1 - c)]\$Y L(i) \quad (4.A7)$$

# APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

- The equilibrium condition is that the supply of central bank money be equal to the demand for central bank money:

$$H = H^d \quad (4.A8)$$

or using equation (4.9):

$$H = [c + \theta(1 - c)]\$YL(i) \quad (4.A9)$$



# APPENDIX: The Determination of the Interest Rate When People Hold Both Currency and Checkable Deposits

- *The supply of central bank money (the left side of equation (4.A9) is equal to the demand for central bank money (the right side of equation (4.A9), which is equal to the term in brackets times the overall demand for money.*