

## Ch 5 The Behaviour of Interest Rates

What explains these interest rate movements? Since nominal interest rate movements are negatively related to bond prices, understanding interest rate changes also helps us understand movements in bond prices.

We can either look at the Supply and Demand for Credit to understand interest rate changes or the Supply and Demand for Bonds to understand bond price changes. We can also look at the Supply and Demand for Money to understand interest rates. That is, we look at economic conditions and market forces (S and D) in the credit market, bond market, money market to get an understanding of the *behavior of interest rates over time*.

## **Ch 5. Determination of Interest Rates: Bond Market and Money Market.**

**This chapter focuses on the Bond market(Demand and Supply components), and the link between the bond market and liquidity preference theory(money market)**

- 1. Asset Theory of demand;**
- 2 Demand and Supply in the Bond Market;**
- 3 Shifts in the demand and supply of bonds;**
- 4 Markets For Money-The Liquidity Preference Framework.**

**For Animated slides, click the following, and open figures 4.1 to 4.7, 4A.1 to 4A.5**

**[http://wps.aw.com/aw\\_mishkin\\_finmks\\_5/32/8383/2146074.cw/index.html](http://wps.aw.com/aw_mishkin_finmks_5/32/8383/2146074.cw/index.html)**

## **(Certain Preliminaries)**

### **Why Do Interest Rates Change?**

Interest rate exerts a significant influence on spending and investment decisions in the economy, and as such its movements are keenly watched by different economic agents, including the Bank of Canada in mitigating the business cycles in the economy. An important question that needs to be addressed is, Why do interest rates change?

This chapter describes two alternative theories of interest rate determination: (a) demand and supply analysis for bonds, and (b) demand and supply for money-known as liquidity preference approach.

Both the markets(the bond and the market for money) are related, and it will be seen that the disequilibrium in the market for money influences the market for bonds and the interest rate in the economy.

(Few Preliminaries) –contd.-

There are two parties in the bond market: (i) an issuer of bond (like firm) and (ii) investor who lends money

### **BOND ISSUING PARTY: Who Issues bonds?**

A firm/production units raise (borrow) money for financing production activities by issuing bonds. When a firm borrows money from people, it has to pay some interest rate on bond (called coupon rate). This (interest rate paid by the company to you) is the cost of finance.

### **BOND BUYERS: Who buys bonds ?**

Investors like you, pension fund companies, mutual fund companies and others.

There are two interest rates that must be clearly distinguished: (a) Interest rate paid on bond (called coupon), which does not change at all till the maturity (one year, five year, ten year etc) of the bond, and the (b) market interest rate which keeps on changing due to the demand and supply of loanable funds (or credit), including government policies. When a company issues a bond, the coupon rate (the interest rate paid on bond) is generally the same as the market interest rate. But with the passage of time, market interest rate changes due to various factors, but the coupon rate promised by the company when the bond was issued does not change.

### **Recalling from Last Chapter: An Inverse Relationship between the Interest rate (market) and the Bond Price**

When new bonds are issued, they typically carry coupon rates at or close to the prevailing market interest rate. Interest rates and bond prices have what's called an "inverse relationship" – meaning, when one goes up, the other goes down. The question is: how does the market interest rate affect the value (price) of a bond you already?

Let's look at an example.: Suppose the ABC company offers a new issue of bonds carrying a 7% coupon. Suppose the market interest rate is also 7% on say Jan 2010. This means it would pay you \$70 a year in interest. After evaluating your investment alternatives, you decide this is a good, so you purchase a bond at its initial price (issue price), \$1,000.

## **(Certain Preliminaries)-contd-**

### **What if Market interest rate Rates Go Up?**

Now let's suppose that later that year, interest(market) rates in general go up due to tight credit conditions. If the market interest rate is now 8% on May 2010. Any company(suppose xyz) which now wants to raise money through issuing bonds must pay 8% as coupon on new bonds; otherwise it can not attract people to invest in its bonds because people can invest in the market and earn 8% on investment. You as a buyer of ABC company's bond will like to sell ABC company's bond which is paying 7%. The buyers in the market will be reluctant to pay you face value (\$1,000) for your 7% ABC bond. In order to sell, you'd have to offer your bond at a lower price – a discount – that would enable it to generate approximately 8% to the new owner. In this case, that would mean a price of about \$875.

### **What if Rates Fall?**

Similarly, if rates dropped to below your original coupon rate of 7%, your bond would be worth more than \$1,000. It would be priced at a premium, since it would be carrying a higher interest rate than what was currently available on the market.

## **Demand for Bonds.**

Before we discuss the demand for bonds, it has to be recognized that the bond is one of the competing assets that individuals/corporations like to hold in their portfolio of assets.

The demand for bonds is therefore needs to be considered in relation to the demand for competing assets. The competing assets can be real assets(like real estate, jewelry, gold) and financial assets(equities, money-because of its liquidity property).

## **Determinants of asset demand**

There are four factors influencing demand for assets, including bonds.

These are:

- (a) Wealth,
- (b) Expected return from the asset.
- (c) Riskiness of the asset.
- (d) Liquidity of the asset.

# Determinants of Asset Demand

**SUMMARY** Table 1 Response of the Quantity of an Asset Demanded to Changes in Wealth, Expected Returns, Risk, and Liquidity

Variable	Change in Variable	Change in Quantity Demanded
Wealth	↑	↑
Expected return relative to other assets	↑	↑
Risk relative to other assets	↑	↓
Liquidity relative to other assets	↑	↑

*Note:* Only increases in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the rightmost column.

## **Factors that Change the Asset Demand: (\* 3)**

**Wealth:** An increase in wealth, other things remaining constant results in the increase in demand for all assets

**Expected returns** - an increase (decrease) in an asset's expected return, relative to alternative assets, increases (decreases) the demand for the asset, *ceteris paribus*.

*Example:* A company's earnings forecast improves (declines), demand for the stock will increase (decrease), resulting in a higher (lower) price.

**Risk** - if an asset's risk increases (decreases), relative to other assets, the demand will fall (rise). Assumes investors are risk-averse. *Example:* a company's credit rating is downgraded (from AAA to C), demand for its bonds will fall, price will fall.

**Liquidity** - the more liquid an asset is, relative to other assets, the greater the demand, *ceteris paribus*. *Example:* Treasury securities are the most liquid asset, demand is high, prices are high, interest rates are low.



**Demand Curve for Bonds** (Bond demanders are bond investors/buyers/savers/lenders and Bond suppliers are bond issuers/sellers/borrowers: Corporations and municipalities),

Investors like: **low** bond prices and **high** interest rates. At lower prices and higher interest rates, the quantity demanded of a bond ( $B_d$ ) will be higher.

As the price falls, the reward for holding the bonds rises, so the quantity demanded goes up.

Example: think of a zero coupon bond promising to pay \$100 in one year. The bond will attract more demand at \$90 than it will be at \$95.

## **Supply Curve for Bonds**

Companies/borrowers like: **high** bond prices and **low** interest rates. The higher the price and the lower the interest rate, the more bonds will be supplied by firms

The higher the price of a bond, the larger the supply will be for two reasons. From the investor's view point, the higher the price, more tempting it is to sell a bond they currently hold. From the point of view of companies seeking finance for a new projects, the higher the price at which they can sell bonds, the better.

# Derivation of Bond Demand Curve

$$i = RET_P^e = \frac{(F - P)}{P}$$

**Point A:**

$$P = \$950$$

$$i = \frac{(\$1000 - \$950)}{\$950} = 0.053 = 5.3\%$$

$$B^d = \$100 \text{ billion}$$

# Derivation of Bond Demand Curve

## Point B:

$$P = \$900$$

$$i = \frac{(\$1000 - \$900)}{\$900} = 0.111 = 11.1\%$$

$$B^d = \$200 \text{ billion}$$

**Point C:**  $P = \$850, i = 17.6\% B^d = \$300 \text{ billion}$

**Point D:**  $P = \$800, i = 25.0\% B^d = \$400 \text{ billion}$

**Point E:**  $P = \$750, i = 33.0\% B^d = \$500 \text{ billion}$

**Demand Curve is  $B^d$  in Figure 1 which connects points A, B, C, D, E.**

**Has usual downward slope**

# Derivation of Bond Supply Curve

**Point F:**  $P = \$750$ ,  $i = 33.0\%$ ,  $B^s = \$100$  billion

**Point G:**  $P = \$800$ ,  $i = 25.0\%$ ,  $B^s = \$200$  billion

**Point C:**  $P = \$850$ ,  $i = 17.6\%$ ,  $B^s = \$300$  billion

**Point H:**  $P = \$900$ ,  $i = 11.1\%$ ,  $B^s = \$400$  billion

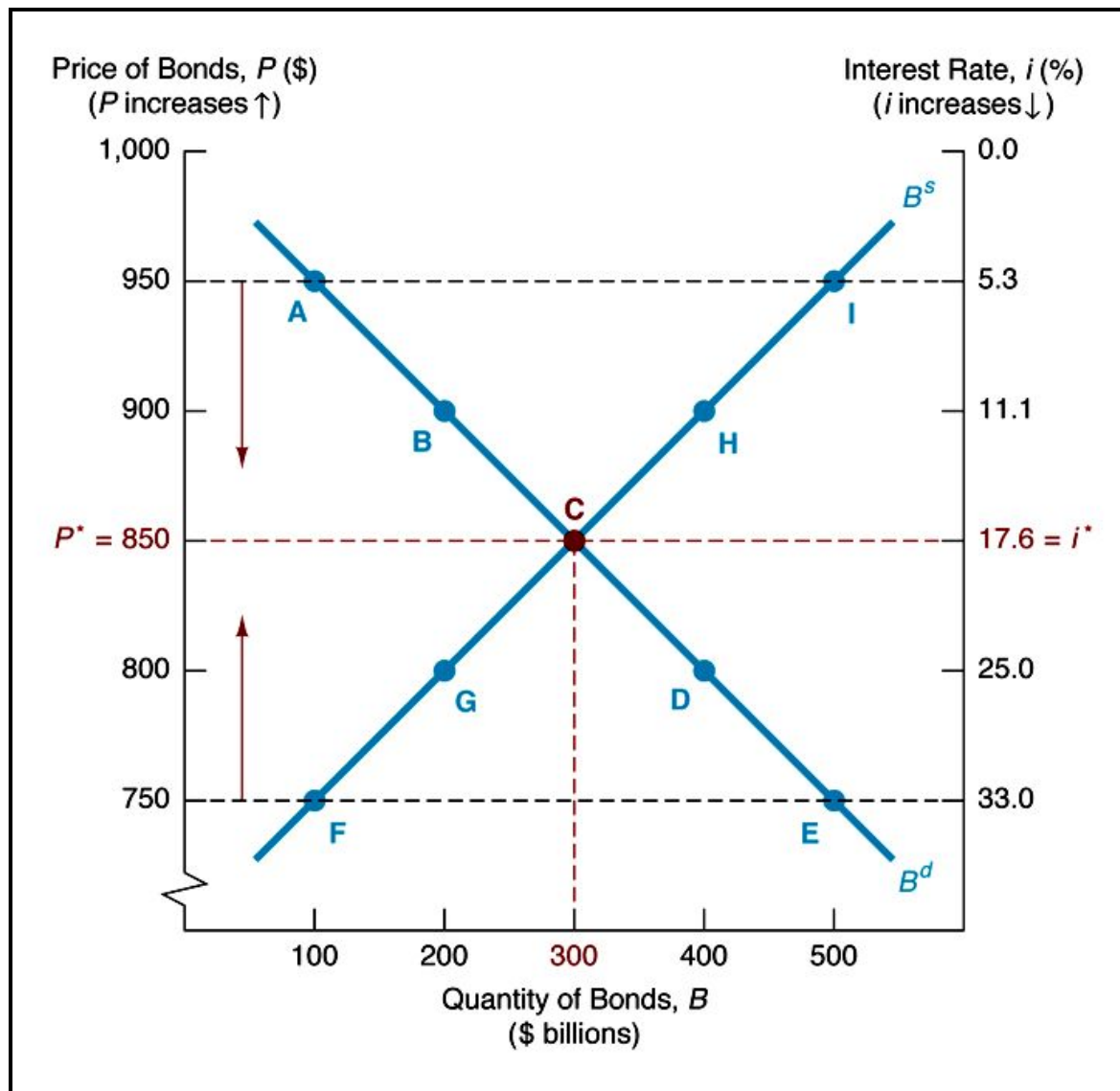
**Point I:**  $P = \$950$ ,  $i = 5.3\%$ ,  $B^s = \$500$  billion

**Supply Curve is  $B^s$  that connects points F, G, C, H, I, and has upward slope**

# Supply and Demand Analysis of the Bond Market

## Market Equilibrium

1. Occurs when  $B^d = B^s$ , at  $P^* = \$850$ ,  $i^* = 17.6\%$
2. When  $P = \$950$ ,  $i = 5.3\%$ ,  $B^s > B^d$  (excess supply):  $P \downarrow$  to  $P^*$ ,  $i \uparrow$  to  $i^*$
3. When  $P = \$750$ ,  $i = 33.0\%$ ,  $B^d > B^s$  (excess demand):  $P \uparrow$  to  $P^*$ ,  $i \downarrow$  to  $i^*$



## SHIFTS IN BOND DEMAND: Factors

**1. Wealth** - If wealth goes up, for an individual or the country, the demand for bonds will rise,  $B_d$  shifts to the right.

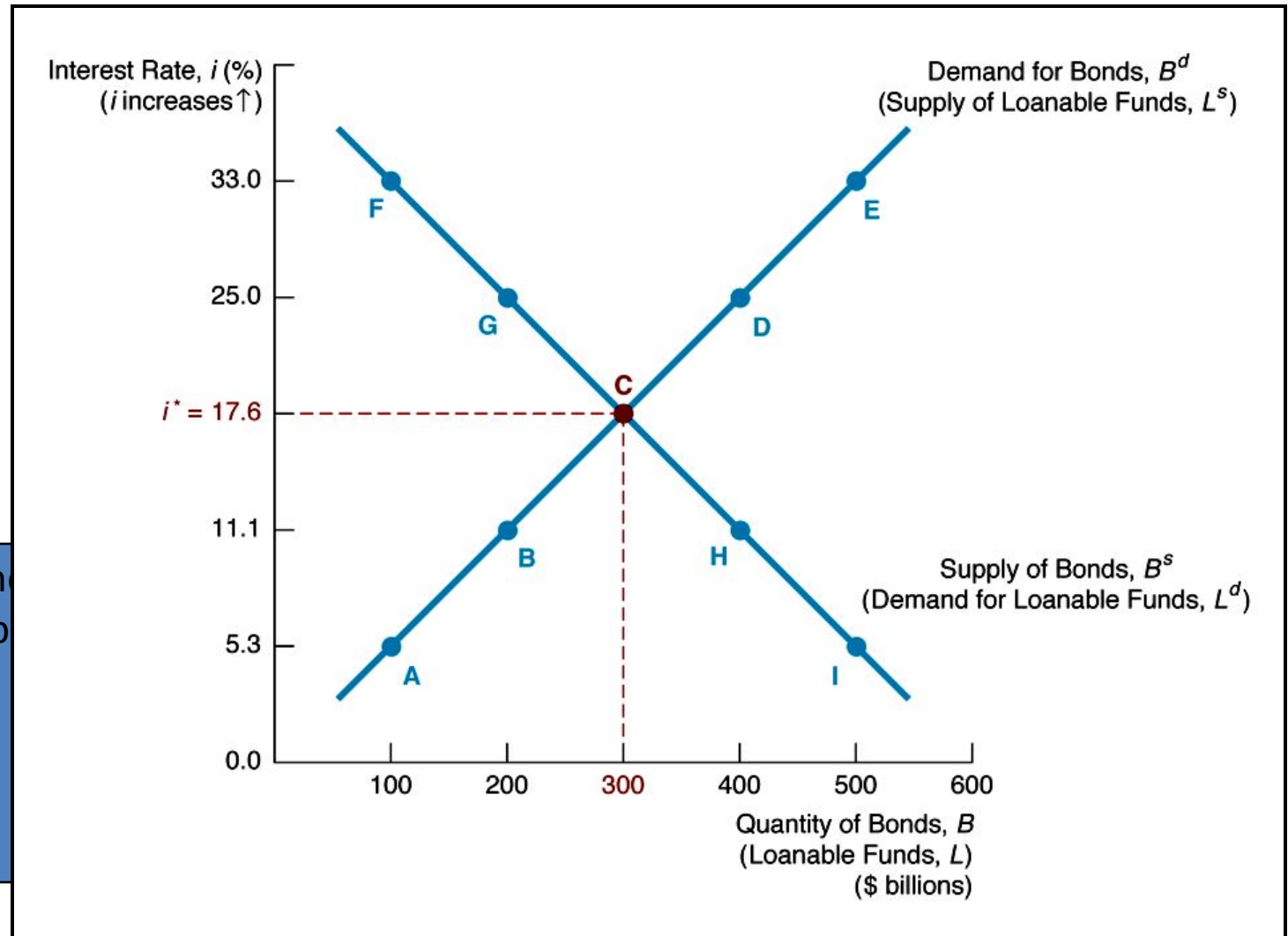
**2. Expected returns** – Recall that return on bond depends on the coupon payment plus capital gain or loss (see slides 16 reproduced from the last chapter). When interest rates fall, bond prices rise, creating a capital gain. Whenever interest rates are expected to fall, then bonds prices are expected to rise, creating an expectation of capital gain. This makes bonds more attractive, shifting demand for bonds to right. We saw in the previous chapter, that lower expected interest rate in future increase the demand for long term bonds (because long term bond prices would be expected to rise more than initially expected), resulting in the shift of demand to the right. On the other hand, higher expected interest rates in the future lower the expected return for long term bonds, resulting in the leftward shift in the bond's demand curve.

**Change in expected inflation** will affect bond demand. An increase in expected inflation will lower bond demand ( $B_d$ ) for several reasons. During inflationary periods, real (physical) assets do very well (real estate, gold, antiques, baseball cards, etc), so investors would shift out of bonds and stocks into real assets when expected inflation increases.

**Risk** - if the riskiness of bonds increases relative to other assets, the demand will fall, shift to the left. An increase in the riskiness of other assets, will increase the demand for bonds. *Example:* Economy goes into recession, junk bonds in general are now considered to be more risky (higher default rate).  $B_d$  falls for junk bonds,

**5. Liquidity** - Increased liquidity of bonds, relative to other assets, increases demand for bonds ( $B_d$ ). Increased liquidity of other assets decreases the demand for bonds.

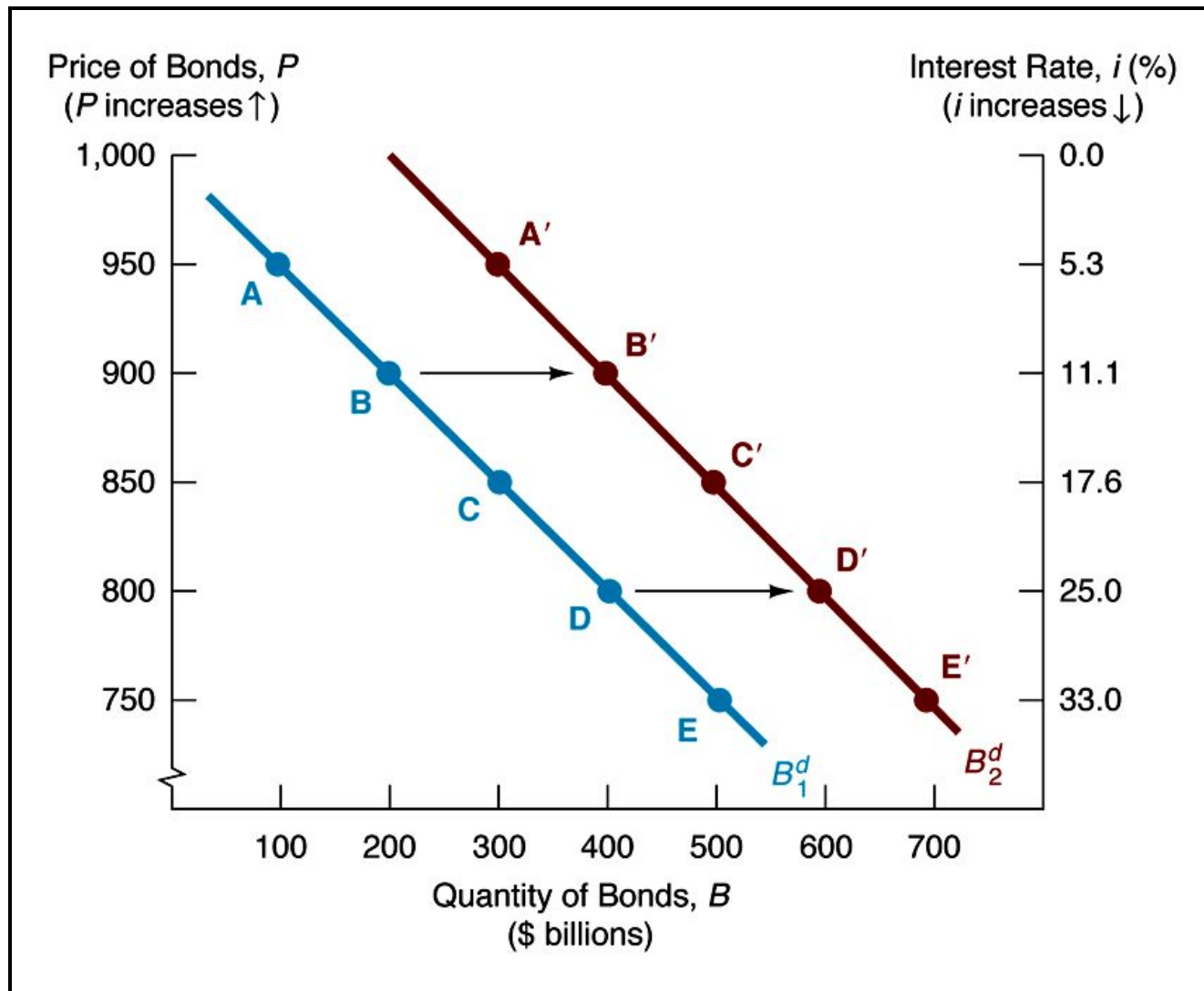
# Loanable Funds Terminology



1. Demand for bonds  
supply of loanable funds
2. Supply of bonds  
demand for loanable funds



# Shifts in the Bond Demand Curve



# Factors that Shift the Bond Demand Curve

## 1. Wealth

- A. Economy grows, wealth  $\uparrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right

## 2. Expected Return

- A.  $i \downarrow$  in future,  $R^e$  for long-term bonds  $\uparrow$ ,  $B^d$  shifts out to right
- B.  $\pi^e \downarrow$ , Relative  $R^e \uparrow$ ,  $B^d$  shifts out to right

## 3. Risk

- A. Risk of bonds  $\downarrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right
- B. Risk of other assets  $\uparrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right

## 4. Liquidity

- A. Liquidity of Bonds  $\uparrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right
- B. Liquidity of other assets  $\downarrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right

# Distinction Between Interest Rates and Returns (Previous Chapter)

## Rate of Return

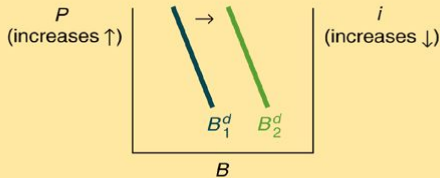
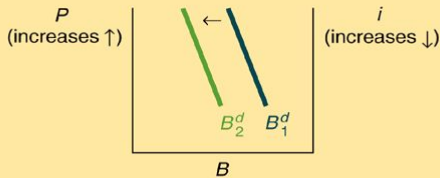
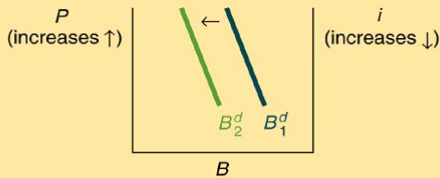
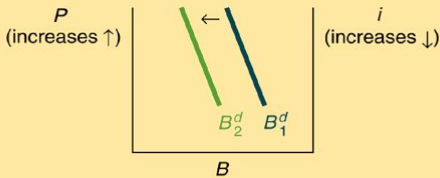
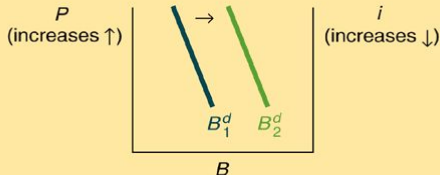
$$RET = \frac{C + P_{t+1} - P_t}{P_t} = i_c + g$$

where:  $i_c = \frac{C}{P_t}$  — current yield

$$g = \frac{P_{t+1} - P_t}{P_t} \text{ — capital gain}$$

# Factors that Shift Demand Curve for Bonds

**SUMMARY Table 2 Factors That Shift the Demand Curve for Bonds**

Variable	Change in Variable	Change in Quantity Demanded	Shift in Demand Curve
Wealth	↑	↑	
Expected interest rate	↑	↓	
Expected inflation	↑	↓	
Riskiness of bonds relative to other assets	↑	↓	
Liquidity of bonds relative to other assets	↑	↑	

Note:  $P$  and  $i$  increase in opposite directions:  $P$  on the left vertical axis increases as we go up the axis, while  $i$  on the right vertical axis increases as we go down the axis. Only increases in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the remaining columns.

# Bond Market and Interest Rates

**Table 6.4 Factors That Increase Bond Demand, Raise Bond Prices, and Lower Interest Rates**

Change	Effect on Bond Demand
An increase in wealth increases demand for all assets, including bonds.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A reduction in expected inflation makes bonds with fixed nominal payments more desirable.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
An increase in the expected return on the bond relative to the expected return on alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A decrease in the expected future interest rate makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A fall in the riskiness of the bond relative to the riskiness of alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
An increase in the liquidity of the bond relative to the liquidity of alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓

## **SHIFTS IN THE SUPPLY OF BONDS: Factors**

**1. Investment opportunities.** The more profitable investment opportunities there are available, the greater the supply of bonds (the greater the demand for credit).

The fewer the opportunities, the lower the supply of bonds.

**2. Expected inflation** - An increase in expected future inflation raises the Demand for Credit now (Supply of Bonds increases). Two reasons: a) higher interest rates in the future, borrow now before interest rates rise and b) higher expected inflation lowers the real rate of interest, benefiting debtors.

**3. Government activity** - Higher govt. deficits increase the Supply of Treasury bonds and shift Supply of Bonds (Bs) curve to the right. When the government is running a surplus, the Supply of Bonds decreases and the Bs shifts to the left.

# Shifts in the Bond Supply Curve

## 1. Profitability of Investment Opportunities

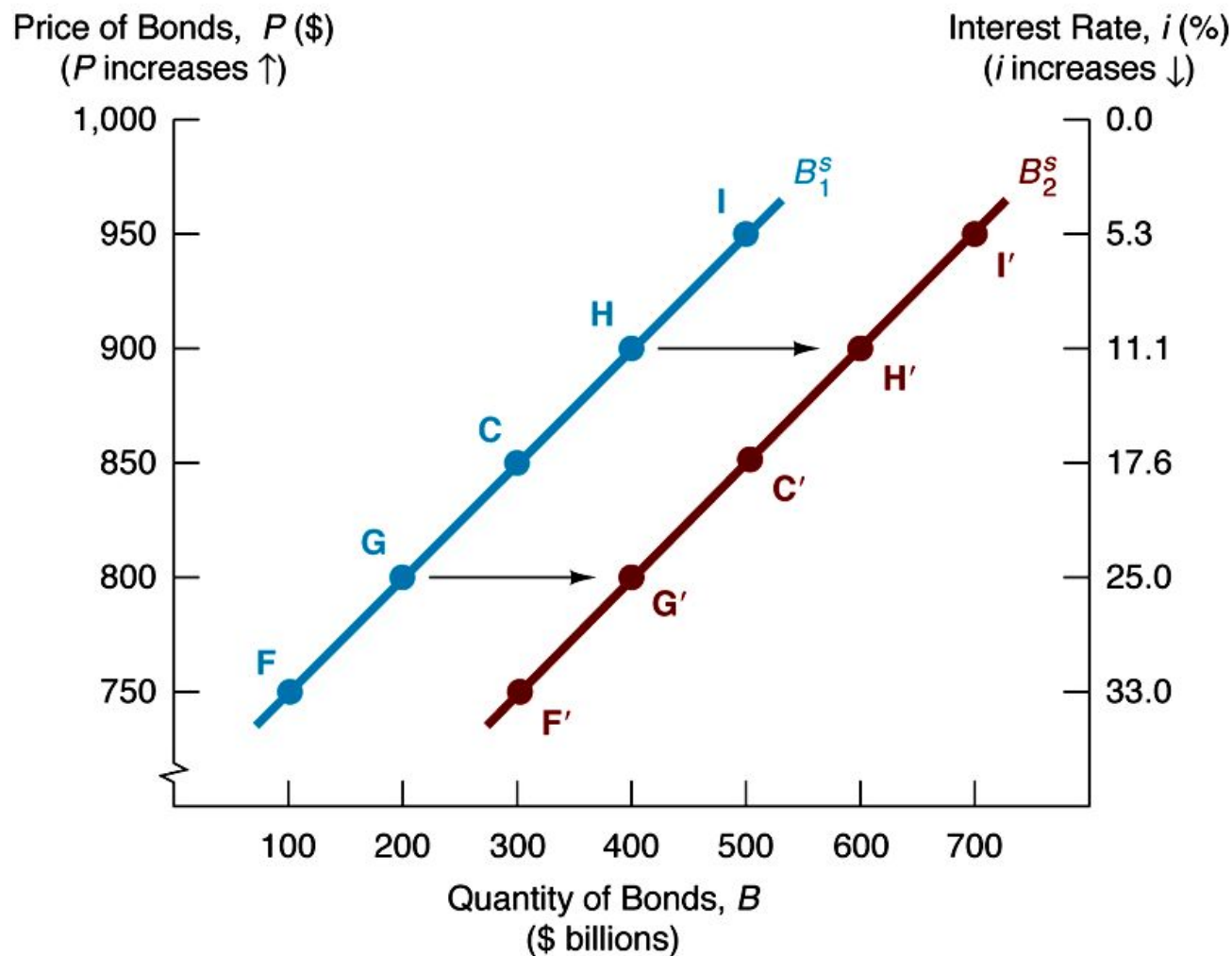
Business cycle expansion, investment opportunities  $\uparrow$   
 $B^s \uparrow$ ,  $B^s$  shifts out to right

## 2. Expected Inflation

$\pi^e \uparrow$ ,  $B^s \uparrow$ ,  $B^s$  shifts out to right

## 3. Government Activities

Deficits  $\uparrow$ ,  $B^s \uparrow$ , shifts out to right



# Factors that Shift Supply Curve for Bonds

**SUMMARY Table 3 Factors That Shift the Supply of Bonds**

Variable	Change in Variable	Change in Quantity Supplied	Shift in Supply Curve
Profitability of investments	↑	↑	<p>The graph shows a rightward shift from supply curve <math>B_1^s</math> to <math>B_2^s</math>. The vertical axis is labeled <math>P</math> (increases ↑) and the horizontal axis is labeled <math>B</math>. The right vertical axis is labeled <math>i</math> (increases ↓).</p>
Expected inflation	↑	↑	<p>The graph shows a rightward shift from supply curve <math>B_1^s</math> to <math>B_2^s</math>. The vertical axis is labeled <math>P</math> (increases ↑) and the horizontal axis is labeled <math>B</math>. The right vertical axis is labeled <math>i</math> (increases ↓).</p>
Government deficit	↑	↑	<p>The graph shows a rightward shift from supply curve <math>B_1^s</math> to <math>B_2^s</math>. The vertical axis is labeled <math>P</math> (increases ↑) and the horizontal axis is labeled <math>B</math>. The right vertical axis is labeled <math>i</math> (increases ↓).</p>

Note:  $P$  and  $i$  increase in opposite directions:  $P$  on the left vertical axis increases as we go up the axis, while  $i$  on the right vertical axis increases as we go down the axis. Only increases in the variables are shown. The effect of decreases in the variables on the change in supply would be the opposite of those indicated in the remaining columns.



# Bond Market and Interest Rates

**Table 6.3 Factors That Increase Bond Supply, Lower Bond Prices, and Raise Interest Rates**

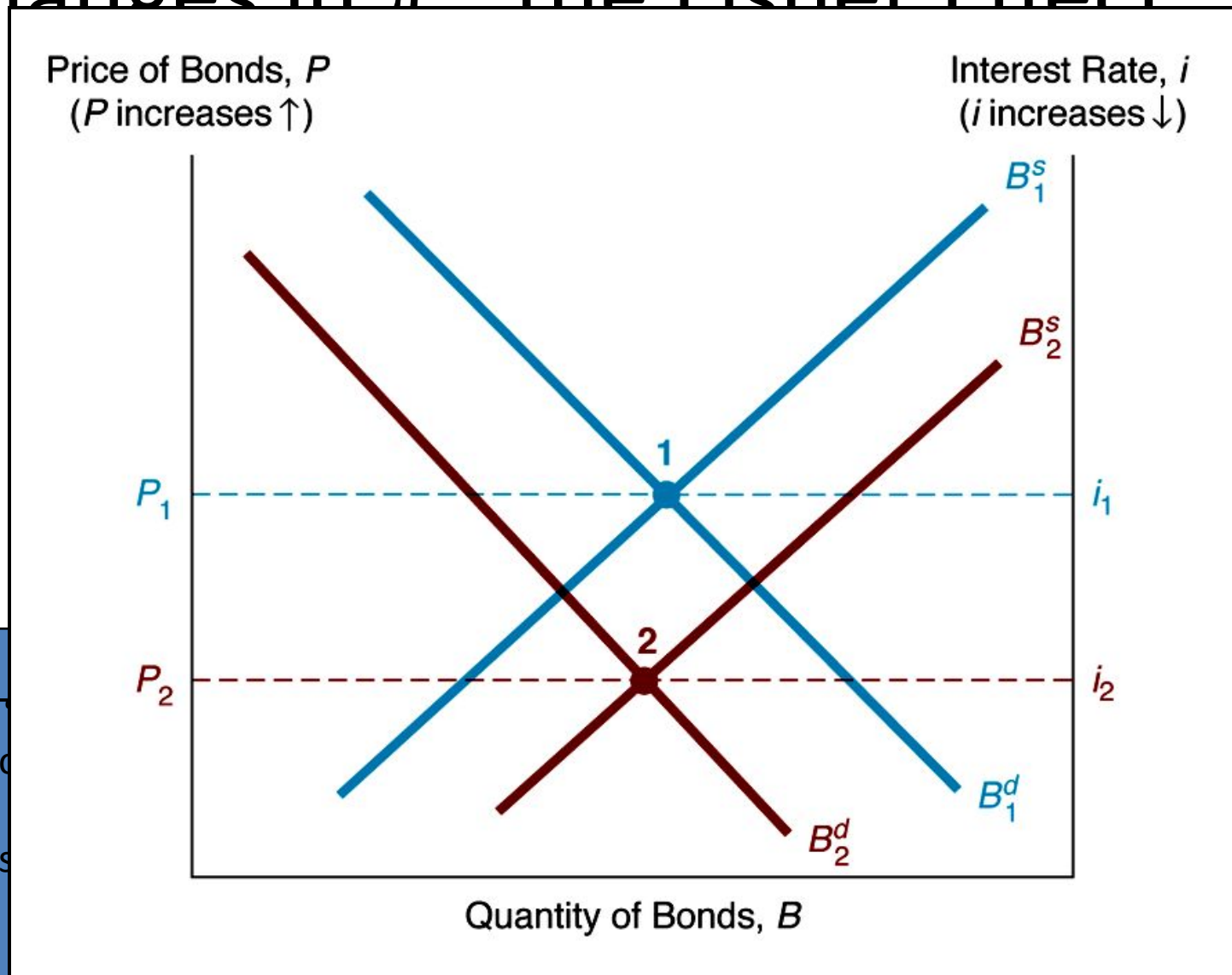
<b>Change</b>	<b>Effect on Bond Supply, Bond Prices, and Interest Rates</b>
An increase in the government's desired expenditure relative to its revenue	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑
An improvement in general business conditions	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑
An increase in expected inflation, reducing the real cost of repayment	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑

# Bonds and Risk

## Sources of Bond Risk

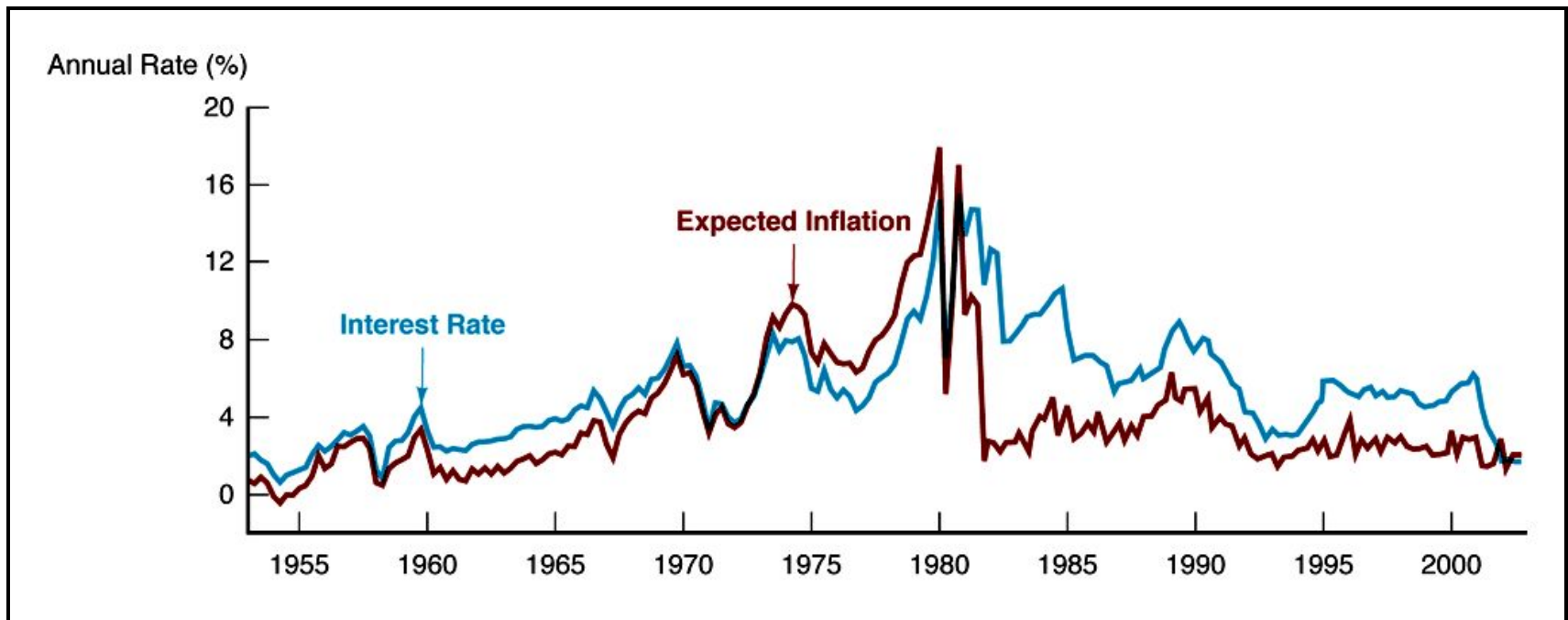
- Default Risk
- Inflation Risk
- Interest-Rate Risk

# Changes in $\pi^e$ : the Fisher Effect



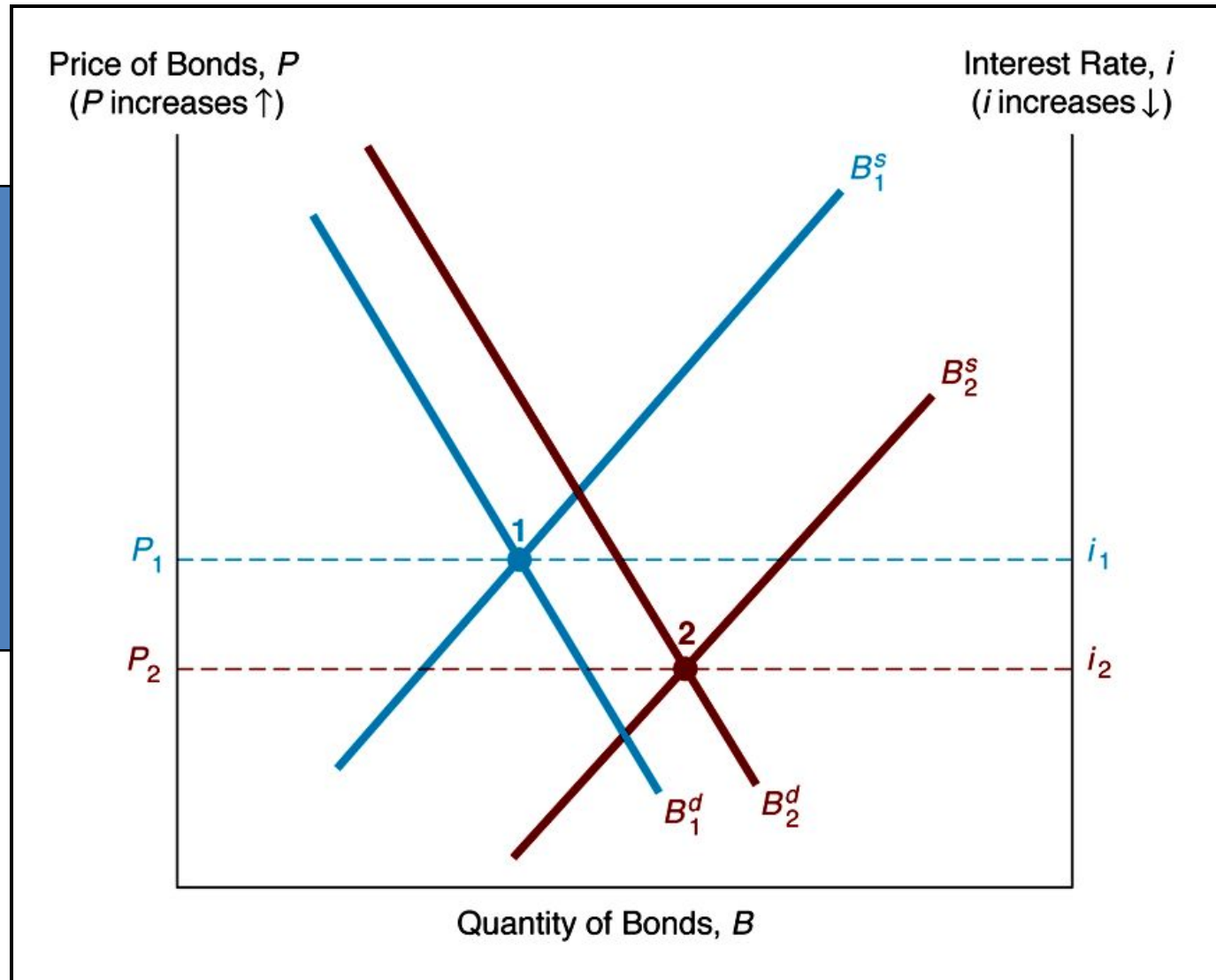
- If  $\pi^e \uparrow$
1. Relative  $RET$   $B^d$  shifts in to left
  2.  $B^s \uparrow$ ,  $B^s$  shifts out to right
  3.  $P \downarrow$ ,  $i \uparrow$

# Evidence on the Fisher Effect



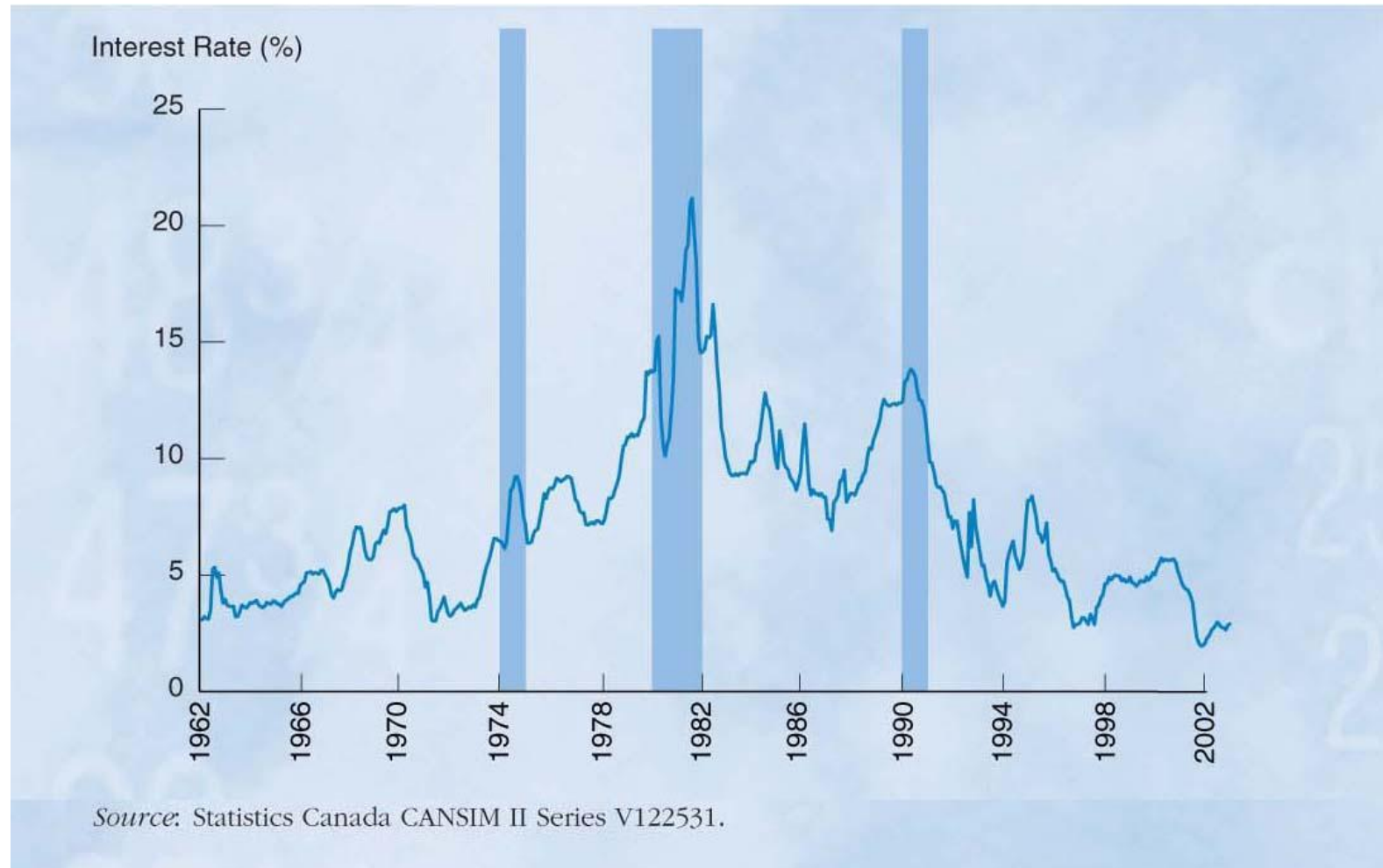
# Business Cycle Expansion

1. Wealth  $\uparrow$ ,  $B^d \uparrow$ ,  $B^d$  shifts out to right
2. Investment  $\uparrow$ ,  $B^s \uparrow$ ,  $B^s$  shifts out to right
3. If  $B^s$  shifts more than  $B^d$  then  $P \downarrow$ ,  $i \uparrow$



In a business cycle expansion, when the income and wealth are Rising, the demand curve for bond and the supply curve for bond, both, will shift to the right. The rightward shift in the supply curve, however, is more than the demand curve. The equilibrium bond prices moves down, and the equilibrium interest rate rises. Thus the interest rate rises during business cycle expansion and falls during recession.

# Evidence on Business Cycles and Interest Rates



# **LIQUIDITY PREFERENCE FRAMEWORK:**

## **Supply AND Demand FOR MONEY**

Another economic framework to analyze the behavior of interest rates is to look at the S and D for money, which also determines the equilibrium interest rate.

Liquidity Preference also helps to understand the Fed policy and the effect that it has on interest rates, since the Fed controls the MS directly and interest rates indirectly.

### **Assumptions of Liquidity Preference Theory:**

**There are two main assets to store wealth – bonds (interest bearing) and money/cash (interest = 0%).**

$B_s + M_s = B_d + M_d$  which says that the Supply of assets (bonds and money) has to equal the Demand for assets (bonds and money).

Interest rates change to clear both bond and money market, bring about equilibrium.



# Relation of Liquidity Preference Framework to Loanable Funds

## Keynes's Major Assumption

### There are Two Categories of Assets in Wealth

Money

Bonds

1. Thus:  $M^s + B^s = \text{Wealth}$
2. Budget Constraint:  $B^d + M^d = \text{Wealth}$
3. Therefore:  $M^s + B^s = B^d + M^d$
4. Subtracting  $M^d$  and  $B^s$  from both sides:

$$M^s - M^d = B^d - B^s$$

### Money Market Equilibrium

5. Occurs when  $M^d = M^s$
6. Then  $M^d - M^s = 0$  which implies that  $B^d - B^s = 0$ , so that  $B^d = B^s$  and bond market is also in equilibrium

1. Thus, equating supply and demand for bonds is equivalent to equating supply and demand for money. We can, therefore, think about determining the equilibrium interest rates by equating  $M^s = M^d$  or  $B^d = B^s$
2. Two frameworks are closely linked, but differ in practice because liquidity preference assumes only two assets, money and bonds, and ignores effects on interest rates from changes in expected returns on real assets.

# Liquidity Preference Analysis

## Demand Curve of Money

1. As  $i \uparrow$ , relative  $RET^e$  on money  $\downarrow$  (equivalently, opportunity cost of money  $\uparrow$ )  $\Rightarrow M^d \downarrow$
2. Demand curve for money has usual downward slope

## Supply curve of Money

1. Assume that central bank controls  $M^s$  and it is a fixed amount
2.  $M^s$  curve is vertical line

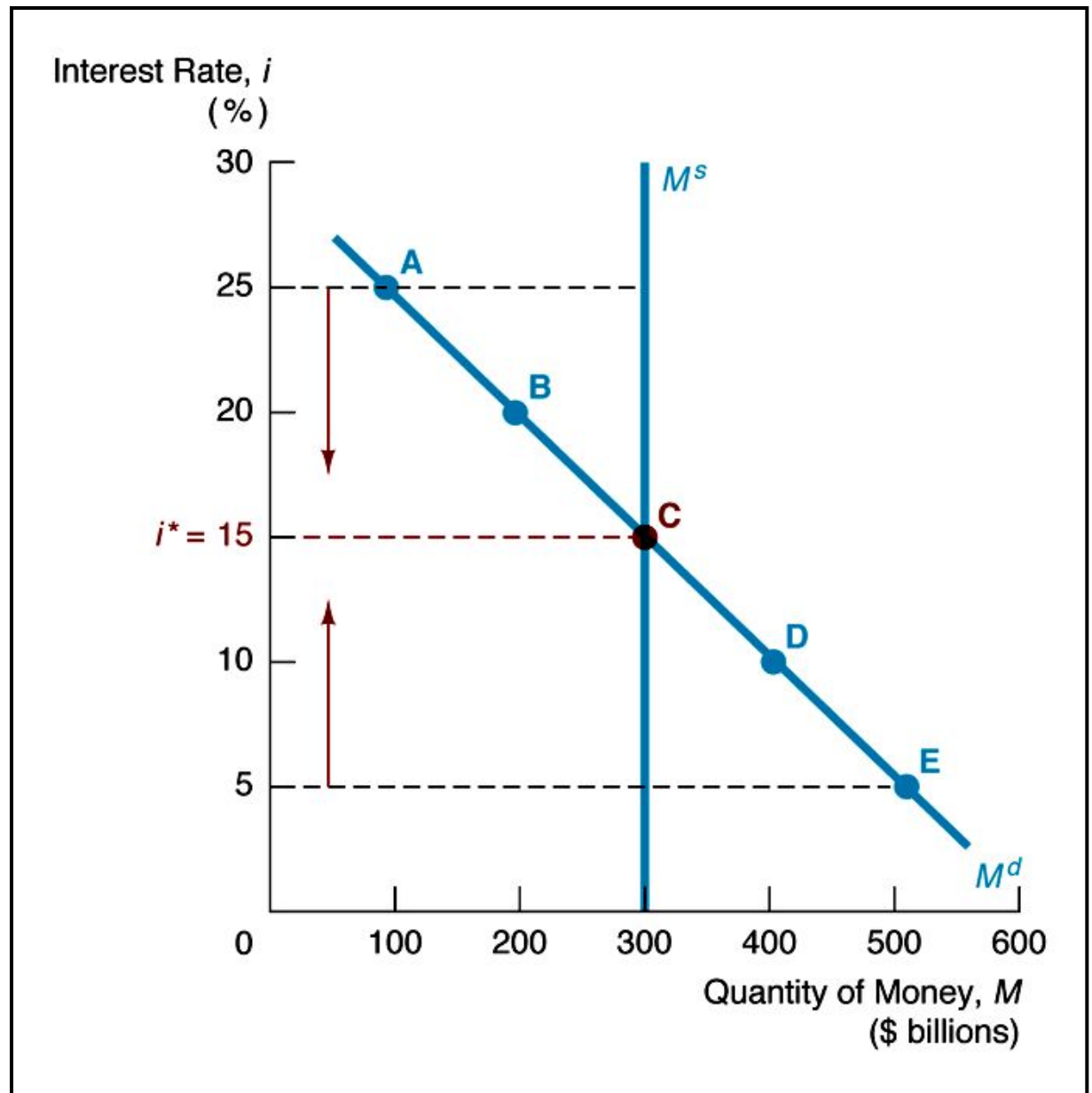
## Market Equilibrium

1. Occurs when  $M^d = M^s$ , at  $i^* = 15\%$
2. If  $i = 25\%$ ,  $M^s > M^d$  (excess supply): Price of bonds  $\uparrow$ ,  $i \downarrow$  to  $i^* = 15\%$
3. If  $i = 5\%$ ,  $M^d > M^s$  (excess demand): Price of bonds  $\downarrow$ ,  $i \uparrow$  to  $i^* = 15\%$

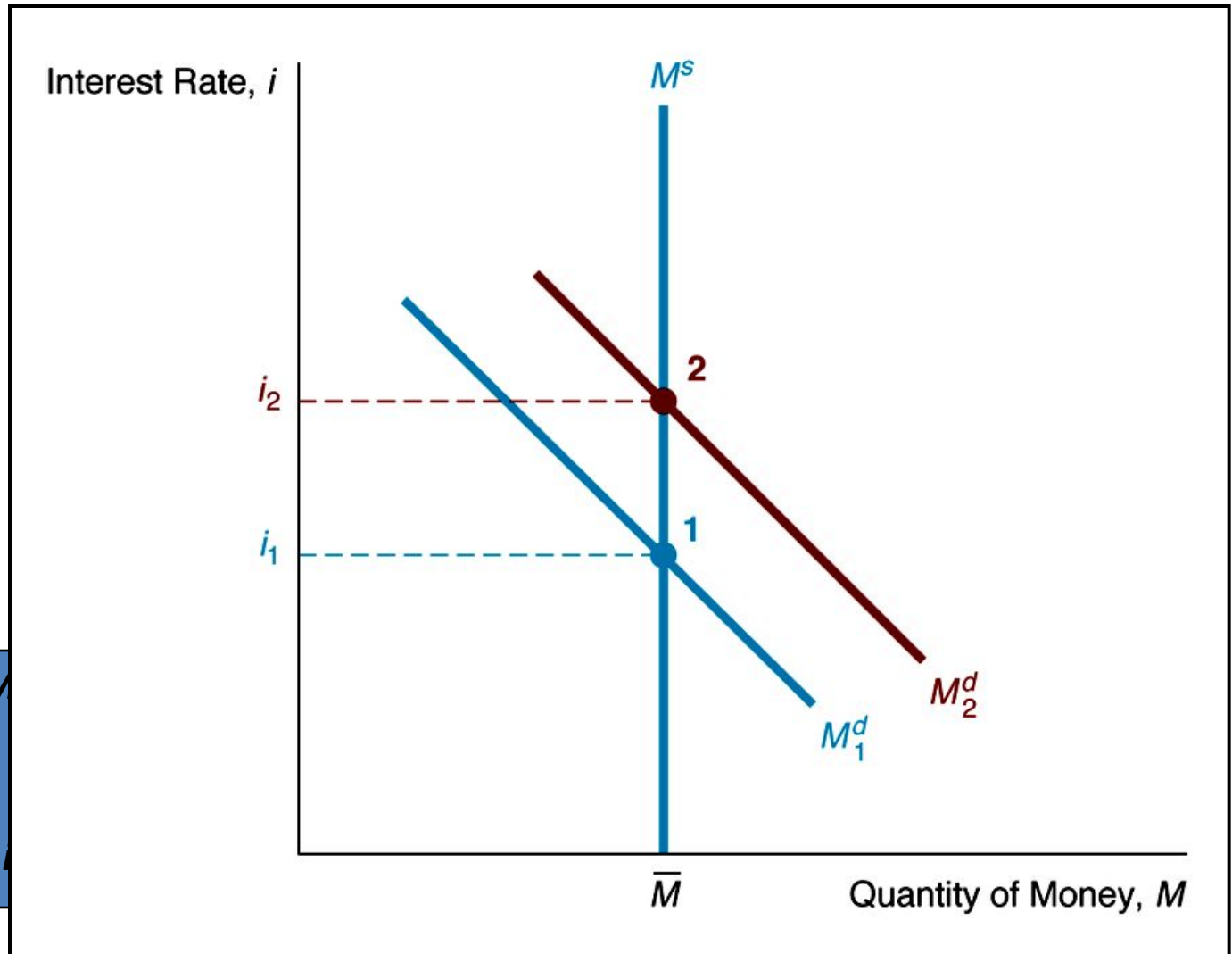
When the interest rate is 25%, there is excess supply of money □ people are holding more money than they desire. People would like to get rid of their excess money balances by trying to buy bonds. Accordingly, they will bid up the prices of bonds. The interest rate will fall toward the equilibrium interest rate of 15%.

Likewise, if the interest rate is 5%, there is an excess demand for money □ People want to hold more money than they have. They will sell bonds in order to obtain more money. This would result in the price of bond to fall, the interest rate will rise as a result.

# Money Market Equilibrium



# Rise in Income or the Price Level



1. Income  $\uparrow$ ,  $M^d \uparrow$ ,  $M^d$  shifts out to right
2.  $M^s$  unchanged
3.  $i^*$  rises from  $i_1$  to  $i_2$

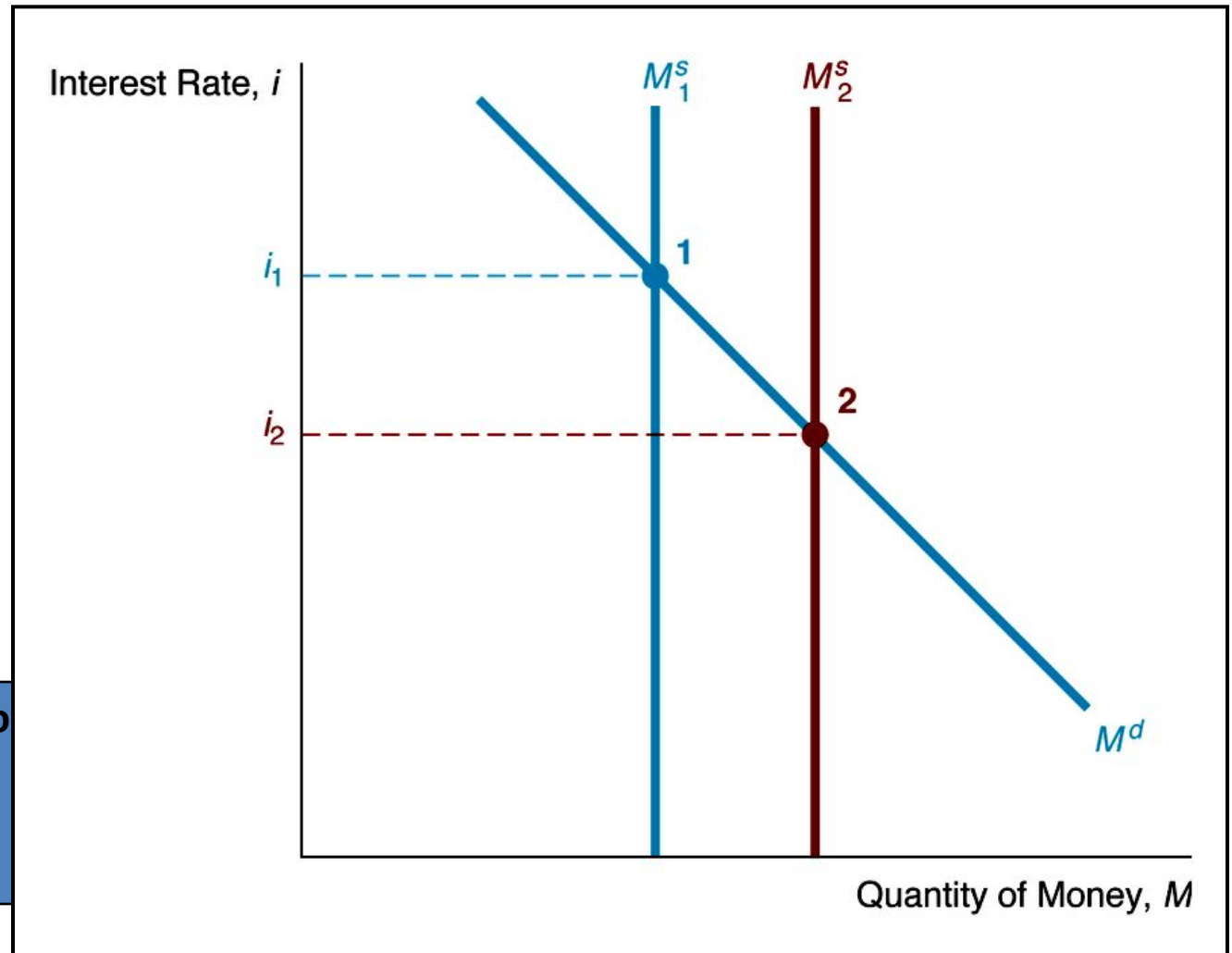
## **Shift in Money Demand Curve**

Two factors cause shift in money demand:  
Income and Price level.

Higher the income, more demand for money to carry out more transactions.

Price Level effect: Since people care about the amount of money they hold in real terms. With increase in the price level, people will like to hold more money. Demand for money will shift to the right. This will have effect on rate of interest. (See the money and bond equation )

# Rise in Money Supply



1.  $M^s \uparrow$ ,  $M^s$  shifts out to
2.  $M^d$  unchanged
3.  $i^*$  falls from  $i_1$  to  $i_2$



**SUMMARY Table 4 Factors That Shift the Demand for and Supply of Money**

Variable	Change in Variable	Change in Money Demand ( $M^d$ ) or Supply ( $M^s$ )	Change in Interest Rate	
Income	↑	$M^d \uparrow$	↑	
Price level	↑	$M^d \uparrow$	↑	
Money supply	↑	$M^s \uparrow$	↓	

*Note:* Only increases in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the remaining columns.

# Money and Interest Rates

## Effects of money on interest rates

### 1. Liquidity Effect

$M^s \uparrow$ ,  $M^s$  shifts right,  $i \downarrow$

### 2. Income Effect

$M^s \uparrow$ , Income  $\uparrow$ ,  $M^d \uparrow$ ,  $M^d$  shifts right,  $i \uparrow$

### 3. Price Level Effect

$M^s \uparrow$ , Price level  $\uparrow$ ,  $M^d \uparrow$ ,  $M^d$  shifts right,  $i \uparrow$

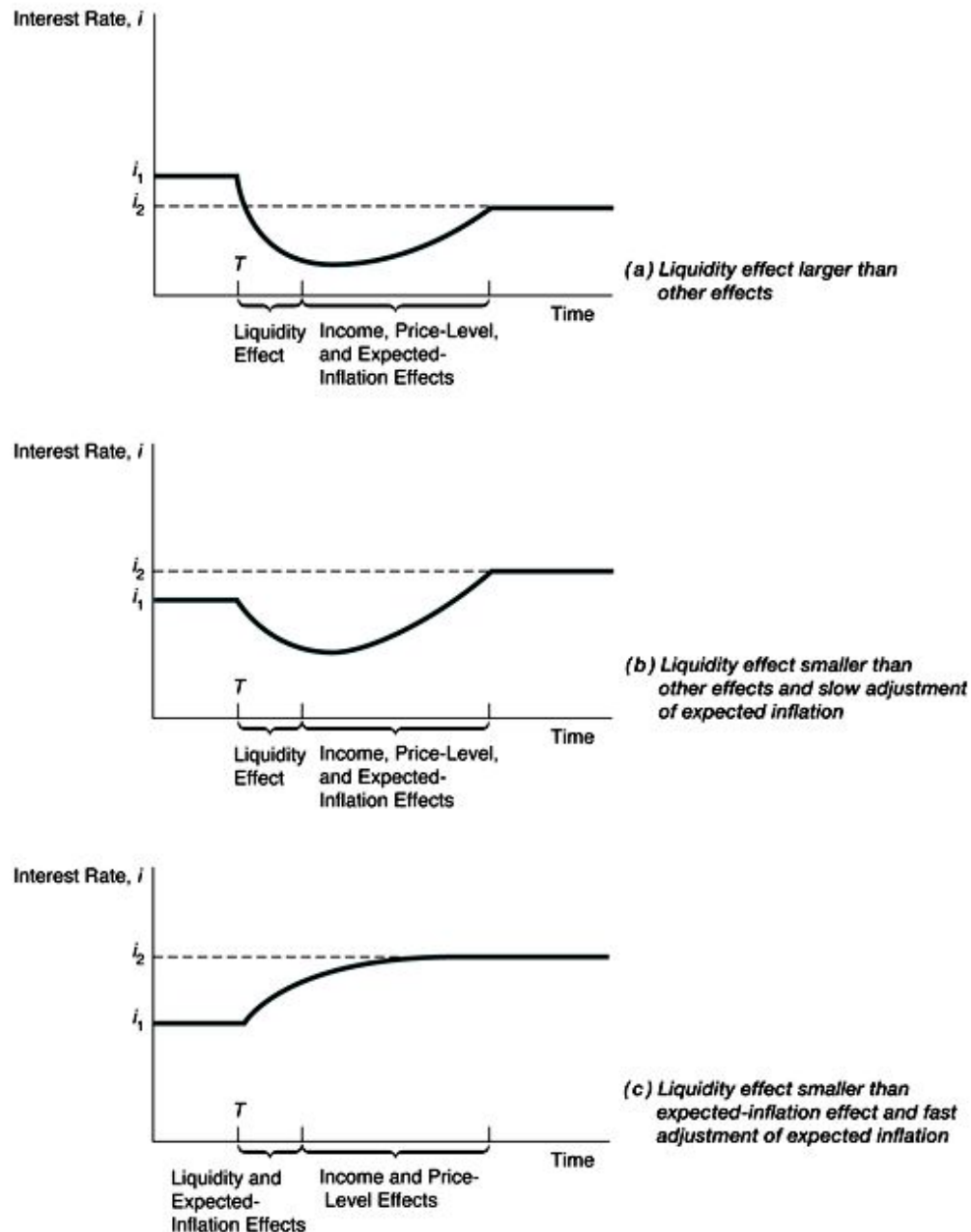
### 4. Expected Inflation Effect

$M^s \uparrow$ ,  $\pi^e \uparrow$ ,  $B^d \downarrow$ ,  $B^s \uparrow$ , Fisher effect,  $i \uparrow$

## Effect of higher rate of money growth on interest rates is ambiguous

1. Because income, price level and expected inflation effects work in opposite direction of liquidity effect

# Does Higher Money Growth Lower Interest Rates?



# Evidence on Money Growth and Interest Rates

