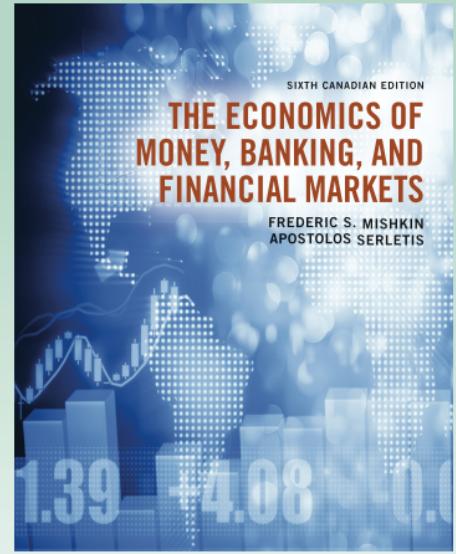


Mishkin/Serletis

The Economics of Money, Banking, and Financial Markets

Sixth Canadian Edition



Chapter 5

The Behaviour of Interest Rates

Learning Objectives

- Identify the factors that affect the demand for assets
- Draw the demand and supply curves for the bond market, and identify the equilibrium interest rate
- Use the liquidity preference framework to connect the bond market and the money market
- List and describe the factors that affect equilibrium interest rates in the bond and money markets
- Identify and illustrate the effects on the interest rate of changes in the money growth over time

Determinants of Asset Demand

1. **Wealth:** the total resources owned by the individual, including all assets
2. **Expected Return:** the return expected over the next period on one asset relative to alternative assets
3. **Risk:** the degree of uncertainty associated with the return on one asset relative to alternative assets
4. **Liquidity:** the ease and speed with which an asset can be turned into cash relative to alternative assets

Theory of Portfolio Choice

Holding all other factors constant, the **quantity demanded of an asset** is:

1. *positively related to wealth*
2. *positively related to its expected return relative to alternative assets*
3. *negatively related to the risk of its returns relative to alternative assets*
4. *positively related to its liquidity relative to alternative assets*

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

SUMMARY TABLE 5-1

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 effects of decreases in the variables on the quantity demanded would be the opposite of those indicated in the rightmost column.

Supply and Demand in the Bond Market

- **Bond Demand**
 - *Holding all else constant, lower prices (higher interest rates) increases the quantity demanded of bonds*
 - *Interest rate and quantity demanded are inversely related*
- **Bond Supply**
 - *Holding all else constant, lower prices (higher interest rates), decreases the quantity supplied of bonds*
 - *Interest rate and quantity supplied are positive related*

$$i = R^e = \frac{F - P}{P}$$

Supply and Demand for Bonds

$\downarrow P (\uparrow i) \rightarrow Q^d$
 $\uparrow P (\downarrow i) \rightarrow \downarrow Q^d$

A particular i
 corresponds to each price
 plots prices and
 quantities -

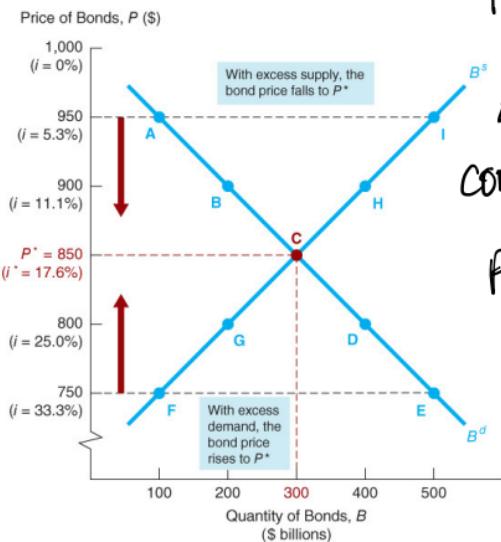


FIGURE 5-1 Supply and Demand for Bonds

Equilibrium in the bond market occurs at point C, the intersection of the demand curve B^d and the bond supply curve B^s . The equilibrium price is $P^* = \$850$, and the equilibrium interest rate is $i^* = 17.6\%$.

interest rate number :

$$i = \frac{\text{Face value} - \text{discounted price}}{\text{discounted price}}$$

As the bond price ↑, quantity of bonds supplied will increase. because the cost of borrowing decreases.

Market Equilibrium

- A **market equilibrium** occurs when the amount that people are willing to buy (demand) equals the amount that people are willing to sell (supply) at a given price
- $B_d = B_s$ defines the equilibrium (or market clearing) price and interest rate
- When $B_d > B_s$, there is **excess demand**, price will rise and interest rate will fall
- When $B_d < B_s$, there is **excess supply**, price will fall and interest rate will rise

Equilibrium condition: $B^d = B^s$

This intersection will determine the equilibrium
or market-clearing price (and equilibrium or
market-clearing interest rate)

Shifts in the Demand for Bonds

- **Wealth:** growing wealth shifts the demand curve for bonds to the right
- **Expected returns:** higher expected *future* interest rates shifts the demand curve to the left
- **Expected inflation:** an increase in the expected rate of inflations shifts the demand curve to shift to the left
- **Risk:** an increase in the riskiness of bonds causes the demand curve to shift to the left
- **Liquidity:** increased liquidity of bonds shifts the demand curve to the right

Shifts in the Demand Curve for Bonds

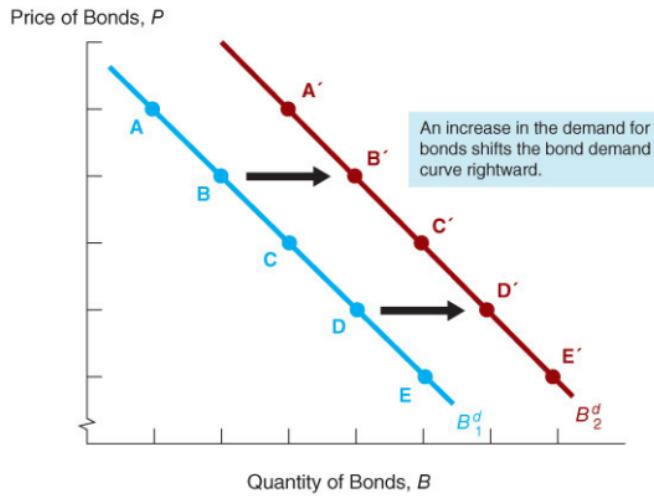


FIGURE 5-2 Shift in the Demand Curve for Bonds

When the demand for bonds increases, the demand curve shifts to the right as shown.

Expected Returns.

For a one-year discounted bond $i = R^e$, R^e only affected by today's interest rate.

For bonds with maturities greater than one year, R^e may not be i .

An increase in i on a long-term bond leads to a decrease in P , $\downarrow R^e$ as we saw in Table 4-2.

Therefore, if people think T^e_i in the future, $R^e \downarrow$ on long term bonds today and $\downarrow Q^d$ for any i .

$$\text{Recall: } i = \frac{E - P}{P}$$

Higher expected future interest rates lower the expected return for long-term bonds, decrease demand and shift to left.

Lower expected future interest rate increases the demand and shift right.

Also, an increase in expected returns on other assets lower the demand of bonds.

Expected inflation:

A change in expected inflation will affect R^e .
on real assets (house, cars) which would.
affect demands for bonds

$\uparrow \pi^e \rightarrow \uparrow$ prices on real assets in the future.

$\uparrow R^e$ on real assets \rightarrow relatively $\downarrow R^e$ on bonds

Therefore, decreased demand for bonds and.
a shift to left.

Or, based on the Fisher Equation, $r = i - \pi^e$
 $\downarrow \pi^e \rightarrow \uparrow r$

$\uparrow r$ (return on bonds) \rightarrow \uparrow demands for bonds
and a right shift.

Summary .

$$r = i - \pi^e$$

$\uparrow \pi^e \rightarrow \downarrow r \rightarrow \downarrow$ demand for bonds
 $\downarrow \pi^e \rightarrow \uparrow r \rightarrow \uparrow$ demand

Notice that expected inflation shifts both demand and supply.

In the case of supply, for a given interest rate (and bond price), when π^e increases, the real cost of borrowing (r) decreases, supply of bonds increases and the supply shifts right.

$$r = \bar{r} - \pi^e$$

Factors That Shift the Demand Curve for Bonds

SUMMARY TABLE 5-2			
Factors That Shift the Demand Curve for Bonds			
Variable	Change in Variable	Change in Quantity Demanded at Each Bond Price	Shift in Demand Curve
Wealth	↑	↑	A graph with Price (P) on the vertical axis and Bonds (B) on the horizontal axis. Two downward-sloping demand curves are shown: a blue one labeled B_d^1 and a red one labeled B_d^2. An arrow points from B_d^1 to B_d^2, indicating a rightward shift.
Expected interest rate	↑	↓	A graph with Price (P) on the vertical axis and Bonds (B) on the horizontal axis. Two downward-sloping demand curves are shown: a blue one labeled B_d^1 and a red one labeled B_d^2. An arrow points from B_d^2 to B_d^1, indicating a leftward shift.
Expected inflation	↑	↓	A graph with Price (P) on the vertical axis and Bonds (B) on the horizontal axis. Two downward-sloping demand curves are shown: a blue one labeled B_d^1 and a red one labeled B_d^2. An arrow points from B_d^2 to B_d^1, indicating a leftward shift.
Riskiness of bonds relative to other assets	↑	↓	A graph with Price (P) on the vertical axis and Bonds (B) on the horizontal axis. Two downward-sloping demand curves are shown: a blue one labeled B_d^1 and a red one labeled B_d^2. An arrow points from B_d^2 to B_d^1, indicating a leftward shift.
Liquidity of bonds relative to other assets	↑	↑	A graph with Price (P) on the vertical axis and Bonds (B) on the horizontal axis. Two downward-sloping demand curves are shown: a blue one labeled B_d^1 and a red one labeled B_d^2. An arrow points from B_d^1 to B_d^2, indicating a rightward shift.

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

Shifts in the Supply of Bonds

- **Investment opportunities:** Higher expected profitability of investment opportunities shifts the supply curve to the right
- **Expected inflation:** an increase in expected inflation shifts the supply curve to the right
- **Government budget:** increased budget deficit shifts the supply curve to the right

Shift in the Supply Curve for Bonds

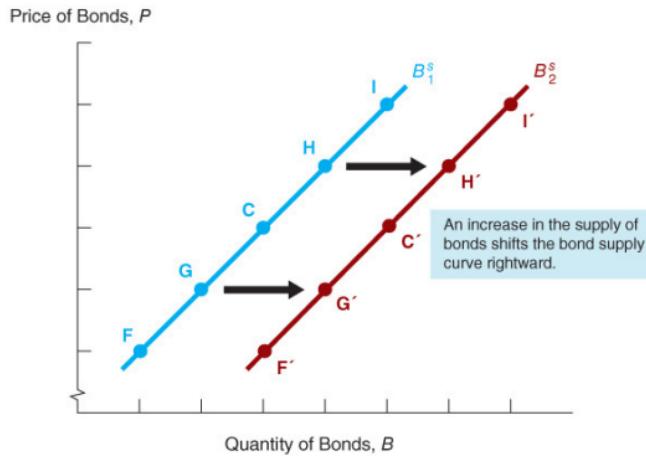


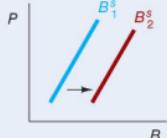
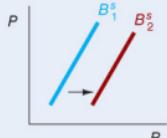
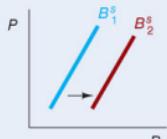
FIGURE 5-3 Shift in the Supply Curve for Bonds

When the supply of bonds increases, the supply curve shifts to the right.

Factors That Shift the Supply Curve of Bonds

SUMMARY TABLE 5-3

Factors that Shift the Supply of Bonds

Variable	Change in Variable	Change in Quantity Supplied at Each Bond Price	Shift in Supply Curve
Profitability of investments	↑	↑	
Expected inflation	↑	↑	
Government deficit	↑	↑	

Note: Only increases in the variables are shown. The effects of decreases in the variables on the supply would be the opposite of those indicated in the remaining columns.

Response to a Change in Expected Inflation

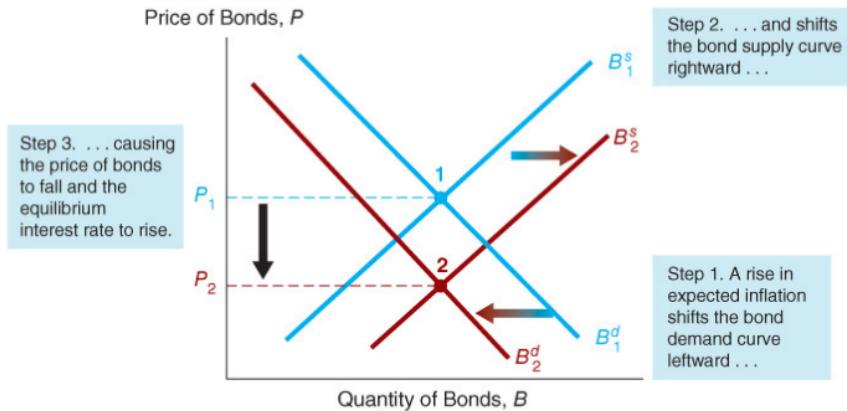


FIGURE 5-4 Response to a Change in Expected Inflation

When expected inflation rises, the supply curve shifts from B^s_1 to B^s_2 , and the demand curve shifts from B^d_1 to B^d_2 . The equilibrium moves from point 1 to point 2, causing the equilibrium bond price to fall from P_1 to P_2 and the equilibrium interest rate to rise.

Expected Inflation and Interest Rates

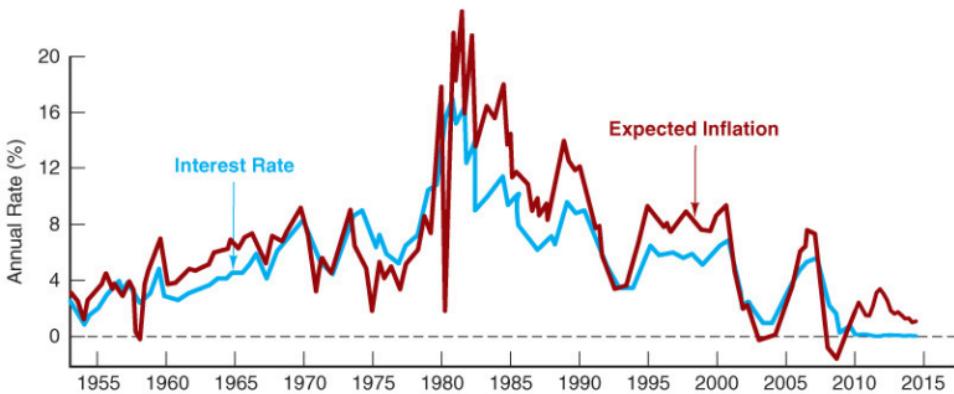


FIGURE 5-5 Expected Inflation and Interest Rates (Three-Month Treasury Bills), 1953–2014

The interest rate on three-month Treasury bills and the expected inflation rate generally move together, as the Fisher effect predicts.

Source: Federal Reserve Bank of St. Louis FRED database: <http://research.stlouisfed.org/fred2/>. Expected inflation calculated using procedures outlined in Frederic S. Mishkin, "The Real Interest Rate: An Empirical Investigation," Carnegie-Rochester Conference Series on Public Policy 15 (1981): 151–200. These procedures involve estimating expected inflation as a function of past interest rates, inflation, and time trends.

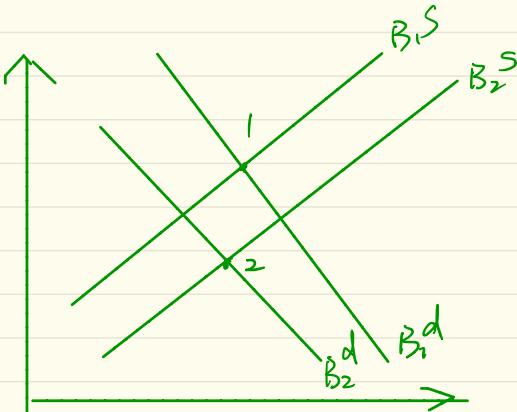
$$r = i - \pi^e.$$

when π^e increases, r decreases.

r represents the return on bonds. Demand decreases.

r represents the cost of borrowing.
Supply increases.

Equilibrium: bond price falls and equilibrium interest rate rises.



can either rise or fall.

$\pi_e \uparrow \rightarrow i \uparrow$ (bond price \downarrow)

$$i = r + \pi_e$$

Response to a Business Cycle Expansion

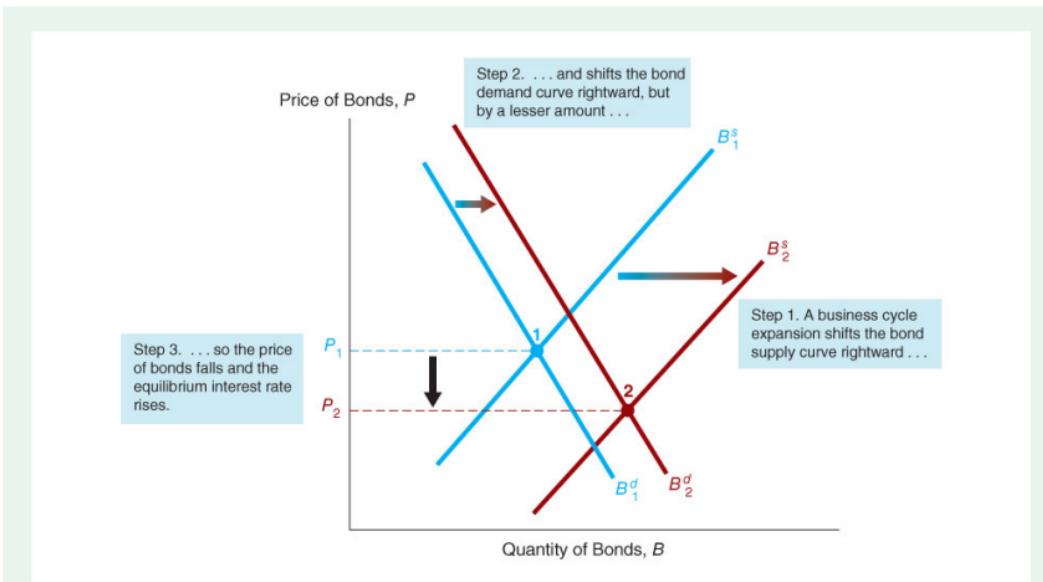


FIGURE 5-6 Response to a Business Cycle Expansion

In a business cycle expansion, when income and wealth are rising, the demand curve shifts rightward from B_d^1 to B_d^2 . If the supply curve shifts to the right more than the demand curve, as in this figure, the equilibrium bond price moves down from P_1 to P_2 and the equilibrium interest rate rises.

To In an expansion, profitable business opportunities are an incentive.

Business Cycle and Interest Rates

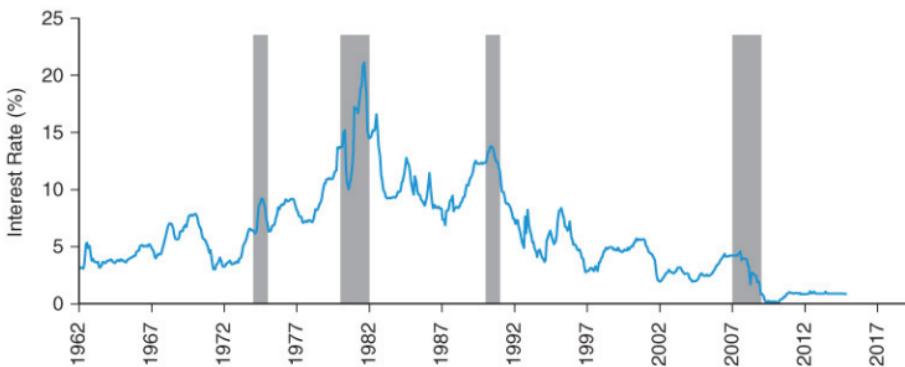


FIGURE 5-7 Business Cycle and Interest Rates (Three-Month Treasury Bills), 1962–2014

Shaded areas indicate periods of recession. The interest rate tends to rise during business cycle expansions and fall during recessions.

Source: Statistics Canada CANSIM series V122531.

The Liquidity Preference Framework

- Equilibrium interest rates are determined by the supply and demand for money
- Two ways to hold wealth: money and bonds
- Total wealth equals total amount of money and bonds

$$Bs + Ms = Bd + Md$$

- Rearrange terms:

$$Bs - Bd = Md - Ms$$

- If the bond market is in equilibrium then the money market must also be in equilibrium

Liquidity Preference framework

- * An alternative model for determining the equilibrium interest rate
- * Developed by John Maynard Keynes.
- * the e-interest-rate is determined in the money market , the market for the medium of exchange instead of the bond market
- * There are only two ways to store wealth (money and bonds) so total wealth = $B^S + M^S$
- * Total wealth also = $B^D + M^D$ because people cannot purchase more assets (bonds) than there are resources (money)

$$B^S + M^S = B^D + M^D$$

$$\text{Rewrite : } B^S - B^D = M^D - M^S$$

if $M^D = M^S$ and the RHS=0 then $B^S = B^D$
and LHS=0.

Both markets are in equilibrium .

- * Use the bond market model to analyze the effects on the interest rate of a change in expected inflation.
- * Use the money market model to analyze the effects on the interest rate of changes in income, the price level, and the money supply.

Demand for Money in the Liquidity Preference Framework

- As the interest rate increases:
 - *the opportunity cost of holding money increases...*
 - *the relative expected return of money decreases...*
- ...and therefore the quantity demanded of money decreases

Shifts in the Demand for Money

- **Income Effect**
 - *a higher level of income causes the demand for money at each interest rate to increase and the demand curve to shift to the right*
- **Price-Level Effect**
 - *a rise in the price level causes the demand for money at each interest rate to increase and the demand curve to shift to the right*

Shifts in the Supply of Money

- Assume that the supply of money is controlled by the central bank
- An increase in the money supply engineered by the Bank of Canada will shift the supply curve for money to the right
- The money supply is therefore **perfectly inelastic**

Equilibrium in the Market for Money

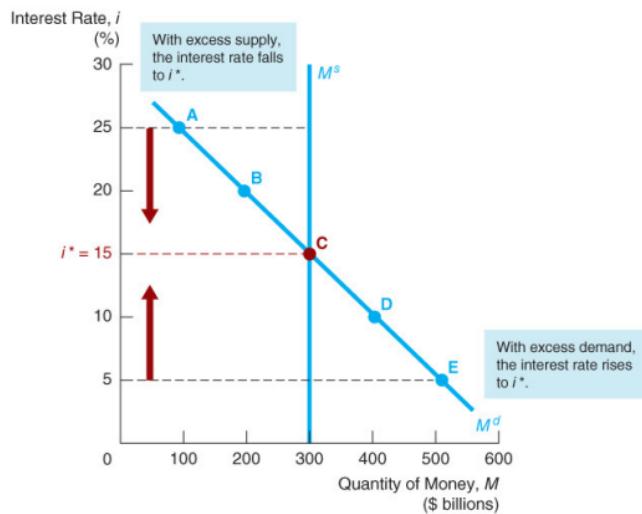


FIGURE 5-8 Equilibrium in the Market for Money

Equilibrium in the market for money occurs at point C, the intersection of the money demand curve M^d and the money supply curve M^s . The equilibrium interest rate is $i^* = 15\%$.

$M^S > M^D$.

Excess supply of the money at that interest rate.
People would buy bonds. Bond price ↑ and $i \downarrow$

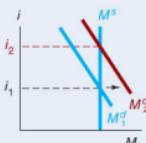
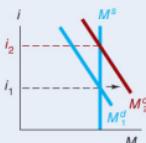
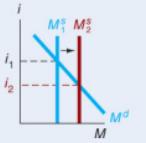
$M^D > M^S$.

Excess Demand of money at that interest rate.
People would sell bonds. Bond price ↓ and $i \uparrow$

Factors That Shift the Demand for and Supply of Money

SUMMARY TABLE 5-4

Factors that Shift the Demand for and Supply of Money

Variable	Change in Variable	Change in Money Demand (M^d) or Supply (M^s) at Each Interest Rate	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 effects of decreases in the variables on demand and supply would be the opposite of those indicated in the remaining columns.

Changes in the Demand for Money

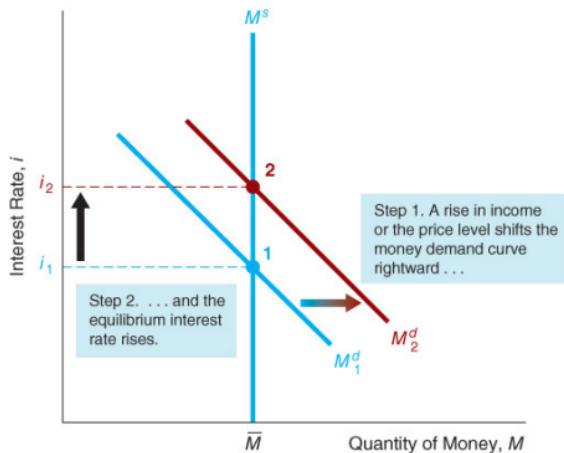


FIGURE 5-9 Response to a Change in Income or the Price Level

In a business cycle expansion, when income is rising, or when the price level rises, the demand curve shifts from M_d^1 to M_d^2 . The supply curve is fixed at $M^s = \bar{M}$. The equilibrium interest rate rises from i_1 to i_2 .

Changes in the Supply of Money

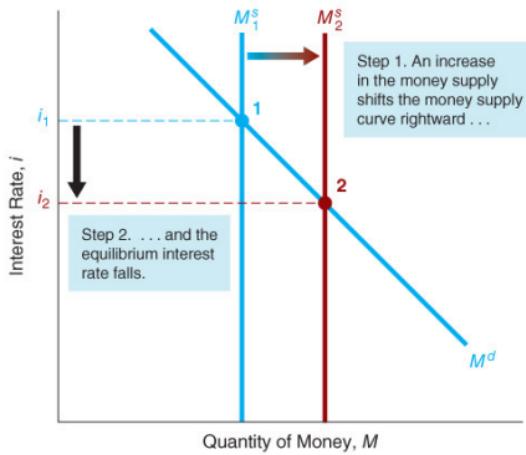


FIGURE 5-10 Response to a Change in the Money Supply

When the money supply increases, the supply curve shifts from M_1^s to M_2^s and the equilibrium interest rate falls from i_1 to i_2 .

Liquidity Preference suggests. $\uparrow M \rightarrow \downarrow i$

Criticism:

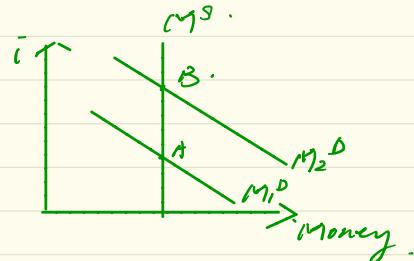
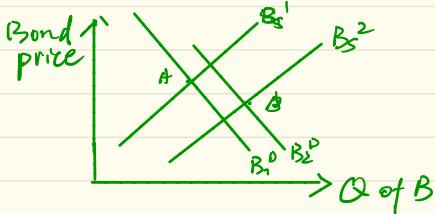
Are there important factors left out of this analysis?
Friedman suggests the Liquidity Preference Result
is correct, called Liquidity effect. But, it is.
only part of story

Money Supply and Interest Rates

- **The income effect** of an increase in the money supply is a rise in the interest rate in response to a higher level of income
- **The price-level effect** from an increase in the money supply is a rise in interest rates in response to the rise in the price level
- **The expected-inflation effect** of an increase in the money supply is a rise in interest rates in response to the rise in the expected inflation rate

The income effect

$\uparrow M^S$ cause \uparrow wealth

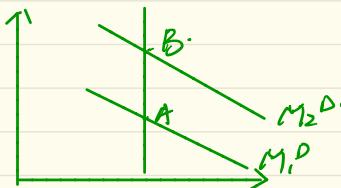


\downarrow Bond Price $\uparrow i$.

The income effect of $\uparrow M^S$ is $\uparrow i$ in respond to $\uparrow Y$ (income)

The Price - level effect

$\uparrow M^S$ can cause $\uparrow P$

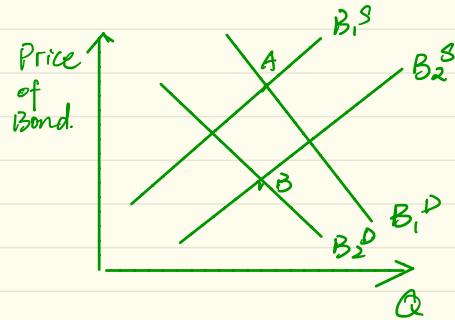


The price level effect. of $\uparrow M^S$ is $\uparrow i$ in respond to $\uparrow P$

The expected · Inflation effect.

$\uparrow M^S$ can cause $\uparrow \bar{w}$

$r = i - \pi^e$ $\uparrow \bar{w}^e$ leads to a low cost of borrowing
 $\uparrow B^S$



The expected - inflation effect of $\uparrow M$ is $\uparrow i$ in respond to $\uparrow \bar{w}^e$

Does a Higher Rate of Growth of the Money Supply Lower Interest Rates?

- Liquidity preference framework leads to the conclusion that an increase in the money supply will lower interest rates: **the liquidity effect**
- **Income effect** finds interest rates rising because increasing the money supply is an expansionary influence on the economy
 - *the demand curve shifts to the right*

Does a Higher Rate of Growth of the Money Supply Lower Interest Rates? (cont'd)

- **Price-level effect** predicts an increase in the money supply leads to a rise in interest rates in response to the rise in the price level
 - *the demand curve shifts to the right*
- **Expected-inflation effect** shows an increase in interest rates because an increase in the money supply may lead people to expect a higher price level in the future
 - *the demand curve shifts to the right*

Does a higher rate of Growth of the Money supply
Lower interest rate

It depends on which effect dominates and how quickly effect takes place.

Response over Time to an Increase in Money Supply Growth

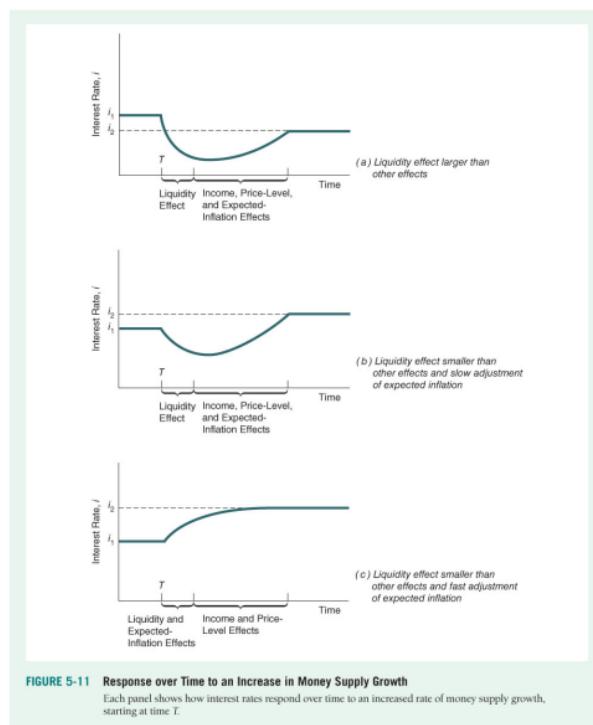


FIGURE 5-11 Response over Time to an Increase in Money Supply Growth

Each panel shows how interest rates respond over time to an increased rate of money supply growth, starting at time T .

Money Growth and Interest Rates

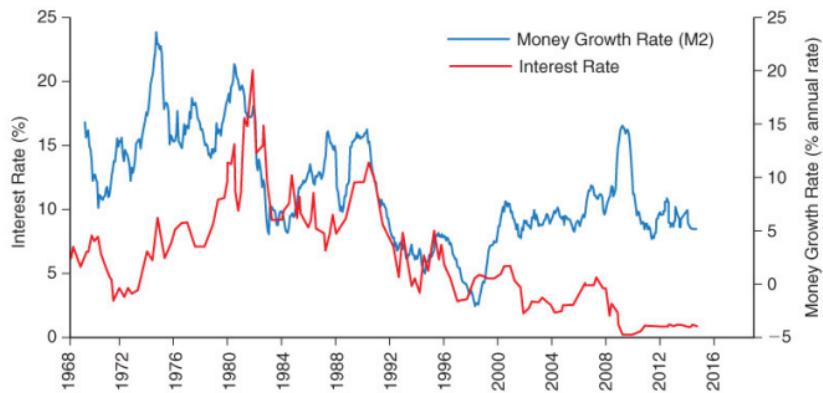


FIGURE 5-12 Money Growth (M2, Annual Rate) and Interest Rates (Three-Month Treasury Bills), 1968–2014

When the rate of money supply growth began to climb in the late 1970s, interest rates rose, indicating that the liquidity effect was dominated by the price-level, income, and expected-inflation effects. By the early 1980s, both interest rates and money growth reached levels unprecedented in the post–World War II period.

Source: Statistics Canada CANSIM series V1.22531 and V41552796.

