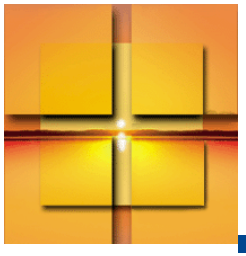
Money, Interest and Inflation

Chapter 28

CHAPTER CHECKLIST

When you have completed your study of this chapter, you will be able to

1. **Explain what determines the demand for money and how the demand for money and the supply of money determine the *nominal* interest rate.**
2. **Explain how in the long run, the quantity of money determines the price level and money growth brings inflation.**
3. **Identify the costs of inflation and the benefits of a stable value of money.**



WHERE WE ARE; WHERE WE'RE HEADING

The Real Economy

Real factors that are independent of the price level determine real GDP, the natural unemployment rate.

Investment and saving determine the real interest rate and, along with population growth and technological change, determine the growth rate of real GDP.

The Money Economy

Money is created by banks and its quantity is controlled by the Fed.

WHERE WE ARE; WHERE WE'RE HEADING

The Money Economy

The effects of money can be best understood in three steps:

- The effects of the Fed's actions on the short-term nominal interest rate
- The long-run effects of the Fed's actions on the price level and the inflation rate
- The details between the short-run and long-run effects

28.1 MONEY AND THE INTEREST RATE

The Demand for Money

Quantity of money demanded

The inventory of money that households and firms choose to hold.

Benefit of Holding Money

The benefit of holding money is the ability to make payments.

The more money you hold, the easier it is for you to make payments.

28.1 MONEY AND THE INTEREST RATE

The marginal benefit of holding money decreases as the quantity of money held increases.

Opportunity Cost of Holding Money

The opportunity cost of holding money is the interest forgone on an alternative asset.

Opportunity Cost: *Nominal* Interest is a *Real* Cost

The opportunity cost of holding money is the *nominal* interest because it is the sum of the real interest rate on an alternative asset plus the expected inflation rate, which is the rate at which money loses buying power.

28.1 MONEY AND THE INTEREST RATE

The Demand for Money Schedule and Curve

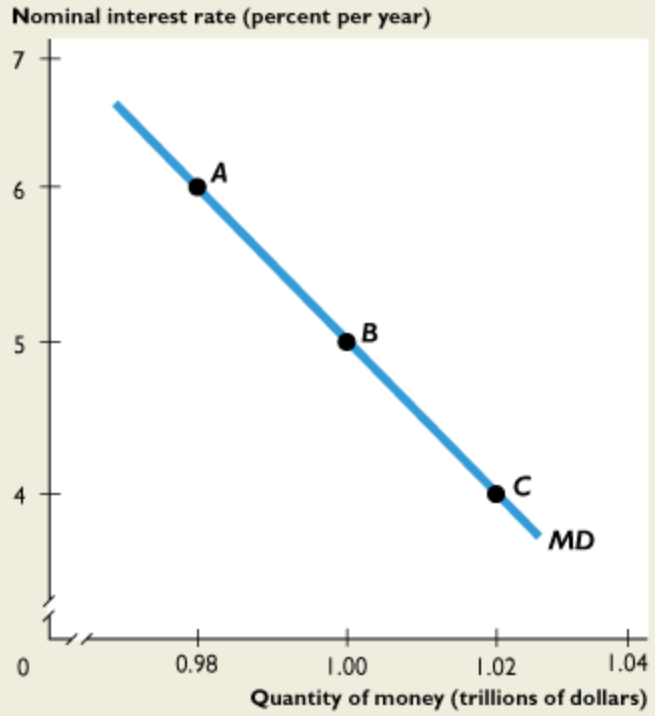
The **demand for money** is the relationship between the quantity of money demanded and the nominal interest rate, when all other influences on the amount of money that people want to hold remain the same.

Figure 28.1 on the next slide illustrate the demand for money.

28.1 MONEY AND THE INTEREST RATE

The lower the nominal interest rate—the opportunity cost of holding money—the greater is the quantity of real money demanded.

	Nominal interest rate (percent per year)	Quantity of money (trillions of dollars)
A	6	0.98
B	5	1.00
C	4	1.02

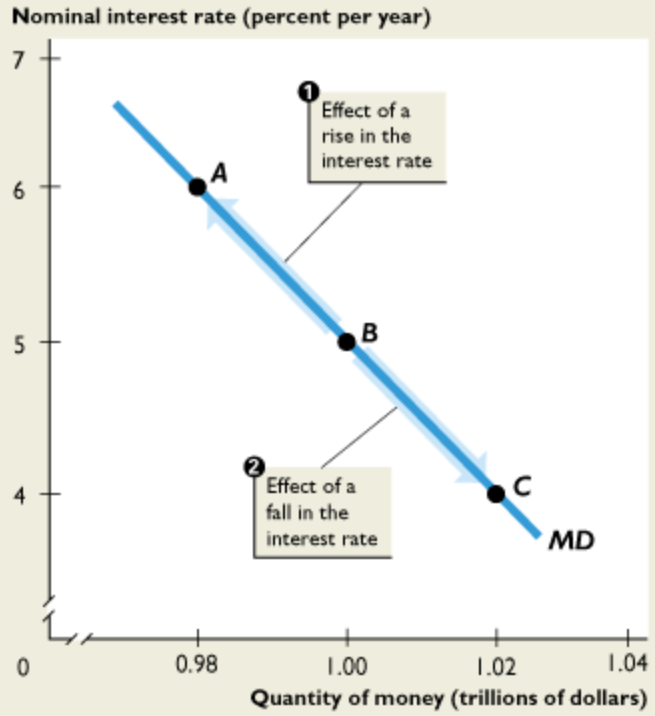


28.1 MONEY AND THE INTEREST RATE

1. Other things remaining the same, an increase in the nominal interest rate decreases the quantity of real money demanded.

2. A decrease in the nominal interest rate increases the quantity of real money demanded.

	Nominal interest rate (percent per year)	Quantity of money (trillions of dollars)
A	6	0.98
B	5	1.00
C	4	1.02



28.1 MONEY AND THE INTEREST RATE

Changes in the Demand for Money

A change in the nominal interest rate brings a change in the quantity of money demanded.

A change in any other influence on money holdings changes the demand for money. The three main influences are:

- The price level
- Real GDP
- Financial technology

28.1 MONEY AND THE INTEREST RATE

The Price Level

An *x* percent rise in the price level brings an *x* percent increase in the quantity of money that people plan to hold because the number of dollars we need to make payments is proportional to the price level.

Real GDP

The demand for money increases as real GDP increases because the number of transactions and payments increase when real GDP increases.

28.1 MONEY AND THE INTEREST RATE

Financial Technology

Daily interest on checking deposits, automatic transfers between checking and savings accounts, automatic teller machines, and debit cards and smart cards have increased the marginal benefit of money and increased the demand for money.

Credit cards have made it easier to buy goods on credit and have decreased the demand for money.

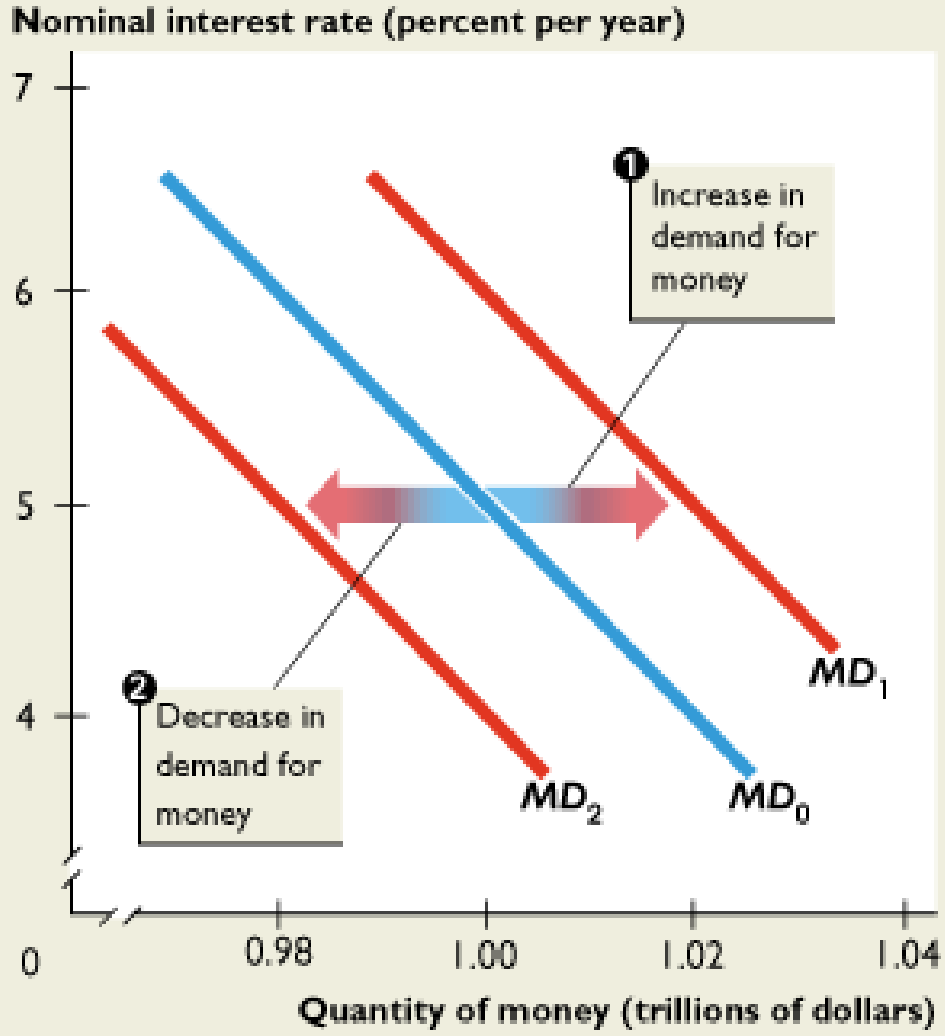
28.1 MONEY AND THE INTEREST RATE

Shifts in the Demand Curve for Money Curve

A change in any influence on money holding other than the nominal interest rate changes the demand for money and shifts the demand for money curve.

Figure 28.2 on the next slide illustrates these shifts.

28.1 MONEY AND THE INTEREST RATE



❶ Effect of a:

- Rise in the price level
- Increase in real GDP
- Change in financial technology that lowers the opportunity cost of holding money or increases the benefit of using money

❷ Effect of a:

- Fall in the price level
- Decrease in real GDP
- Change in financial technology that develops a substitute for money

28.1 MONEY AND THE INTEREST RATE

The Nominal Interest Rate

The nominal interest rate adjusts to make the quantity of money demanded equal the quantity of money supplied.

The **supply of money** is the relationship between the quantity of money supplied and the nominal interest rate.

On any given day, the quantity of money is fixed.

28.1 MONEY AND THE INTEREST RATE

- When the interest rate is above its equilibrium level, the quantity of money supplied exceeds the quantity of money demanded.
- People are holding too much money, so they try to get rid of money by buying other financial assets.
- The demand for financial assets increases, the prices of these assets rise, and the interest rate falls.

28.1 MONEY AND THE INTEREST RATE

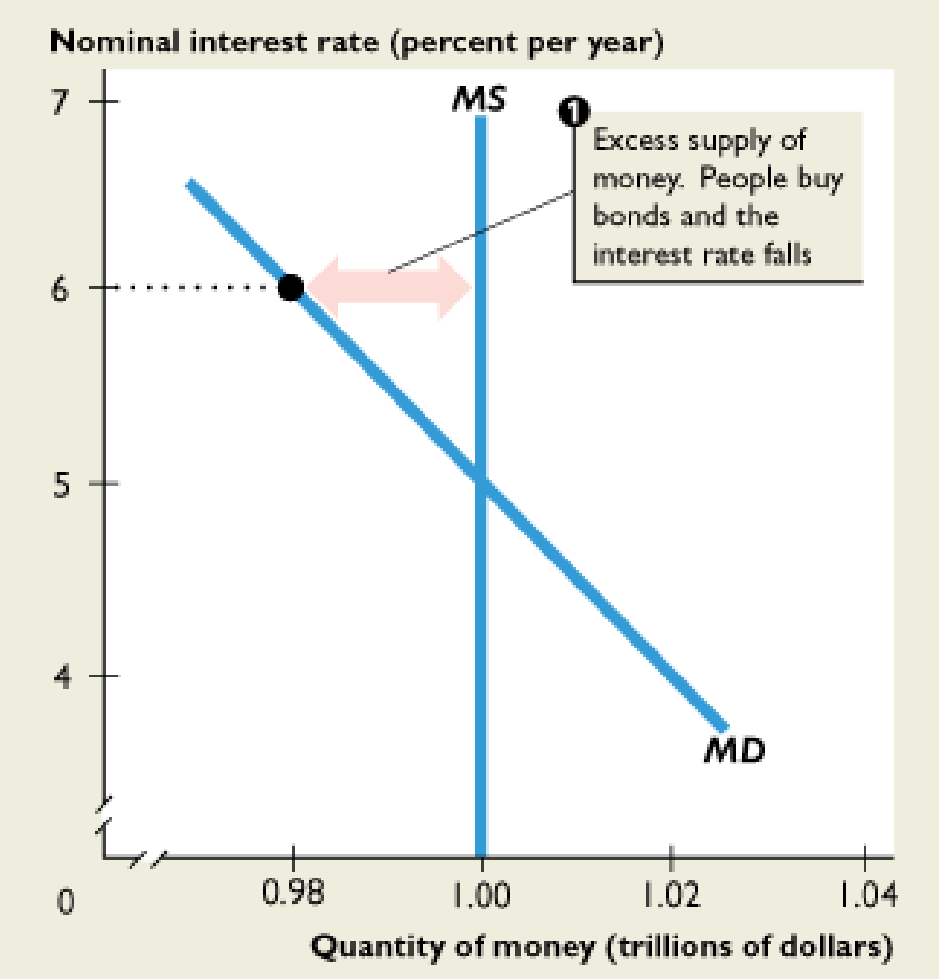
- When the interest rate is below its equilibrium level, the quantity of money demanded exceeds the quantity of money supplied.
- People are holding too little money, so they try to get more money by selling other financial assets.
- The demand for financial assets decreases, the prices of these assets fall, and the interest rate rises.

Figure 28.4 on the next slide illustrates the equilibrium and adjustment toward it.

28.1 MONEY AND THE INTEREST RATE

1. If the interest rate is 6 percent a year, the quantity of money held exceeds the quantity demanded. People buy bonds, the price of a bond rises, and the interest rate falls.

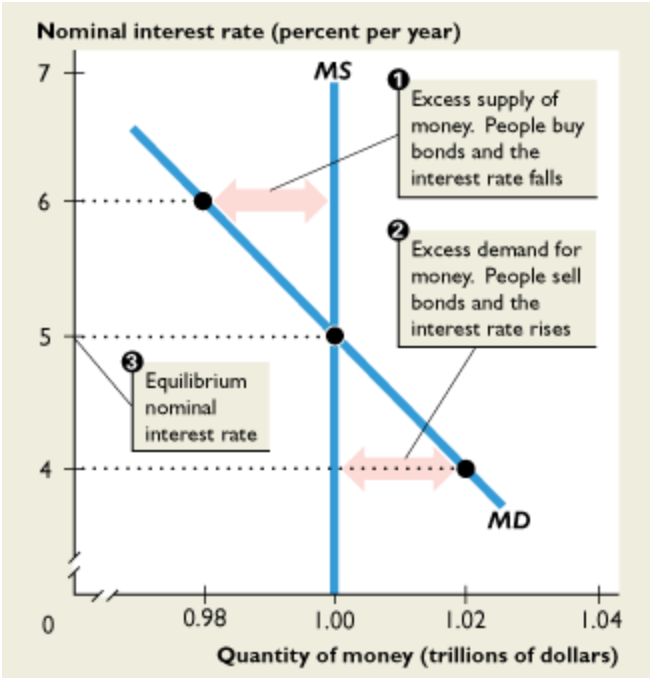
A decrease in the nominal interest rate increases the quantity of real money demanded.



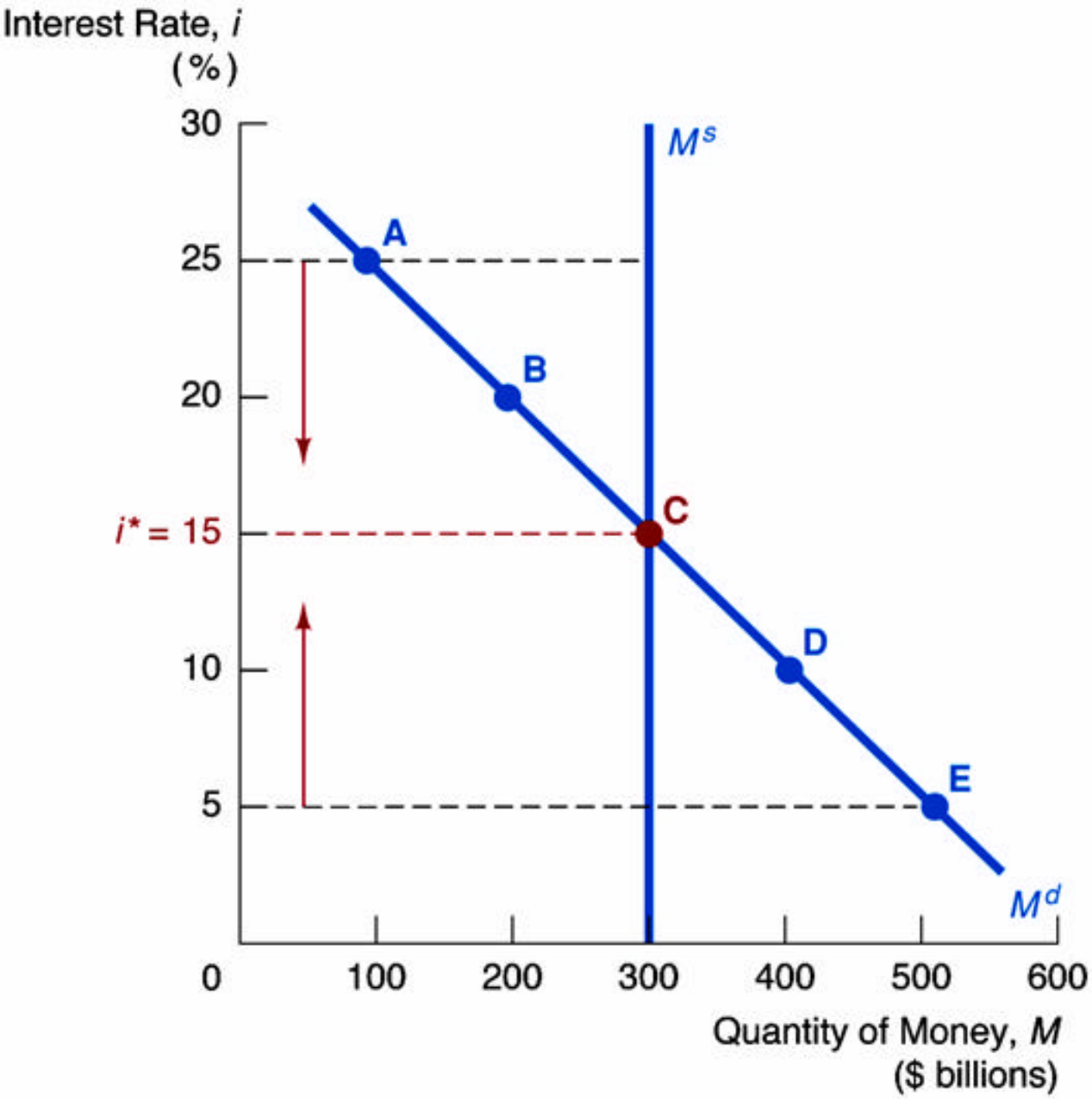
28.1 MONEY AND THE INTEREST RATE

2. If the interest rate is 4 percent a year, the quantity of money held is less than the quantity demanded. People sell bonds, the price of a bond falls, and the interest rate rises.

A rise in the nominal interest rate decreases the quantity of real money demanded.



3. If the interest rate is 5 percent a year, the quantity of money held equals the quantity demanded and the money market is in equilibrium.


Interest Rate, i
(%)
30
25
20
i* = 15
10
5
0
100
200
300
400
500
600
A
B
C
D
E
Ms
Md
Quantity of Money, M
($ billions)

28.1 MONEY AND THE INTEREST RATE

Changing the Interest Rate

To change the interest rate, the Fed changes the quantity of money.

If the Fed *increases* the quantity of money, the interest rate *falls*.

If the Fed *decreases* the quantity of money, the interest rate *rises*.

Figure 28.4 on the next slide illustrates these changes.

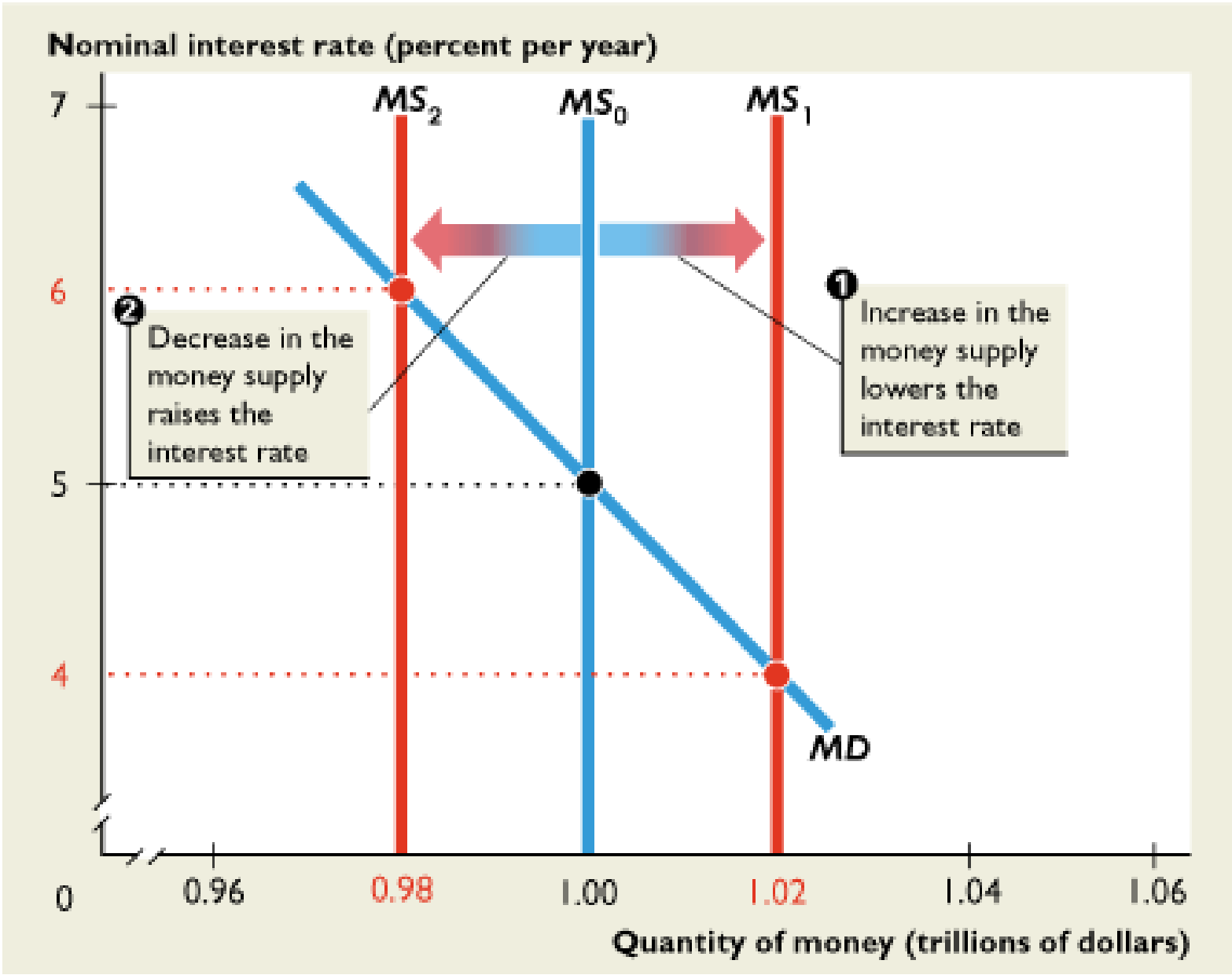
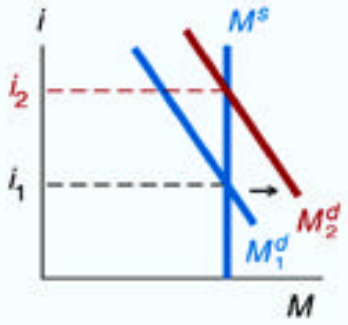
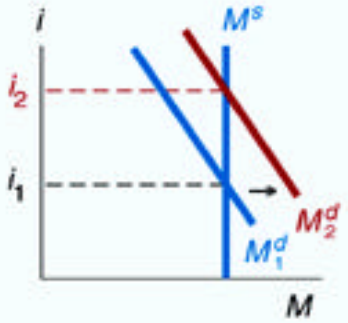
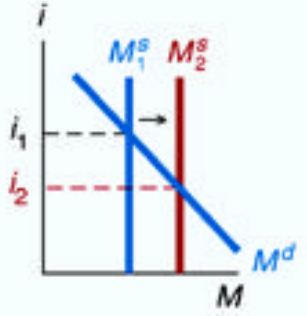

Nominal interest rate (percent per year)
7
6
5
4
0
MS_2
MS_0
MS_1
MD
2 Decrease in the money supply raises the interest rate
1 Increase in the money supply lowers the interest rate
0.96
0.98
1.00
1.02
1.04
1.06
Quantity of money (trillions of dollars)

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 ↑	↑	
Price level	↑	M^d ↑	↑	
Money supply	↑	M^s ↑	↓	

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.

28.2 THE PRICE LEVEL AND INFLATION

The Money Market in the Long Run

The *long run* refers to the economy at full employment or when we smooth out the effects of the business cycle.

–In the short run, the interest rate adjusts to make the quantity of money demanded equal the quantity of money supplied.

–In the long run, the price level does the adjusting.

–Consequently, changes in Money Supply influence real interest rates and so expected real interest rates

28.2 THE PRICE LEVEL AND INFLATION

Potential GDP and Financial Technology

Potential GDP and financial technology, which influence the demand for money, are determined by real factors and are independent of the price level.

The Nominal Interest Rate in the Long Run

The nominal interest rate equals the real interest rate plus the expected inflation rate.

The real interest rate is independent of the price level in the long run. The expected inflation rate depends on monetary policy in the long run.

28.2 THE PRICE LEVEL AND INFLATION

Money Market Equilibrium in the Long Run

All the influences on money holding except the price level are determined by real forces in the long run and are given.

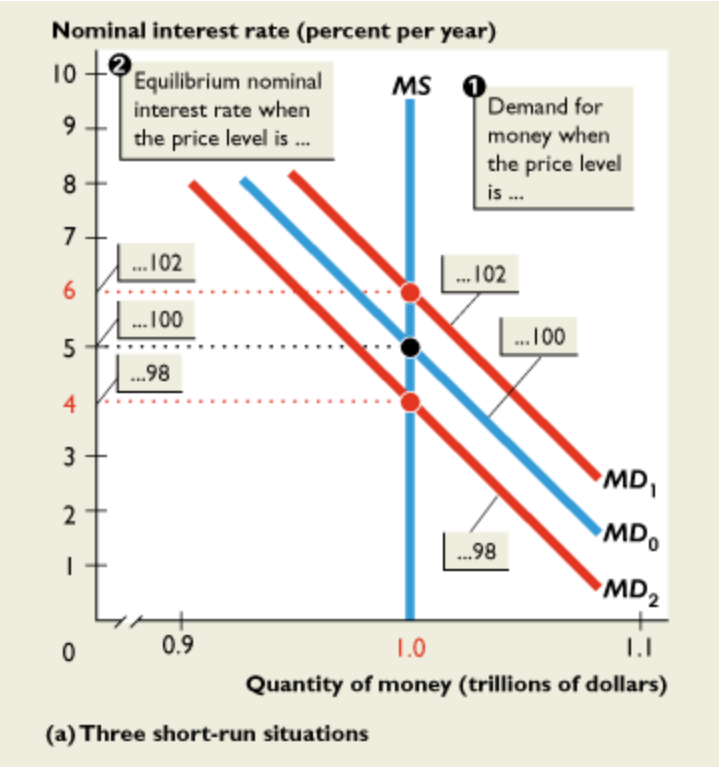
Money market equilibrium determines the price level.

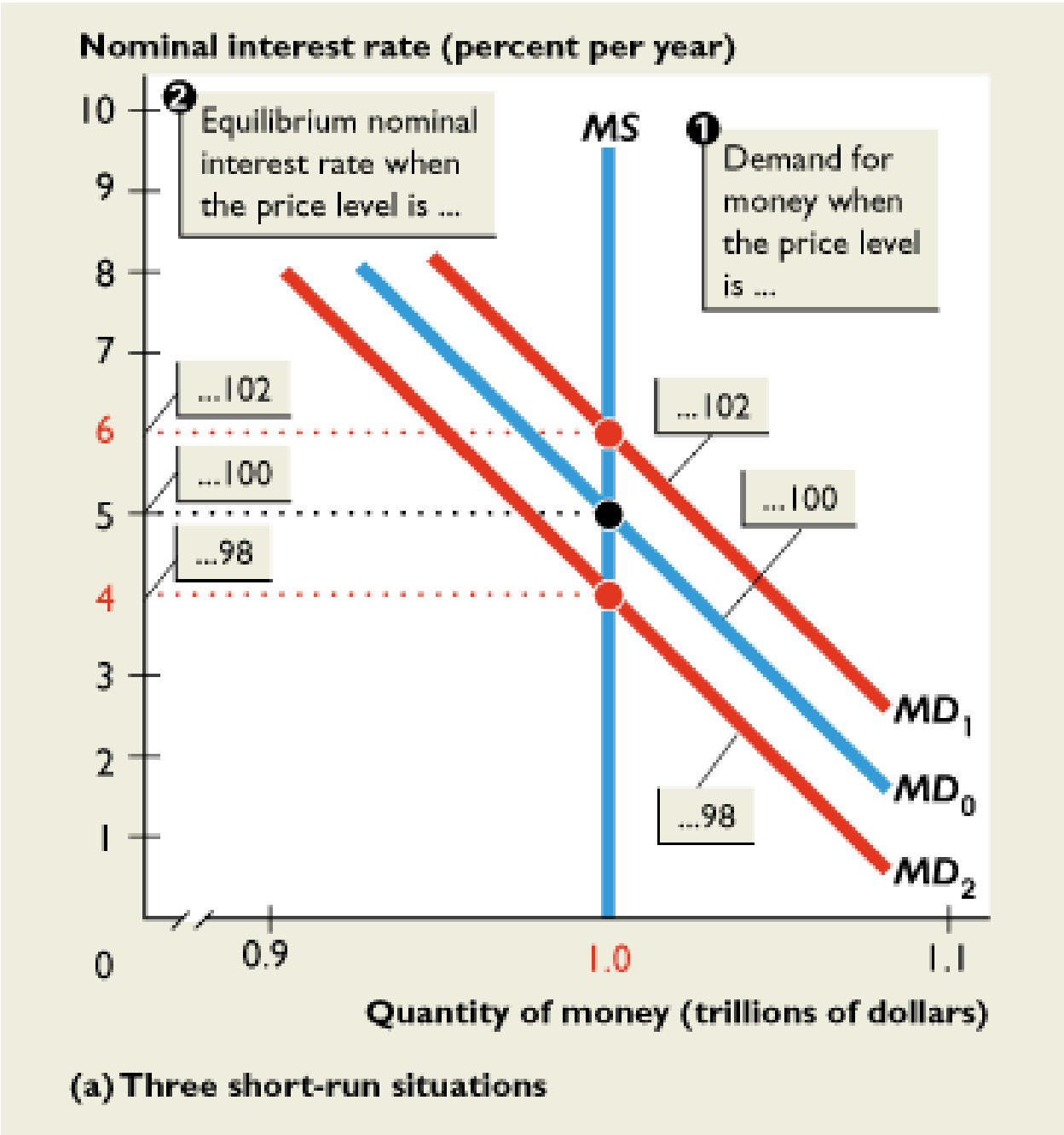
Figure 28.5 on the next slides illustrates the long-run equilibrium.

28.2 THE PRICE LEVEL AND INFLATION

1. The demand for money depends on the price level.

2. The equilibrium nominal interest rate also depends on the price level.





(a) Three short-run situations

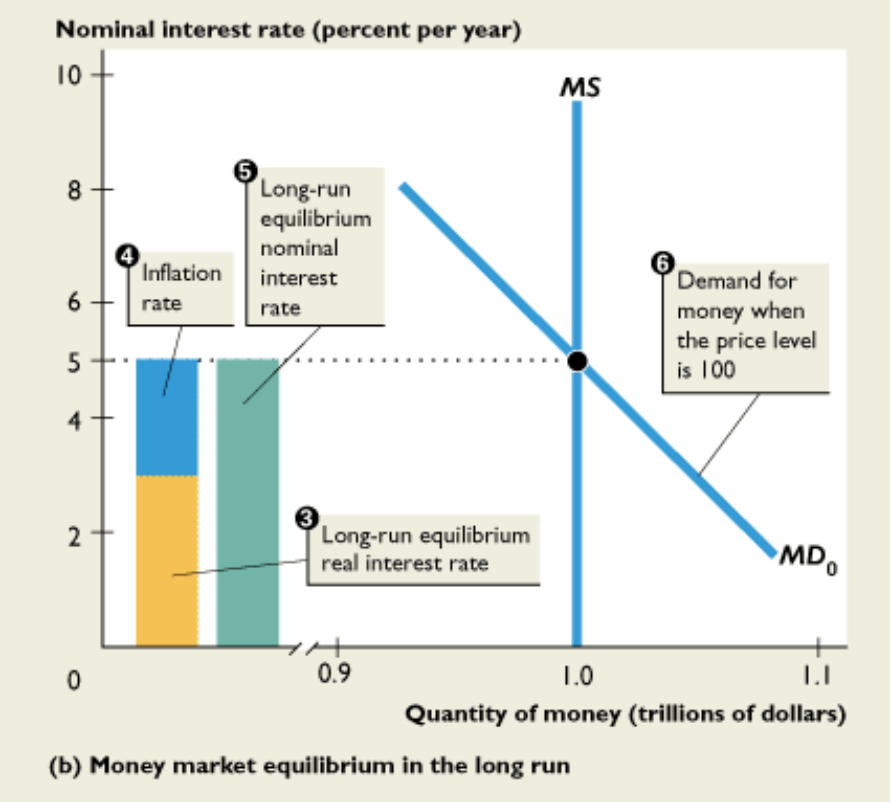
28.2 THE PRICE LEVEL AND INFLATION

3. The long-run equilibrium real interest rate (this is 3%)

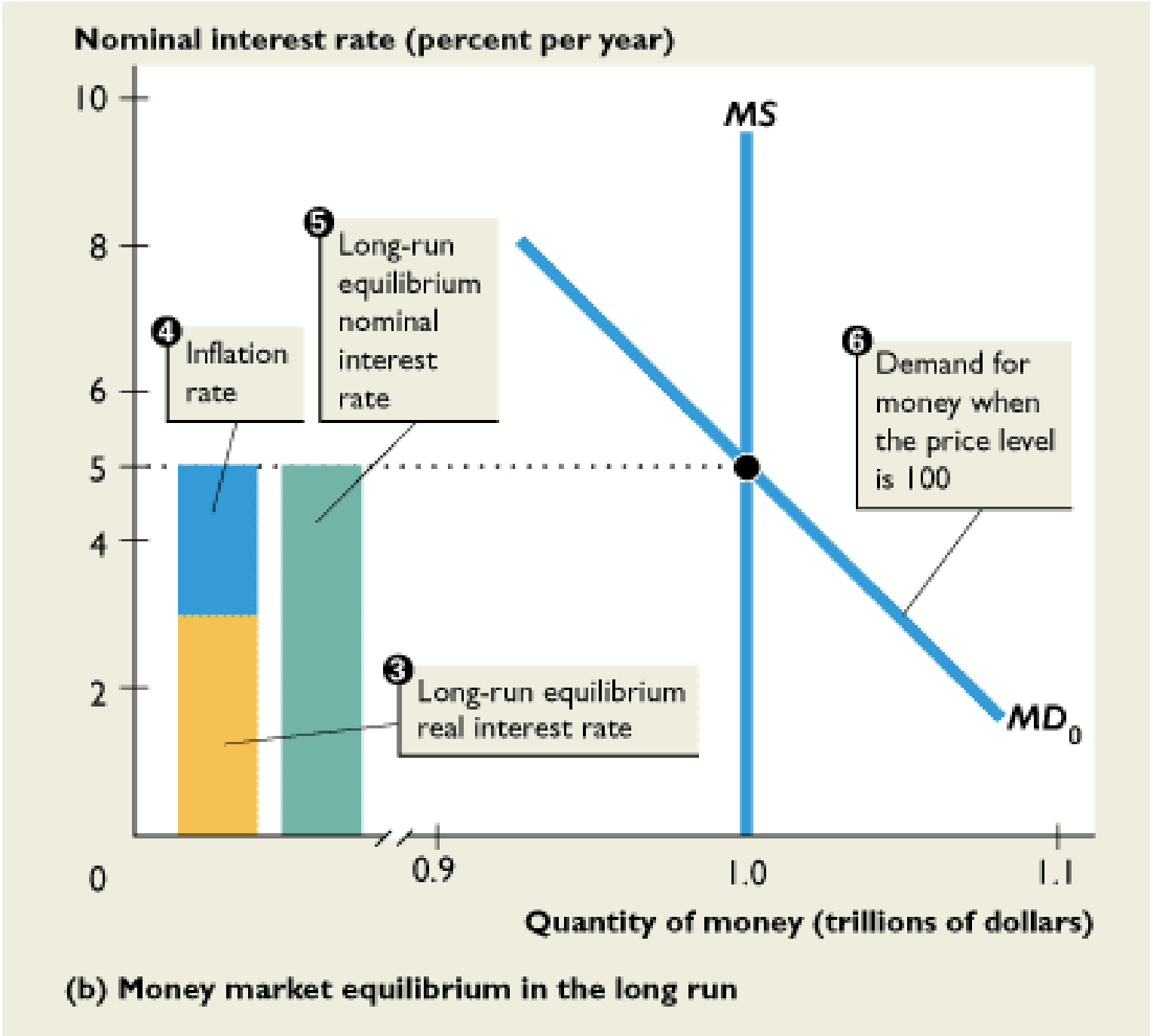
4. Plus the inflation rate (which is 2%) determines…….

5. The long-run equilibrium nominal interest rate.

6. The price level adjusts to 100 to achieve money market equilibrium at the long-run equilibrium interest rate.



(b) Money market equilibrium in the long run


Nominal interest rate (percent per year)
10
8
6
5
4
2
0
MS
5 Long-run equilibrium nominal interest rate
4 Inflation rate
6 Demand for money when the price level is 100
3 Long-run equilibrium real interest rate
MD0
0.9
1.0
1.1
Quantity of money (trillions of dollars)
(b) Money market equilibrium in the long run

28.2 THE PRICE LEVEL AND INFLATION

A Change in the Quantity of Money

If the Fed increases the quantity of money from $1 trillion to $1.02 trillion—a 2 percent increase—the nominal interest rate falls.

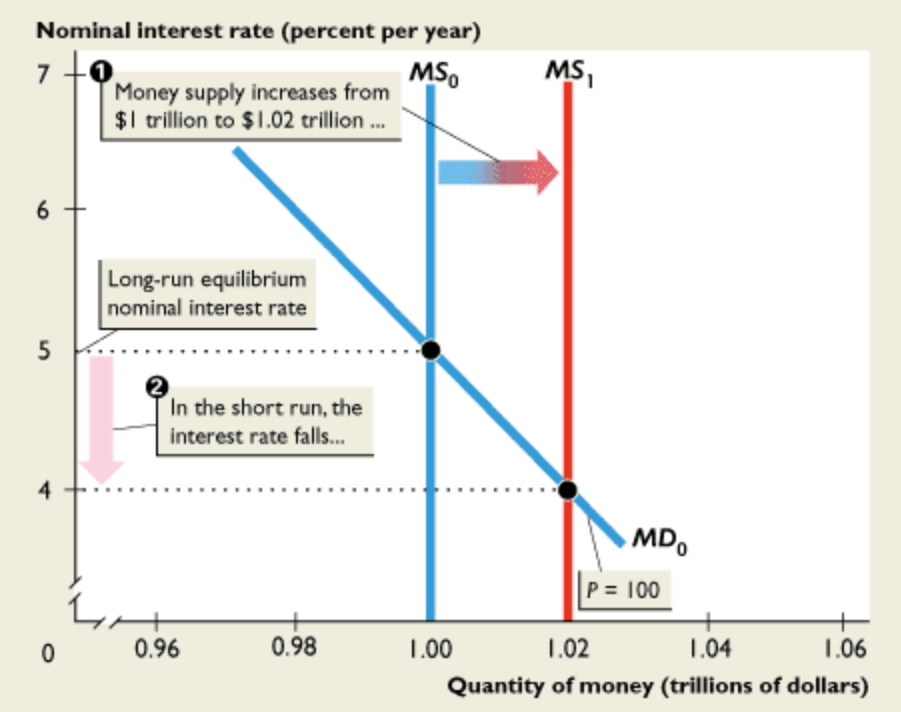
But eventually, the nominal interest rate returns to its long run equilibrium level and the price level rises by 2 percent.

Figure 28.6 on the next slide illustrates this outcome.

28.2 THE PRICE LEVEL AND INFLATION

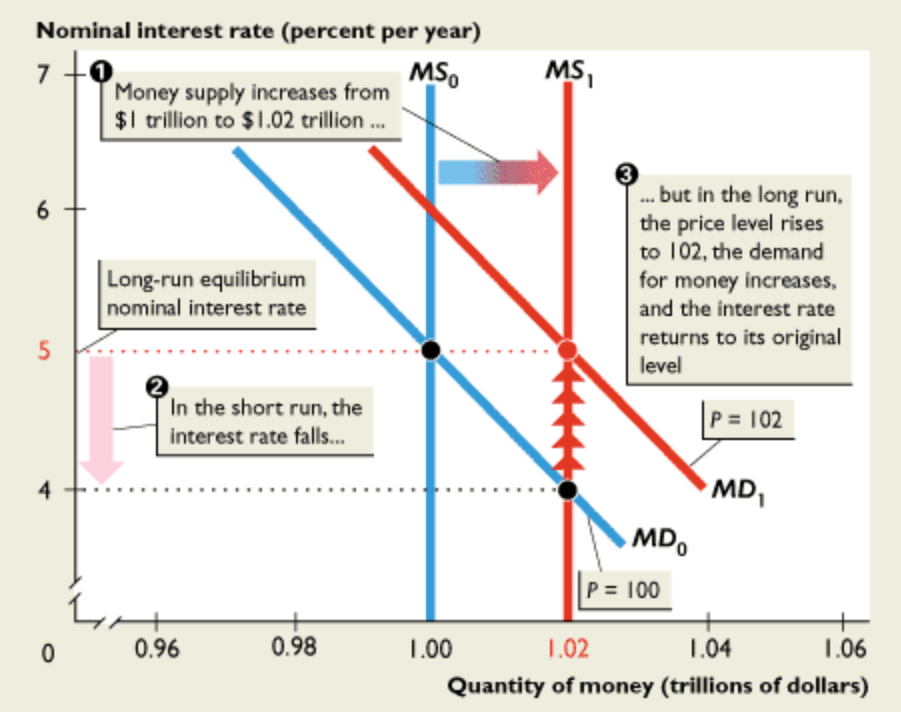
1. The money supply increases by 2 percent from $1 trillion to $1.02 trillion and the supply curve shifts from MS_0 to MS_1.

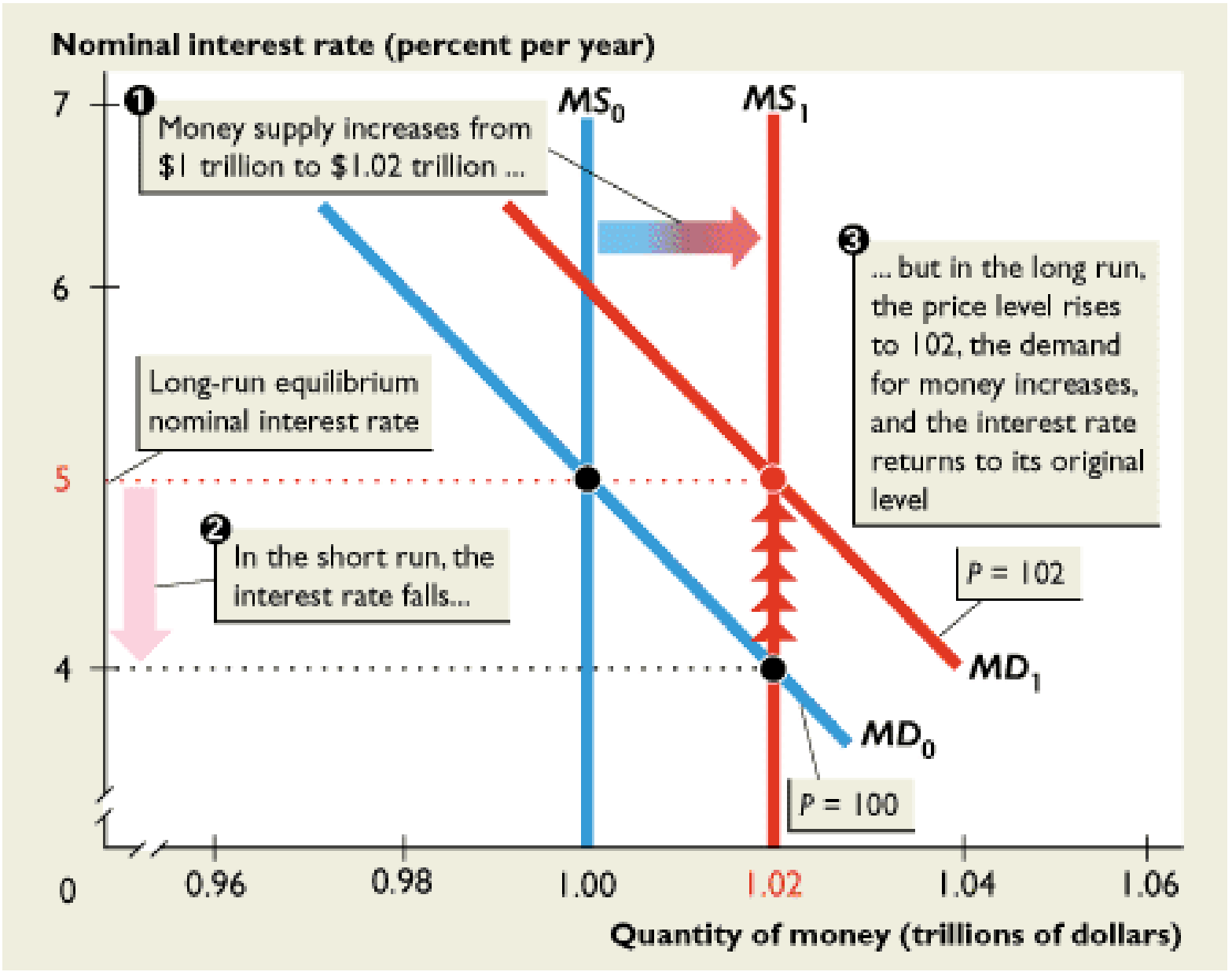
2. In the short run, the interest rate falls to 4 percent a year.



28.2 THE PRICE LEVEL AND INFLATION

3. In the long run, the price level rises by 2 percent from 100 to 102, the demand for money increases from MD_0 to MD_1, and the nominal interest rate returns to its long-run equilibrium level.




Nominal interest rate (percent per year)
7
6
5
4
0
1 Money supply increases from $1 trillion to $1.02 trillion ...
MS_0
MS_1
3 ... but in the long run, the price level rises to 102, the demand for money increases, and the interest rate returns to its original level
Long-run equilibrium nominal interest rate
2 In the short run, the interest rate falls...
P = 102
MD_1
MD_0
P = 100
0.96
0.98
1.00
1.02
1.04
1.06
Quantity of money (trillions of dollars)

KEY CONCLUSION:

IN THE LONG RUN, OTHER THINGS REMAINING CONSTANT, A GIVEN PERCENTAGE CHANGE IN THE QUANTITY OF MONEY BRINGS AN EQUAL PERCENTAGE CHANGE IN THE PRICE LEVEL

28.2 THE PRICE LEVEL AND INFLATION

The Quantity Theory of Money

ANOTHER WAY OF LOOKING AT THE RELATION BETWEEEN MONEY SUPPLY AND THE PRICE LEVEL

Quantity theory of money

The proposition that in the long run, an increase in the quantity of money brings an equal percentage increase in the price level (other things remaining the same).

28.2 THE PRICE LEVEL AND INFLATION

The Velocity of Circulation and the Equation of Exchange

Velocity of circulation

The average speed with which a dollar circulates in the economy as people use it to buy goods and services—nominal GDP divided by quantity of money.

V = (P*Y)/M

P = GDP DEFLATOR / 100

Y = REAL GDP

M = QUANTITY OF MONEY

28.2 THE PRICE LEVEL AND INFLATION

The Velocity of Circulation and the Equation of Exchange

The **equation of exchange** states that the quantity of money multiplied by the velocity of circulation equals the price level multiplied by real GDP.

Then the equation of exchange is

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

The velocity of circulation = V

The quantity of money = M

The price level = P

Real GDP = Y

28.2 THE PRICE LEVEL AND INFLATION

The Quantity Theory Prediction

The equation of exchange, $M \times V = P \times Y$, implies that

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

On the left is the price level and on the right are all the things that influence the price level.

These influences are the quantity of money, the velocity of circulation, and real GDP.

28.2 THE PRICE LEVEL AND INFLATION

The velocity of circulation is relatively stable and does not change when the quantity of money changes.

In the long run, real GDP equals potential GDP, which is independent of the quantity of money.

So, in the long run, the price level is proportional to the quantity of money.

28.2 THE PRICE LEVEL AND INFLATION

Inflation and the Quantity Theory of Money

The equation of exchange tells us the relationship between the price *level*, the quantity of money, the velocity of circulation, and real GDP.

It implies a relationship between the rates of change of these variables, which is:

Money growth + Velocity growth =

Inflation + Real GDP growth

28.2 THE PRICE LEVEL AND INFLATION

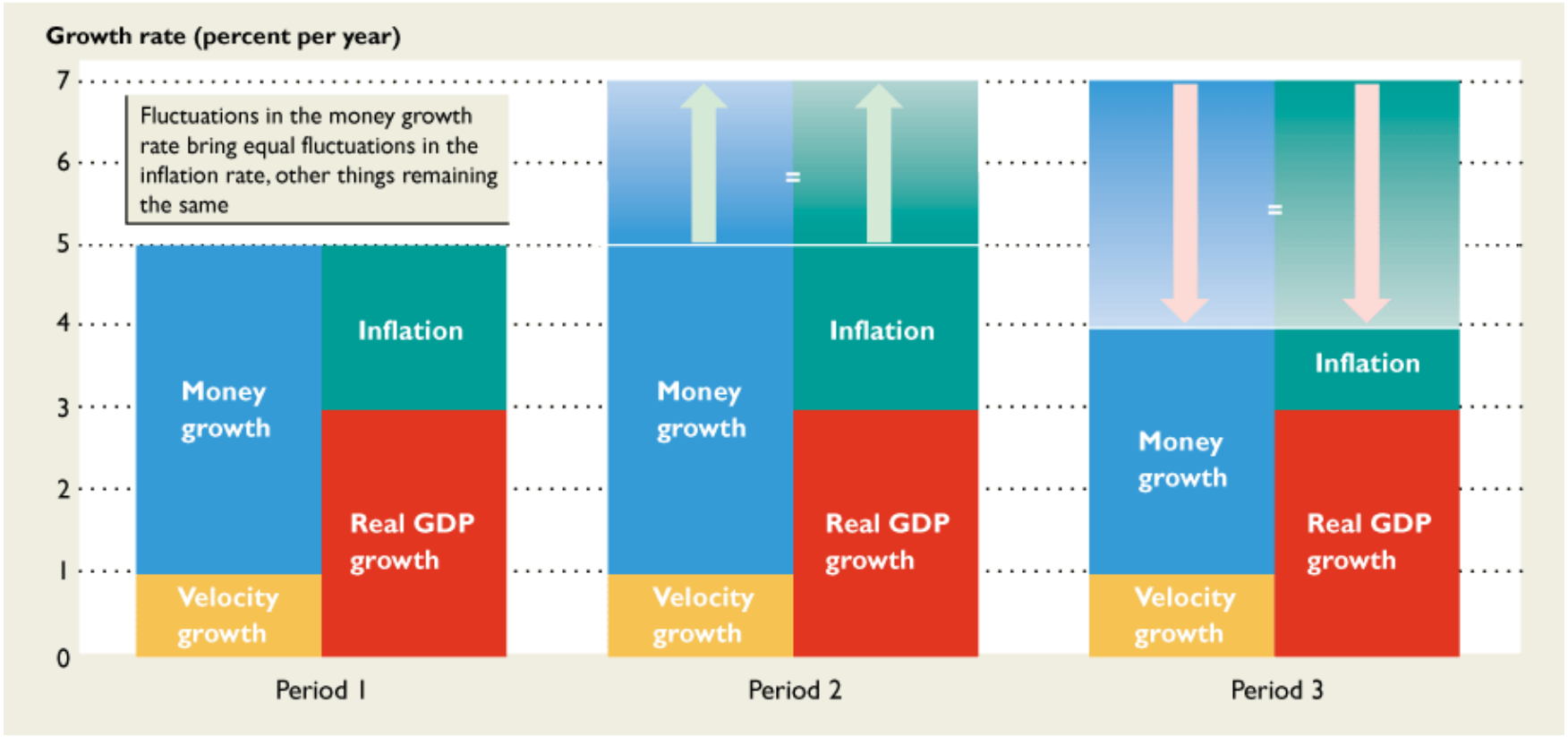
Changes in the Inflation Rate

Because, in the long run, both velocity growth and real GDP growth are independent of the rate of money growth:

A change in the money growth rate brings an equal change in the inflation rate.

28.2 THE PRICE LEVEL AND INFLATION

Figure 28.7 illustrates the effect of a change in the money growth rate on the inflation rate.



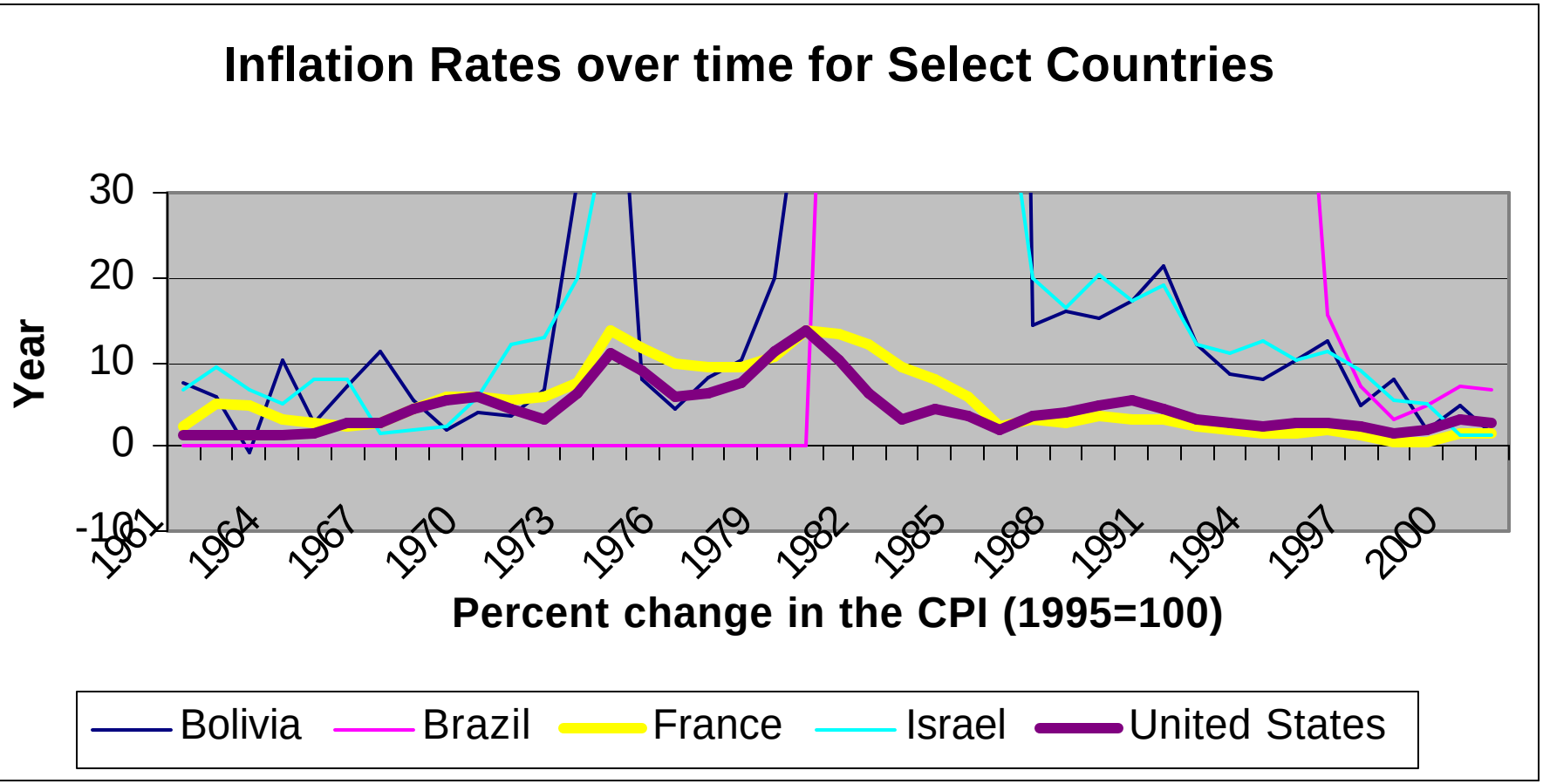
28.2 THE PRICE LEVEL AND INFLATION

Hyperinflation

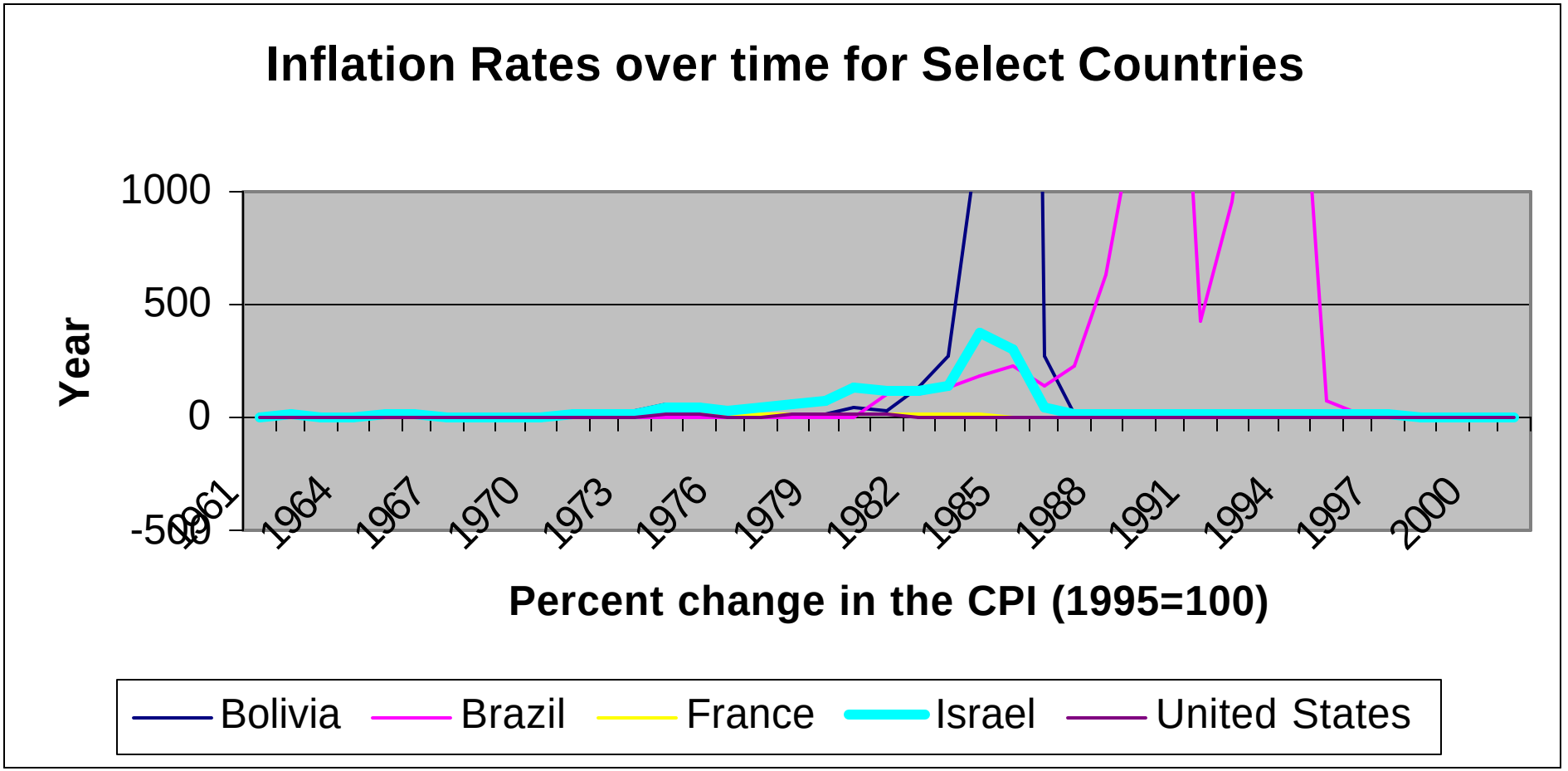
If the quantity of money grows rapidly, the inflation rate will be very high.

An inflation rate that exceeds 50 percent a month is called **hyperinflation**.

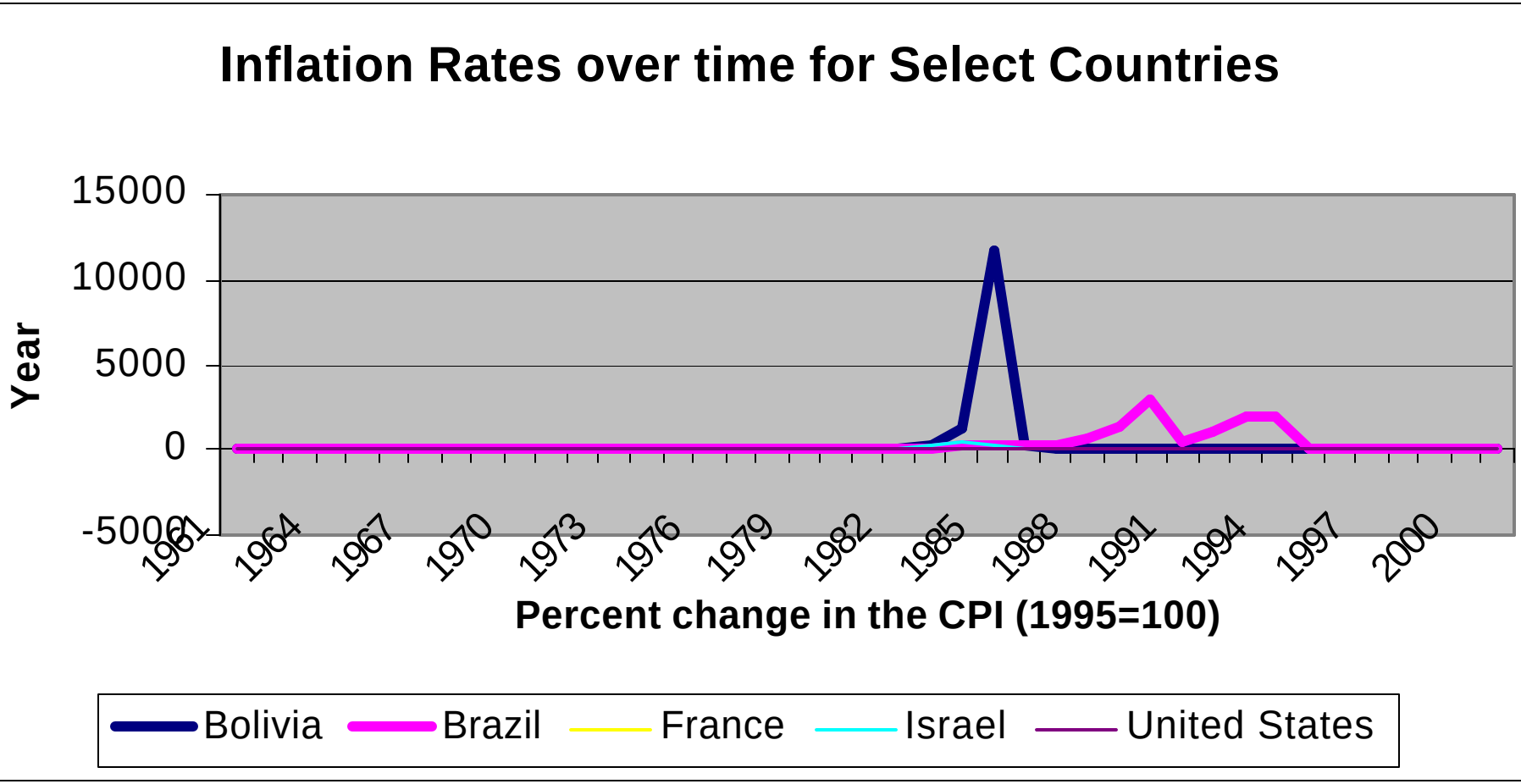
Examples of Extreme Inflation – Hyperinflation



Examples of Extreme Inflation – Hyperinflation



Examples of Extreme Inflation – Hyperinflation



28.3 THE COST OF INFLATION

Inflation is costly for four reasons:

- Tax costs
- Shoe-leather costs
- Confusion costs
- Uncertainty costs

28.3 THE COST OF INFLATION

Tax Costs

Government gets revenue from inflation.

Inflation is a tax!

Inflation Is a Tax

When the quantity of money increases, the government gets the new money to spend.

28.3 THE COST OF INFLATION

Inflation Tax, Saving, and Investment

- The inflation tax is bigger than the tax on money holding, and it interacts with the income tax to lower saving and investment.
- The core of the problem is that inflation increases the nominal interest rate, and because income taxes are paid on nominal interest income, the true income tax rate rises with inflation.

28.3 THE COST OF INFLATION

The higher the inflation rate, the higher is the true income tax rate on income from capital.

And the higher the tax rate, the higher is the interest rate paid by borrowers and the lower is the after-tax interest rate received by lenders.

28.3 THE COST OF INFLATION

Shoe-Leather Costs

So-called “shoe-leather” costs arise from an increase in the velocity of circulation of money and an increase in the amount of running around that people do to try to avoid incurring losses from the falling value of money.

28.3 THE COST OF INFLATION

When money loses value at a rapid anticipated rate, it does not function well as a store of value and people try to avoid holding it.

They spend their incomes as soon as they receive them, and firms pay out incomes—wages and dividends—as soon as they receive revenue from their sales.

The velocity of circulation increases.

28.3 THE COST OF INFLATION

Confusion Costs

Money is our measuring rod of value.

Borrowers and lenders, workers and employers, all make agreements in terms of money.

Inflation makes the value of money change, so it changes the units on our measuring rod.

28.3 THE COST OF INFLATION

Uncertainty Costs

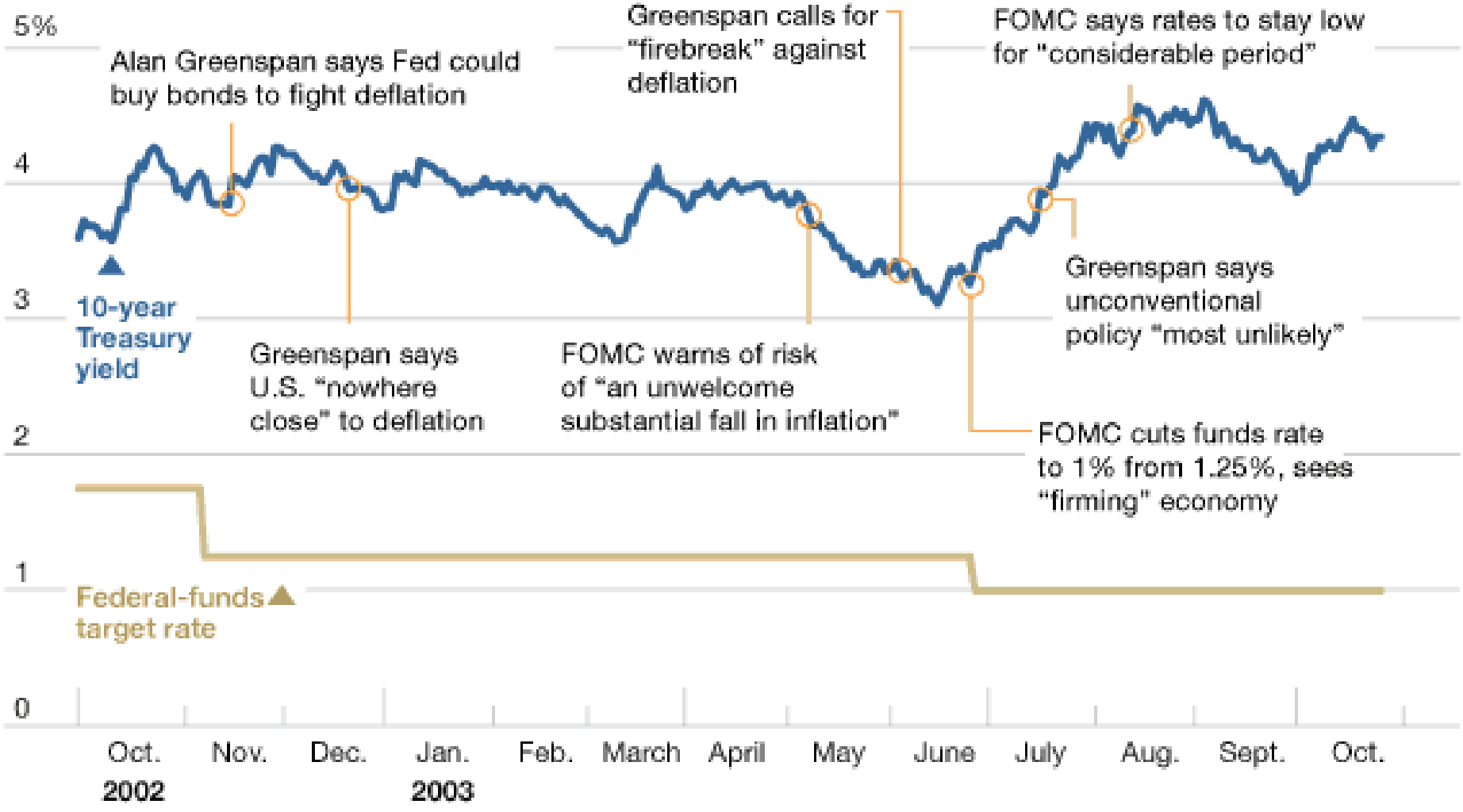
A high inflation rate is brings increased uncertainty about the long-term inflation rate.

Increased uncertainty also misallocates resources. Instead of concentrating on the activities at which they have a comparative advantage, people find it more profitable to search for ways of avoiding the losses that inflation inflicts.

Gains and losses occur because of unpredictable changes in the value of money.

THE MESSAGE AND THE MARKETS

A timeline showing major Fed statements on the economy and monetary policy, as well as bond yields and the federal-funds rate



Sources: Federal Reserve; WSJ Market Data Group

28.3 THE COST OF INFLATION

How Big Is the Cost of Inflation?

The cost of inflation depends on its rate and its predictability.

The higher the rate, the greater is the cost.

And the more unpredictable the rate, the greater is the cost.