



After studying this chapter, you will be able to:

- ◆ Explain what determines aggregate supply in the long run and in the short run
- ◆ Explain what determines aggregate demand
- ◆ Explain how real GDP and the price level are determined and how changes in aggregate supply and aggregate demand bring economic growth, inflation, and the business cycle
- ◆ Describe the main schools of thought in macroeconomics today

10

AGGREGATE SUPPLY AND AGGREGATE DEMAND

The pace at which production grows and prices rise is uneven. In 2004, real GDP grew by 3.6 percent, but 2008 had zero growth and 2009 saw real GDP shrink by more than 2 percent.

Similarly, during recent years, prices have increased at rates ranging from more than 3 percent in 2005 to a barely perceptible less than 1 percent in 2009.

The uneven pace of economic growth and inflation—the business cycle—is the subject of this chapter and the two that follow it.

This chapter explains a model of real GDP and the price level—the *aggregate supply–aggregate demand model* or *AS-AD model*. This model represents the consensus view of macroeconomists on how real GDP and the price level are determined. The model provides a framework for understanding the forces that make our economy expand, that bring inflation, and that cause business cycle fluctuations. The *AS-AD model* also provides a framework within which we can see the range of views of macroeconomists in different schools of thought.

In *Reading Between the Lines* at the end of the chapter, we use the *AS-AD model* to interpret the course of U.S. real GDP and the price level in 2010.

◆ Aggregate Supply

The purpose of the aggregate supply–aggregate demand model that you study in this chapter is to explain how real GDP and the price level are determined and how they interact. The model uses similar ideas to those that you encountered in Chapter 3 when you learned how the quantity and price in a competitive market are determined. But the *aggregate supply–aggregate demand* model (*AS-AD* model) isn't just an application of the competitive market model. Some differences arise because the *AS-AD* model is a model of an imaginary market for the total of all the final goods and services that make up real GDP. The quantity in this “market” is real GDP and the price is the price level measured by the GDP deflator.

One thing that the *AS-AD* model shares with the competitive market model is that both distinguish between *supply* and the *quantity supplied*. We begin by explaining what we mean by the quantity of real GDP supplied.

Quantity Supplied and Supply

The *quantity of real GDP supplied* is the total quantity of goods and services, valued in constant base-year (2005) dollars, that firms plan to produce during a given period. This quantity depends on the quantity of labor employed, the quantity of physical and human capital, and the state of technology.

At any given time, the quantity of capital and the state of technology are fixed. They depend on decisions that were made in the past. The population is also fixed. But the quantity of labor is not fixed. It depends on decisions made by households and firms about the supply of and demand for labor.

The labor market can be in any one of three states: at full employment, above full employment, or below full employment. At full employment, the quantity of real GDP supplied is *potential GDP*, which depends on the full-employment quantity of labor (see Chapter 6, pp. 139–141). Over the business cycle, employment fluctuates around full employment and the quantity of real GDP supplied fluctuates around potential GDP.

Aggregate supply is the relationship between the quantity of real GDP supplied and the price level. This relationship is different in the long run than in the short run and to study aggregate supply, we distinguish between two time frames:

- Long-run aggregate supply
- Short-run aggregate supply

Long-Run Aggregate Supply

Long-run aggregate supply is the relationship between the quantity of real GDP supplied and the price level when the money wage rate changes in step with the price level to maintain full employment. The quantity of real GDP supplied at full employment equals potential GDP and this quantity is the same regardless of the price level.

The long-run aggregate supply curve in Fig. 10.1 illustrates long-run aggregate supply as the vertical line at potential GDP labeled *LAS*. Along the long-run aggregate supply curve, as the price level changes, the money wage rate also changes so the real wage rate remains at the full-employment equilibrium level and real GDP remains at potential GDP. The long-run aggregate supply curve is always vertical and is always located at potential GDP.

The long-run aggregate supply curve is vertical because potential GDP is independent of the price level. The reason for this independence is that a movement along the *LAS* curve is accompanied by a change in *two* sets of prices: the prices of goods and services—the price level—and the prices of the factors of production, most notably, the money wage rate. A 10 percent increase in the prices of goods and services is matched by a 10 percent increase in the money wage rate. Because the price level and the money wage rate change by the same percentage, the *real wage rate* remains unchanged at its full-employment equilibrium level. So when the price level changes and the real wage rate remains constant, employment remains constant and real GDP remains constant at potential GDP.

Production at a Pepsi Plant You can see more clearly why real GDP is unchanged when all prices change by the same percentage by thinking about production decisions at a Pepsi bottling plant. How does the quantity of Pepsi supplied change if the price of Pepsi changes and the wage rate of the workers and prices of all the other resources used vary by the same percentage? The answer is that the quantity supplied doesn't change. The firm produces the quantity that maximizes profit. That quantity depends on the price of Pepsi relative to the cost of producing it. With no change in price *relative to cost*, production doesn't change.

Short-Run Aggregate Supply

Short-run aggregate supply is the relationship between the quantity of real GDP supplied and the price level when the money wage rate, the prices of other resources, and potential GDP remain constant. Figure 10.1 illustrates this relationship as the short-run aggregate supply curve *SAS* and the short-run aggregate supply schedule. Each point on the *SAS* curve corresponds to a row of the short-run aggregate supply schedule. For example, point *A* on the *SAS* curve and row *A* of the schedule tell us that if the price level is 100, the quantity of real GDP supplied is \$12 trillion. In the short run, a rise in the price level brings an increase in the quantity of real GDP supplied. The short-run aggregate supply curve slopes upward.

With a given money wage rate, there is one price level at which the real wage rate is at its full-employment equilibrium level. At this price level, the quantity of real GDP supplied equals potential GDP and the *SAS* curve intersects the *LAS* curve. In this example, that price level is 110. If the price level rises above 110, the quantity of real GDP supplied increases along the *SAS* curve and exceeds potential GDP; if the price level falls below 110, the quantity of real GDP supplied decreases along the *SAS* curve and is less than potential GDP.

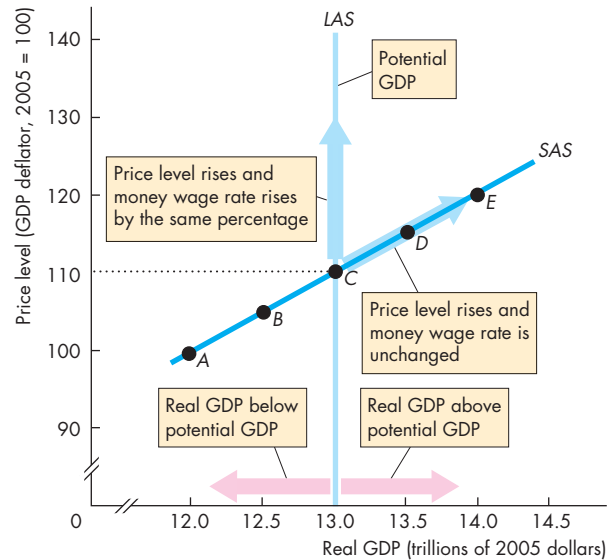
Back at the Pepsi Plant You can see why the short-run aggregate supply curve slopes upward by returning to the Pepsi bottling plant. If production increases, marginal cost rises and if production decreases, marginal cost falls (see Chapter 2, p. 33).

If the price of Pepsi rises with no change in the money wage rate and other costs, Pepsi can increase profit by increasing production. Pepsi is in business to maximize its profit, so it increases production.

Similarly, if the price of Pepsi falls while the money wage rate and other costs remain constant, Pepsi can avoid a loss by decreasing production. The lower price weakens the incentive to produce, so Pepsi decreases production.

What's true for Pepsi bottlers is true for the producers of all goods and services. When all prices rise, the price level rises. If the price level rises and the money wage rate and other factor prices remain constant, all firms increase production and the quantity of real GDP supplied increases. A fall in the price level has the opposite effect and decreases the quantity of real GDP supplied.

FIGURE 10.1 Long-Run and Short-Run Aggregate Supply



	Price level (GDP deflator)	Real GDP supplied (trillions of 2005 dollars)
A	100	12.0
B	105	12.5
C	110	13.0
D	115	13.5
E	120	14.0

In the long run, the quantity of real GDP supplied is potential GDP and the *LAS* curve is vertical at potential GDP. In the short-run, the quantity of real GDP supplied increases if the price level rises, while all other influences on supply plans remain the same.

The short-run aggregate supply curve, *SAS*, slopes upward. The short-run aggregate supply curve is based on the aggregate supply schedule in the table. Each point *A* through *E* on the curve corresponds to the row in the table identified by the same letter.

When the price level is 110, the quantity of real GDP supplied is \$13 trillion, which is potential GDP. If the price level rises above 110, the quantity of real GDP supplied increases and exceeds potential GDP; if the price level falls below 110, the quantity of real GDP supplied decreases below potential GDP.

Changes in Aggregate Supply

A change in the price level changes the quantity of real GDP supplied, which is illustrated by a movement along the short-run aggregate supply curve. It does not change aggregate supply. Aggregate supply changes when an influence on production plans other than the price level changes. These other influences include changes in potential GDP and changes in the money wage rate. Let's begin by looking at a change in potential GDP.

Changes in Potential GDP When potential GDP changes, aggregate supply changes. An increase in potential GDP increases both long-run aggregate supply and short-run aggregate supply.

Figure 10.2 shows the effects of an increase in potential GDP. Initially, the long-run aggregate supply curve is LAS_0 and the short-run aggregate supply curve is SAS_0 . If potential GDP increases to \$14 trillion, long-run aggregate supply increases and the long-run aggregate supply curve shifts rightward to LAS_1 . Short-run aggregate supply also increases, and the short-run aggregate supply curve shifts rightward to SAS_1 . The two supply curves shift by the same amount only if the full-employment price level remains constant, which we will assume to be the case.

Potential GDP can increase for any of three reasons:

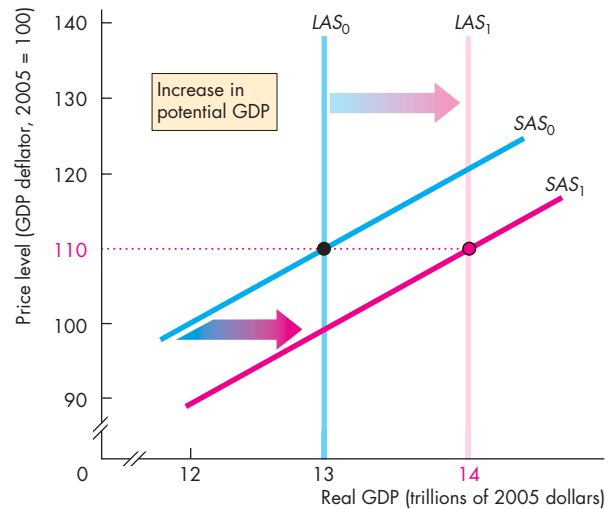
- An increase in the full-employment quantity of labor
- An increase in the quantity of capital
- An advance in technology

Let's look at these influences on potential GDP and the aggregate supply curves.

An Increase in the Full-Employment Quantity of Labor A Pepsi bottling plant that employs 100 workers bottles more Pepsi than does an otherwise identical plant that employs 10 workers. The same is true for the economy as a whole. The larger the quantity of labor employed, the greater is real GDP.

Over time, potential GDP increases because the labor force increases. But (with constant capital and technology) *potential* GDP increases only if the full-employment quantity of labor increases. Fluctuations in employment over the business cycle bring fluctuations in real GDP. But these changes in real GDP are fluctuations around potential GDP. They are not changes in potential GDP and long-run aggregate supply.

FIGURE 10.2 A Change in Potential GDP



An increase in potential GDP increases both long-run aggregate supply and short-run aggregate supply. The long-run aggregate supply curve shifts rightward from LAS_0 to LAS_1 and the short-run aggregate supply curve shifts from SAS_0 to SAS_1 .

 **economylab** animation

An Increase in the Quantity of Capital A Pepsi bottling plant with two production lines bottles more Pepsi than does an otherwise identical plant that has only one production line. For the economy, the larger the quantity of capital, the more productive is the labor force and the greater is its potential GDP. Potential GDP per person in the capital-rich United States is vastly greater than that in capital-poor China or Russia.

Capital includes *human capital*. One Pepsi plant is managed by an economics major with an MBA and has a labor force with an average of 10 years of experience. This plant produces a larger output than does an otherwise identical plant that is managed by someone with no business training or experience and that has a young labor force that is new to bottling. The first plant has a greater amount of human capital than the second. For the economy as a whole, the larger the quantity of *human capital*—the skills that people have acquired in school and through on-the-job training—the greater is potential GDP.

An Advance in Technology A Pepsi plant that has pre-computer age machines produces less than one that uses the latest robot technology. Technological change enables firms to produce more from any given amount of factors of production. So even with fixed quantities of labor and capital, improvements in technology increase potential GDP.

Technological advances are by far the most important source of increased production over the past two centuries. As a result of technological advances, one farmer in the United States today can feed 100 people and in a year one autoworker can produce almost 14 cars and trucks.

Let's now look at the effects of changes in the money wage rate.

Changes in the Money Wage Rate When the money wage rate (or the money price of any other factor of production such as oil) changes, short-run aggregate supply changes but long-run aggregate supply does not change.

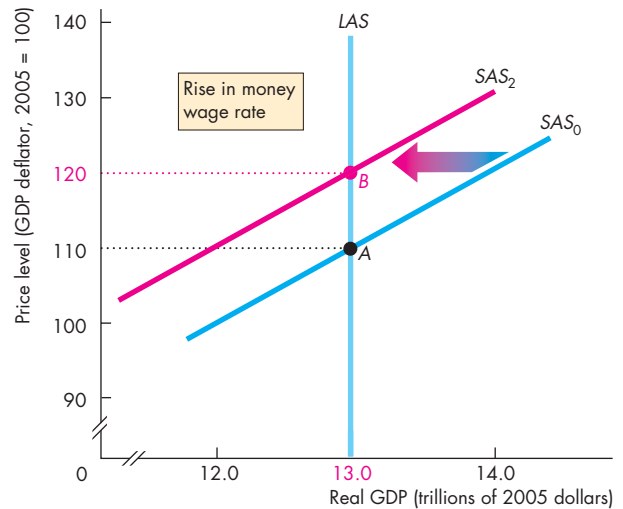
Figure 10.3 shows the effect of an increase in the money wage rate. Initially, the short-run aggregate supply curve is SAS_0 . A rise in the money wage rate *decreases* short-run aggregate supply and shifts the short-run aggregate supply curve leftward to SAS_2 .

A rise in the money wage rate decreases short-run aggregate supply because it increases firms' costs. With increased costs, the quantity that firms are willing to supply at each price level decreases, which is shown by a leftward shift of the SAS curve.

A change in the money wage rate does not change long-run aggregate supply because on the LAS curve, the change in the money wage rate is accompanied by an equal percentage change in the price level. With no change in *relative* prices, firms have no incentive to change production and real GDP remains constant at potential GDP. With no change in potential GDP, the long-run aggregate supply curve LAS does not shift.

What Makes the Money Wage Rate Change? The money wage rate can change for two reasons: departures from full employment and expectations about inflation. Unemployment above the natural rate puts downward pressure on the money wage rate, and unemployment below the natural rate puts upward pressure on it. An expected rise in the inflation rate makes the money wage rate rise faster, and an expected fall in the inflation rate slows the rate at which the money wage rate rises.

FIGURE 10.3 A Change in the Money Wage Rate



A rise in the money wage rate decreases short-run aggregate supply and shifts the short-run aggregate supply curve leftward from SAS_0 to SAS_2 . A rise in the money wage rate does not change potential GDP, so the long-run aggregate supply curve does not shift.

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REVIEW QUIZ

- 1 If the price level and the money wage rate rise by the same percentage, what happens to the quantity of real GDP supplied? Along which aggregate supply curve does the economy move?
- 2 If the price level rises and the money wage rate remains constant, what happens to the quantity of real GDP supplied? Along which aggregate supply curve does the economy move?
- 3 If potential GDP increases, what happens to aggregate supply? Does the LAS curve shift or is there a movement along the LAS curve? Does the SAS curve shift or is there a movement along the SAS curve?
- 4 If the money wage rate rises and potential GDP remains the same, does the LAS curve or the SAS curve shift or is there a movement along the LAS curve or the SAS curve?

You can work these questions in Study Plan 10.1 and get instant feedback.



Aggregate Demand

The quantity of real GDP demanded (Y) is the sum of real consumption expenditure (C), investment (I), government expenditure (G), and exports (X) minus imports (M). That is,

$$Y = C + I + G + X - M.$$

The *quantity of real GDP demanded* is the total amount of final goods and services produced in the United States that people, businesses, governments, and foreigners plan to buy.

These buying plans depend on many factors. Some of the main ones are

1. The price level
2. Expectations
3. Fiscal policy and monetary policy
4. The world economy

We first focus on the relationship between the quantity of real GDP demanded and the price level. To study this relationship, we keep all other influences on buying plans the same and ask: How does the quantity of real GDP demanded vary as the price level varies?

The Aggregate Demand Curve

Other things remaining the same, the higher the price level, the smaller is the quantity of real GDP demanded. This relationship between the quantity of real GDP demanded and the price level is called **aggregate demand**. Aggregate demand is described by an *aggregate demand schedule* and an *aggregate demand curve*.

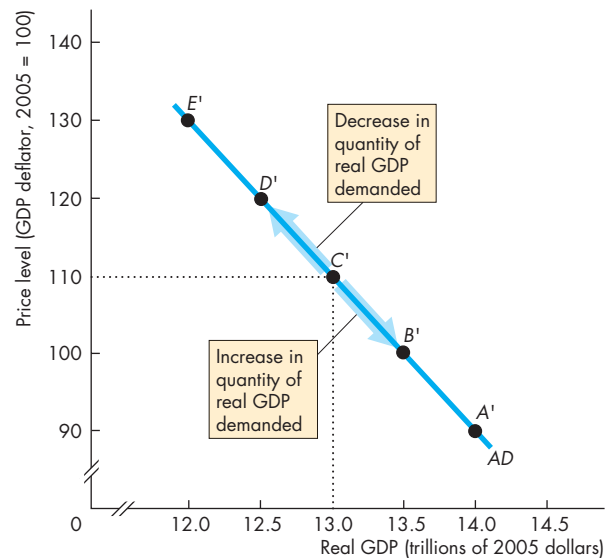
Figure 10.4 shows an aggregate demand curve (AD) and an aggregate demand schedule. Each point on the AD curve corresponds to a row of the schedule. For example, point C' on the AD curve and row C' of the schedule tell us that if the price level is 110, the quantity of real GDP demanded is \$13 trillion.

The aggregate demand curve slopes downward for two reasons:

- Wealth effect
- Substitution effects

Wealth Effect When the price level rises but other things remain the same, *real* wealth decreases. Real

FIGURE 10.4 Aggregate Demand



	Price level (GDP deflator)	Real GDP demanded (trillions of 2005 dollars)
A'	90	14.0
B'	100	13.5
C'	110	13.0
D'	120	12.5
E'	130	12.0

The aggregate demand curve (AD) shows the relationship between the quantity of real GDP demanded and the price level. The aggregate demand curve is based on the aggregate demand schedule in the table. Each point A' through E' on the curve corresponds to the row in the table identified by the same letter. When the price level is 110, the quantity of real GDP demanded is \$13 trillion, as shown by point C' in the figure. A change in the price level, when all other influences on aggregate buying plans remain the same, brings a change in the quantity of real GDP demanded and a movement along the AD curve.

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wealth is the amount of money in the bank, bonds, stocks, and other assets that people own, measured not in dollars but in terms of the goods and services that the money, bonds, and stocks will buy.

People save and hold money, bonds, and stocks for many reasons. One reason is to build up funds for education expenses. Another reason is to build up enough funds to meet possible medical expenses or other big bills. But the biggest reason is to build up enough funds to provide a retirement income.

If the price level rises, real wealth decreases. People then try to restore their wealth. To do so, they must increase saving and, equivalently, decrease current consumption. Such a decrease in consumption is a decrease in aggregate demand.

Maria's Wealth Effect You can see how the wealth effect works by thinking about Maria's buying plans. Maria lives in Moscow, Russia. She has worked hard all summer and saved 20,000 rubles (the ruble is the currency of Russia), which she plans to spend attending graduate school when she has finished her economics degree. So Maria's wealth is 20,000 rubles. Maria has a part-time job, and her income from this job pays her current expenses. The price level in Russia rises by 100 percent, and now Maria needs 40,000 rubles to buy what 20,000 once bought. To try to make up some of the fall in value of her savings, Maria saves even more and cuts her current spending to the bare minimum.

Substitution Effects When the price level rises and other things remain the same, interest rates rise. The reason is related to the wealth effect that you've just studied. A rise in the price level decreases the real value of the money in people's pockets and bank accounts. With a smaller amount of real money around, banks and other lenders can get a higher interest rate on loans. But faced with a higher interest rate, people and businesses delay plans to buy new capital and consumer durable goods and cut back on spending.

This substitution effect involves changing the timing of purchases of capital and consumer durable goods and is called an *intertemporal* substitution effect—a substitution across time. Saving increases to increase future consumption.

To see this intertemporal substitution effect more clearly, think about your own plan to buy a new computer. At an interest rate of 5 percent a year, you might borrow \$1,000 and buy the new computer. But at an interest rate of 10 percent a year, you might decide that the payments would be too high. You don't abandon your plan to buy the computer, but you decide to delay your purchase.

A second substitution effect works through international prices. When the U.S. price level rises and other things remain the same, U.S.-made goods and services become more expensive relative to foreign-made goods and services. This change in *relative prices* encourages people to spend less on U.S.-made items and more on foreign-made items. For example, if the U.S. price level rises relative to the Japanese price level, Japanese buy fewer U.S.-made cars (U.S. exports decrease) and Americans buy more Japanese-made cars (U.S. imports increase). U.S. GDP decreases.

Maria's Substitution Effects In Moscow, Russia, Maria makes some substitutions. She was planning to trade in her old motor scooter and get a new one. But with a higher price level and a higher interest rate, she decides to make her old scooter last one more year. Also, with the prices of Russian goods sharply increasing, Maria substitutes a low-cost dress made in Malaysia for the Russian-made dress she had originally planned to buy.

Changes in the Quantity of Real GDP Demanded

When the price level rises and other things remain the same, the quantity of real GDP demanded decreases—a movement up along the *AD* curve as shown by the arrow in Fig. 10.4. When the price level falls and other things remain the same, the quantity of real GDP demanded increases—a movement down along the *AD* curve.

We've now seen how the quantity of real GDP demanded changes when the price level changes. How do other influences on buying plans affect aggregate demand?

Changes in Aggregate Demand

A change in any factor that influences buying plans other than the price level brings a change in aggregate demand. The main factors are

- Expectations
- Fiscal policy and monetary policy
- The world economy

Expectations An increase in expected future income increases the amount of consumption goods (especially big-ticket items such as cars) that people plan to buy today and increases aggregate demand.

An increase in the expected future inflation rate increases aggregate demand today because people decide to buy more goods and services at today's relatively lower prices.

An increase in expected future profits increases the investment that firms plan to undertake today and increases aggregate demand.

Fiscal Policy and Monetary Policy The government's attempt to influence the economy by setting and changing taxes, making transfer payments, and purchasing goods and services is called **fiscal policy**. A tax cut or an increase in transfer payments—for example, unemployment benefits or welfare payments—increases aggregate demand. Both of these influences operate by increasing households' *disposable* income. **Disposable income** is aggregate income minus taxes plus transfer payments. The greater the disposable income, the greater is the quantity of consumption goods and services that households plan to buy and the greater is aggregate demand.

Government expenditure on goods and services is one component of aggregate demand. So if the government spends more on spy satellites, schools, and highways, aggregate demand increases.

The Federal Reserve's (Fed's) attempt to influence the economy by changing interest rates and the quantity of money is called **monetary policy**. The Fed influences the quantity of money and interest rates by using the tools and methods described in Chapter 8.

An increase in the quantity of money increases aggregate demand through two main channels: It lowers interest rates and makes it easier to get a loan.

With lower interest rates, businesses plan a greater level of investment in new capital and households plan greater expenditure on new homes, on home improvements, on automobiles, and a host of other consumer durable goods. Banks and others eager to lend lower their standards for making loans and more people are able to get home loans and other consumer loans.

A decrease in the quantity of money has the opposite effects and lowers aggregate demand.

The World Economy Two main influences that the world economy has on aggregate demand are the exchange rate and foreign income. The *exchange rate* is the amount of a foreign currency that you can buy with a U.S. dollar. Other things remaining the same, a rise in the exchange rate decreases aggregate

Economics in Action

Fiscal Policy to Fight Recession

In February 2008, Congress passed legislation that gave \$168 billion to businesses and low- and middle-income Americans—\$600 to a single person and \$1,200 to a couple with an additional \$300 for each child. The benefit was scaled back for individuals with incomes above \$75,000 a year and for families with incomes greater than \$150,000 a year.

The idea of the package was to stimulate business investment and consumption expenditure and increase aggregate demand.



Deal makers Senators Harry Reid and Mitch McConnell

Monetary Policy to Fight Recession

In October 2008 and the months that followed, the Federal Reserve, in concert with the European Central Bank, the Bank of Canada, and the Bank of England, cut the interest rate and took other measures to ease credit and encourage banks and other financial institutions to increase their lending. The U.S. interest rate was the lowest (see below).

Like the earlier fiscal stimulus package, the idea of these interest rate cuts and easier credit was to stimulate business investment and consumption expenditure and increase aggregate demand.





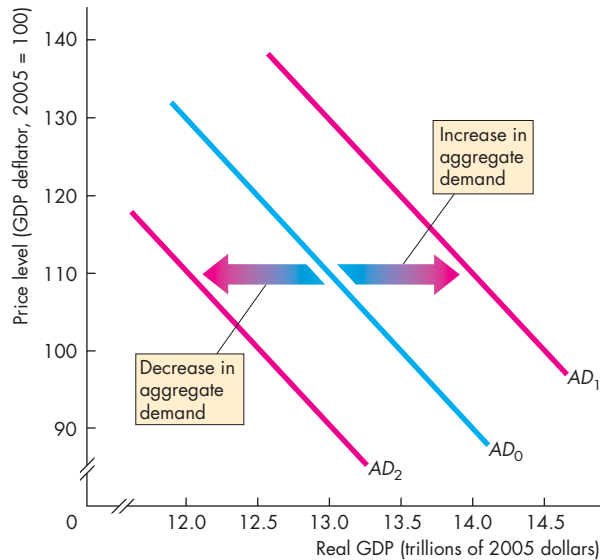
	0.20%		1.75%
Ben Bernanke Federal Reserve		Jean-Claude Trichet ECB	
	0.50%		0.25%
Mervyn King Bank of England		Mark Carney Bank of Canada	

FIGURE 10.5 Changes in Aggregate Demand

Aggregate demand

Decreases if:

- Expected future income, inflation, or profit decreases
- Fiscal policy decreases government expenditure, increases taxes, or decreases transfer payments
- Monetary policy decreases the quantity of money and increases interest rates
- The exchange rate increases or foreign income decreases

Increases if:

- Expected future income, inflation, or profit increases
- Fiscal policy increases government expenditure, decreases taxes, or increases transfer payments
- Monetary policy increases the quantity of money and decreases interest rates
- The exchange rate decreases or foreign income increases

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demand. To see how the exchange rate influences aggregate demand, suppose that the exchange rate is 1.20 euros per U.S. dollar. A Nokia cell phone made in Finland costs 120 euros, and an equivalent Motorola phone made in the United States costs \$110. In U.S. dollars, the Nokia phone costs \$100,

so people around the world buy the cheaper phone from Finland. Now suppose the exchange rate falls to 1 euro per U.S. dollar. The Nokia phone now costs \$120 and is more expensive than the Motorola phone. People will switch from the Nokia phone to the Motorola phone. U.S. exports will increase and U.S. imports will decrease, so U.S. aggregate demand will increase.

An increase in foreign income increases U.S. exports and increases U.S. aggregate demand. For example, an increase in income in Japan and Germany increases Japanese and German consumers' and producers' planned expenditures on U.S.-produced goods and services.

Shifts of the Aggregate Demand Curve When aggregate demand changes, the aggregate demand curve shifts. Figure 10.5 shows two changes in aggregate demand and summarizes the factors that bring about such changes.

Aggregate demand increases and the *AD* curve shifts rightward from AD_0 to AD_1 when expected future income, inflation, or profit increases; government expenditure on goods and services increases; taxes are cut; transfer payments increase; the quantity of money increases and the interest rate falls; the exchange rate falls; or foreign income increases.

Aggregate demand decreases and the *AD* curve shifts leftward from AD_0 to AD_2 when expected future income, inflation, or profit decreases; government expenditure on goods and services decreases; taxes increase; transfer payments decrease; the quantity of money decreases and the interest rate rises; the exchange rate rises; or foreign income decreases.

REVIEW QUIZ

- 1 What does the aggregate demand curve show? What factors change and what factors remain the same when there is a movement along the aggregate demand curve?
- 2 Why does the aggregate demand curve slope downward?
- 3 How do changes in expectations, fiscal policy and monetary policy, and the world economy change aggregate demand and the aggregate demand curve?

You can work these questions in Study Plan 10.2 and get instant feedback.



Explaining Macroeconomic Trends and Fluctuations

The purpose of the *AS-AD* model is to explain changes in real GDP and the price level. The model's main purpose is to explain business cycle fluctuations in these variables. But the model also aids our understanding of economic growth and inflation trends. We begin by combining aggregate supply and aggregate demand to determine real GDP and the price level in equilibrium. Just as there are two time frames for aggregate supply, there are two time frames for macroeconomic equilibrium: a long-run equilibrium and a short-run equilibrium. We'll first look at short-run equilibrium.

Short-Run Macroeconomic Equilibrium

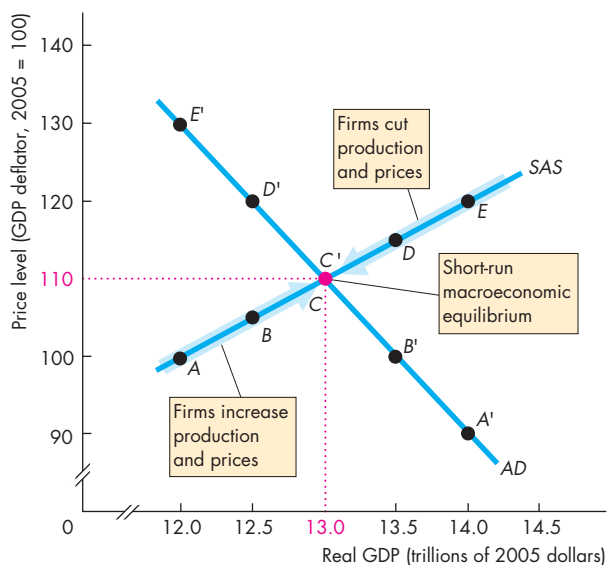
The aggregate demand curve tells us the quantity of real GDP demanded at each price level, and the short-run aggregate supply curve tells us the quantity of real GDP supplied at each price level. **Short-run macroeconomic equilibrium** occurs when the quantity of real GDP demanded equals the quantity of real GDP supplied. That is, short-run macroeconomic equilibrium occurs at the point of intersection of the *AD* curve and the *SAS* curve.

Figure 10.6 shows such an equilibrium at a price level of 110 and real GDP of \$13 trillion (points *C* and *C'*).

To see why this position is the equilibrium, think about what happens if the price level is something other than 110. Suppose, for example, that the price level is 120 and that real GDP is \$14 trillion (at point *E* on the *SAS* curve). The quantity of real GDP demanded is less than \$14 trillion, so firms are unable to sell all their output. Unwanted inventories pile up, and firms cut both production and prices. Production and prices are cut until firms can sell all their output. This situation occurs only when real GDP is \$13 trillion and the price level is 110.

Now suppose the price level is 100 and real GDP is \$12 trillion (at point *A* on the *SAS* curve). The quantity of real GDP demanded exceeds \$12 trillion, so firms are unable to meet the demand for their output. Inventories decrease, and customers clamor for goods and services, so firms increase production and raise prices. Production and prices increase until firms can meet the demand for their

FIGURE 10.6 Short-Run Equilibrium



Short-run macroeconomic equilibrium occurs when real GDP demanded equals real GDP supplied—at the intersection of the aggregate demand curve (*AD*) and the short-run aggregate supply curve (*SAS*).

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output. This situation occurs only when real GDP is \$13 trillion and the price level is 110.

In the short run, the money wage rate is fixed. It does not adjust to move the economy to full employment. So in the short run, real GDP can be greater than or less than potential GDP. But in the long run, the money wage rate does adjust and real GDP moves toward potential GDP. Let's look at long-run equilibrium and see how we get there.

Long-Run Macroeconomic Equilibrium

Long-run macroeconomic equilibrium occurs when real GDP equals potential GDP—equivalently, when the economy is on its *LAS* curve.

When the economy is away from long-run equilibrium, the money wage rate adjusts. If the money wage rate is too high, short-run equilibrium is below potential GDP and the unemployment rate is above the natural rate. With an excess supply of labor, the money wage rate falls. If the money wage rate is too low, short-run equilibrium is above potential GDP and the unemployment rate is below the natural rate.

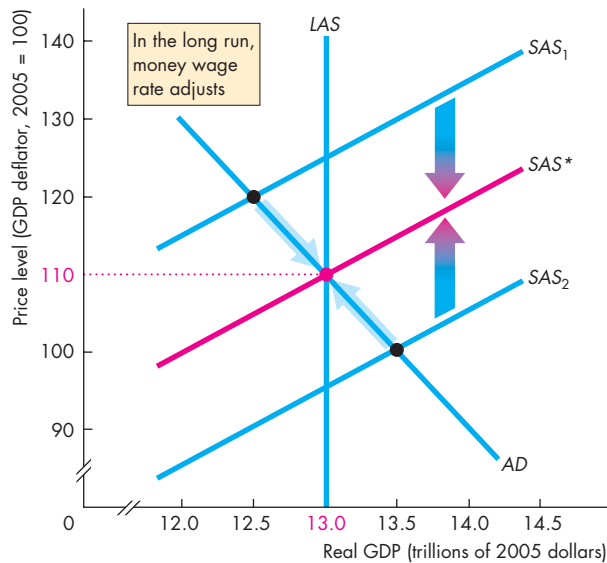
With an excess demand for labor, the money wage rate rises.

Figure 10.7 shows the long-run equilibrium and how it comes about. If short-run aggregate supply curve is SAS_1 , the money wage rate is too high to achieve full employment. A fall in the money wage rate shifts the SAS curve to SAS^* and brings full employment. If short-run aggregate supply curve is SAS_2 , the money wage rate is too low to achieve full employment. Now, a rise in the money wage rate shifts the SAS curve to SAS^* and brings full employment.

In long-run equilibrium, potential GDP determines real GDP and potential GDP and aggregate demand together determine the price level. The money wage rate adjusts until the SAS curve passes through the long-run equilibrium point.

Let's now see how the $AS-AD$ model helps us to understand economic growth and inflation.

FIGURE 10.7 Long-Run Equilibrium



In long-run macroeconomic equilibrium, real GDP equals potential GDP. So long-run equilibrium occurs where the aggregate demand curve, AD , intersects the long-run aggregate supply curve, LAS . In the long run, aggregate demand determines the price level and has no effect on real GDP. The money wage rate adjusts in the long run, so that the SAS curve intersects the LAS curve at the long-run equilibrium price level.



Economic Growth and Inflation in the $AS-AD$ Model

Economic growth results from a growing labor force and increasing labor productivity, which together make potential GDP grow (Chapter 6, pp. 141–144). Inflation results from a growing quantity of money that outpaces the growth of potential GDP (Chapter 8, pp. 200–201).

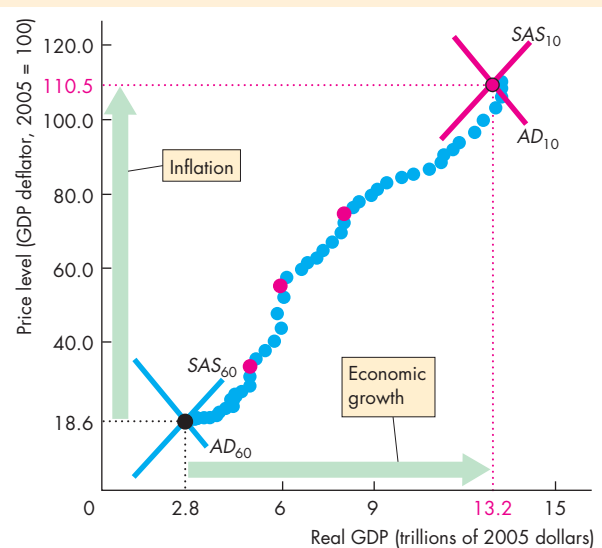
The $AS-AD$ model explains and illustrates economic growth and inflation. It explains economic growth as increasing long-run aggregate supply and it explains inflation as a persistent increase in aggregate demand at a faster pace than that of the increase in potential GDP.

Economics in Action

U.S. Economic Growth and Inflation

The figure is a *scatter diagram* of U.S. real GDP and the price level. The graph has the same axes as those of the $AS-AD$ model. Each dot represents a year between 1960 and 2010. The red dots are recession years. The pattern formed by the dots shows the combination of economic growth and inflation. Economic growth was fastest during the 1960s; inflation was fastest during the 1970s.

The $AS-AD$ model interprets each dot as being at the intersection of the SAS and AD curves.



The Path of Real GDP and the Price Level

Source of data: Bureau of Economic Analysis.

Figure 10.8 illustrates this explanation in terms of the shifting *LAS* and *AD* curves.

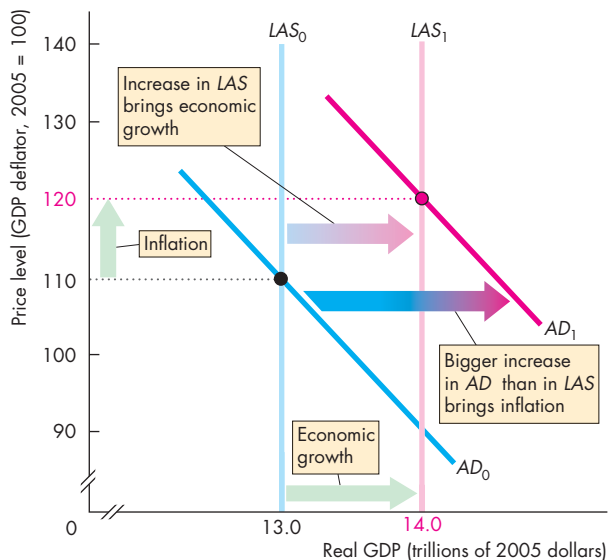
When the *LAS* curve shifts rightward from LAS_0 to LAS_1 , potential GDP grows from \$13 trillion to \$14 trillion and in long-run equilibrium, real GDP also grows to \$14 trillion.

When the *AD* curve shifts rightward from AD_0 to AD_1 , which is a growth of aggregate demand that outpaces the growth of potential GDP, the price level rises from 110 to 120.

If aggregate demand were to increase at the same pace as long-run aggregate supply, real GDP would grow with no inflation.

Our economy experiences periods of growth and inflation, like those shown in Fig. 10.8, but it does not experience *steady* growth and *steady* inflation. Real GDP fluctuates around potential GDP in a business cycle. When we study the business cycle, we ignore economic growth and focus on the fluctuations around the trend. By doing so, we see the business cycle more clearly. Let's now see how the *AS-AD* model explains the business cycle.

FIGURE 10.8 Economic Growth and Inflation



Economic growth results from a persistent increase in potential GDP—a rightward shift of the *LAS* curve. Inflation results from persistent growth in the quantity of money that shifts the *AD* curve rightward at a faster pace than the real GDP growth rate.



The Business Cycle in the AS-AD Model

The business cycle occurs because aggregate demand and short-run aggregate supply fluctuate but the money wage rate does not adjust quickly enough to keep real GDP at potential GDP. Figure 10.9 shows three types of short-run equilibrium.

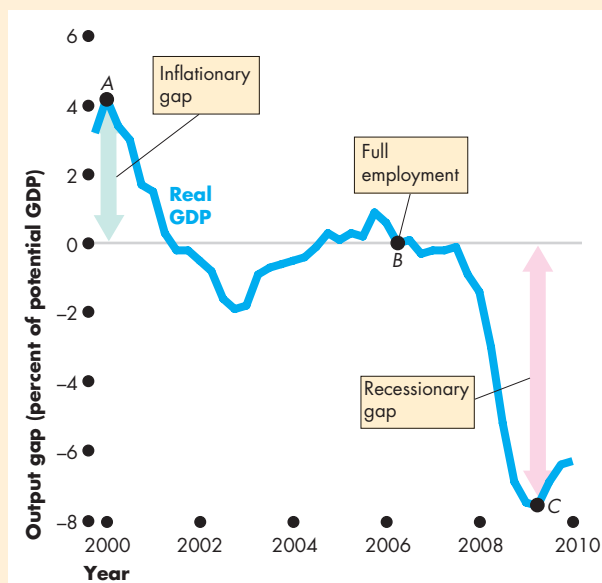
Figure 10.9(a) shows an above full-employment equilibrium. An **above full-employment equilibrium** is an equilibrium in which real GDP exceeds potential GDP. The gap between real GDP and potential GDP is the **output gap**. When real GDP exceeds potential GDP, the output gap is called an **inflationary gap**.

The above full-employment equilibrium shown in Fig. 10.9(a) occurs where the aggregate demand curve AD_0 intersects the short-run aggregate supply curve SAS_0 at a real GDP of \$13.2 trillion. There is an inflationary gap of \$0.2 trillion.

Economics in Action

The U.S. Business Cycle

The U.S. economy had an inflationary gap in 2006 (at A in the figure), full employment in 2006 (at B), and a recessionary gap in 2009 (at C). The fluctuating output gap in the figure is the real-world version of Fig. 10.9(d) and is generated by fluctuations in aggregate demand and short-run aggregate supply.



The U.S. Output Gap

Sources of data: Bureau of Economic Analysis and Congressional Budget Office.

Figure 10.9(b) is an example of **full-employment equilibrium**, in which real GDP equals potential GDP. In this example, the equilibrium occurs where the aggregate demand curve AD_1 intersects the short-run aggregate supply curve SAS_1 at an actual and potential GDP of \$13 trillion.

In part (c), there is a below full-employment equilibrium. A **below full-employment equilibrium** is an equilibrium in which potential GDP exceeds real GDP. When potential GDP exceeds real GDP, the output gap is called a **recessionary gap**.

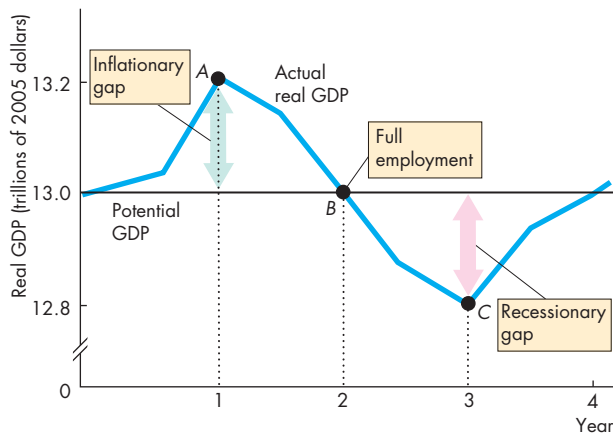
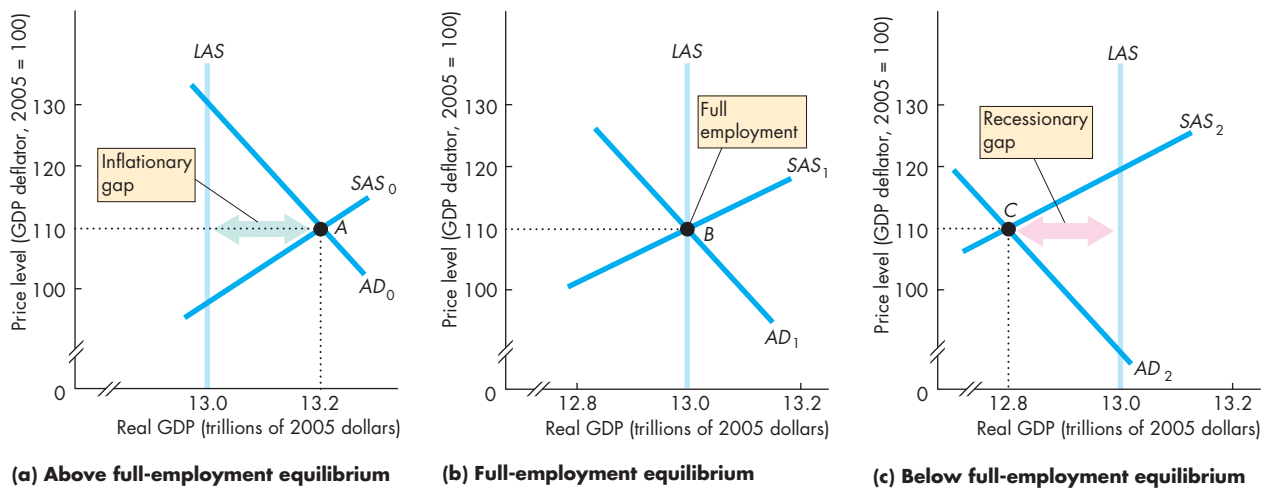
The below full-employment equilibrium shown in

Fig. 10.9(c) occurs where the aggregate demand curve AD_2 intersects the short-run aggregate supply curve SAS_2 at a real GDP of \$12.8 trillion. Potential GDP is \$13 trillion, so the recessionary gap is \$0.2 trillion.

The economy moves from one type of macroeconomic equilibrium to another as a result of fluctuations in aggregate demand and in short-run aggregate supply. These fluctuations produce fluctuations in real GDP. Figure 10.9(d) shows how real GDP fluctuates around potential GDP.

Let's now look at some of the sources of these fluctuations around potential GDP.

FIGURE 10.9 The Business Cycle



Part (a) shows an above full-employment equilibrium in year 1; part (b) shows a full-employment equilibrium in year 2; and part (c) shows a below full-employment equilibrium in year 3. Part (d) shows how real GDP fluctuates around potential GDP in a business cycle.

In year 1, an inflationary gap exists and the economy is at point A in parts (a) and (d). In year 2, the economy is at full employment and the economy is at point B in parts (b) and (d). In year 3, a recessionary gap exists and the economy is at point C in parts (c) and (d).

Fluctuations in Aggregate Demand

One reason real GDP fluctuates around potential GDP is that aggregate demand fluctuates. Let's see what happens when aggregate demand increases.

Figure 10.10(a) shows an economy at full employment. The aggregate demand curve is AD_0 , the short-run aggregate supply curve is SAS_0 , and the long-run aggregate supply curve is LAS . Real GDP equals potential GDP at \$13 trillion, and the price level is 110.

Now suppose that the world economy expands and that the demand for U.S.-produced goods increases in Asia and Europe. The increase in U.S. exports increases aggregate demand in the United States, and the aggregate demand curve shifts rightward from AD_0 to AD_1 in Fig. 10.10(a).

Faced with an increase in demand, firms increase production and raise prices. Real GDP increases to \$13.5 trillion, and the price level rises to 115. The economy is now in an above full-employment equilibrium. Real GDP exceeds potential GDP, and there is an inflationary gap.

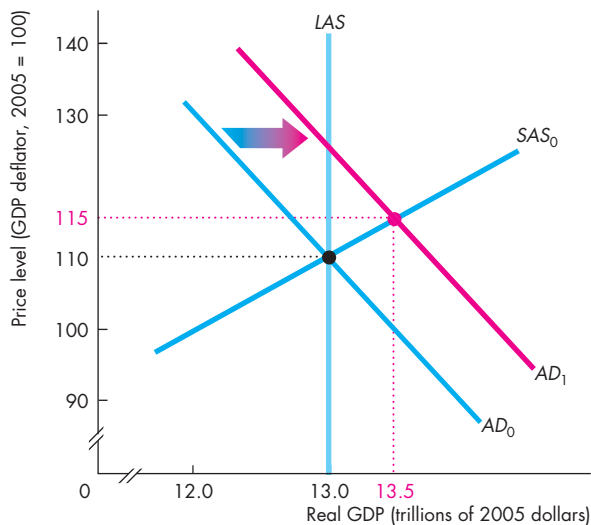
The increase in aggregate demand has increased the prices of all goods and services. Faced with higher prices, firms increased their output rates. At this stage, prices of goods and services have increased but the money wage rate has not changed. (Recall that as we move along the SAS curve, the money wage rate is constant.)

The economy cannot produce in excess of potential GDP forever. Why not? What are the forces at work that bring real GDP back to potential GDP?

Because the price level has increased and the money wage rate is unchanged, workers have experienced a fall in the buying power of their wages and firms' profits have increased. Under these circumstances, workers demand higher wages and firms, anxious to maintain their employment and output levels, meet those demands. If firms do not raise the money wage rate, they will either lose workers or have to hire less productive ones.

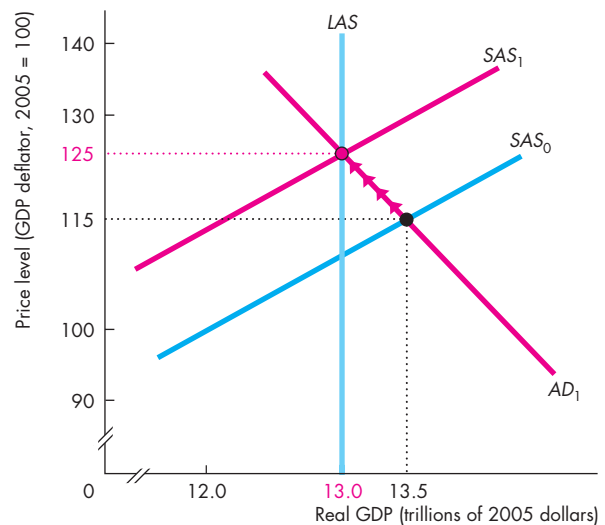
As the money wage rate rises, the short-run aggregate supply begins to decrease. In Fig. 10.10(b), the short-run aggregate supply curve begins to shift from

FIGURE 10.10 An Increase in Aggregate Demand



(a) Short-run effect

An increase in aggregate demand shifts the aggregate demand curve from AD_0 to AD_1 . In short-run equilibrium, real GDP increases to \$13.5 trillion and the price level rises to 115. In this situation, an inflationary gap exists. In the long run in part (b), the money wage rate rises and the short-run aggregate



(b) Long-run effect

supply curve shifts leftward. As short-run aggregate supply decreases, the SAS curve shifts from SAS_0 to SAS_1 and intersects the aggregate demand curve AD_1 at higher price levels and real GDP decreases. Eventually, the price level rises to 125 and real GDP decreases to \$13 trillion—potential GDP.

SAS_0 toward SAS_1 . The rise in the money wage rate and the shift in the SAS curve produce a sequence of new equilibrium positions. Along the adjustment path, real GDP decreases and the price level rises. The economy moves up along its aggregate demand curve as shown by the arrows in the figure.

Eventually, the money wage rate rises by the same percentage as the price level. At this time, the aggregate demand curve AD_1 intersects SAS_1 at a new full-employment equilibrium. The price level has risen to 125, and real GDP is back where it started, at potential GDP.

A decrease in aggregate demand has effects similar but opposite to those of an increase in aggregate demand. That is, a decrease in aggregate demand shifts the aggregate demand curve leftward. Real GDP decreases to less than potential GDP, and a recessionary gap emerges. Firms cut prices. The lower price level increases the purchasing power of wages and increases firms' costs relative to their output prices because the money wage rate is unchanged. Eventually, the money wage rate falls and the short-run aggregate supply increases.

Let's now work out how real GDP and the price level change when aggregate supply changes.

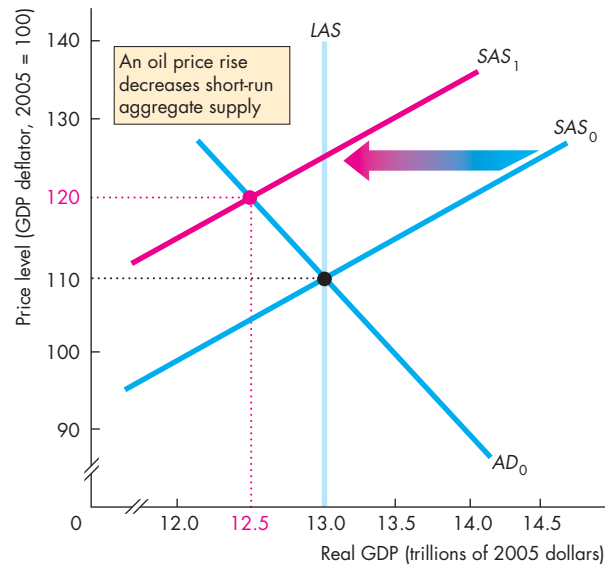
Fluctuations in Aggregate Supply

Fluctuations in short-run aggregate supply can bring fluctuations in real GDP around potential GDP. Suppose that initially real GDP equals potential GDP. Then there is a large but temporary rise in the price of oil. What happens to real GDP and the price level?

Figure 10.11 answers this question. The aggregate demand curve is AD_0 , the short-run aggregate supply curve is SAS_0 , and the long-run aggregate supply curve is LAS . Real GDP is \$13 trillion, which equals potential GDP, and the price level is 110. Then the price of oil rises. Faced with higher energy and transportation costs, firms decrease production. Short-run aggregate supply decreases, and the short-run aggregate supply curve shifts leftward to SAS_1 . The price level rises to 120, and real GDP decreases to \$12.5 trillion. Because real GDP decreases, the economy experiences recession. Because the price level increases, the economy experiences inflation. A combination of recession and inflation, called **stagflation**, actually occurred in the United States in the mid-1970s and early 1980s, but events like this are not common.

When the price of oil returns to its original level, the economy returns to full employment.

FIGURE 10.11 A Decrease in Aggregate Supply



An increase in the price of oil decreases short-run aggregate supply and shifts the short-run aggregate supply curve from SAS_0 to SAS_1 . Real GDP falls from \$13 trillion to \$12.5 trillion, and the price level rises from 110 to 120. The economy experiences stagflation.

 animation

REVIEW QUIZ

- 1 Does economic growth result from increases in aggregate demand, short-run aggregate supply, or long-run aggregate supply?
- 2 Does inflation result from increases in aggregate demand, short-run aggregate supply, or long-run aggregate supply?
- 3 Describe three types of short-run macroeconomic equilibrium.
- 4 How do fluctuations in aggregate demand and short-run aggregate supply bring fluctuations in real GDP around potential GDP?

You can work these questions in Study Plan 10.3 and get instant feedback.



We can use the $AS-AD$ model to explain and illustrate the views of the alternative schools of thought in macroeconomics. That is your next task.

Macroeconomic Schools of Thought

Macroeconomics is an active field of research, and much remains to be learned about the forces that make our economy grow and fluctuate. There is a greater degree of consensus and certainty about economic growth and inflation—the longer-term trends in real GDP and the price level—than there is about the business cycle—the short-term fluctuations in these variables. Here, we'll look only at differences of view about short-term fluctuations.

The *AS-AD* model that you've studied in this chapter provides a good foundation for understanding the range of views that macroeconomists hold about this topic. But what you will learn here is just a first glimpse at the scientific controversy and debate. We'll return to these issues at various points later in the text and deepen your appreciation of the alternative views.

Classification usually requires simplification, and classifying macroeconomists is no exception to this general rule. The classification that we'll use here is simple, but it is not misleading. We're going to divide macroeconomists into three broad schools of thought and examine the views of each group in turn. The groups are

- Classical
- Keynesian
- Monetarist

The Classical View

A **classical** macroeconomist believes that the economy is self-regulating and always at full employment. The term “classical” derives from the name of the founding school of economics that includes Adam Smith, David Ricardo, and John Stuart Mill.

A **new classical** view is that business cycle fluctuations are the efficient responses of a well-functioning market economy that is bombarded by shocks that arise from the uneven pace of technological change.

The classical view can be understood in terms of beliefs about aggregate demand and aggregate supply.

Aggregate Demand Fluctuations In the classical view, technological change is the most significant influence on both aggregate demand and aggregate

supply. For this reason, classical macroeconomists don't use the *AS-AD* framework. But their views can be interpreted in this framework. A technological change that increases the productivity of capital brings an increase in aggregate demand because firms increase their expenditure on new plant and equipment. A technological change that lengthens the useful life of existing capital decreases the demand for new capital, which decreases aggregate demand.

Aggregate Supply Response In the classical view, the money wage rate that lies behind the short-run aggregate supply curve is instantly and completely flexible. The money wage rate adjusts so quickly to maintain equilibrium in the labor market that real GDP always adjusts to equal potential GDP.

Potential GDP itself fluctuates for the same reasons that aggregate demand fluctuates: technological change. When the pace of technological change is rapid, potential GDP increases quickly and so does real GDP. And when the pace of technological change slows, so does the growth rate of potential GDP.

Classical Policy The classical view of policy emphasizes the potential for taxes to stunt incentives and create inefficiency. By minimizing the disincentive effects of taxes, employment, investment, and technological advance are at their efficient levels and the economy expands at an appropriate and rapid pace.

The Keynesian View

A **Keynesian** macroeconomist believes that left alone, the economy would rarely operate at full employment and that to achieve and maintain full employment, active help from fiscal policy and monetary policy is required.

The term “Keynesian” derives from the name of one of the twentieth century's most famous economists, John Maynard Keynes (see p. 317).

The Keynesian view is based on beliefs about the forces that determine aggregate demand and short-run aggregate supply.

Aggregate Demand Fluctuations In the Keynesian view, *expectations* are the most significant influence on aggregate demand. Those expectations are based on herd instinct, or what Keynes himself called “animal spirits.” A wave of pessimism about future profit prospects can lead to a fall in aggregate demand and plunge the economy into recession.

Aggregate Supply Response In the Keynesian view, the money wage rate that lies behind the short-run aggregate supply curve is extremely sticky in the downward direction. Basically, the money wage rate doesn't fall. So if there is a recessionary gap, there is no automatic mechanism for getting rid of it. If it were to happen, a fall in the money wage rate would increase short-run aggregate supply and restore full employment. But the money wage rate doesn't fall, so the economy remains stuck in recession.

A modern version of the Keynesian view, known as the **new Keynesian** view, holds not only that the money wage rate is sticky but also that prices of goods and services are sticky. With a sticky price level, the short-run aggregate supply curve is horizontal at a fixed price level.

Policy Response Needed The Keynesian view calls for fiscal policy and monetary policy to actively offset changes in aggregate demand that bring recession.

By stimulating aggregate demand in a recession, full employment can be restored.

The Monetarist View

A **monetarist** is a macroeconomist who believes that the economy is self-regulating and that it will normally operate at full employment, provided that monetary policy is not erratic and that the pace of money growth is kept steady.

The term “monetarist” was coined by an outstanding twentieth-century economist, Karl Brunner, to describe his own views and those of Milton Friedman (see p. 375).

The monetarist view can be interpreted in terms of beliefs about the forces that determine aggregate demand and short-run aggregate supply.

Aggregate Demand Fluctuations In the monetarist view, *the quantity of money* is the most significant influence on aggregate demand. The quantity of money is determined by the Federal Reserve (the Fed). If the Fed keeps money growing at a steady pace, aggregate demand fluctuations will be minimized and the economy will operate close to full employment. But if the Fed decreases the quantity of money or even just slows its growth rate too abruptly, the economy will go into recession. In the monetarist view, all recessions result from inappropriate monetary policy.

Aggregate Supply Response The monetarist view of short-run aggregate supply is the same as the Keynesian view: the money wage rate is sticky. If the economy is in recession, it will take an unnecessarily long time for it to return unaided to full employment.

Monetarist Policy The monetarist view of policy is the same as the classical view on fiscal policy. Taxes should be kept low to avoid disincentive effects that decrease potential GDP. Provided that the quantity of money is kept on a steady growth path, no active stabilization is needed to offset changes in aggregate demand.

The Way Ahead

In the chapters that follow, you're going to encounter Keynesian, classical, and monetarist views again. In the next chapter, we study the original Keynesian model of aggregate demand. This model remains useful today because it explains how expenditure fluctuations are magnified and bring changes in aggregate demand that are larger than the changes in expenditure. We then go on to apply the *AS-AD* model to a deeper look at U.S. inflation and business cycles.

Our attention then turns to short-run macroeconomic policy—the fiscal policy of the Administration and Congress and the monetary policy of the Fed.

REVIEW QUIZ

- 1 What are the defining features of classical macroeconomics and what policies do classical macroeconomists recommend?
- 2 What are the defining features of Keynesian macroeconomics and what policies do Keynesian macroeconomists recommend?
- 3 What are the defining features of monetarist macroeconomics and what policies do monetarist macroeconomists recommend?

You can work these questions in Study Plan 10.4 and get instant feedback.



◆ To complete your study of the *AS-AD* model, *Reading Between the Lines* on pp. 258–259 looks at the U.S. economy in 2010 through the eyes of this model.