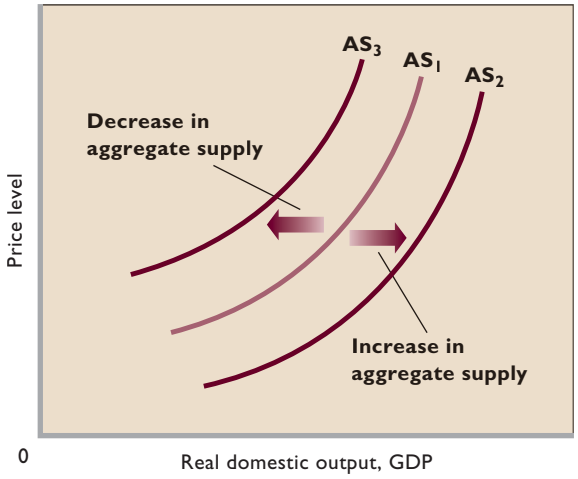
FIGURE 29.6 Changes in aggregate supply. A change in one or more of the listed determinants of aggregate supply will shift the aggregate supply curve. The rightward shift of the aggregate supply curve from AS_1 to AS_2 represents an increase in aggregate supply; the leftward shift of the curve from AS_1 to AS_3 shows a decrease in aggregate supply.



Determinants of Aggregate Supply: Factors That Shift the Aggregate Supply Curve

1. Change in input prices
   a. Domestic resource prices
   b. Prices of imported resources
2. Change in productivity
3. Change in legal-institutional environment
   a. Business taxes and subsidies
   b. Government regulations

to the left, as from AS_1 to AS_3. When per-unit production costs change for reasons other than changes in real output, the aggregate supply curve shifts.

The three aggregate supply determinants listed in Figure 29.6 require more discussion.

Input Prices

Input or resource prices—to be distinguished from the output prices that make up the price level—are a major ingredient of per-unit production costs and therefore a key determinant of aggregate supply. These resources can either be domestic or imported.

Domestic Resource Prices

As stated earlier, wages and salaries make up about 75 percent of all business costs. Other things equal, decreases in wages reduce per-unit production costs. So the aggregate supply curve shifts to the right. Increases in wages shift the curve to the left. Examples:

- Labor supply increases because of substantial immigration. Wages and per-unit production costs fall, shifting the AS curve to the right.
- Labor supply decreases because a rapid increase in pension income causes many older workers to opt for early retirement. Wage rates and per-unit production costs rise, shifting the AS curve to the left.

Similarly, the aggregate supply curve shifts when the prices of land and capital inputs change. Examples:

- The price of machinery and equipment falls because of declines in the prices of steel and electronic components. Per-unit production costs decline, and the AS curve shifts to the right.
- The supply of available land resources expands through discoveries of mineral deposits, irrigation of land, or technical innovations that transform "nonresources" (say, vast desert lands) into valuable resources (productive lands). The price of land declines, per-unit production costs fall, and the AS curve shifts to the right.

Prices of Imported Resources

Just as foreign demand for U.S. goods contributes to U.S. aggregate demand, resources imported from abroad (such as oil, tin, and copper) add to U.S. aggregate supply. Added supplies of resources—whether domestic or imported—typically reduce per-unit production costs. A decrease in the price of imported resources increases U.S. aggregate supply, while an increase in their price reduces U.S. aggregate supply.

A good example of the major effect that changing resource prices can have on aggregate supply is the oil price hikes of the 1970s. At that time, a group of oil-producing nations called the Organization of Petroleum Exporting Countries (OPEC) worked in concert to decrease oil production in order to raise the price of oil. The 10-fold increase in the price of oil that OPEC achieved during the 1970s drove up per-unit production costs and jolted the U.S. aggregate supply curve leftward. By contrast, a sharp decline in oil prices in the mid-1980s resulted in a rightward shift of the U.S. aggregate supply curve. In 1999 OPEC again reasserted itself, raising oil prices and therefore per-unit production costs for some U.S. producers including

airlines and shipping companies like FedEx and UPS. More recent increases in the price of oil have been mostly due to increases in demand rather than changes in supply caused by OPEC. But keep in mind that no matter what their cause, increases in the price of oil and other resources raise production costs and decrease aggregate supply.

Exchange-rate fluctuations are one factor that may alter the price of imported resources. Suppose that the dollar appreciates, enabling U.S. firms to obtain more foreign currency with each dollar. This means that domestic producers face a lower *dollar* price of imported resources. U.S. firms will respond by increasing their imports of foreign resources, thereby lowering their per-unit production costs at each level of output. Falling per-unit production costs will shift the U.S. aggregate supply curve to the right.

A depreciation of the dollar will have the opposite set of effects and will shift the aggregate supply curve to the left.

Productivity

The second major determinant of aggregate supply is **productivity,** which is a measure of the relationship between a nation's level of real output and the amount of resources used to produce that output. Productivity is a measure of average real output, or of real output per unit of input:

$$\text{Productivity} = \frac{\text{total output}}{\text{total inputs}}$$

An increase in productivity enables the economy to obtain more real output from its limited resources. It does this by reducing the per-unit cost of output (per-unit production cost). Suppose, for example, that real output is 10 units, that 5 units of input are needed to produce that quantity, and that the price of each input unit is $2. Then

$$\text{Productivity} = \frac{\text{total output}}{\text{total inputs}} = \frac{10}{5} = 2$$

and

$$\text{Per-unit production cost} = \frac{\text{total input cost}}{\text{total output}}$$

$$= \frac{\$2 \times 5}{10} = \$1$$

Note that we obtain the total input cost by multiplying the unit input cost by the number of inputs used.

Now suppose productivity increases so that real output doubles to 20 units, while the price and quantity of the input remain constant at $2 and 5 units. Using the above equations, we see that productivity rises from 2 to 4 and that the per-unit production cost of the output falls from $1 to $.50. The doubled productivity has reduced the per-unit production cost by half.

WORKED PROBLEMS

W 29.1
Productivity and costs

By reducing the per-unit production cost, an increase in productivity shifts the aggregate supply curve to the right. The main source of productivity advance is improved production technology, often embodied within new plant and equipment that replaces old plant and equipment. Other sources of productivity increases are a better-educated and better-trained workforce, improved forms of business enterprises, and the reallocation of labor resources from lower-productivity to higher-productivity uses.

Much rarer, decreases in productivity increase per-unit production costs and therefore reduce aggregate supply (shift the curve to the left).

Legal-Institutional Environment

Changes in the legal-institutional setting in which businesses operate are the final determinant of aggregate supply. Such changes may alter the per-unit costs of output and, if so, shift the aggregate supply curve. Two changes of this type are (1) changes in taxes and subsidies and (2) changes in the extent of regulation.

Business Taxes and Subsidies

Higher business taxes, such as sales, excise, and payroll taxes, increase per-unit costs and reduce short-run aggregate supply in much the same way as a wage increase does. An increase in such taxes paid by businesses will increase per-unit production costs and shift aggregate supply to the left.

Similarly, a business subsidy—a payment or tax break by government to producers—lowers production costs and increases short-run aggregate supply. For example, the Federal government subsidizes firms that blend ethanol (derived from corn) with gasoline to increase the U.S. gasoline supply. This reduces the per-unit production cost of making blended gasoline. To the extent that this and other subsidies are successful, the aggregate supply curve shifts rightward.

Government Regulation

It is usually costly for businesses to comply with government regulations. More regulation therefore tends to increase per-unit production costs and shift the aggregate supply curve to the left. "Supply-side" proponents of deregulation of the economy have argued forcefully that, by increasing efficiency and reducing the paperwork associated with complex regulations, deregulation will reduce per-unit costs and shift the

aggregate supply curve to the right. Other economists are less certain. Deregulation that results in accounting manipulations, monopolization, and business failures is likely to shift the AS curve to the left rather than to the right.

QUICK REVIEW 29.2

- The immediate-short-run aggregate supply curve is horizontal at the economy's current price level to reflect the fact that in the immediate short run input and output prices are fixed so that producers will supply whatever quantity of real output is demanded at the current output prices.
- The short-run aggregate supply curve (or simply the "aggregate supply curve") is upward-sloping because it reflects the fact that in the short run wages and other input prices remain fixed while output prices vary. Given fixed resource costs, higher output prices raise firm profits and encourage them to increase their output levels. The curve's upward slope reflects rising per-unit production costs as output expands.
- The long-run aggregate supply curve is vertical because, given sufficient time, wages and other input prices rise and fall to match price-level changes; because price-level changes do not change real rewards, they do not change production decisions.
- By altering per-unit production costs independent of changes in the level of output, changes in one or more of the determinants of aggregate supply (Figure 29.6) shift the aggregate supply curve.
- An increase in short-run aggregate supply is shown as a rightward shift of the aggregate supply curve; a decrease is shown as a leftward shift of the curve.

Equilibrium and Changes in Equilibrium

Of all the possible combinations of price levels and levels of real GDP, which combination will the economy gravitate toward, at least in the short run? **Figure 29.7 (Key Graph)** and its accompanying table provide the answer. Equilibrium occurs at the price level that equalizes the amounts of real output demanded and supplied. The intersection of the aggregate demand curve AD and the aggregate supply curve AS establishes the economy's **equilibrium price level** and **equilibrium real output.** So aggregate demand and aggregate supply *jointly* establish the price level and level of real GDP.

In Figure 29.7 the equilibrium price level and level of real output are 100 and $510 billion, respectively. To illustrate why, suppose the price level is 92 rather than 100. We see from the table that the lower price level will encourage businesses to produce real output of $502 billion. This is shown by point *a* on the AS curve in the graph. But, as revealed by the table and point *b* on the aggregate demand curve, buyers will want to purchase $514 billion of real output at price level 92. Competition among buyers to purchase the lesser available real output of $502 billion will eliminate the $12 billion (= $514 billion − $502 billion) shortage and pull up the price level to 100.

As the table and graph show, the rise in the price level from 92 to 100 encourages producers to increase their real output from $502 billion to $510 billion and causes buyers to scale back their purchases from $514 billion to $510 billion. When equality occurs between the amounts of real output produced and purchased, as it does at price level 100, the economy has achieved equilibrium (here, at $510 billion of real GDP).

INTERACTIVE GRAPHS
G 29.1
Aggregate demand–aggregate supply

Now let's apply the AD-AS model to various situations that can confront the economy. For simplicity we will use *P* and *Q* symbols, rather than actual numbers. Remember that these symbols represent, respectively, price index values and amounts of real GDP.

Increases in AD: Demand-Pull Inflation

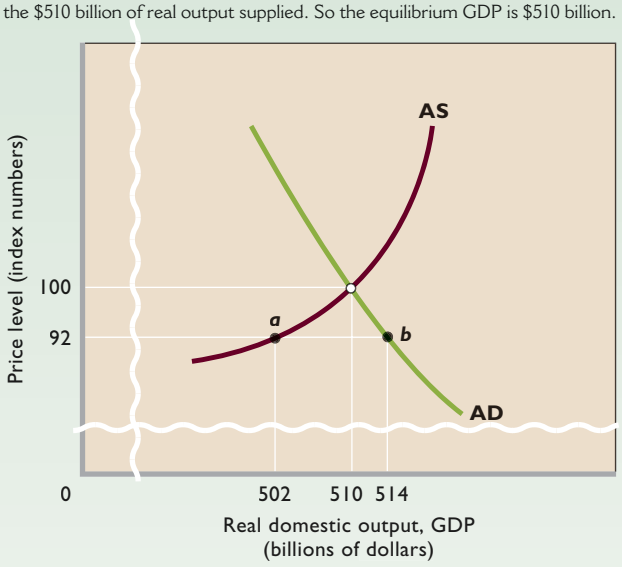
Suppose the economy is operating at its full-employment output and businesses and government decide to increase their spending—actions that shift the aggregate demand curve to the right. Our list of determinants of aggregate demand (Figure 29.2) provides several reasons why this shift might occur. Perhaps firms boost their investment spending because they anticipate higher future profits from investments in new capital. Those profits are predicated on having new equipment and facilities that incorporate a number of new technologies. And perhaps government increases spending to expand national defense.

As shown by the rise in the price level from P_1 to P_2 in Figure 29.8, the increase in aggregate demand beyond the full-employment level of output causes inflation. This is *demand-pull inflation* because the price level is being pulled up by the increase in aggregate demand. Also, observe that the increase in demand expands real output from the full-employment level Q_f to Q_1. The distance between Q_1 and Q_f is a positive, or "inflationary," GDP gap. Actual GDP exceeds potential GDP.

The classic American example of demand-pull inflation occurred in the late 1960s. The escalation of the war in Vietnam resulted in a 40 percent increase in defense

keygraph

FIGURE 29.7 The equilibrium price level and equilibrium real GDP. The intersection of the aggregate demand curve and the aggregate supply curve determines the economy's equilibrium price level. At the equilibrium price level of 100 (in index-value terms), the $510 billion of real output demanded matches the $510 billion of real output supplied. So the equilibrium GDP is $510 billion.



Real Output Demanded (Billions)	Price Level (Index Number)	Real Output Supplied (Billions)
$506	108	$513
508	104	512
510	***100***	***510***
512	96	507
514	92	502

QUICK QUIZ FOR FIGURE 29.7

1. The AD curve slopes downward because:
   - **a.** per-unit production costs fall as real GDP increases.
   - **b.** the income and substitution effects are at work.
   - **c.** changes in the determinants of AD alter the amounts of real GDP demanded at each price level.
   - **d.** decreases in the price level give rise to real-balances effects, interest-rate effects, and foreign purchases effects that increase the amounts of real GDP demanded.
2. The AS curve slopes upward because:
   - **a.** per-unit production costs rise as real GDP expands toward and beyond its full-employment level.
   - **b.** the income and substitution effects are at work.
   - **c.** changes in the determinants of AS alter the amounts of real GDP supplied at each price level.
   - **d.** increases in the price level give rise to real-balances effects, interest-rate effects, and foreign purchases effects that increase the amounts of real GDP supplied.
3. At price level 92:
   - **a.** a GDP surplus of $12 billion occurs that drives the price level up to 100.
   - **b.** a GDP shortage of $12 billion occurs that drives the price level up to 100.
   - **c.** the aggregate amount of real GDP demanded is less than the aggregate amount of GDP supplied.
   - **d.** the economy is operating beyond its capacity to produce.
4. Suppose real output demanded rises by $4 billion at each price level. The new equilibrium price level will be:
   - **a.** 108.
   - **b.** 104.
   - **c.** 96.
   - **d.** 92.

Answers: 1. d; 2. a; 3. b; 4. b

spending between 1965 and 1967 and another 15 percent increase in 1968. The rise in government spending, imposed on an already growing economy, shifted the economy's aggregate demand curve to the right, producing the worst inflation in two decades. Actual GDP exceeded potential GDP, thereby creating an inflationary GDP gap. Inflation jumped from 1.6 percent in 1965 to 5.7 percent by 1970. **(Key Question 4)**

A careful examination of Figure 29.8 reveals an interesting point concerning the multiplier effect. The increase in aggregate demand from AD_1 to AD_2 increases real output only to Q_1, not to Q_2, because part of the

FIGURE 29.8 An increase in aggregate demand that causes demand-pull inflation. The increase of aggregate demand from AD_1 to AD_2 causes demand-pull inflation, shown as the rise in the price level from P_1 to P_2. It also causes an inflationary GDP gap of Q_1 minus Q_f. The rise of the price level reduces the size of the multiplier effect. If the price level had remained at P_1, the increase in aggregate demand from AD_1 to AD_2 would increase output from Q_f to Q_2 and the multiplier would have been at full strength. But because of the increase in the price level, real output increases only from Q_f to Q_1 and the multiplier effect is reduced.

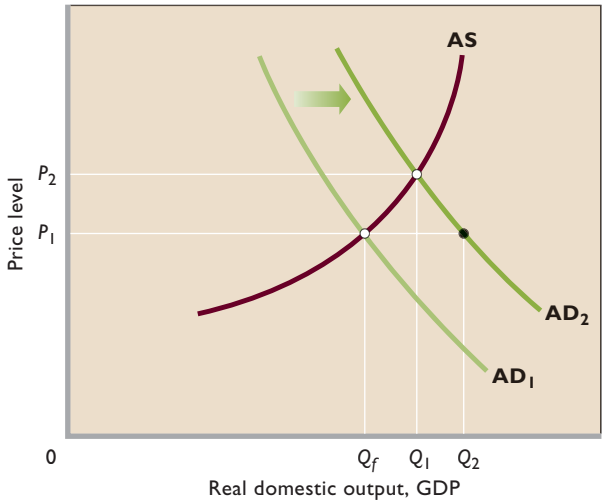
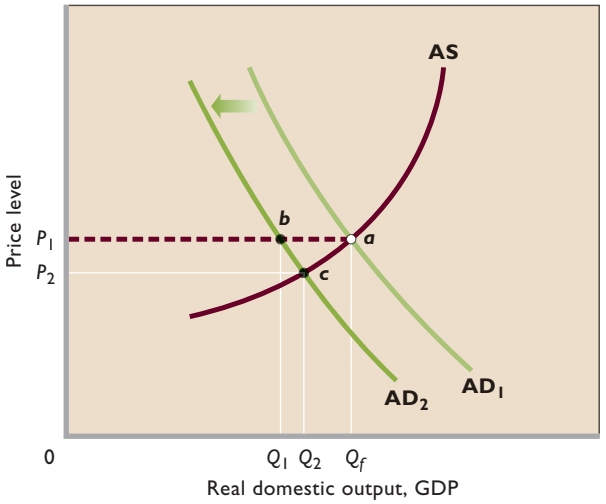


FIGURE 29.9 A decrease in aggregate demand that causes a recession. If the price level is downwardly inflexible at P_1, a decline of aggregate demand from AD_1 to AD_2 will move the economy leftward from *a* to *b* along the horizontal broken-line segment (similar to an immediate-short-run aggregate supply curve) and reduce real GDP from Q_f to Q_1. Idle production capacity, cyclical unemployment, and a recessionary GDP gap (of Q_1 minus Q_f) will result. If the price level were flexible downward, the decline in aggregate demand would move the economy depicted from *a* to *c* instead of from *a* to *b*.



increase in aggregate demand is absorbed as inflation as the price level rises from P_1 to P_2. Had the price level remained at P_1, the shift of aggregate demand from AD_1 to AD_2 would have increased real output to Q_2. The full-strength multiplier effect of Chapters 27 and 28 would have occurred. But in Figure 29.8 inflation reduced the increase in real output—and thus the multiplier effect—by about one-half. For any initial increase in aggregate demand, the resulting increase in real output will be smaller the greater is the increase in the price level. Price-level flexibility weakens the realized multiplier effect.

Decreases in AD: Recession and Cyclical Unemployment

Decreases in aggregate demand describe the opposite end of the business cycle: recession and cyclical unemployment (rather than above-full employment and demand-pull inflation). For example, in 2000 investment spending substantially declined in the wake of an overexpansion of capital during the second half of the 1990s. In Figure 29.9 we show the resulting decline in aggregate demand as a leftward shift from AD_1 to AD_2.

But now we add an important twist to the analysis—a twist that makes use of the fact that fixed prices lead to horizontal aggregate supply curves (a fact explained earlier in this chapter in the section on the immediate-short-run aggregate supply curve). What goes up—the price level—does not always go down. *Deflation*—a decline in the price level—is a rarity in the American economy. Suppose, for example, that the economy represented by Figure 29.9 moves from *a* to *b*, rather than from *a* to *c*. The outcome is a decline of real output from Q_f to Q_1, with *no* change in the price level. In this case, it is as if the aggregate supply curve in Figure 29.9 is horizontal at P_1, to the left of Q_f, as indicated by the dashed line. This decline of real output from Q_f to Q_1 constitutes a *recession*, and since fewer workers are needed to produce the lower output, *cyclical unemployment* arises. The distance between Q_1 and Q_f is a negative, or "recessionary," GDP gap—the amount by which actual output falls short of potential output.

Close inspection of Figure 29.9 also reveals that without a fall in the price level, the multiplier is at full strength. With the price level stuck at P_1, real GDP decreases by $Q_f - Q_1$, which matches the full leftward shift of the AD curve. The multiplier of Chapters 27 and 28 is at full strength when changes in aggregate demand occur along what, in effect, is a horizontal segment of the AS curve. This full-strength multiplier would also exist for an increase in aggregate demand from AD_2 to AD_1 along this broken line, since none of the increase in output would be dissipated as inflation. We will say more about that in Chapter 30.

All recent recessions in the United States have mimicked the "GDP gap but no deflation" scenario shown in Figure 29.9. Consider the recession of 2001, which resulted from a significant decline in investment spending. Because of the resulting decline in aggregate demand, GDP fell short of potential GDP by an average $67 billion for each of the last three quarters of the year. Between February 2001 and December 2001, unemployment increased by 1.8 million workers, and the nation's unemployment rate rose from 4.2 percent to 5.8 percent. Although the rate of inflation fell—an outcome called *disinflation*—the price level did not decline. That is, deflation did not occur.

Real output takes the brunt of declines in aggregate demand in the U.S. economy because the price level tends to be inflexible in a downward direction. There are numerous reasons for this.

- ***Fear of price wars*** Some large firms may be concerned that if they reduce their prices, rivals not only will match their price cuts but may retaliate by making even deeper cuts. An initial price cut may touch off an unwanted *price war:* successively deeper and deeper rounds of price cuts. In such a situation, each firm eventually ends up with far less profit or higher losses than would be the case if each had simply maintained its prices. For this reason, each firm may resist making the initial price cut, choosing instead to reduce production and lay off workers.
- ***Menu costs*** Firms that think a recession will be relatively short-lived may be reluctant to cut their prices. One reason is what economists metaphorically call **menu costs,** named after their most obvious example: the cost of printing new menus when a restaurant decides to reduce its prices. But lowering prices also creates other costs. Additional costs derive from (1) estimating the magnitude and duration of the shift in demand to determine whether prices should be lowered, (2) repricing items held in inventory, (3) printing and mailing new catalogs, and (4) communicating new prices to customers, perhaps through advertising. When menu costs are present, firms may choose to avoid them by retaining current prices. That is, they may wait to see if the decline in aggregate demand is permanent.
- ***Wage contracts*** Firms rarely profit from cutting their product prices if they cannot also cut their wage rates. Wages are usually inflexible downward because large parts of the labor force work under contracts prohibiting wage cuts for the duration of the contract. (Collective bargaining agreements in major industries frequently run for 3 years.) Similarly, the wages and salaries of nonunion workers are usually adjusted once a year, rather than quarterly or monthly.
- ***Morale, effort, and productivity*** Wage inflexibility downward is reinforced by the reluctance of many employers to reduce wage rates. Some current wages may be so-called **efficiency wages**—wages that elicit maximum work effort and thus minimize labor costs per unit of output. If worker productivity (output per hour of work) remains constant, lower wages *do* reduce labor costs per unit of output. But lower wages might impair worker morale and work effort, thereby reducing productivity. Considered alone, lower productivity raises labor costs per unit of output because less output is produced. If the higher labor costs resulting from reduced productivity exceed the cost savings from the lower wage, then wage cuts will increase rather than reduce labor costs per unit of output. In such situations, firms will resist lowering wages when they are faced with a decline in aggregate demand.

ORIGIN OF THE IDEA
O 29.2
Efficiency wage

- ***Minimum wage*** The minimum wage imposes a legal floor under the wages of the least-skilled workers. Firms paying those wages cannot reduce that wage rate when aggregate demand declines.

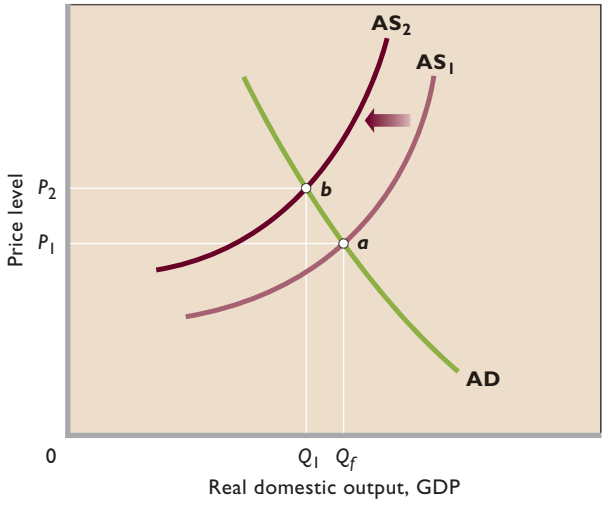
But a major "caution" is needed here: Although most economists agree that prices and wages tend to be inflexible downward in the short run, prices and wages are more flexible than in the past. Intense foreign competition and the declining power of unions in the United States have undermined the ability of workers and firms to resist price and wage cuts when faced with falling aggregate demand. This increased flexibility may be one reason the recession of 2001 was relatively mild. The U.S. auto manufacturers, for example, maintained output in the face of falling demand by offering zero-interest loans on auto purchases. This, in effect, was a disguised price cut. But our description in Figure 29.9 remains valid. In the 2001 recession, the overall price level did not decline although output fell by .5 percent and unemployment rose by 1.8 million workers.

Decreases in AS: Cost-Push Inflation

Suppose that a major terrorist attack on oil facilities severely disrupts world oil supplies and drives up oil prices by, say, 300 percent. Higher energy prices would spread through the economy, driving up production and distribution costs on a wide variety of goods. The U.S. aggregate supply curve would shift to the left, say, from AS_1 to AS_2 in Figure 29.10. The resulting increase in the price level would be *cost-push inflation*.

The effects of a leftward shift in aggregate supply are doubly bad. When aggregate supply shifts from AS_1 to AS_2, the economy moves from *a* to *b*. The price level rises from

FIGURE 29.10 A decrease in aggregate supply that causes cost-push inflation. A leftward shift of aggregate supply from AS_1 to AS_2 raises the price level from P_1 to P_2 and produces cost-push inflation. Real output declines and a recessionary GDP gap (of Q_1 minus Q_f) occurs.



CONSIDER THIS . . .

Ratchet Effect

A *ratchet analogy* is a good way to think about the effects of changes in aggregate demand on the price level. A ratchet is a tool or mechanism such as a winch, car jack, or socket wrench that cranks a wheel forward but does not allow it to go backward. Properly set, each allows the operator to move an object (boat, car, or nut) in one direction while preventing it from moving in the opposite direction.

Product prices, wage rates, and per-unit production costs are highly flexible upward when aggregate demand increases along the aggregate supply curve. In the United States, the price level has increased in 57 of the 58 years since 1950.

But when aggregate demand decreases, product prices, wage rates, and per-unit production costs are inflexible downward. The U.S. price level has declined in only a single year (1955) since 1950, even though aggregate demand and real output have declined in a number of years.

In terms of our analogy, increases in aggregate demand ratchet the U.S. price level upward. Once in place, the higher price level remains until it is ratcheted up again. The higher price level tends to remain even with declines in aggregate demand.

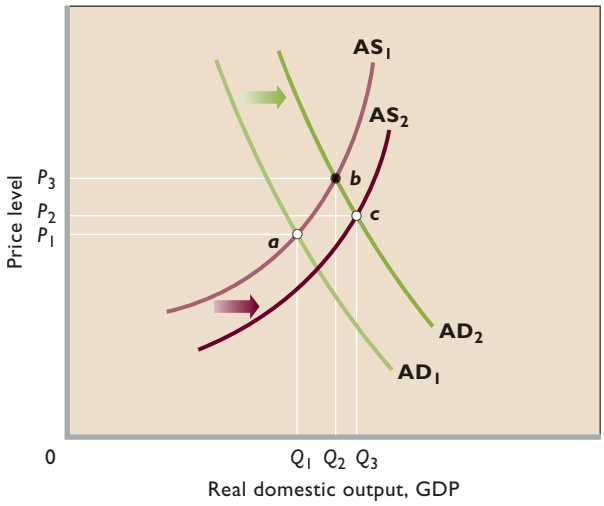
P_1 to P_2 and real output declines from Q_f to Q_1. Along with the cost-push inflation, a recession (and negative GDP gap) occurs. That is exactly what happened in the United States in the mid-1970s when the price of oil rocketed upward. Then, oil expenditures were about 10 percent of U.S. GDP, compared to only 3 percent today. So, as indicated in this chapter's Last Word, the U.S. economy is now less vulnerable to cost-push inflation arising from such "aggregate supply shocks." That said, it is not *immune* from such shocks.

Increases in AS: Full Employment with Price-Level Stability

Between 1996 and 2000, the United States experienced a combination of full employment, strong economic growth, and very low inflation. Specifically, the unemployment rate fell to 4 percent and real GDP grew nearly 4 percent annually, *without igniting inflation*. At first thought, this "macroeconomic bliss" seems to be incompatible with the AD-AS model. The aggregate supply curve suggests that increases in aggregate demand that are sufficient for over-full employment will raise the price level (see Figure 29.8). Higher inflation, so it would seem, is the inevitable price paid for expanding output beyond the full-employment level.

But inflation remained very mild in the late 1990s. Figure 29.11 helps explain why. Let's first suppose that aggregate demand increased from AD_1 to AD_2 along

FIGURE 29.11 Growth, full employment, and relative price stability. Normally, an increase in aggregate demand from AD_1 to AD_2 would move the economy from *a* to *b* along AS_1. Real output would expand to Q_2, and inflation would result (P_1 to P_3). But in the late 1990s, significant increases in productivity shifted the aggregate supply curve, as from AS_1 to AS_2. The economy moved from *a* to *c* rather than from *a* to *b*. It experienced strong economic growth (Q_1 to Q_3), full employment, and only very mild inflation (P_1 to P_2) before receding in March 2001.

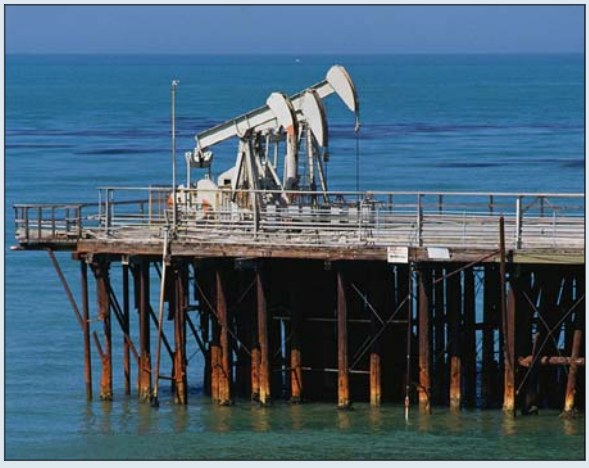


LAST Word

Has the Impact of Oil Prices Diminished?

Significant Changes in Oil Prices Historically Have Shifted the Aggregate Supply Curve and Greatly Affected the U.S. Economy. Have the Effects of Such Changes Weakened?

The United States has experienced several aggregate supply shocks—abrupt shifts of the aggregate supply curve—caused by significant changes in oil prices. In the mid-1970s the price of oil rose from $4 to $12 per barrel, and then again in the late 1970s it increased to $24 per barrel and eventually to $35. These oil price increases shifted the aggregate supply curve leftward, causing rapid cost-push inflation and ultimately rising unemployment and a negative GDP gap.



In the late 1980s and through most of the 1990s, oil prices fell, sinking to a low of $11 per barrel in late 1998. This decline created a positive aggregate supply shock beneficial to the U.S. economy. But in response to those low oil prices, in late 1999 OPEC teamed with Mexico, Norway, and Russia to restrict oil output and thus boost prices. That action, along with a rapidly growing international demand for oil, sent oil prices upward once again. By March 2000 the price of a barrel of oil reached $34, before settling back to about $25 to $28 in 2001 and 2002.

Some economists feared that the rising price of oil would increase energy prices by so much that the U.S. aggregate supply curve would shift to the left, creating cost-push inflation. But inflation in the United States remained modest.

Then came a greater test: A "perfect storm"—continuing conflict in Iraq, the rising demand for oil in India and China, a pickup of economic growth in several industrial nations, disruption of oil production by hurricanes, and concern about political developments in Venezuela—pushed the price of oil to over $60 a barrel in 2005. (You can find the current daily price of oil at OPEC's Web site, **www.opec.org.**) The U.S. inflation rate rose in 2005, but *core inflation* (the inflation rate after subtracting changes in the prices of food and energy) remained steady. Why have rises in oil prices lost their inflationary punch?

In the early 2000s, other determinants of aggregate supply swamped the potential inflationary impacts of the oil price increases. Lower production costs resulting from rapid productivity advance and lower input prices from global competition more than compensated for the rise in oil prices. Put simply, aggregate supply did not decline as it had in earlier periods.

Perhaps of greater importance, oil prices are a less significant factor in the U.S. economy than they were in the 1970s. Prior to 1980, changes in oil prices greatly affected core inflation in the United States. But since 1980 they have had very little effect on core inflation.* The main reason has been a significant decline in the amount of oil and gas used in producing each dollar of U.S. output. In 2005 producing a dollar of real GDP required about 7000 Btus of oil and gas, compared to 14,000 Btus in 1970. (A Btu, or British thermal unit, is the amount of energy required to heat one pound of water by one degree Fahrenheit.) Part of this decline resulted from new production techniques spawned by the higher oil and energy prices. But equally important has been the changing relative composition of GDP, away from larger, heavier items (such as earth-moving equipment) that are energy-intensive to make and transport and toward smaller, lighter items (such as microchips and software). Experts on energy economics estimate that the U.S. economy is about 33 percent less sensitive to oil price fluctuations than it was in the early 1980s and 50 percent less sensitive than in the mid-1970s.†

A final reason why changes in oil prices seem to have lost their inflationary punch is that the Federal Reserve has become more vigilant and adept at maintaining price stability through monetary policy. The Fed did not let the oil price increases of 1999–2000 become generalized as core inflation. The same turned out to be true with the dramatic rise in oil prices that resulted from the "perfect storm" of 2005. It remains to be seen whether the Fed can do the same with the dramatic demand-driven rise in oil prices that happened in 2007–2008, when the price of oil rose from just over $50 per barrel in January 2007 to over $140 per barrel in July 2008. (We will discuss monetary policy in depth in Chapter 33.)

*Mark A. Hooker, "Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regimes," *Journal of Money, Credit and Banking*, May 2002, pp. 540–561.

†Stephen P. A. Brown and Mine K. Yücel, "Oil Prices and the Economy," Federal Reserve Bank of Dallas *Southwest Economy*, July–August 2000, pp. 1–6.

aggregate supply curve AS_1. Taken alone, that increase in aggregate demand would move the economy from *a* to *b*. Real output would rise from full-employment output Q_1 to beyond-full-employment output Q_2. The economy would experience inflation, as shown by the increase in the price level from P_1 to P_3. Such inflation had occurred at the end of previous vigorous expansions of aggregate demand, including the expansion of the late 1980s.

Between 1990 and 2000, however, larger-than-usual increases in productivity occurred because of a burst of new technology relating to computers, the Internet, inventory management systems, electronic commerce, and so on. We represent this higher-than-usual productivity growth as the rightward shift from AS_1 to AS_2 in Figure 29.11. The relevant aggregate demand and aggregate supply curves thus became AD_2 and AS_2, not AD_2 and AS_1. Instead of moving from *a* to *b*, the economy moved from *a* to *c*. Real output increased from Q_1 to Q_3, and the price level rose only modestly (from P_1 to P_2). The shift of the aggregate supply curve from AS_1 to AS_2 accommodated the rapid increase in aggregate demand and kept inflation mild. This remarkable combination of rapid productivity growth, rapid real GDP growth, full employment, and relative price-level stability led some observers to proclaim that the United States was experiencing a "new era" or a New Economy.

But in 2001 the New Economy came face-to-face with the old economic principles. Aggregate demand declined because of a substantial fall in investment spending, and in March 2001 the economy experienced a recession. The terrorist attacks of September 11, 2001, further dampened private spending and prolonged the recession throughout 2001. The unemployment rate rose from 4.2 percent in January 2001 to 6 percent in December 2002.

Throughout 2001 the Federal Reserve lowered interest rates to try to halt the recession and promote recovery. Those Fed actions, along with Federal tax cuts, increased military spending, and strong demand for new housing, helped spur recovery. The economy haltingly resumed its economic growth in 2002 and 2003 and then expanded rapidly in 2004 and 2005. Robust growth continued in 2006 and the first three quarters of 2007. But the economy greatly slowed in late 2007 and early 2008, leading many economists to predict a 2008 recession.

We will examine stabilization policies, such as those carried out by the Federal government and the Federal Reserve, in chapters that follow. **(Key Questions 5, 6, and 7)**

QUICK REVIEW 29.3

- The equilibrium price level and amount of real output are determined at the intersection of the aggregate demand curve and the aggregate supply curve.
- Increases in aggregate demand beyond the full-employment level of real GDP cause demand-pull inflation.
- Decreases in aggregate demand cause recessions and cyclical unemployment, partly because the price level and wages tend to be inflexible in a downward direction.
- Decreases in aggregate supply cause cost-push inflation.
- Full employment, high economic growth, and price stability are compatible with one another if productivity-driven increases in aggregate supply are sufficient to balance growing aggregate demand.

Summary

1. The aggregate demand–aggregate supply model (AD-AS model) is a variable-price model that enables analysis of simultaneous changes of real GDP and the price level.
2. The aggregate demand curve shows the level of real output that the economy will purchase at each price level.
3. The aggregate demand curve is downsloping because of the real-balances effect, the interest-rate effect, and the foreign purchases effect. The real-balances effect indicates that inflation reduces the real value or purchasing power of fixed-value financial assets held by households, causing cutbacks in consumer spending. The interest-rate effect means that, with a specific supply of money, a higher price level increases the demand for money, thereby raising the interest rate and reducing investment purchases. The foreign purchases effect suggests that an increase in one country's price level relative to the price levels in other countries reduces the net export component of that nation's aggregate demand.
4. The determinants of aggregate demand consist of spending by domestic consumers, by businesses, by government, and by foreign buyers. Changes in the factors listed in Figure 29.2 alter the spending by these groups and shift the aggregate demand curve. The extent of the shift is determined by the size of the initial change in spending and the strength of the economy's multiplier.
5. The aggregate supply curve shows the levels of real output that businesses will produce at various possible price levels. The slope of the aggregate supply curve depends upon the flexibility of input and output prices. Since these vary over time, aggregate supply curves are categorized into three time horizons,