



## CHAPTER 10

# Aggregate Demand and Aggregate Supply

In an update of its *Monetary Policy Report* in October 2005, the Bank of Canada reported:

In line with the Bank's outlook, and given that the Canadian economy now appears to be operating at capacity, some further reduction of monetary stimulus will be required to maintain a balance between aggregate supply and demand over the next four to six quarters, and to keep inflation on target. However, with risks to the global outlook tilted to the downside as we look to 2007 and beyond, the Bank will monitor international developments particularly closely.<sup>1</sup>

This is precisely the language of the **aggregate demand–aggregate supply model** (AD–AS model), which we will develop in this chapter. The AD–AS model enables us to analyze changes in both real GDP and the price level simultaneously. The AD–AS model therefore provides insights on inflation, unemployment, and economic growth. In later chapters, we will see that it also explains the logic of macroeconomic stabilization policies.

### 10.1 Aggregate Demand

**Aggregate demand** is a schedule or curve that shows the amounts of real output (real GDP) that buyers collectively desire to purchase at each possible price level. The relationship between the price level (as measured by the GDP price index) and the amount of real GDP demanded is inverse or negative: When the price level rises, the quantity of real GDP demanded decreases; when the price level falls, the quantity of real GDP demanded increases.

#### Aggregate Demand Curve

The inverse relationship between the price level and real GDP is shown in Figure 10-1, where the aggregate demand curve AD slopes downward, as does the demand curve for an individual product. Why the downward slope? The explanation rests on three effects of a price-level change.

<sup>1</sup> <http://www.bankofcanada.ca/en/mpr/pdf/mproct05.pdf>

### IN THIS CHAPTER YOU WILL LEARN:

- 10.1** About aggregate demand (AD) and the factors that cause it to change
- 10.2** About aggregate supply (AS) and the factors that cause it to change
- 10.3** How AD and AS determine an economy's equilibrium price level and level of real GDP
- A10.1** (Appendix) How the aggregate demand curve relates to the aggregate expenditure model

### aggregate demand–aggregate supply model

The macroeconomic model that uses aggregate demand and aggregate supply to explain price level and real domestic output.

### aggregate demand

A schedule or curve that shows the total quantity of goods and services demanded (purchased) at different price levels.



### ORIGIN 10.1 Real-Balances Effect

### real-balances effect

The inverse relationship between the price level and the real value (or purchasing power) of financial assets with fixed money value.

### interest-rate effect

The direct relationship between price level and the demand for money, which affects interest rates, and, as a result, total spending in the economy.

### foreign-trade effect

The inverse relationship between the net exports of an economy and its price level relative to price levels in the economies of trading partners.

## REAL-BALANCES EFFECT

A change in the price level produces a **real-balances effect**. Here is how it works. A higher price level reduces the purchasing power of the public's accumulated saving balances. In particular, the real value of assets with fixed money values, such as savings accounts or bonds, diminishes. Because a higher price level erodes the purchasing power of such assets, the public is poorer in real terms and will reduce its spending. A household might buy a new car or a plasma TV if the purchasing power of its financial asset balances is, say \$50,000. But if inflation erodes the purchasing power of its asset balances to \$30,000, the family may defer its purchase. So a higher price level means less consumption spending.

## INTEREST-RATE EFFECT

The aggregate demand curve also slopes downward because of the **interest-rate effect**. When we draw an aggregate demand curve, we assume that the supply of money in the economy is fixed. But when the price level rises, consumers need more money for purchases, and businesses need more money to meet their payrolls and to buy other resources. A \$10 bill will do when the price of an item is \$10, but a \$10 bill plus a loonie is needed when the item costs \$11. In short, a higher price level increases the demand for money. So, given a fixed supply of money, an increase in money demand will drive up the price paid for its use. The price of money is the interest rate.

Higher interest rates restrain investment spending and interest-sensitive consumption spending. Firms that expect a 6 percent rate of return on a potential purchase of capital will find that investment profitable when the interest rate is, say, 5 percent. But the investment will be unprofitable and will not be made when the interest rate has risen to 7 percent. Similarly, consumers may decide not to purchase a new house or automobile when the interest rate on loans goes up. So, by increasing the demand for money and consequently the interest rate, a higher price level reduces the amount of real output demanded.

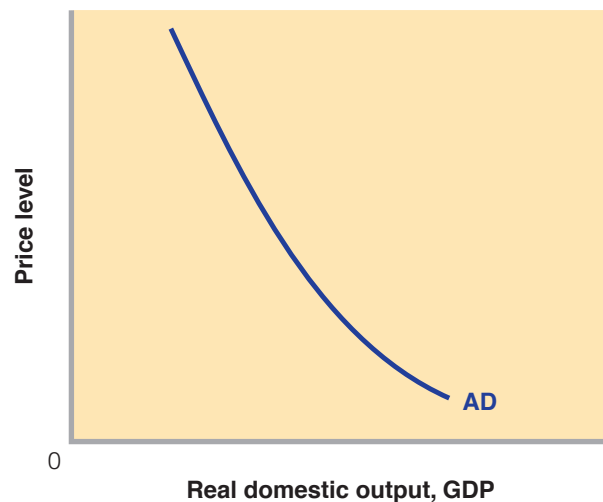
## FOREIGN-TRADE EFFECT

The final reason why the aggregate demand curve slopes downward is the **foreign-trade effect**. When the Canadian price level rises relative to foreign price levels, foreigners buy fewer Canadian goods and Canadians buy more foreign goods. Therefore, Canadian exports fall and Canadian imports rise. In short, the rise in the price level reduces the quantity of Canadian goods demanded as net exports.

**FIGURE 10-1**

## The Aggregate Demand Curve

The downward-sloping aggregate demand curve AD indicates an inverse relationship between the price level and the amount of real output purchased.



These three effects, of course, work in the opposite directions for a decline in the price level. A decline in the price level increases consumption through the real-balances effect and interest-rate effect; increases investment through the interest-rate effect; and raises net exports by increasing exports and decreasing imports through the foreign-trade effect.

## Changes in Aggregate Demand

Other things equal, a change in the price level will change the amount of aggregate spending and therefore change the amount of real GDP demanded by the economy. Movements along a fixed aggregate demand curve represent these changes in real GDP. However, if one or more of those other things changes, the entire aggregate demand curve will shift. We call these “other things” **determinants of aggregate demand**. They are listed in Figure 10-2.

**determinants of aggregate demand**  
Factors (such as consumption spending, investment, government spending, and net exports) that shift the aggregate demand curve.

In Figure 10-2, the rightward shift of the curve from  $AD_1$  to  $AD_2$  shows an increase in aggregate demand. At each price level, the amount of real goods and services demanded is larger than before. The leftward shift of the curve from  $AD_1$  to  $AD_3$  shows a decrease in aggregate demand; the amount of real GDP demanded at each price level is lower.

Let's examine each determinant of aggregate demand that is listed in Figure 10-2.

### CONSUMER SPENDING

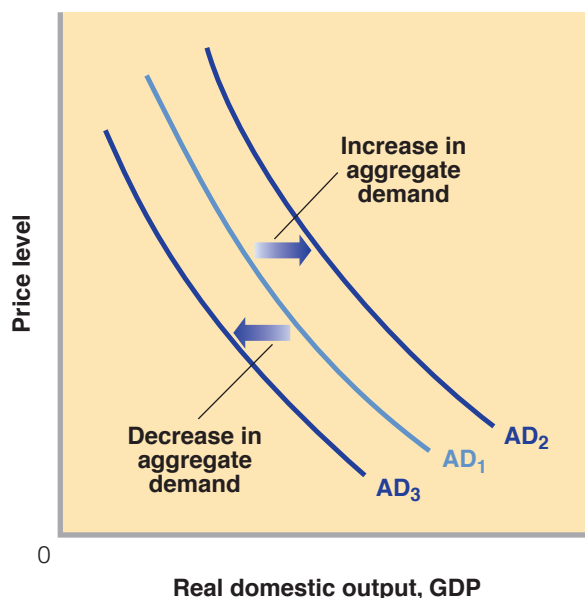
Even when the Canadian price level is constant, domestic consumers may change their purchases of Canadian-produced real output. If those consumers decide to buy more output at each price level, the aggregate demand curve will shift to the right, as from  $AD_1$  to  $AD_2$  in Figure 10-2. If they decide to buy less output, the aggregate demand curve will shift to the left, as from  $AD_1$  to  $AD_3$ .

Several factors other than a change in the price level may change consumer spending and thus shift the aggregate demand curve. As Figure 10-2 shows, those factors are real consumer wealth, consumer expectations, household borrowing, and taxes.

**FIGURE 10-2**

## Changes in Aggregate Demand

A change in one or more of the listed determinants of aggregate demand will change aggregate demand. An increase in aggregate demand is shown as a rightward shift of the AD curve, here from  $AD_1$  to  $AD_2$ ; a decrease in aggregate demand is shown as a leftward shift, here from  $AD_1$  to  $AD_3$ .



### Determinants of aggregate demand: factors that shift the aggregate demand curve

1. Change in consumer spending
  - a. Consumer wealth
  - b. Consumer expectations
  - c. Household borrowing
  - d. Personal taxes
2. Change in investment spending
  - a. Interest rates
  - b. Expected returns
    - Expected future business conditions
    - Technology
    - Degree of excess capacity
    - Business taxes
3. Change in government spending
4. Change in net export spending
  - a. National income abroad
  - b. Exchange rates

**Consumer Wealth** Consumer wealth is the total dollar value of all assets owned by consumers in the economy less the dollar value of their liabilities (debts). Assets include stocks, bonds, and real estate. Liabilities include mortgages, car loans, and credit card balances. Consumer wealth sometimes changes suddenly and unexpectedly due to surprising changes in asset values. An unforeseen increase in the stock market is a good example. The increase in wealth prompts pleasantly surprised consumers to save less and buy more out of their current incomes than they had previously been planning. The resulting increase in consumer spending—the so-called wealth effect—shifts the aggregate demand curve to the right. In contrast, an unexpected decline in asset values will cause an unanticipated reduction in consumer wealth at each price level. As consumers tighten their belts in response to the bad news, a “reverse wealth effect” sets in. Unpleasantly surprised consumers increase savings and reduce consumption, thereby shifting the aggregate demand curve to the left.

**Consumer Expectations** Changes in expectations about the future may change consumer spending. When people expect their future real income to rise, they spend more of their current income. Thus current consumption spending increases (current saving falls), and the aggregate demand curve shifts to the right. Similarly, a widely held expectation of surging inflation in the near future may increase aggregate demand today because consumers will want to buy products before their prices rise. Conversely, expectations of lower future income or lower future prices may reduce current consumption and shift the aggregate demand curve to the left.

**Household Borrowing** Consumers can increase their consumption spending by borrowing. Doing so shifts the aggregate demand curve to the right. By contrast, a decrease in borrowing for consumption purposes shifts the aggregate demand curve to the left. The aggregate demand curve will also shift to the left if consumers increase their savings rates in order to pay off their debts. With more money flowing to debt repayment, consumption expenditures decline and the AD curve shifts left.

**Personal Taxes** A reduction in personal income tax rates raises take-home income and increases consumer purchases at each possible price level. Tax cuts shift the aggregate demand curve to the right. Tax increases reduce consumption spending and shift the curve to the left.

## INVESTMENT SPENDING

Investment spending (the purchase of capital goods) is a second major determinant of aggregate demand. A decline in investment spending at each price level will shift the aggregate demand curve to the left. An increase in investment spending will shift it to the right.

**Real Interest Rates** Other things equal, an increase in interest rates will lower investment spending and reduce aggregate demand. We are not referring here to the interest-rate effect resulting from a change in the price level. Instead, we are identifying a change in the interest rate that results from, say, a change in the nation’s money supply. An increase in the money supply lowers the interest rate, thereby increasing investment and aggregate demand. A decrease in the money supply raises the interest rate, reduces investment, and decreases aggregate demand.

**Expected Returns** Higher expected returns on investment projects will increase the demand for capital goods and shift the aggregate demand curve to the right. Alternatively, declines in expected returns will decrease investment and shift the curve to the left. Expected returns, in turn, are influenced by several factors:

- **Expectations about Future Business Conditions** If firms are optimistic about future business conditions, they are more likely to invest more today. On the other hand, if they think the economy will deteriorate in the future, they will invest less today.
- **Technology** New and improved technologies increase expected returns on investment and thus increase aggregate demand. For example, recent advances in microbiology have motivated pharmaceutical companies to establish new labs and production facilities.

- **Degree of Excess Capacity** Other things equal, firms operating factories at well below capacity have little incentive to build new factories. But when firms discover that their excess capacity is dwindling or has completely disappeared, their expected returns on new investment in factories and capital equipment rises. Thus, they increase their investment spending and the aggregate demand curve shifts to the right.
- **Business Taxes** An increase in business taxes will reduce after-tax profits from capital investment and lower expected returns. So investment and aggregate demand will decline. A decrease in business taxes will have the opposite effect.

The variability of interest rates and investment expectations makes investment quite volatile. In contrast to consumption, investment spending rises and falls quite often, independent of changes in total income. Investment, in fact, is the least stable component of aggregate demand.

### GOVERNMENT SPENDING

Government purchases are the third determinant of aggregate demand. An increase in government purchases (for example, more computers for government agencies) will shift the aggregate demand curve to the right, provided tax collections and interest rates do not change as a result. In contrast, a reduction in government spending (for example, fewer transportation projects) will shift the curve to the left.

### NET EXPORT SPENDING

The final determinant of aggregate demand is net export spending. Other things equal, a rise of Canadian *exports* means increased foreign demand for Canadian goods, whereas lower Canadian *imports* implies that Canadian consumers have decreased their demand for foreign-produced products. So, a rise in net exports (higher exports and/or lower imports) shifts the aggregate demand curve to the right. In contrast, a decrease in Canadian net exports shifts the aggregate demand curve leftward. (These changes in net exports are *not* those prompted by a change in the Canadian price level—those associated with the foreign-trade effect. The changes here explain shifts of the AD curve, not movements along the AD curve.)

What might cause net exports to change, other than the price level? Two possibilities are changes in national income abroad and changes in exchange rates.

**National Income Abroad** Rising national income abroad encourages foreigners to buy more products, some of which are made in Canada. Canadian net exports thus rise and the Canadian aggregate demand curve shifts to the right. Declines in national income abroad, of course, do the opposite: They reduce Canadian net exports and shift the aggregate demand curve in Canada to the left. For example, in 2008 the U.S. economy, Canada's largest trading partner, slowed down perceptibly and our exports to the U.S. declined.

**Exchange Rates** Changes in the dollar's exchange rate—the prices of foreign currencies in terms of the Canadian dollar—may affect Canadian net exports and therefore aggregate demand. Suppose the Canadian dollar depreciates in terms of the euro (the euro appreciates in terms of the dollar). The new relative lower value of dollars and higher value of euros make Canadian goods less expensive, so European consumers buy more Canadian goods and Canadian exports rise. But Canadian consumers now find European goods more expensive, so reduce their imports from Europe. Canadian exports rise and Canadian imports fall. Conclusion: Dollar depreciation increases net exports (imports go down; exports go up) and therefore increases aggregate demand. Dollar *appreciation* has the opposite effects: Net exports fall (imports go up; exports go down) and aggregate demand declines.

## QUICK REVIEW

- ▶ Aggregate demand reflects an inverse relationship between the price level and the amount of real output demanded.
- ▶ Changes in the price level create real-balances, interest-rate, and foreign-trade effects that explain the downward slope of the aggregate demand curve.
- ▶ Changes in one or more of the determinants of aggregate demand (Figure 10-2) alter the amounts of real GDP demanded at each price level; they shift the aggregate demand curve.
- ▶ An increase in aggregate demand is shown as a rightward shift of the aggregate demand curve; a decrease, as a leftward shift of the curve.

## 10.2 Aggregate Supply

### aggregate supply

A schedule or curve that shows the total quantity of goods and services supplied (produced) at different price levels.

**Aggregate supply** is a schedule or curve showing the relationship between the price level of output and the amount of real domestic output that firms in the economy produce. This relationship varies depending on the time horizon and how quickly output prices and input prices can change. We will define three time horizons.

- In the *immediate short run*, both input prices and output prices are fixed.
- In the *short run*, input prices are fixed but output prices can vary.
- In the *long run*, input prices as well as output prices can vary.

In Chapter 4, we discussed both the immediate short run and the long run in terms of how an automobile maker named Buzzer Auto responds to changes in the demand for its new car, the Prion. Here we extend the logic of that chapter to the economy as a whole in order to discuss how total output varies with the price level in the immediate short run, the short run, and the long run. As you will see, the relationship between the price level and total output is different in each of the three time horizons because input prices are stickier than output prices. While both become more flexible as time passes, output prices usually adjust more rapidly.

### Aggregate Supply in the Immediate Short Run

Depending on the type of firm, the immediate short run can last anywhere from a few days to a few months. It lasts as long as *both* input prices and output prices stay fixed. Input prices are fixed in both the immediate short run and the short run by contractual agreements. In particular, 75 percent of the average firm's costs are wages and salaries—and these are almost always fixed by labour contracts for months or years at a time. As a result, they are usually fixed for a much longer duration than output prices, which can begin to change within a few days or a few months depending upon the type of firm.

Output prices are also typically fixed in the immediate short run. This is most often caused by firms setting fixed prices for their customers and then agreeing to supply whatever quantity demanded results at those fixed prices. For instance, once an appliance manufacturer sets its annual list prices for refrigerators, stoves, and microwaves, it is obligated to supply however many or few appliances customers want to buy at those prices. Similarly, a catalogue company is obliged to sell however many customers want to buy of its products at the prices listed in its current catalogue. And it is stuck supplying those quantities demanded until it sends out its next catalogue.

With output prices fixed and firms selling as much as customers want to purchase at those fixed prices, the **immediate-short-run aggregate supply curve**  $AS_{ISR}$  is a horizontal line, as shown in Figure 10-3. The  $AS_{ISR}$  curve is horizontal at the overall price level  $P_p$ , which is calculated from all of the individual prices set by the various firms in the economy. Its horizontal shape implies that the

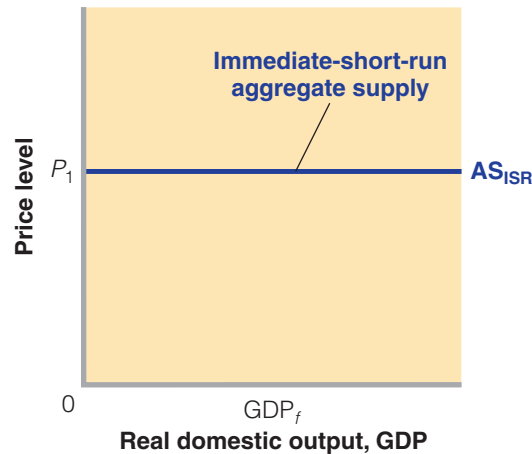
### immediate-short-run aggregate supply curve ( $AS_{ISR}$ )

An aggregate supply curve for which real output, but not the price level, changes when the aggregate demand curve shifts.

FIGURE 10-3

### Aggregate Supply in the Immediate Short Run

In the immediate short run, the aggregate supply curve  $AS_{ISR}$  is horizontal at the economy's current price level,  $P_1$ . With output prices fixed, firms collectively supply the level of output that is demanded at those prices.



total amount of output supplied in the economy depends directly on the volume of spending that results at price level  $P_1$ . If total spending is low at price level  $P_1$ , firms will supply a small amount to match the low level of spending. If total spending is high at price level  $P_1$ , they will supply a high level of output to match the high level of spending. The amount of output that results may be higher than or lower than the economy's full-employment output level  $GDP_f$ .

Notice, however, that firms will respond in this manner to changes in total spending only as long as output prices remain fixed. As soon as firms are able to change their product prices, they can respond to changes in consumer spending not only by increasing or decreasing output but also by raising or lowering prices. This is the situation that leads to the upward-sloping short-run aggregate supply curve, which we discuss next.

### Aggregate Supply in the Short Run

The short run begins after the immediate short run ends. As it relates to macroeconomics, the short run is a period of time during which output prices are flexible but input prices are either totally fixed or highly inflexible.

These assumptions about output prices and input prices are general—they relate to the economy in the aggregate. Naturally, some input prices are more flexible than others. Since gasoline prices are quite flexible, a package delivery firm like UPS that uses gasoline as an input will have at least one very flexible input price. On the other hand, wages at UPS are set by multi-year labour contracts negotiated with its drivers' union. Because wages are the firm's largest and most important input cost, it is the case that, overall, UPS faces input prices that are inflexible for several years at a time. Thus, its "short run"—during which it can change the shipping prices that it charges its customers but during which it must deal with substantially fixed input prices—is actually quite long. Keep this in mind as we derive the short-run aggregate supply for the entire economy. Its applicability does not depend on some arbitrary definition of how long the "short run" should be. Instead, the short run for which the model is relevant is any period of time during which output prices are flexible but input prices are fixed or nearly fixed.

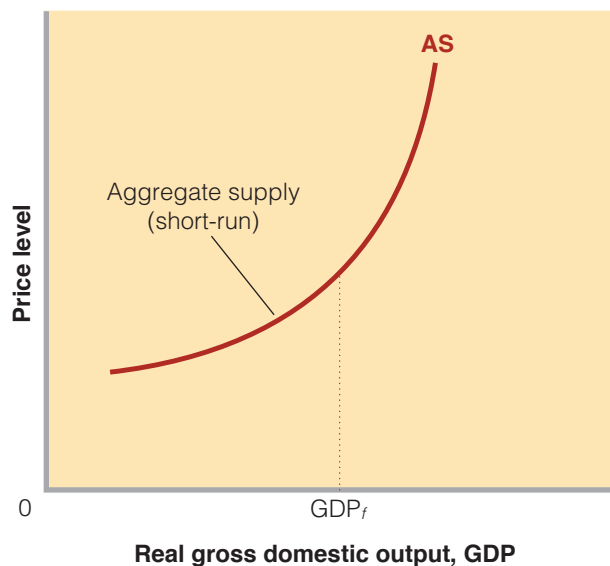
As illustrated in Figure 10-4, the **short-run aggregate supply curve**  $AS$  slopes upward because with input prices fixed, changes in the price level will raise or lower real firm profits. To see how this works, consider an economy that has only a single multi-product firm called Mega Buzzer and in which the firm's owners must receive a real profit of \$20 in order to produce the full-employment output of 100 units. Assume the owner's only input (aside from entrepreneurial talent) is 10 units of

#### short-run aggregate supply curve

An aggregate supply curve for which real output, but not the price level, changes when the aggregate demand curve shifts.

## FIGURE 10-4 Short-Run Aggregate Supply Curve

The upward-sloping aggregate supply curve AS indicates a direct (or positive) relationship between the price level and the amount of real output that firms will offer for sale. The AS curve is relatively flat below the full-employment output because unemployed resources and unused capacity allow firms to respond to price-level rises with large increases in real output. It is relatively steep beyond the full-employment output because resource shortages and capacity limitations make it difficult to expand real output as the price level rises.



hired labour at \$8 per worker, for a total wage cost of \$80. Also assume that the 100 units of output sell for \$1 per unit, so total revenue is \$100. Mega Buzzer’s nominal profit is \$20 ( $= \$100 - \$80$ ), and using the \$1 price to designate the base-price index of 100 its real profit is also \$20 ( $= \$20/1.00$ ). Well and good; the full-employment output is produced.

Next, consider what will happen if the price of Mega Buzzer’s output doubles. The doubling of the price level will boost total revenue from \$100 to \$200, but since we are discussing the short run, during which input prices are fixed, the \$8 nominal wage for each of the 10 workers will remain unchanged so that total costs stay at \$80. Nominal profit will rise from \$20 ( $= \$100 - \$80$ ) to \$120 ( $= \$200 - \$80$ ). Dividing that \$120 profit by the new price index of 200 ( $= 2.0$  in hundredths), we find that Mega Buzzer’s real profit is now \$60. The rise in the real reward from \$20 to \$60 prompts the firm (economy) to produce more output. Conversely, price-level declines reduce real profits and cause the firm (economy) to reduce its output. So, in the short run, there is a direct, or positive, relationship between the price level and real output. When the price level rises, real output rises and when the price level falls, real output falls. The result is an upward-sloping short-run aggregate supply curve. Notice, however, that the slope of the short-run aggregate supply curve is not constant. It is relatively flat at outputs below the full-employment output level  $GDP_f$  and relatively steep at outputs above it. This has to do with the fact that per-unit production costs underlie the short-run aggregate supply curve. Recall from Chapter 7 that

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

The per-unit production cost of any specific level of output establishes that output’s price level because the associated price level must cover all the costs of production, including profit “costs.”

As the economy expands in the short run, per-unit production costs generally rise because of reduced efficiency. But the extent of that rise depends on where the economy is operating relative to its capacity. When the economy is operating below its full-employment output, it has large amounts of unused machinery and equipment and large numbers of unemployed workers. Firms can put these idle human and property resources back to work with little upward pressure on per-unit production costs. And as output expands, few if any shortages of inputs or production bottlenecks



will arise to raise per-unit production costs. That is why the slope of the short-run aggregate supply curve increases only slowly at output levels below the full-employment output level  $GDP_f$ .

On the other hand, when the economy is operating beyond  $GDP_f$ , the vast majority of its available resources are already employed. Adding more workers to a relatively fixed number of highly used capital resources such as plant and equipment creates congestion in the workplace and reduces the efficiency (on average) of workers. Adding more capital, given the limited number of available workers, leaves equipment idle and reduces the efficiency of capital. Adding more land resources when capital and labour are highly constrained reduces the efficiency of land resources. Under these circumstances, total input costs rise more rapidly than total output. The result is rapidly rising per-unit production costs that give the short-run aggregate supply curve its rapidly increasing slope at output levels beyond  $GDP_f$ .

## Aggregate Supply in the Long Run

In macroeconomics, the long run is the time horizon over which both input prices and output prices are flexible. It begins after the short run ends. Depending on the type of firm and industry, this may be from a couple of weeks to several years in the future. But for the economy as a whole, it is the time horizon over which all output and input prices—including wage rates—are fully flexible.

The **long-run aggregate supply curve**  $AS_{LR}$  is vertical at the economy's full-employment output  $GDP_f$ , as shown in Figure 10-5. The vertical curve means that in the long run the economy will produce the full-employment output level no matter what the price level is. How can this be? Shouldn't higher prices cause firms to increase output? The explanation lies in the fact that in the long run when both input prices and output prices are flexible profit levels will always adjust to give firms exactly the right profit incentive to produce exactly the full-employment output level  $GDP_f$ .

To see why this is true, look back at the short-run aggregate supply curve  $AS$  shown in Figure 10-4. Suppose the economy starts out producing at the full-employment output level  $GDP_f$  and that the price level at that moment has an index value of 100. Now suppose that output prices double, so that the price index goes to 200. We previously demonstrated for our single-firm economy that this doubling of the price level would cause profits to rise in the short run and that the higher profits would motivate the firm to increase output.

This outcome, however, is totally dependent upon the fact that input prices are fixed in the short run. Consider what will happen in the long run when they are free to change. Firms can produce beyond the full-employment output level only by running factories and businesses at extremely high rates of utilization. This creates a great deal of demand for the economy's limited supply of productive resources. In particular, labour is in great demand because the only way to produce beyond full employment is if workers are working overtime.

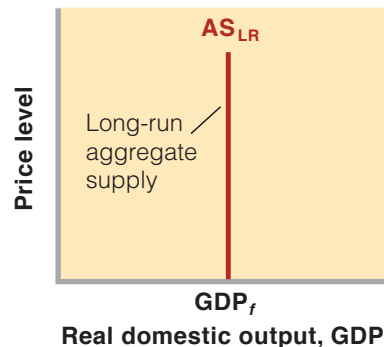
### long-run aggregate supply curve ( $AS_{LR}$ )

The aggregate supply curve associated with a time period in which input prices (especially nominal wages) are fully responsive to changes in the price level.

**FIGURE 10-5**

## Aggregate Supply in the Long Run

The long-run aggregate supply curve  $AS_{LR}$  is vertical at the full-employment level of real GDP ( $GDP_f$ ) because in the long run wages and other input prices rise and match changes in the price level. So price-level changes do not affect firms' profits and thus they create no incentive for firms to alter their output.





An aggregate supply curve identifies the relationship between the price level and real output.

As time passes and input prices are free to change, the high demand will start to raise input prices. In particular, overworked employees will demand and receive raises as employers scramble to deal with the labour shortages that arise when the economy is producing at above its full-employment output level. As input prices increase, firm profits will begin to fall. And as they decline, so does the motive firms have to produce more than the full-employment output level. This process of rising input prices and falling profits continues until the rise in input prices exactly matches the initial change in output prices (in our example, they both double). When that happens, firm profits in real terms return to their original level so that firms are once again motivated to produce at exactly the full-employment output level. This adjustment process means that in the long run the economy will produce at full employment regardless of the price level (in our example, at either  $P = 100$  or  $P = 200$ ). That is why the long-run aggregate supply curve  $AS_{LR}$  is vertical above the full-employment output level. Every possible price level on the vertical axis is associated with the economy producing at the full-employment output level in the long run once input prices adjust to exactly match changes in output prices.

## Focusing on the Short Run

The immediate-short-run aggregate supply curve, the short-run aggregate supply curve, and the long-run aggregate supply curve are all important. Each curve is appropriate to situations that match its respective assumptions about the flexibility of input and output prices. In the remainder of the book, we will have several different opportunities to refer to each curve. But our focus in the rest of this chapter and the several chapters that immediately follow will be on short-run aggregate supply curves, such as the AS curve shown in Figure 10-4. Indeed, unless explicitly stated otherwise, all references to “aggregate supply” are to the AS curve in the short run.

Our emphasis on the short-run aggregate supply curve AS stems from our interest in understanding the business cycle in the simplest possible way. It is a fact that real-world economies typically manifest simultaneous changes in both their price levels and their levels of real output. The upward-sloping short-run AS curve is the only version of aggregate supply that can handle simultaneous movements in both of these variables. By contrast, the price level is assumed fixed in the immediate-short-run version of aggregate supply illustrated in Figure 10-3 and the economy’s output is always equal to the full-employment output level in the long-run version of aggregate supply shown in Figure 10-5. This renders these versions of the aggregate supply curve less useful as part of a core model for analyzing business cycles and demonstrating the short-run government policies designed to deal with them. In our current discussion, we will reserve use of the immediate short run and the long run for specific, clearly identified situations. Later in the book we will explore how the short-run AS curve and long-run AS curve are linked, and how that linkage adds several additional macroeconomic insights about cycles and policy.

## Changes in Aggregate Supply

An existing aggregate supply curve identifies the relationship between the price level and real output, other things equal. But when one or more of these “other things” change, the curve itself shifts. The rightward shift of the curve from  $AS_1$  to  $AS_3$  in Figure 10-6 represents an increase in aggregate supply, indicating that firms are willing to produce and sell more real output at each price level. The leftward shift of the curve from  $AS_1$  to  $AS_2$  represents a decrease in aggregate supply. At each price level, firms will not produce as much output as before.

Figure 10-6 lists the “other things” that shift the aggregate supply curve. Called the **determinants of aggregate supply**, they collectively determine the location of the aggregate supply curve and shift the curve when they change. Changes in these determinants cause per-unit production costs to be either higher or lower than before *at each price level*. These changes in per-unit production cost affect profits, which leads firms to alter the amount of output they are willing to produce *at each price level*. For example, firms may collectively offer \$1 trillion of real output at a price level of 1.0 (100 in index value), rather than \$900 billion. Or, they may offer \$800 billion rather than \$1 trillion.

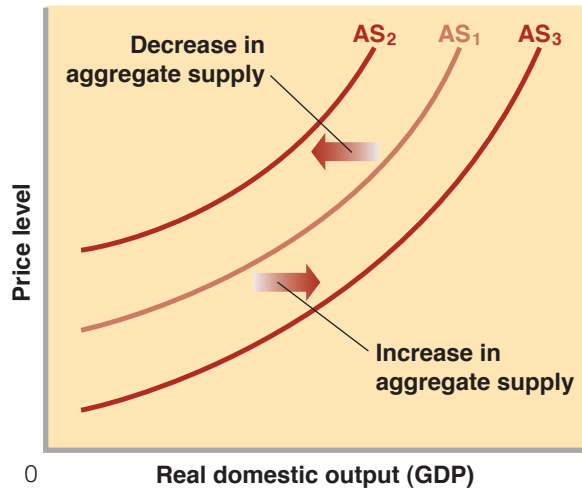
### determinants of aggregate supply

Factors such as input prices, productivity, and the legal-institutional environment that shift the aggregate supply curve.

FIGURE 10-6

## Changes in Short-Run 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  $AS_3$  represents an increase in aggregate supply; the leftward shift of the curve from  $AS_1$  to  $AS_2$  shows a decrease in aggregate supply.



### Determinants of the short-run aggregate supply: factors that shift the aggregate supply curve

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

The point is that when one of the determinants listed in Figure 10-6 changes, the aggregate supply curve shifts to the right or left. Changes that reduce per-unit production cost shift the aggregate supply curve to the right, as from  $AS_1$  to  $AS_2$ ; changes that increase per-unit production costs shift it 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 determinants of aggregate supply listed in Figure 10-6 require more discussion.

### INPUT PRICES

Input or resource prices—to be distinguished from the output prices that make up the price level—are a key determinant of aggregate supply. These resources can be either 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 and salaries reduce per-unit production costs. So, the aggregate supply shifts to the right. Increases in wages and salaries shift the curve to the left. Examples:

- Labour supply increases because of substantial immigration. Wages and per-unit production costs fall, shifting the AS curve to the right.
- Labour 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 capital (machinery and equipment) falls because of declines in the prices of steel and electronic components. Per-unit production costs decline and the AS shifts to the right.
- Land resources expand through discoveries of mineral deposits, irrigation of land, or technical innovations that transform “non-resources” (say, vast northern shrub 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 Canadian goods contributes to Canadian aggregate demand, resources imported from abroad (such as oil, tin, and coffee beans) add to Canadian aggregate supply. Added resources—whether domestic or imported—boost production capacity. Generally, a decrease in the price of imported resources increases Canadian aggregate supply, and an increase in their price reduces Canadian 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 the Petroleum Exporting Countries (OPEC) worked in concert to decrease oil production in order to raise the price of oil. The tenfold increase in the price of oil that OPEC achieved during the 1970s drove up per-unit production costs and jolted the Canadian aggregate supply curve leftward. By contrast, a sharp decline in oil prices in the mid-1980s resulted in a rightward shift of the Canadian aggregate supply curve. In 1999 OPEC again reasserted itself, raising oil prices and therefore per-unit production costs for some Canadian 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 change the price of imported resources. Suppose the Canadian dollar appreciates. This means that domestic producers face a lower *dollar* price of imported resources. Canadian firms would 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 would shift the Canadian aggregate supply curve to the right.

A depreciation of the dollar will have the opposite effects and will shift the aggregate supply 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 it. Productivity is a measure of real output per unit of input:

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

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

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

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 \$0.50. The doubled productivity has reduced the per-unit production cost by half.



**WORKED  
PROBLEM 10.1**  
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 a better-trained workforce, improved forms of business enterprises, and the reallocation of labour 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 business taxes and subsidies, and (2) changes in the extent of regulation.

**Business Taxes and Subsidies** Higher business taxes—corporate income taxes and capital, sales, excise, and payroll taxes—increase per-unit costs and reduce 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 the aggregate supply curve to the left. Similarly, a business subsidy—a payment or tax break by government to producers—lowers production costs and increases aggregate supply.

**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.

## QUICK REVIEW

- ▶ 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 the per-unit production cost independent of changes in the level of output, changes in one or more of the determinants of aggregate supply (Figure 10-6) shift the short-run aggregate supply curve.
- ▶ An increase in short-run aggregate supply is shown as a rightward shift of the curve; a decrease is shown as a leftward shift of the curve.

## 10.3 Equilibrium and Changes in Equilibrium

### equilibrium price level

The price level at which the aggregate demand curve intersects the aggregate supply curve.

### equilibrium real domestic output

The real domestic output at which the aggregate demand curve intersects the aggregate supply curve.

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 10-7 (Key Graph)** and its accompanying table provide the answer. Equilibrium occurs at the price level that equalizes the amount 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 domestic output**. So, aggregate demand and aggregate supply jointly establish the price level and level of real GDP.

In Figure 10-7 the equilibrium price level and level of real output are 100 and \$510 billion, respectively. To illustrate why, suppose the price level were 92 rather than 100. We see from the table that the lower price level would 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 would 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 excess demand for the output of the economy causes the price level to rise from 92 to 100, which encourages producers to increase their real output from \$502 billion to \$510 billion, thereby increasing GDP. In increasing their real output, producers hire more employees, reducing the unemployment level in the economy. 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).

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

### Increases in AD: Demand-Pull Inflation

Suppose households and businesses decide to increase their consumption and investment spending—actions that shift the aggregate demand curve to the right. Our list of determinants of aggregate demand (Figure 10-2) provides several reasons why this shift might occur. Perhaps consumers feel wealthier because of large gains in their stock holdings. As a result, consumers would consume more (save less) of their current income. Perhaps firms boost their investment spending because they anticipate higher future profits from investments in new capital. Those profits are based on having new equipment and facilities that incorporate a number of new technologies. And perhaps government increases spending in health care.

As shown by the rise in the price level from  $P_1$  to  $P_2$  in Figure 10-8, 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  $GDP_f$  to  $GDP_1$ . The distance between  $GDP_1$  and  $GDP_f$  is an **inflationary gap**, the amount by which equilibrium GDP exceeds potential GDP. An inflationary gap is also referred to as a positive GDP gap. (**Key Question 4**)

A careful examination of Figure 10-8 reveals an interesting point. The increase in aggregate demand from  $AD_1$  to  $AD_2$  increases real output only to  $GDP_1$ , not to  $GDP_2$ , because part of the 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  $GDP_2$ . But in Figure 10-8 inflation reduced the increase in real output only to  $GDP_1$ . For any initial increase in aggregate demand, the resulting increase in real output will be smaller the greater the increase in the price level.

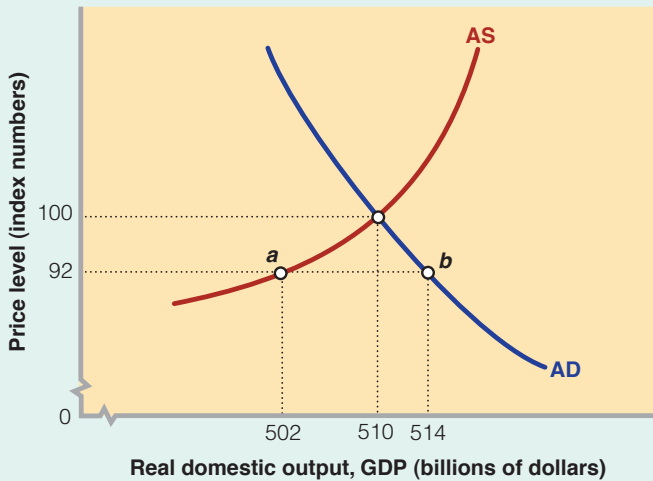
### inflationary gap

The amount by which equilibrium GDP exceeds potential GDP.

**KEY GRAPH**

**FIGURE 10-7 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
<b>510</b>	<b>100</b>	<b>510</b>
512	96	505
514	92	502

**Quick Quiz**

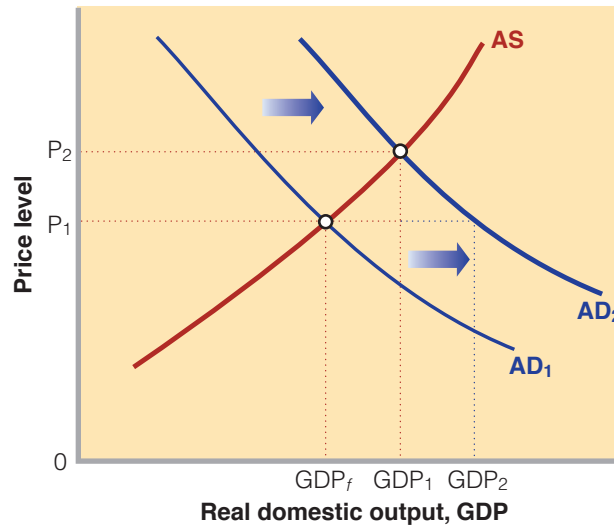
- The AD curve slopes downward because**
  - per-unit production costs fall as real GDP increases.
  - the income and substitution effects are at work.
  - changes in the determinants of AD alter the amounts of real GDP demanded at each price level.
  - decreases in the price level give rise to real-balances,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

**Answers:**

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

### FIGURE 10-8 An Increase in Aggregate Demand that Causes Demand-Pull Inflation

An increase in aggregate demand generally increases both the GDP and price level. The increase in aggregate demand from  $AD_1$  to  $AD_2$  is partly dissipated in inflation ( $P_1$  to  $P_2$ ) and real output increases only from  $GDP_f$  to  $GDP_1$ .



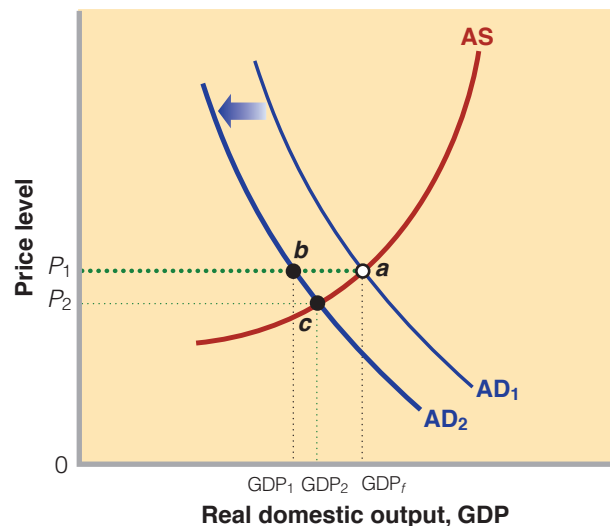
### Decreases in AD: Recession and Cyclical Unemployment

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 10-9 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 readily go down. *Deflation*, a decline in the price level, is a rarity in the Canadian economy.

### FIGURE 10-9 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 (an immediate-short-run aggregate supply curve) and reduce real GDP from  $GDP_f$  to  $GDP_1$ . Idle production capacity, cyclical unemployment, and a recessionary GDP gap (of  $GDP_f$  minus  $GDP_1$ ) will result. If the price level were flexible downward, the decline in aggregate demand would move the economy  $a$  to  $c$  instead of from  $a$  to  $b$ .







## CONSIDER THIS

### The Global Financial Crisis and the Decrease in Aggregate Demand

Figure 10-9 helps demonstrate the recession in Canada in 2008–09, brought about by the global financial crisis. A large unexpected decrease in aggregate demand (as from  $AD_1$  to  $AD_2$ ) occurred because private-sector spending suddenly declined. Viewed through the determinants of aggregate demand:

- *Consumer spending* declined because of (a) reduced consumer wealth due to reductions in stock market value, (b) fearful consumer expectations about future employment and income levels, and (c) increased emphasis on saving more and borrowing less.
- *Investment spending* declined because of lower expected returns on investment. These lower expectations resulted from the prospects of poor future business conditions and high degrees of excess capacity.
- *Net exports* declined because our major trading partner, the U.S., was in deep recession due to the burst of the housing bubble.

The decline in aggregate demand jolted the Canadian economy from a point such as  $a$  in Figure 10-9 leftward to a point such as  $b$ . Because the price level remained roughly constant, the decline in aggregate demand caused the economy to move leftward along the immediate-short-run aggregate supply curve (the dashed horizontal line). As a result, real GDP took the brunt of the blow, declining sharply (as from  $GDP_f$  to  $GDP_1$ ). By contrast, if prices had been more flexible, then the economy could have slid down the downward-sloping AS curve (as from point  $a$  to point  $c$ ), with the result being a smaller decrease in real GDP (as from  $GDP_f$  to  $GDP_2$ ). But with the price level roughly constant, a full-strength multiplier occurred, as illustrated in Figure 10-9 by the decline of output from  $GDP_f$  to  $GDP_1$ , rather than from  $GDP_f$  to  $GDP_2$ . As of March 2009, the Canadian economy was experiencing a significant negative GDP gap (as illustrated by  $GDP_1$  minus  $GDP_f$  in the figure), which was accompanied by a large reduction in employment, a large increase in unemployment, and a sharp rise in the unemployment rate. In August 2009, the unemployment rate reached an 11-year high of 8.7 percent.

The economy represented by Figure 10-9 moves from  $a$  to  $b$ , rather than from  $a$  to  $c$ . The outcome is a decline of real output from  $GDP_f$  to  $GDP_1$ , with no change in the price level. It is as though the aggregate supply curve in Figure 10-9 is horizontal at  $P_1$  leftward from  $GDP_f$ , as indicated by the dashed line. This decline of real output from  $GDP_f$  to  $GDP_1$  constitutes a *recession*, and since fewer workers are needed to produce the lower output, *cyclical unemployment* arises. The distance between  $GDP_1$  and  $GDP_f$  is a **recessionary gap**, the amount by which actual output falls short of the full-employment output. A recessionary gap is also referred to as a *negative GDP gap*. Such a gap occurred in Canada during 2001 when unemployment rose to 7.7 percent of the labour force from 6.8 percent in 2000. But unlike the American economy, Canada did not slip into recession in 2001; economic growth slowed to 1.9 percent in 2001, from a strong 4.4 percent in 2000.

Close inspection of Figure 10-9 reveals that, with the price level stuck at  $P_1$ , real GDP decreases by the full leftward shift of the AD curve. Real output takes the full brunt of the decline in aggregate demand because product prices tend 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 also 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 it 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, including (1) estimating the magnitude and

#### recessionary gap

The amount by which equilibrium GDP falls short of potential GDP.

#### menu costs

Costs associated with changing the prices of goods and services.

duration of the shift in demand to determine whether prices should be lowered, (2) re-pricing items held in inventory, (3) printing and mailing new catalogues, 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.



## ORIGIN 10.2 Efficiency Wages

### efficiency wages

Wages that elicit maximum work effort and thus minimize labour cost per unit of output.

- **Wage Contracts** It usually is not profitable for firms to cut their product prices if they cannot also cut their wage rates. Wages are usually inflexible downward because large parts of the labour force work under contracts prohibiting wage cuts for the duration of the contract. (It is not uncommon for collective bargaining agreements in major industries to run for three years.) Similarly, the wages and salaries of non-union 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 labour costs per unit of output. If worker productivity (output per hour of work) remains constant, lower wages *do* reduce labour costs per unit of output. But lower wages might lower worker morale and work effort, thereby reducing productivity. Considered alone, lower productivity raises labour costs per unit of output because less output is produced. If the higher labour costs resulting from reduced productivity exceed the cost savings from the lower wage, then wage cuts will increase rather than reduce labour costs per unit of output. In such situations, firms will resist lowering wages when they are faced with a decline in aggregate demand.
- **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 wages and prices tend to be inflexible downward in the short run, wages and prices are more flexible than in the past. Intense foreign competition and the declining power of unions in Canada 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 for the relatively mild recessions in recent times. In 2002 and 2003 Canadian 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 10-9 remains valid. In 2001 the overall price level did not decline although unemployment rose by 80,000 workers.



## CONSIDER THIS | The Ratchet Effect

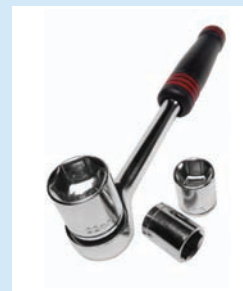
A ratchet analogy is a good way to think about effects of changes in aggregate demand on the price level. A ratchet is a tool or mechanism such as a winch, car jack, or socket wrench that cranks a wheel forward but does not allow it to go backward. Properly set, each allows the operator to move an object (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 Canada, 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 price level has declined in only a single year (1953) since 1950, even though aggregate demand and real output have declined in a number of years, such as 1946, 1954, 1982, and 1991.

In terms of our analogy, increases in aggregate demand ratchet the Canadian 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.



## Decreases in AS: Cost-Push Inflation

Suppose that tropical storms in areas where there are major oil facilities severely disrupt world oil supplies and drive 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 Canadian aggregate supply curve would shift to the left, say from  $AS_1$  to  $AS_2$  in Figure 10-10. The resulting increase in 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  $P_1$  to  $P_2$  and real output declines from  $GDP_f$  to  $GDP_2$ . Along with the cost-push inflation, a recession (and negative GDP gap) occurs. That is exactly what happened in Canada in the mid-1970s when the price of oil rocketed upward. Then, oil expenditures were about 10 percent of Canadian GDP, compared to only 3 percent today. So, as indicated in this chapter's Last Word, the Canadian economy is now less vulnerable to cost-push inflation arising from such aggregate supply shocks.

## Increases in AS: Full Employment with Price-Level Stability

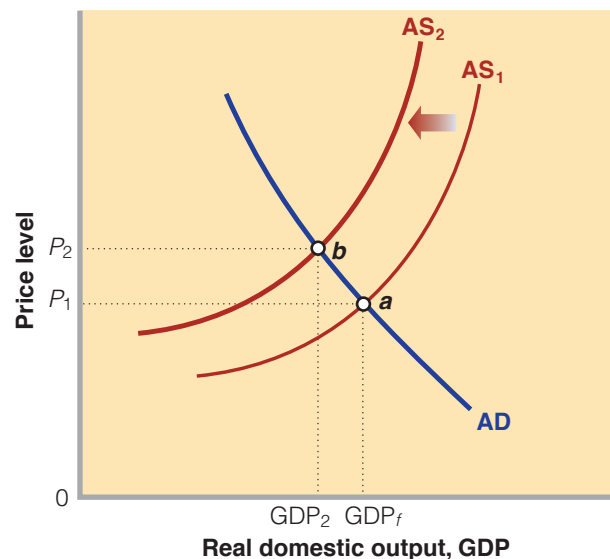
For the first time in more than a decade, in early 2000 Canada experienced full employment, strong economic growth, and very low inflation. Specifically, in 2000 the unemployment rate fell below 7 percent—a level not seen since 1975—and real GDP grew at 4.3 percent, *without igniting inflation*. At first thought, this “macroeconomic bliss” seems to be incompatible with the AD–AS model. An upward-sloping aggregate supply curve suggests that increases in aggregate demand that are sufficient for full employment (or overfull employment) will raise the price level. Higher inflation, so it would seem, is the inevitable price paid for expanding output to and beyond the full-employment level.

But inflation remained very mild in the late 1990s and early 2000s. Figure 10-11 helps explain why. Let's first suppose that aggregate demand increased from  $AD_1$  to  $AD_2$  along the 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 less than full-employment real output  $GDP_1$  to full-capacity real output  $GDP_2$ . 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 in the late 1980s.

**FIGURE 10-10**

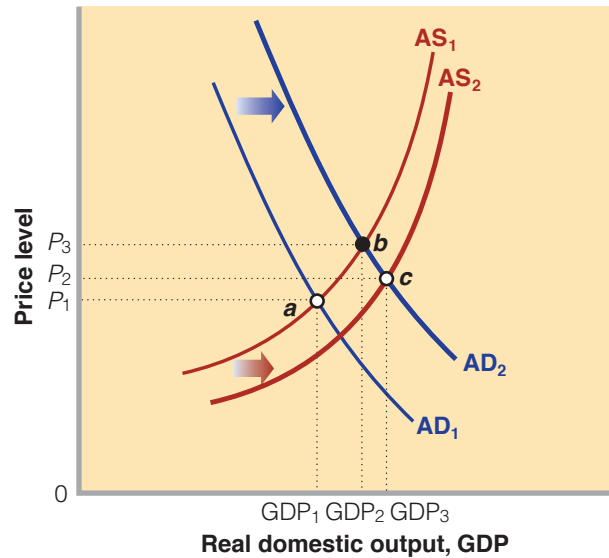
### A Decrease in Aggregate Supply That Causes Cost-Push Inflation

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 negative GDP gap (of  $GDP_f$  minus  $GDP_2$ ) occurs.



## FIGURE 10-11 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 its full-capacity level ( $GDP_2$ ), 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 ( $GDP_1$  to  $GDP_3$ ), full employment, and only very mild inflation ( $P_1$  to  $P_2$ ).



A shift of the aggregate supply curve to the right shifts the economy's full employment and its full capacity output.

In the more recent period, however, larger-than-usual increases in productivity occurred due to a burst of new technology relating to computers, the Internet, inventory management systems, electronic commerce, and so on. The quickened productivity growth reduced per-unit production cost and shifted the aggregate supply curve to the right, as from  $AS_1$  to  $AS_2$  in Figure 10-11. 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  $GDP_1$  to  $GDP_3$  and the price level rose only modestly (from  $P_1$  to  $P_2$ ). The shift of the aggregate supply curve from  $AS_1$  to  $AS_2$  increased the economy's full-employment output and its full-capacity output. That accommodated the increase in aggregate demand without causing inflation.

But in 2001 the macroeconomic bliss of the late 1990s came face to face with the old economic principles. Aggregate demand growth slowed because of a substantial fall in investment spending. The terrorist attacks of September 11, 2001 in the U.S. further dampened aggregate demand through lower exports to our largest trading partner. The unemployment rate inched up from 6.8 percent in January 2001 to 7.7 percent in mid-2002.

Throughout 2001 the Bank of Canada lowered interest rates to try to halt the slowdown and promote recovery. The lower interest rates spurred aggregate demand, particularly the demand for new housing, and helped spur recovery. The economy resumed its economic growth in 2002. Growth continued through 2008, during which the unemployment rate reached a 37-year low of 6.0 percent. Yet price stability continued as the core rate of inflation stayed at about 2 percent despite hefty increases in oil prices during 2008. We will examine government stabilization policies such as those carried out by the Bank of Canada in the AD-AS context in chapters that follow.

*(Key Questions 5, 6, and 7)*

## QUICK REVIEW

- ▶ The equilibrium price level and amount of real output are determined at the intersection of the aggregate demand and aggregate supply curves.
- ▶ 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 if productivity-driven increases in aggregate supply are sufficient to balance growing aggregate demand.

## The 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 Canadian economy. Have the effects of such changes weakened?

Canada 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 changes shifted the aggregate supply curve leftward, causing rapid inflation, 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 Canadian 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 Canadian aggregate supply curve would shift to the left, creating cost-push inflation. But inflation in Canada remained modest.

Then came a greater test: A “perfect storm”—continuing conflict in Iraq, the rising demand for oil in China and India, a pickup of economic growth in several industrial nations, disruption of oil production by hurricanes in the United States, 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 basket price of oil at OPEC’s Web site, [www.opec.org](http://www.opec.org).) The Canadian 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. The overall trend of lower production costs resulting from rapid productivity advances 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 Canadian economy than they were in the 1970s. Prior to 1980, changes in oil prices greatly affected core inflation in Canada. But since 1980 they have had very little effect on core inflation.<sup>2</sup> The main reason has been a significant decline in the amount of oil and gas used in producing each dollar of Canadian GDP. In 2005 producing a dollar of 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 the 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). American 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.<sup>3</sup> Given the similarities between the Canadian and U.S. economies, there is reason to believe that similar magnitudes also hold for the Canadian economy.

A final reason why changes in oil prices seem to have lost their inflationary punch is that the Bank of Canada has become more vigilant and adept at maintaining price stability through monetary policy. The Bank of Canada 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 in 2007 and 2008, when the price of oil rose from just over \$50 per barrel in January 2007 to over \$140 per barrel in July 2008. But the onset of a world recession in the fall of 2008

sent the price of oil to below \$40 in February 2009. (We will discuss monetary policy in depth in Chapter 13.)

It should be noted that higher oil prices have had differential impacts across Canada. The higher oil prices have been a boon to Alberta's economy because it made the exploitation of its oil sands economically feasible. To a much lesser extent, Newfoundland and Nova Scotia have also indirectly benefited from higher oil prices because of their offshore oil reserves. On the other hand, the higher oil prices have hardly been welcome by consumers (particularly low-income families) and businesses in provinces such as Ontario and Quebec.

<sup>2</sup>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.

<sup>3</sup>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.

## Question

Go to the OPEC website, [www.opec.org](http://www.opec.org), and find the current "OPEC basket price" of oil. By clicking on that amount, you will find the annual prices of oil for the past five years. By what percentage is the current price higher or lower than five years ago? Next, go to the Statistics Canada website (<http://www40.statcan.ca/l01/cst01/econ05-eng.htm>) and find Canada's real GDP for the past five years. By what percentage is real GDP higher or lower than it was five years ago? What if, anything, can you conclude about the relationship between the price of oil and the level of real GDP in Canada?

## CHAPTER SUMMARY

### 10.1 ► AGGREGATE DEMAND

- 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.
- The aggregate demand curve shows the level of real output that the economy will purchase at each price level.
- The aggregate demand curve is downward-sloping because of the real-balances effect, the interest-rate effect, and the foreign-trade effect. The real-balances effect indicates that inflation reduces the real value or purchasing power of fixed-value financial assets held by households, causing them to retrench on their consumer spending. The interest-rate effect means that, with a specific supply of money, a higher price level increases the demand for money, raising the interest rate and reducing consumption and investment purchases. The foreign-trade effect suggests that an increase in one country's price level relative to other countries' reduces the net exports component of that nation's aggregate demand.
- The determinants of aggregate demand are spending by domestic consumers, businesses, government, and foreign buyers. Changes in the factors listed in Figure 10-2 alter the spending by these groups and shift the aggregate demand curve.

### 10.2 ► AGGREGATE SUPPLY

- 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 that each have different underlying assumptions about the flexibility of input and output prices.
- The *immediate-short-run aggregate supply curve* assumes that both input prices and output prices are fixed. With output prices fixed, the aggregate supply curve is a horizontal line at the current price level. The *short-run aggregate supply curve* assumes nominal wages and other input prices remain fixed while output prices vary. The aggregate supply curve is generally upsloping because per-unit production costs, and hence the prices that firms must receive, rise as real output expands. The aggregate supply curve is relatively steep to the right of the full-employment output level and relatively flat to the left of it. The *long-run aggregate supply curve* assumes that nominal wages and other input prices fully match any change in the price level. The curve is vertical at the full-employment output level.

- Because the short-run aggregate supply curve is the only version of aggregate supply that can handle simultaneous changes in the price level and real output, it serves well as the core aggregate supply curve for analyzing the business cycle and economic policy. Unless stated otherwise, all references to "aggregate supply" refer to the immediate-short-run aggregate supply and the short-run aggregate supply curve.
- Figure 10-6 lists the determinants of aggregate supply: input prices, productivity, and the legal-institutional environment. A change in any one of these factors will change per-unit production costs at each level of output and therefore alter the location of the aggregate supply curve.

### 10.3 ► EQUILIBRIUM AND CHANGES IN EQUILIBRIUM

- The intersection of the aggregate demand and aggregate supply curves determines an economy's equilibrium price level and real GDP. At the intersection, the quantity of real GDP demanded equals the quantity of real GDP supplied.
- Increases in aggregate demand to the right of the full-employment output cause inflation and positive GDP gaps (actual GDP exceeds potential GDP). An upward-sloping aggregate supply curve weakens the effect of an increase in aggregate demand because a portion of the increase in aggregate demand is dissipated in inflation.
- Shifts of the aggregate demand curve to the left of the full-employment output cause recession, negative GDP gaps, and cyclical unemployment. The price level may not fall during recessions because of downwardly inflexible prices and wages. This inflexibility results from fear of price wars, menu costs, wage contracts, efficiency wages, and minimum wages. When the price level is fixed, in essence there is a horizontal portion of the aggregate supply curve, referred to as the immediate-short-run aggregate supply curve.
- Leftward shifts of the aggregate supply curve reflect increases in per-unit production costs and cause cost-push inflation, with accompanying negative GDP gaps.
- Rightward shifts of the aggregate supply curve, caused by large improvements in productivity, help explain the simultaneous achievement of full employment, economic growth, and price stability that Canada achieved between 1996 and 2000, and 2002 and 2008.

## TERMS AND CONCEPTS

aggregate demand–aggregate supply model, p. 226  
 aggregate demand, p. 226  
 real-balances effect, p. 226  
 interest-rate effect, p. 226  
 foreign-trade effect, p. 226  
 determinants of aggregate demand, p. 227

aggregate supply, p. 230  
 immediate-short-run aggregate supply curve, p. 230  
 short-run aggregate supply curve, p. 231  
 long-run aggregate supply curve, p. 233  
 determinants of aggregate supply, p. 234  
 equilibrium price level, p. 238

equilibrium real domestic output, p. 238  
 inflationary gap, p. 238  
 recessionary gap, p. 241  
 menu costs, p. 241  
 efficiency wages, p. 242

## STUDY QUESTIONS

**LO ► 10.1** 1. Why is the aggregate demand curve downward sloping? Specify how your explanation differs from that for the downward-sloping demand curve for a single product.

**LO ► 10.1** 2. Distinguish between the “real-balances effect” and the “wealth effect” as the terms are used in this chapter. How does each relate to the aggregate demand curve?

**LO ► 10.2** 3. What assumptions cause the immediate-short-run aggregate supply curve to be horizontal? Why is the long-run aggregate supply curve vertical? Explain the shape of the short-run aggregate supply curve. Why is the short-run curve relatively flat to the left of the full-employment output and relatively steep to its right?

**LO ► 10.3** 4. **KEY QUESTION** Suppose that the aggregate demand and the aggregate supply schedules for a hypothetical economy are as shown below:

Amount of real domestic output demanded (billions)	Price level (price index)	Amount of real domestic output supplied (billions)
\$100	300	\$400
200	250	400
300	200	300
400	150	200
500	150	100

- Use these data to graph the aggregate demand and supply curves. Find the equilibrium price level and level of real output in this hypothetical economy. Is the equilibrium real output also the potential GDP? Explain.
- Why will a price level of 150 not be an equilibrium price level in this economy? Why not 250?

c. Suppose that buyers desire to purchase \$200 billion of extra real output at each price level. Sketch in the new aggregate demand curve as  $AD_1$ . What factors might cause this change in aggregate demand? What are the new equilibrium price level and level of real output?

5. **KEY QUESTION** Suppose that the hypothetical economy in question 4 has the following relationship between its real output and the input quantities necessary for producing that output:

**LO ► 10.3**

Input quantity	Real domestic output
150.0	400
112.5	300
75.0	200

- What is productivity in this economy?
- What is the per-unit cost of production if the price of each input unit is \$2?
- Assume that the input price increases from \$2 to \$3 with no accompanying change in productivity. What is the new per-unit cost of production? In what direction would the \$1 increase in input price push the aggregate supply curve? What effect would this shift in the short-run aggregate supply have on the price level and the level of real output?
- Suppose that the increase in input price does not occur but instead that productivity increases by 100 percent. What would be the new per-unit cost of production? What effect would this change in per-unit production cost have on the short-run aggregate supply curve? What effect would this shift in the short-run aggregate supply have on the price level and the level of real output?



- LO > 10.3** 6. **KEY QUESTION** What effects would each of the following have on aggregate demand or short-run aggregate supply? In each case use a diagram to show the expected effects on the equilibrium price level and level of real output. Assume all other things remain constant.
- A widespread fear of recession among consumers.
  - A \$2 per pack increase in the excise tax on cigarettes.
  - A reduction in interest rates at each price level.
  - A major increase in federal spending for health care.
  - The expectation of rapid inflation.
  - The complete disintegration of OPEC, causing oil prices to fall by one-half.
  - A 10 percent reduction in personal income tax rates.
  - An increase in labour productivity (with no change in nominal wages).
  - A 12 percent increase in nominal wages (with no change in productivity).
  - Depreciation in the international value of the dollar.

- LO > 10.3** 7. **KEY QUESTION** Assume that (a) the price level is flexible upward but not downward and (b) the economy is currently operating at its full-employment output. Other things equal, how will each of the following affect the equilibrium price level and equilibrium level of real output in the short run?
- An increase in aggregate demand.
  - A decrease in aggregate supply, with no change in aggregate demand.
  - Equal increases in aggregate demand and aggregate supply.
  - A decrease in aggregate demand.
  - An increase in aggregate demand that exceeds an increase in aggregate supply

- LO > 10.3** 8. Explain how an upward-sloping aggregate supply curve weakens the impact of a rightward shift of the aggregate demand curve.

- LO > 10.3** 9. Why does a reduction in aggregate demand reduce real output, rather than the price level?

- LO > 10.3** 10. Explain: "Unemployment can be caused by a decrease of aggregate demand or a decrease of aggregate supply." In each case, specify the price-level outcomes.

- LO > 10.3** 11. Use shifts in the AD and AS curves to explain (a) the Canadian experience of strong economic growth, full employment, and price stability in the late 1990s and early 2000s; and (b) how a strong negative wealth effect from, say, a precipitous drop in the stock market could cause a recession even though productivity is surging.

- LO > 10.3** 12. Suppose the aggregate demand and supply schedules for a hypothetical economy are as shown below:

Amount of real domestic output demanded (billions)	Price level (price index)	Amount of real domestic output supplied (billions)
\$ 60	350	\$240
120	300	240
180	250	180
240	200	120
300	150	60

- What will be the equilibrium price and output level in this hypothetical economy? Is it also the full-employment level of output? Explain.
  - Why won't the 200 index be the equilibrium price level? Why won't the 300 index be the equilibrium price level?
  - Suppose demand increases by \$120 billion at each price level. What will be the new equilibrium price and output levels?
  - List five factors that might cause a change in aggregate demand.
13. Use this aggregate demand–aggregate supply schedule for a hypothetical economy to answer the following questions. **LO > 10.3**

Real domestic output demanded (billions)	Price level (price index)	Real domestic output supplied (billions)
\$3000	350	\$9000
4000	300	8000
5000	250	7000
6000	200	6000
7000	150	5000
8000	100	4000

- What will be the equilibrium price level and quantity of real domestic output?
- If the quantity of real domestic output demanded increased by \$2000 at each price level, what will be the new equilibrium price level and quantity of real domestic output?
- Using the original data from the table, if the quantity of real domestic output demanded *increased* by \$5000 and the quantity of real domestic output supplied *increased* by \$1000 at each price level, what would be the new equilibrium price level and quantity of real domestic output?

## INTERNET APPLICATION QUESTIONS

- 1. The Interest-Rate Effect—Price Levels and Interest Rates.** The interest-rate effect suggests that as the price level rises so do interest rates, and rising interest rates reduce certain kinds of consumption and investment spending. Use the links on the McConnell-Brue-Flynn-Barbiero Web site (Chapter 10) and compare price levels (all items) and interest rates (prime business loan rate) over the past five years. Do the data support the link between the price level and interest rates?
- 2. Aggregate Demand and Supply—Equilibrium Prices and GDPs.** Go to the statistical section of the OECD through the McConnell-Brue-Flynn-Barbiero Web site (Chapter 10) to retrieve the data on inflation (see CPI under short-term indicators) and GDP for Canada, the United States, Germany, and Japan. Assume that these CPI and GDP figures represent the equilibrium price and real GDPs for their respective years. Plot the price/GDP levels for the past three years for each country using a graph similar to Figure 10-7. Are there any similarities across countries? Speculate on changes in aggregate demand and supply that most likely produced the succession of equilibrium points. (*Note:* AS usually moves rightward at a slow, steady annual pace.)

# Appendix to Chapter 10

## A10.1 THE RELATIONSHIP OF THE AGGREGATE DEMAND CURVE TO THE AGGREGATE EXPENDITURES MODEL\*

### Derivation of the Aggregate Demand Curve from the Aggregate Expenditures Model

We can directly connect the downward-sloping aggregate demand curve of Figure 10-1 to the aggregate expenditures model discussed in Chapter 9 by relating the various possible price levels to corresponding equilibrium GDPs. In Figure A10-1 we have stacked the aggregate expenditures model (Figure A10-1a) and the aggregate demand curve (Figure A10-1b) vertically. We can do this because the horizontal axes of both models measure real GDP. Now let's derive the AD curve in three distinct steps (throughout this discussion, keep in mind that price level  $P_1 < \text{price level } P_2 < \text{price level } P_3$ ):

- First suppose that the economy's price level is  $P_1$  and its aggregate expenditures schedule is  $AE_1$ , the top schedule in Figure A10-1a. The equilibrium GDP is then  $GDP_1$  at point 1. So in Figure A10-1b we can plot the equilibrium real output  $GDP_1$  and the corresponding price level  $P_1$ . This gives us one point  $1'$  in Figure A10-1b.
- Now assume the price level rises from  $P_1$  to  $P_2$ . Other things equal, this higher price level will (1) decrease the value of wealth, decreasing consumption expenditures; (2) increase the interest rate, reducing investment and interest-sensitive consumption expenditures; and (3) increase imports and decrease exports, reducing net export expenditures. The aggregate expenditures schedule will fall from  $AE_1$  to, say,  $AE_2$  in Figure A10-1a, giving us equilibrium  $GDP_2$  at point 2. In Figure A10-1b we plot this new price-level–real-output combination,  $P_2$  and  $GDP_2$ , as point  $2'$ .
- Finally, suppose the price level rises from  $P_2$  to  $P_3$ . The value of real wealth balances, the interest rate rises, exports fall, and imports rise. Consequently, the consumption, investment, and net export schedules fall, shifting the aggregate expenditures schedule downward from  $AE_2$  to  $AE_3$ , which gives us equilibrium  $GDP_3$  at point 3. In Figure A10-1b, this enables us to locate point  $3'$ , where the price level is  $P_3$  and real output is  $GDP_3$ .

In summary, increases in the economy's price level will successively shift its aggregate expenditures schedule downward and will reduce real GDP. The resulting price level–real GDP combination will yield various points such as  $1'$ ,  $2'$ , and  $3'$  in Figure A10-1b. Together, such points locate the downward-sloping aggregate demand curve for the economy.

### Aggregate Demand Shifts and the Aggregate Expenditures Model

The determinants of aggregate demand listed in Figure 10-2 are the components of the aggregate expenditures model discussed in Chapter 9. When one of those determinants changes, the aggregate expenditures schedule shifts too. We can easily link such shifts in the aggregate expenditures schedule to shifts of the aggregate demand curve.

Let's suppose the price level is constant. In Figure A10-2 we begin with the aggregate expenditures schedule at  $AE_1$  in diagram (a), yielding real output of  $GDP_1$ . Assume now that investment spending increases in response to more optimistic business expectations, so that the aggregate expenditures schedule rises from  $AE_1$  to  $AE_2$ . (The notation "at  $P_1$ " reminds us that the price level is assumed to be constant.) The result will be a multiplied increase in real output from  $GDP_1$  to  $GDP_2$ .

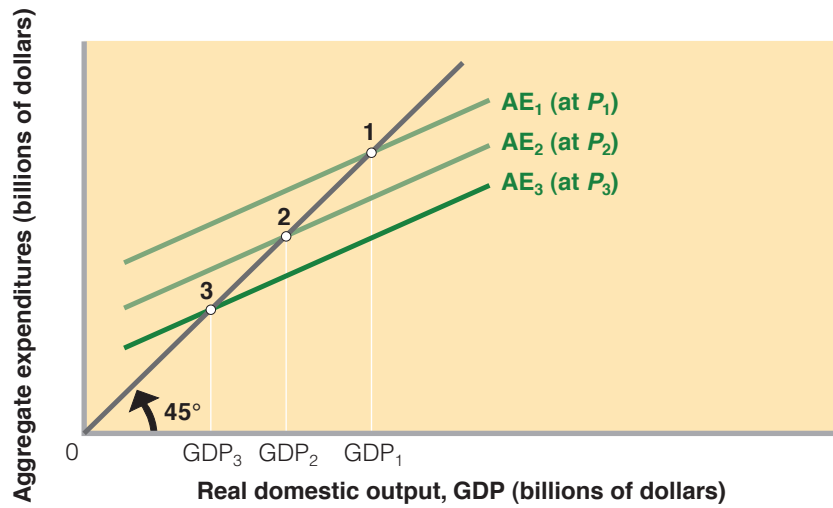
In Figure A10-2b, the increase in investment spending is reflected in the horizontal distance between  $AD_1$  and the broken curve to its right. The immediate effect of the increase in investment is an increase in aggregate demand by the exact amount of the new spending. But then the multiplier process magnifies the initial increase in investment into successive rounds of consumption spending and an ultimate multiplied increase in aggregate demand from  $AD_1$  to  $AD_2$ . Equilibrium real output rises from  $GDP_1$  to  $GDP_2$ , the same multiplied increase in real GDP as that in Figure A10-2a. The initial increase in investment in (a) has shifted the AD curve in (b) by a horizontal distance equal to the change in investment times the multiplier. This particular change in real GDP is still associated with the constant price level  $P_1$ . To generalize,

$$\text{Shift of AD curve} = \text{initial change in spending} \times \text{multiplier}$$

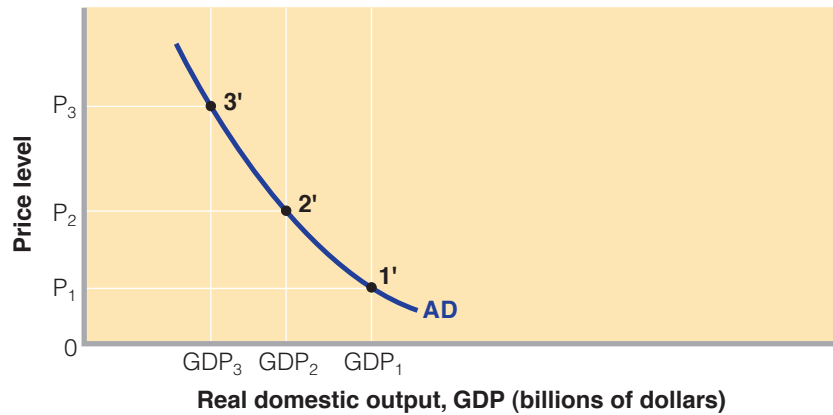
\*This appendix presumes knowledge of the aggregate expenditures model discussed in Chapter 9 and should be skipped if Chapter 9 was not assigned.

## FIGURE A10-1 Deriving the Aggregate Demand Curve from the Expenditures Model

(a) Rising price levels from  $P_1$  to  $P_2$  to  $P_3$  shift the aggregate expenditures curve downward from  $AE_1$  to  $AE_2$  to  $AE_3$  and reduce real GDP from  $GDP_1$  to  $GDP_2$  to  $GDP_3$ . (b) The aggregate demand curve AD is derived by plotting the successively lower real GDPs from the upper graph against the  $P_1$ ,  $P_2$ , and  $P_3$  price levels.



(a) Aggregate expenditures model

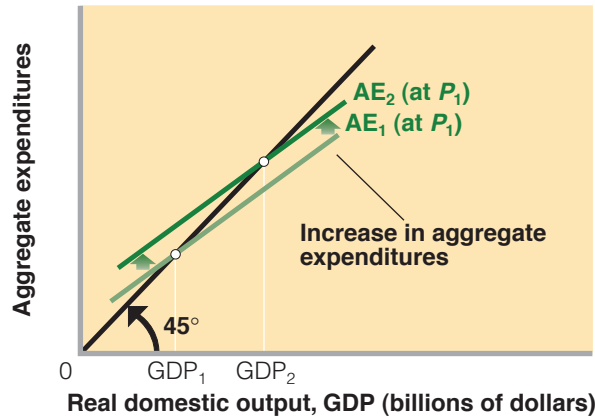


(b) Aggregate demand-aggregate supply model

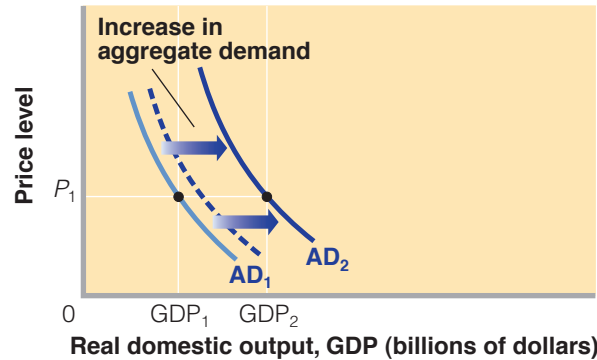
## Shifts in the Aggregate Expenditures Schedule and in the Aggregate Demand Curve

**FIGURE A10-2**

Panel (a): A change in some determinant of consumption, investment, or net exports (other than the price level) shifts the aggregate expenditures schedule upward from  $AE_1$  to  $AE_2$ . The multiplier increases real output from  $GDP_1$  to  $GDP_2$ . Panel (b): The counterpart of this change is an initial rightward shift of the aggregate demand curve (from  $AD_1$  to the broken curve). This leads to a multiplied rightward shift of the curve to  $AD_2$ , which is just sufficient to show the same increase in GDP as in the aggregate expenditures model.



(a) Aggregate expenditures model



(b) Aggregate demand–aggregate supply model

### APPENDIX SUMMARY

- A change in the price level alters the location of the aggregate expenditures schedule through the real-balances, interest-rate, and foreign-trade effects. The aggregate demand curve is derived from the aggregate expenditures model by allowing the price level to change and observing the effect on the aggregate expenditures schedule and thus on equilibrium GDP.
- With the price level held constant, increases in consumption, investment, government, and net export expenditures shift the aggregate expenditures schedule upward and the aggregate demand curve to the right. Decreases in these spending components reduce the opposite effects.

### APPENDIX STUDY QUESTIONS

- LO ▶ A10.1** 1. Explain carefully: “A change in the price level shifts the aggregate expenditures curve but not the aggregate demand curve.”
- LO ▶ A10.1** 2. Suppose the price level is constant and investment spending increases sharply. How would you show this increase in the aggregate expenditures model? What would be the outcome for real GDP? How would you show this rise in investment in

the aggregate demand–aggregate supply model, assuming the economy is operating in what, in effect, is a horizontal range of the aggregate supply curve?

3. How does the aggregate expenditures analysis differ from the aggregate demand–aggregate supply analysis? **LO ▶ A10.1**