

## Other Import Barriers

Two sets of policies that influence imports are:

- Health, safety, and regulation barriers
- Voluntary export restraints

**Health, Safety, and Regulation Barriers** Thousands of detailed health, safety, and other regulations restrict international trade. For example, Canadian food imports are examined by the Canadian Food Inspection Agency, which is “mandated to safeguard Canada’s food supply and the plants and animals upon which safe and high-quality food depends.” The discovery of BSE (mad cow disease) in just one cow in 2003 was enough to close down international trade in Canadian beef. The European Union bans imports of most genetically modified foods, such as Canadian-produced soybeans. Although regulations of the type we’ve just described are not designed to limit international trade, they have that effect.

**Voluntary Export Restraints** A *voluntary export restraint* is like a quota allocated to a foreign exporter of a good. This type of trade barrier isn’t common. It was initially used during the 1980s when Japan voluntarily limited its exports of car parts to the United States.

## Export Subsidies

A *subsidy* is a payment by the government to a producer. You studied the effects of a subsidy on the quantity produced and the price of a subsidized farm product in Chapter 6, pp. 140–141.

An *export subsidy* is a payment by the government to the producer of an exported good. Export subsidies are illegal under a number of international agreements, including the North American Free Trade Agreement (NAFTA), and the rules of the World Trade Organization (WTO).

Although export subsidies are illegal, the subsidies that the Canadian, U.S., and E.U. governments pay to farmers end up increasing domestic production, some of which gets exported. These exports of subsidized farm products make it harder for producers in other countries, notably in Africa and Central and South America, to compete in global markets. Export subsidies bring gains to domestic producers, but they result in inefficient underproduction in the rest of the world and create a deadweight loss.

## Economics in Action

### Self-Interest Beats the Social Interest

The **World Trade Organization (WTO)** is an international body established by the world’s major trading nations for the purpose of supervising international trade and lowering the barriers to trade.

In 2001, at a meeting of trade ministers from all the WTO member-countries held in Doha, Qatar, an agreement was made to begin negotiations to lower tariff barriers and quotas that restrict international trade in farm products and services. These negotiations are called the **Doha Development Agenda** or the **Doha Round**.

In the period since 2001, thousands of hours of conferences in Cancún in 2003, Geneva in 2004, and Hong Kong in 2005, and ongoing meetings at WTO headquarters in Geneva, costing millions of taxpayers’ dollars, have made disappointing progress.

Rich nations, led by the United States, the European Union, and Japan, want greater access to the markets of developing nations in exchange for allowing those nations greater access to the markets of the rich world, especially those for farm products.

Developing nations, led by Brazil, China, India, and South Africa, want access to the markets of farm products of the rich world, but they also want to protect their infant industries.

With two incompatible positions, these negotiations are stalled and show no signs of a breakthrough. The self-interests of rich nations and developing nations are preventing the achievement of the social interest.

## REVIEW QUIZ

- 1 What are the tools that a country can use to restrict international trade?
- 2 Explain the effects of a tariff on domestic production, the quantity bought, and the price.
- 3 Explain who gains and who loses from a tariff and why the losses exceed the gains.
- 4 Explain the effects of an import quota on domestic production, consumption, and price.
- 5 Explain who gains and who loses from an import quota and why the losses exceed the gains.

Work these questions in Study Plan 7.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

## The Case Against Protection

You've just seen that free trade promotes prosperity and protection is inefficient. Yet trade is restricted with tariffs, quotas, and other barriers. Why? Seven arguments for trade restrictions are that protecting domestic industries from foreign competition:

- Helps an infant industry grow.
- Counteracts dumping.
- Saves domestic jobs.
- Allows us to compete with cheap foreign labour.
- Penalizes lax environmental standards.
- Prevents rich countries from exploiting developing countries.
- Reduces offshore outsourcing that sends good Canadian jobs to other countries.

### Helps an Infant Industry Grow

Comparative advantages change with on-the-job experience—*learning-by-doing*. When a new industry or a new product is born—an *infant industry*—it is not as productive as it will become with experience. It is argued that such an industry should be protected from international competition until it can stand alone and compete.

It is true that learning-by-doing can change comparative advantage, but this fact doesn't justify protecting an infant industry. Firms anticipate and benefit from learning-by-doing without protection from foreign competition.

When Research In Motion started to build its smartphone, BlackBerry, productivity was at first low. But after a period of learning-by-doing, huge productivity gains followed. Research In Motion didn't need a tariff to achieve these productivity gains.

### Counteracts Dumping

**Dumping** occurs when a foreign firm sells its exports at a lower price than its cost of production. Dumping might be used by a firm that wants to gain a global monopoly. In this case, the foreign firm sells its output at a price below its cost to drive domestic firms out of business. When the domestic firms have gone, the foreign firm takes advantage of its monopoly position and charges a higher price for its product.

Dumping is illegal under the rules of the World Trade Organization and is usually regarded as a

justification for temporary tariffs, which are called *countervailing duties*.

But it is virtually impossible to detect dumping because it is hard to determine a firm's costs. As a result, the test for dumping is whether a firm's export price is below its domestic price. But this test is weak because it is rational for a firm to charge a low price in a market in which the quantity demanded is highly sensitive to price and a higher price in a market in which demand is less price sensitive.

### Saves Domestic Jobs

First, free trade does destroy some jobs, but it also creates other jobs. It brings about a global rationalization of labour and allocates labour resources to their highest-valued activities. International trade in textiles has cost tens of thousands of jobs in Canada as textile mills and other factories closed. But tens of thousands of jobs have been created in other countries as textile mills opened. And tens of thousands of Canadian workers have better-paying jobs than as textile workers because Canadian export industries have expanded and created new jobs. More jobs have been created than destroyed.

Although protection can save particular jobs, it does so at a high cost. For example, until 2005, U.S. textile jobs were protected by an international agreement called the Multifibre Arrangement. The U.S. International Trade Commission (ITC) has estimated that because of import quotas, 72,000 jobs existed in the textile industry that would otherwise have disappeared and that the annual clothing expenditure in the United States was \$15.9 billion (\$160 per family) higher than it would have been with free trade. Equivalently, the ITC estimated that each textile job saved cost \$221,000 a year.

Imports don't only destroy jobs. They create jobs for retailers that sell imported goods and for firms that service those goods. Imports also create jobs by creating income in the rest of the world, some of which is spent on Canadian-made goods and services.

### Allows Us to Compete with Cheap Foreign Labour

With the removal of tariffs on trade between Canada, the United States, and Mexico, people said we would hear a “giant sucking sound” as jobs rushed to Mexico. That didn't happen. Why?

It didn't happen because low-wage labour is low-productivity labour. If a Canadian autoworker earns

\$40 an hour and produces 20 units of output an hour, the average labour cost of a unit of output is \$2. If a Mexican autoworker earns \$4 an hour and produces 1 unit of output an hour, the average labour cost of a unit of output is \$4. Other things remaining the same, the higher a worker's productivity, the higher is the worker's wage rate. High-wage workers have high productivity; low-wage workers have low productivity.

It is *comparative advantage*, not wage differences, that drive international trade and that enable us to compete with Mexico and Mexico to compete with us.

### **Penalizes Lax Environmental Standards**

Another argument for protection is that it provides an incentive to poor countries to raise their environmental standards—free trade with the richer and “greener” countries is a reward for improved environmental standards.

This argument for protection is weak. First, a poor country cannot afford to be as concerned about its environmental standard as a rich country can. Today, some of the worst pollution of air and water is found in China, Mexico, and Eastern Europe. But only a few decades ago, London and Los Angeles topped the pollution league chart. The best hope for cleaner air in Beijing and Mexico City is rapid income growth, which free trade promotes. As incomes grow, emerging countries have the *means* to match their desires to improve their environment. Second, a poor country may have a comparative advantage at doing “dirty” work, which helps it to raise its income and at the same time enables the global economy to achieve higher environmental standards than would otherwise be possible.

### **Prevents Rich Countries from Exploiting Developing Countries**

Another argument for protection is that international trade must be restricted to prevent the people of the rich industrial world from exploiting the poorer people of the developing countries and forcing them to work for slave wages.

Child labour and near-slave labour are serious problems. But by trading with poor countries, we increase the demand for the goods that these countries produce and increase the demand for their labour. When the demand for labour in developing countries increases, the wage rate rises. So, rather than exploiting people in developing countries, trade can improve their opportunities and increase their incomes.

### **Reduces Offshore Outsourcing that Sends Good Canadian Jobs to Other Countries**

**Offshore outsourcing**—buying goods, components, or services from firms in other countries—brings gains from trade identical to those of any other type of trade. We could easily change the names of the items traded from T-shirts and regional jets (the examples in the previous sections of this chapter) to banking services and call-centre services (or any other pair of services). A Canadian bank might export banking services to Indian firms, and Indians might provide call-centre services to Canadian firms. This type of trade would benefit both Canadians and Indians, provided Canada has a comparative advantage in banking services and India has a comparative advantage in call-centre services.

Despite the gain from specialization and trade that offshore outsourcing brings, many people believe that it also brings costs that eat up the gains. Why?

A major reason is that it seems to send good Canadian jobs to other countries. It is true that some manufacturing and service jobs are going overseas. But others are expanding at home. Canada imports call-centre services, but it exports education, health-care, legal, financial, and a host of other types of services. The number of jobs in these sectors is expanding and will continue to expand.

The exact number of jobs that have moved to lower-cost offshore locations is not known, and estimates vary. But even the highest estimate is small compared to the normal rate of job creation and labour turnover.

Gains from trade do not bring gains for every single person. Canadians, on average, gain from offshore outsourcing, but some people lose. The losers are those who have invested in the human capital to do a specific job that has now gone offshore.

Unemployment benefits provide short-term temporary relief for these displaced workers. But the long-term solution requires retraining and the acquisition of new skills.

Beyond bringing short-term relief through unemployment benefits, government has a larger role to play. By providing education and training, it can enable the labour force of the twenty-first century to engage in the ongoing learning and sometimes rapid retooling that jobs we can't foresee today will demand.

Schools, colleges, and universities will expand and become better at doing their job of producing a more highly educated and flexible labour force.

## AT ISSUE

### Is Offshore Outsourcing Bad or Good for Canada?

The Royal Bank of Canada, Bell Canada, and Sears Canada engage in offshore outsourcing. They buy services from firms in other countries. Buying goods and components has been going on for centuries, but buying *services* such as customer support call-centre services is new and is made possible by the development of low-cost telephone and Internet service.

Should this type of offshore outsourcing be discouraged and penalized with taxes and regulations?

#### Bad

- Whenever a major company announces job cuts and a decision to send some jobs abroad, there is an outcry from not only the affected workers but also the broader community. It seems clear: Offshore outsourcing is bad for Canadians.
- Surveys of opinion find that around 70 percent of people in advanced economies such as Canada think outsourcing hurts jobs and incomes at home and only a small minority think it helps.



Have these Indian call-centre workers destroyed Canadian jobs? Or does their work benefit Canadian workers?

#### Good

- Economist N. Gregory Mankiw speaking about the U.S. situation, but relevant to all countries, says, “I think outsourcing … is probably a plus for the economy in the long run.”
- Mankiw goes on to say that it doesn’t matter whether “items produced abroad come on planes, ships, or over fibre-optic cables … the economics is basically the same.”
- What Greg Mankiw is saying is that the economic analysis of the gains from international trade—exactly the same as what you have studied on pp. 153–156—applies to all types of international trade.
- Offshore outsourcing, like all other forms of international trade, is a source of gains for all.

### Avoiding Trade Wars

We have reviewed the arguments commonly heard in favour of protection and the counterarguments against it. But one counterargument to protection that is general and quite overwhelming is that protection invites retaliation and can trigger a trade war.

A trade war is a contest in which when one country raises its import tariffs, other countries retaliate with increases of their own, which trigger yet further increases from the first country.

A trade war occurred during the Great Depression of the 1930s when the United States introduced the Smoot-Hawley tariff. Country after country retaliated with its own tariff, and in a short period, world trade had almost disappeared. The costs to all countries were large and led to a renewed international resolve to avoid such self-defeating moves in the future. The costs are also the impetus behind current attempts to liberate trade.

### Why Is International Trade Restricted?

Why, despite all the arguments against protection, is trade restricted? There are two key reasons:

- Tariff revenue
- Rent seeking

**Tariff Revenue** Government revenue is costly to collect. In developed countries such as Canada, a well-organized tax collection system is in place that can generate billions of dollars of income tax and sales tax revenues.

But governments in developing countries have a difficult time collecting taxes from their citizens. Much economic activity takes place in an informal economy with few financial records. The one area in which economic transactions are well recorded is international trade. So tariffs on international trade are a convenient source of revenue in these countries.

**Rent Seeking** Rent seeking is the major reason why international trade is restricted. **Rent seeking** is lobbying for special treatment by the government to create economic profit or to divert consumer surplus or producer surplus away from others. Free trade increases consumption possibilities *on average*, but not everyone shares in the gain and some people even lose. Free trade brings benefits to some and imposes costs on others, with total benefits exceeding total costs. The uneven distribution of costs and benefits is the principal obstacle to achieving more liberal international trade.

Returning to the example of trade in T-shirts and airplanes, the benefits from free trade accrue to all the producers of airplanes and to those producers of T-shirts that do not bear the costs of adjusting to a smaller garment industry. These costs are transition costs, not permanent costs. The costs of moving to free trade are borne by the garment producers and their employees who must become producers of other goods and services in which Canada has a comparative advantage.

The number of winners from free trade is large, but because the gains are spread thinly over a large number of people, the gain per person is small. The winners could organize and become a political force lobbying for free trade. But political activity is costly. It uses time and other scarce resources and the gains per person are too small to make the cost of political activity worth bearing.

In contrast, the number of losers from free trade is small, but the loss per person is large. Because the loss per person is large, the people who lose *are* willing to incur considerable expense to lobby against free trade.

Both the winners and losers weigh benefits and costs. Those who gain from free trade weigh the benefits it brings against the cost of achieving it. Those who lose from free trade and gain from protection weigh the benefit of protection against the cost of maintaining it. The protectionists undertake a larger quantity of political lobbying than the free traders.

## Compensating Losers

If, in total, the gains from free international trade exceed the losses, why don't those who gain compensate those who lose so that everyone is in favour of free trade?

Some compensation does take place. When Canada entered the North American Free Trade

Agreement (NAFTA) with the United States and Mexico, the United States set up a \$56 million fund to support and retrain workers who lost their jobs as a result of the new trade agreement. During NAFTA's first six months, only 5,000 workers applied for benefits under this scheme.

The losers from international trade are also compensated indirectly through the normal unemployment compensation arrangements. But only limited attempts are made to compensate those who lose.

The main reason full compensation is not attempted is that the costs of identifying all the losers and estimating the value of their losses would be enormous. Also, it would never be clear whether a person who has fallen on hard times is suffering because of free trade or for other reasons that might be largely under her or his control. Furthermore, some people who look like losers at one point in time might, in fact, end up gaining. The young auto-worker who loses his job in Windsor and gets a job on Alberta's oil patch might resent the loss of work and the need to move. But a year later, looking back on events, he counts himself fortunate.

Because we do not, in general, compensate the losers from free international trade, protectionism is a popular and permanent feature of our national economic and political life.

## REVIEW QUIZ

- 1 What are the infant industry and dumping arguments for protection? Are they correct?
- 2 Can protection save jobs and the environment and prevent workers in developing countries from being exploited?
- 3 What is offshore outsourcing? Who benefits from it and who loses?
- 4 What are the main reasons for imposing a tariff?
- 5 Why don't the winners from free trade win the political argument?

Work these questions in Study Plan 7.4 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

We end this chapter on global markets in action with *Economics in the News* on pp. 168–169, where we apply what you've learned by looking at the benefits of and obstacles to a Canadian free-trade deal with Japan.

# Obstacles to Free Trade

## Japan May Offer Canada Head Start on Pork Tariffs

Bloomberg

April 23, 2014

Japan, the world's largest pork importer, may accelerate tariff talks with Canada to increase pressure on the United States to ease demands for cuts in agricultural protection, the Asian nation's biggest hog farmers group said.

Canada, the largest pork exporter after the United States and the European Union, has been in talks with Japan on a bilateral trade pact since November 2012. Japan agreed to almost halve its tariff on Australian pork under a deal reached earlier this month between the two governments. The four countries are among 12 nations negotiating the Trans-Pacific Partnership.

"Canada is eager to boost pork sales to Japan and may seek treatment similar to what Japan gave to Australia," Takashi Koiso, a director at Japan Pork Producers Association, said in an interview in Tokyo. Lawmakers from Prime Minister Shinzo Abe's ruling Liberal Democratic Party said the tariff reduction Japan offered to Australia is a "red line" for the TPP. ...

"We cannot accept tariff cuts beyond the level agreed to with Australia, or our industry will be undermined," said Hisao Kuramoto, the pork association's managing director.

Costs to produce pork for Japanese farmers are more than double those in the United States and Canada as the Asian nation imports almost all of its feed grains. Corn and soybean futures in the United States, the largest supplier to Japan, have climbed 19 percent and 13 percent this year respectively. ...

Japan imported 738,455 tonnes of pork worth 390 billion yen (\$3.8 billion) last year, of which 281,139 tonnes, or 38 percent, was from the United States, according to the agriculture ministry. Canada was the second-biggest supplier with 142,212 tonnes, followed by Denmark with 113,951 tonnes. ...

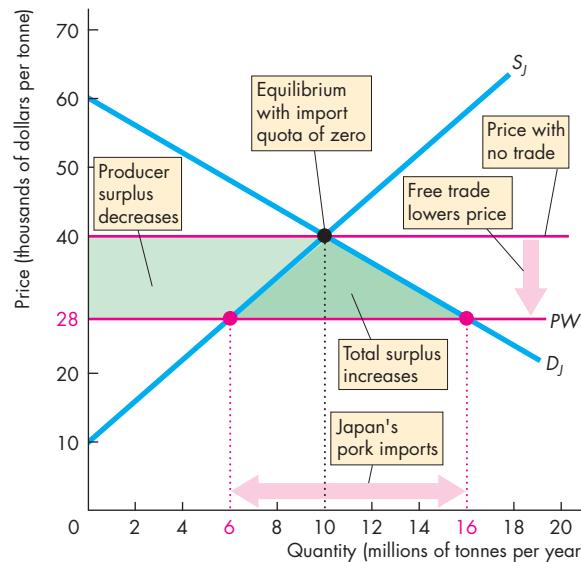
Written by Aya Takada. Copyright © 2014. Used by permission of Bloomberg L.P.  
All rights reserved.

### ESSENCE OF THE STORY

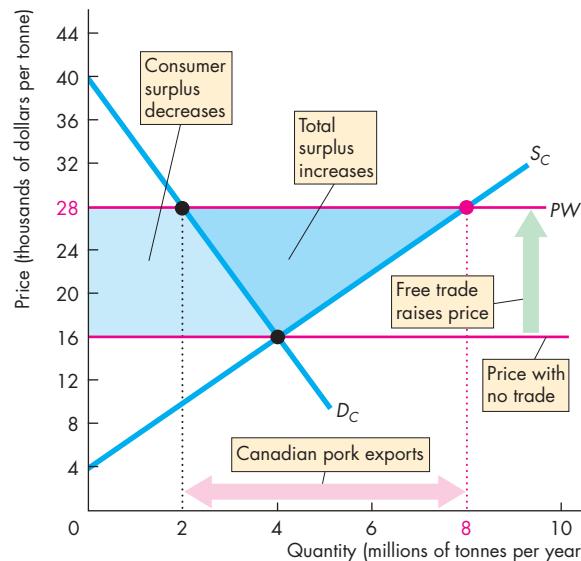
- Japan is the world's largest pork importer and Canada is the world's third-largest pork exporter.
- The cost of producing pork in Japan is more than double the cost in Canada and the United States.
- Japan imported 738,455 tonnes of pork in 2013 of which 142,212 tonnes were from Canada.
- Japan imposes a high tariff on pork imports but has done a deal with Australia to almost halve its rate.
- Canada wants Japan to lower its tariff on Canadian pork.
- Japan's pork association says it cannot accept tariff cuts beyond the level agreed to with Australia.

## ECONOMIC ANALYSIS

- Canada is one of 12 Pacific-rim nations that are attempting to reach a deal that lowers barriers to trade.
- Japan, one of the two largest of the Pacific-rim economies, presents obstacles that stand in the way of a deal.
- The core of the problem is Japan's wish to protect its farmers, who form a strong political lobby.
- Figure 1 shows how Japan is protecting its pork farmers but damaging its consumers' interest.
- The demand curve is  $D_J$  and the supply curve is  $S_J$ . With a total ban on pork imports (an import quota of zero), the price of pork is \$40,000 per tonne and 10 million tonnes are produced and consumed per year.
- If Japan opened up its pork market to free international trade, the price of pork would fall. In Fig. 1, the price falls to the world price (assumed) of \$28,000 per tonne, shown by the line  $PW$ .
- With free trade, Japan can buy pork at \$28,000 per tonne and the price in Japan falls to that level. The quantity of pork demanded increases to 16 million tonnes, the quantity supplied decreases to 6 million tonnes, and 10 million tonnes are imported. (Assumed quantities.)
- The Japanese pork producers' surplus shrinks and the Japanese consumer surplus expands by the amount of the light green area. Consumer surplus also increases and total surplus increases by the darker green area.
- The farm lobby in Japan is strong and the government is unwilling to risk losing votes by permitting free trade in pork. But it has moved in that direction in its deal with Australia, and it is expected to move further in a deal with Canada.
- Figure 2 shows why Canada is interested in this deal. The demand curve for pork is  $D_C$  and the supply curve is  $S_C$ . If there were no international trade in pork, the price in Canada would be \$16,000 per tonne and 4 million tonnes would be produced and consumed each year.
- With free trade, Canada can sell pork at the world price of \$28,000 per tonne and the price in Canada rises to that level. The quantity of pork demanded decreases to 2 million tonnes, the quantity supplied increases to 8 million tonnes, and 6 million tonnes are exported. (Assumed quantities.)
- Canadian consumer surplus shrinks and Canadian pork producers' surplus expands by the amount of the light blue area. Producer surplus also increases and total surplus increases by the darker blue area.



**Figure 1 The Market for Pork in Japan**



**Figure 2 The Market for Pork in Canada**



## SUMMARY

### Key Points

#### How Global Markets Work (pp. 152–154)

- Comparative advantage drives international trade.
- If the world price of a good is lower than the domestic price, the rest of the world has a comparative advantage in producing that good and the domestic country gains by producing less, consuming more, and importing the good.
- If the world price of a good is higher than the domestic price, the domestic country has a comparative advantage in producing that good and gains by producing more, consuming less, and exporting the good.

Working Problems 1 to 3 will give you a better understanding of how global markets work.

#### Winners, Losers, and the Net Gain from Trade

(pp. 155–156)

- Compared to a no-trade situation, in a market with imports, consumer surplus is larger, producer surplus is smaller, and total surplus is larger with free international trade.
- Compared to a no-trade situation, in a market with exports, consumer surplus is smaller, producer surplus is larger, and total surplus is larger with free international trade.

Working Problem 4 will give you a better understanding of winners, losers, and the net gains from trade.

#### International Trade Restrictions (pp. 157–163)

- Countries restrict international trade by imposing tariffs, import quotas, and other import barriers.
- Trade restrictions raise the domestic price of imported goods, lower the quantity imported, decrease consumer surplus, increase producer surplus, and create a deadweight loss.

Working Problems 5 to 10 will give you a better understanding of international trade restrictions.

#### The Case Against Protection (pp. 164–167)

- Arguments that protection helps an infant industry to grow and counteracts dumping are weak.
- Arguments that protection saves jobs, allows us to compete with cheap foreign labour, is needed to penalize lax environmental standards, and prevents exploitation of developing countries are flawed.
- Offshore outsourcing is just a new way of reaping gains from trade and does not justify protection.
- Trade restrictions are popular because protection brings a small loss per person to a large number of people and a large gain per person to a small number of people. Those who gain have a stronger political voice than those who lose and it is too costly to identify and compensate losers.

Working Problem 11 will give you a better understanding of the case against protection.

### Key Terms

- Dumping, 164  
 Exports, 152  
 Import quota, 160

- Imports, 152  
 Offshore outsourcing, 165

### MyEconLab Key Terms Quiz

- Rent seeking, 167  
 Tariff, 157



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 7 Study Plan.

The table shows the Canadian demand schedule for honey and the supply schedule of honey by Canadian producers. The world price of honey is \$8 a jar.

Price (dollars per jar)	Quantity demanded (millions of jars per year)	Quantity supplied (millions of jars per year)
5	10	0
6	8	3
7	6	6
8	4	9
9	2	12
10	0	15

### Questions

- With no international trade, what is the price of honey and the quantity bought and sold in Canada? Does Canada have a comparative advantage in producing honey? With free international trade, does Canada export or import honey?
- With free international trade, what is the Canadian price of honey, the quantity bought by Canadians, the quantity produced in Canada, and the quantity of honey exported or imported?
- Does Canada gain from international trade in honey? Do all Canadians gain? If not, who loses and do the gains exceed the losses?

### Solutions

- With no international trade, the price of honey is that at which the quantity demanded equals the quantity supplied. The table shows that this price is \$7 a jar at which the equilibrium quantity is 6 million jars a year.

The price of honey in Canada is less than the world price, which means that the opportunity cost of producing a jar of honey in Canada is *less* than the opportunity cost of producing it in the rest of the world. So Canadian producers have a comparative advantage in producing honey, and with free international trade, Canada exports honey.

**Key Point:** Comparative advantage is determined by comparing the opportunity cost of producing the good in Canada and the world price.

- With free international trade, the price of honey in Canada rises to the world price of \$8 a jar. Canadians cut their consumption of honey to 4 million jars a year while Canadian honey

producers expand production to 9 million jars a year. Canada exports 5 million jars of honey a year. The figure shows the quantities bought and produced in Canada and the quantity exported.

**Key Point:** As the domestic price rises to the world price, the quantity demanded decreases and the quantity supplied increases, and the difference is exported.

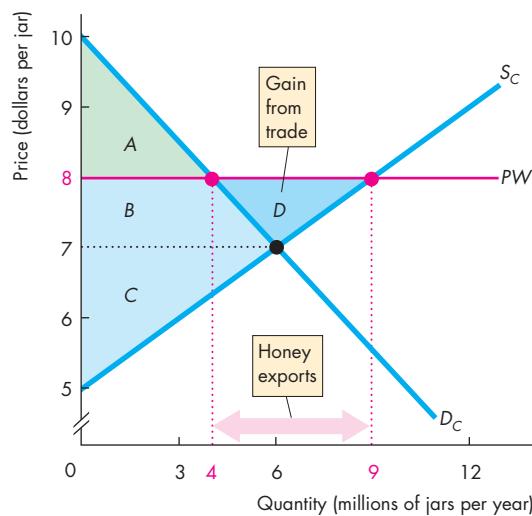
- With free international trade, Canada gains from exporting honey because the higher price and the larger quantity of honey produced increase Canada's total surplus from honey.

Consumers lose because the price of honey rises and they buy less honey. Consumer surplus from honey decreases. But the higher price and the larger quantity produced increase producer surplus from honey. Canada gains because the increase in producer surplus is greater than the loss in consumer surplus.

The figure shows that, with no trade, consumer surplus equals area *A* + *B* and producer surplus equals area *C*. With free international trade, consumer surplus shrinks to area *A*, producer surplus expands to area *B* + *C* + *D*, and total surplus (the gains from trade in honey) increases by area *D*.

**Key Point:** Free trade increases the total surplus, but for an exporting country some consumer surplus is transferred to producers of the exported good.

### Key Figure



**MyEconLab** Interactive Graph

## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 11 in Chapter 7 Study Plan and get instant feedback.

### How Global Markets Work (Study Plan 7.1)

Use the following data to work Problems 1 to 3.

Wholesalers buy and sell roses in containers that hold 120 stems. The table provides information about the wholesale market for roses in North America. The demand schedule is the wholesalers' demand and the supply schedule is the North American rose growers' supply.

Price (dollars per container)	Quantity demanded (millions of containers per year)	Quantity supplied (millions of containers per year)
100	15	0
125	12	2
150	9	4
175	6	6
200	3	8
225	0	10

Wholesalers can buy roses at auction in Aalsmeer, Holland, for \$125 per container.

1. a. With no international trade, what would be the price of a container of roses and how many containers of roses a year would be bought and sold in North America?  
b. At the price in your answer to part (a), does North America or the rest of the world have a comparative advantage in producing roses?
2. If North American wholesalers buy roses at the lowest possible price, how many do they buy from North American growers and how many do they import?
3. Draw a graph to illustrate the North American wholesale market for roses. Show the equilibrium in that market with no international trade and the equilibrium with free trade. Mark the quantity of roses grown in North America, the quantity imported, and the total quantity bought.

### Winners, Losers, and the Net Gain from Trade (Study Plan 7.2)

4. Use the information on the North American wholesale market for roses in Problem 1 to:
  - a. Explain who gains and who loses from free international trade in roses compared to a situation in which North Americans buy only roses grown locally.

- b. Draw a graph to illustrate the gains and losses from free trade.
- c. Calculate the gain from international trade.

### International Trade Restrictions (Study Plan 7.3)

Use the information on the North American wholesale market for roses in Problem 1 to work Problems 5 to 10.

5. If a tariff of \$25 per container is imposed on imports of roses, explain how the price of roses, the quantity of roses bought, the quantity produced in North America, and the quantity imported change.
6. Who gains and who loses from this tariff?
7. Draw a graph of the North American market for roses to illustrate the gains and losses from the tariff. On the graph identify the gains and losses, the tariff revenue, and the deadweight loss created.
8. If an import quota of 5 million containers is imposed on roses, what happens to the price of roses, the quantity of roses bought, the quantity produced in North America, and the quantity imported?
9. Who gains and who loses from this quota?
10. Draw a graph to illustrate the gains and losses from the import quota. On the graph identify the gains and losses, the importers' profit, and the deadweight loss.

### The Case Against Protection (Study Plan 7.4)

#### 11. Chinese Tire Maker Rejects Charge of Defects

U.S. regulators ordered the recall of more than 450,000 faulty tires. The Chinese producer of the tires disputed the allegations and hinted that the recall might be an effort to hamper Chinese exports to the United States.

Source: *International Herald Tribune*, June 26, 2007

- a. What does the news clip imply about the comparative advantage of producing tires in the United States and China?
- b. Could product quality be a valid argument against free trade? If it could, explain how.



## ADDITIONAL PROBLEMS AND APPLICATIONS

### MyEconLab

You can work these problems in MyEconLab if assigned by your instructor.

#### How Global Markets Work

12. Suppose that the world price of eggs is \$1 a dozen, Canada does not trade internationally, and the equilibrium price of eggs in Canada is \$3 a dozen. Canada then begins to trade internationally.
  - a. How does the price of eggs in Canada change?
  - b. Do Canadians buy more or fewer eggs?
  - c. Do Canadian egg farmers produce more or fewer eggs?
  - d. Does Canada export or import eggs and why?
  - e. Would employment in the Canadian egg industry change? If so, how?
13. Suppose that the world price of steel is \$100 a tonne, India does not trade internationally, and the equilibrium price of steel in India is \$60 a tonne. India then begins to trade internationally.
  - a. How does the price of steel in India change?
  - b. How does the quantity of steel produced in India change?
  - c. How does the quantity of steel bought by India change?
  - d. Does India export or import steel and why?
14. A semiconductor is a key component in your laptop, cellphone, and iPad. The table provides information about the market for semiconductors in Canada.

Price (dollars per unit)	Quantity demanded (billions of units per year)	Quantity supplied
10	25	0
12	20	20
14	15	40
16	10	60
18	5	80
20	0	100

Producers of semiconductors can get \$18 a unit on the world market.

- a. With no international trade, what would be the price of a semiconductor and how many semiconductors a year would be bought and sold in Canada?
- b. Does Canada have a comparative advantage in producing semiconductors?

#### 15. Act Now, Eat Later

The hunger crisis in poor countries has its roots in Canadian, U.S., and E.U. policies of subsidizing the diversion of food crops to produce bio-fuels like corn-based ethanol. That is, doling out subsidies to put the world's dinner into the gas tank.

Source: *Time*, May 5, 2008

- a. What is the effect on the world price of corn of the increased use of corn to produce ethanol in Canada, the United States, and Europe?
- b. How does the change in the world price of corn affect the quantity of corn produced in a poor developing country with a comparative advantage in producing corn, the quantity it consumes, and the quantity that it either exports or imports?

#### Winners, Losers, and the Net Gain from Trade

16. Draw a graph of the market for corn in the poor developing country in Problem 15(b) to show the changes in consumer surplus, producer surplus, and deadweight loss that arise.

Use the following news clip to work Problems 17 and 18.

#### South Korea to Resume Canadian Beef Imports

South Korea will reopen its market to most Canadian beef. South Korea banned imports of beef in 2003 amid concerns over a case of mad cow disease. The ban closed what was then the fourth-largest market for Canadian beef, valued at \$50 million a year.

Source: Bloomberg, June 28, 2011

17. Explain how South Korea's import ban on Canadian beef affected beef producers and consumers in South Korea. Draw a graph of the South Korean market for beef to show how this ban changes consumer surplus and producer surplus and creates deadweight loss.
18. Assuming that South Korea is the only importer of Canadian beef, explain how South Korea's ban on beef imports affected beef producers and consumers in Canada. Draw a graph of the market for beef in Canada to show how this ban changes Canadian consumer surplus and producer surplus from beef and creates deadweight loss.

### International Trade Restrictions

Use the following information to work Problems 19 to 21.

Before 1995, trade between Canada and Mexico was subject to tariffs. In 1995, Mexico joined NAFTA and all Canadian and Mexican tariffs have gradually been removed.

19. Explain how the price that Canadian consumers pay for goods from Mexico and the quantity of Canadian imports from Mexico have changed. Who are the winners and who are the losers from this free trade?
20. Explain how the quantity of Canadian exports to Mexico and the Canadian government's tariff revenue from trade with Mexico have changed.
21. Suppose that this year, tomato growers in Ontario lobby the Canadian government to impose an import quota on Mexican tomatoes. Explain who in Canada would gain and who would lose from such a quota.

Use the following information to work Problems 22 and 23.

Suppose that in response to huge job losses in the Canadian textile industry, the Government of Canada imposes a 100 percent tariff on imports of textiles from China.

22. Explain how the tariff on textiles will change the price that Canadians pay for textiles, the quantity of textiles imported, and the quantity of textiles produced in Canada.
23. Explain how the Canadian and Chinese gains from trade will change. Who in Canada will lose and who will gain?

Use the following information to work Problems 24 and 25.

With free trade between Australia and Canada, Australia would export beef to Canada. But Canada imposes an import quota on Australian beef.

24. Explain how this quota influences the price that Canadians pay for beef, the quantity of beef produced in Canada, and the Canadian and the Australian gains from trade.
25. Explain who in Canada gains from the quota on beef imports and who loses.

### The Case Against Protection

#### 26. Trading Up

The cost of protecting jobs in uncompetitive sectors through tariffs is high: Saving a job in

the sugar industry costs American consumers \$826,000 in higher prices a year; saving a dairy industry job costs \$685,000 per year; and saving a job in the manufacturing of women's handbags costs \$263,000.

Source: *The New York Times*, June 26, 2006

- a. What are the arguments for saving the jobs mentioned in this news clip? Explain why these arguments are faulty.
- b. Is there any merit to saving these jobs?

### Economics in the News

27. After you have studied *Economics in the News* on pp. 168–169, answer the following questions.
  - a. What is the TPP?
  - b. Who in Canada would benefit and who would lose from a successful TPP?
  - c. Illustrate your answer to part (b) with an appropriate graphical analysis assuming that tariffs are not completely eliminated.
  - d. Who in Japan and other TPP nations would benefit and who would lose from a successful TPP?
  - e. Illustrate with an appropriate graphical analysis who in Japan would benefit and who would lose from a successful TPP, assuming that all Japan's import quotas and tariffs are completely eliminated.

#### 28. E.U. Agrees to Trade Deal with South Korea

Italy has dropped its resistance to an E.U. trade agreement with South Korea, which will wipe out \$2 billion in annual duties on E.U. exports. Italians argued that the agreement, which eliminates E.U. duties on South Korean cars, would put undue pressure on its own automakers.

Source: *The Financial Times*, September 16, 2010

- a. What is a free-trade agreement? What is its aim?
- b. Explain how a tariff on E.U. car imports changes E.U. production of cars, purchases of cars, and imports of cars. Illustrate your answer with an appropriate graphical analysis.
- c. Show on your graph the changes in consumer surplus and producer surplus that result from free trade in cars.
- d. Explain why Italian automakers opposed cuts in car import tariffs.

# The Amazing Market

## PART TWO

The five chapters that you've just studied explain how markets work. The market is an amazing instrument. It enables people who have never met and who know nothing about each other to interact and do business. It also enables us to allocate our scarce resources to the uses that we value most highly. Markets can be very simple or highly organized. Markets are ancient and they are modern.

A simple and ancient market is one that the American historian Daniel J. Boorstin describes in *The Discoverers* (p. 161). In the late fourteenth century,

*The Muslim caravans that went southward from Morocco across the Atlas Mountains arrived after twenty days at the shores of the Senegal River. There the Moroccan traders laid out separate piles of salt, of beads from Ceutan coral, and cheap manufactured goods. Then they retreated out of sight. The local tribesmen, who lived in the strip mines where they dug their gold, came to the shore and put a heap of gold beside each pile of Moroccan goods. Then they, in turn, went out of view, leaving the Moroccan traders either to take the gold offered for a particular pile or to reduce the pile of their merchandise to suit the offered price in gold. Once again the Moroccan traders withdrew, and the process went on. By this system of commercial etiquette, the Moroccans collected their gold.*

Auctions on eBay and government auction of the airwaves that cellphone companies use are organized and modern markets. Susan Athey, whom you will meet on the following page, is a world-renowned expert on the design of auctions.

Everything and anything that can be exchanged is traded in markets to the benefit of both buyers and sellers.

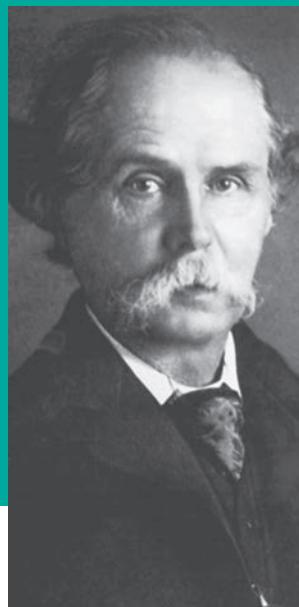
Alfred Marshall (1842–1924) grew up in an England that was being transformed by the railroad and by the expansion of manufacturing. Mary Paley was one of Marshall's students at Cambridge, and when Alfred and Mary married in 1877, celibacy rules barred Alfred from continuing to teach at Cambridge. By 1884, with more liberal rules, the Marshalls returned to Cambridge, where Alfred became Professor of Political Economy.

Many economists had a hand in refining the demand and supply model, but the first thorough and complete statement of the model as we know it today was set out by Alfred Marshall, with the help of Mary Paley Marshall. Published in 1890, this monumental treatise, *The Principles of Economics*, became the textbook on economics on both sides of the Atlantic for almost half a century.

## UNDERSTANDING HOW MARKETS WORK

*"The forces to be dealt with are ... so numerous, that it is best to take a few at a time. ... Thus we begin by isolating the primary relations of supply, demand, and price."*

**ALFRED MARSHALL**  
*The Principles  
of Economics*





TALKING WITH

**Susan Athey\***



SUSAN ATHEY is Professor of Economics at Harvard University. Born in 1970, she completed high school in three years, wrapped up three majors—in economics, mathematics, and computer science—at Duke University at 20, completed her Ph.D. at Stanford University at 24, and was voted tenure at MIT and Stanford at 29. After teaching at MIT for six years and Stanford for five years, she moved to Harvard in 2006. Among her many honours and awards, the most prestigious is the John Bates Clark Medal given to the best economist under 40. She is the first woman to receive this award.

Professor Athey's research is broad both in scope and style. A government that wants to auction natural resources will turn to her fundamental discoveries (and possibly consult with her) before deciding how to organize the auction. An economist who wants to test a theory using a large data set will use her work on statistics and econometrics.

Michael Parkin and Robin Bade talked with Susan Athey about her research, what economists have learned about designing markets, and her advice to students.

*Professor Athey, what sparked your interest in economics?*

I was studying mathematics and computer science, but I felt that the subjects were not as relevant as I would like. I discovered economics through a research project with a professor who was working on auctions. I had a summer job working for a firm that sold computers to the government through auctions. Eventually my professor, Bob Marshall, wrote two articles on the topic and testified before Congress to help reform the system for government procurement of computers. That really inspired me and showed me the power of economic ideas to change the world and to make things work more efficiently.

*What is the connection between an auction and the supply and demand model?*

The basic laws of supply and demand can be seen in evidence in an auction market like eBay. The more sellers that are selling similar products, the lower the prices they can expect to achieve. Similarly the more buyers there are demanding those objects, the higher the prices the sellers can achieve.

An important thing for an auction marketplace is to attract a good balance of buyers and sellers so that both the buyers and the sellers find it more profitable to transact in that marketplace rather than using some other mechanism. From a seller's perspective, the more bidders there are on the platform, the greater the demand and the higher the prices. And from the buyer's perspective, the more sellers there are on the platform, the greater the supply and the lower the prices.

**The basic laws of supply and demand can be seen in evidence in an auction market like eBay.**

*Can we think of an auction as a mechanism for finding the equilibrium price and quantity?*

Exactly. We can think of the whole collection of auctions on eBay as being a mechanism to discover a market-clearing price, and individual items might sell a little higher or a little lower but overall we believe that the prices on eBay auctions will represent equilibrium prices.

\*Read the full interview with Susan Athey in [MyEconLab](#).



## PART THREE HOUSEHOLDS' CHOICES

# 8

## UTILITY AND DEMAND

After studying this chapter,  
you will be able to:

- ◆ Explain the limits to consumption and describe preferences using the concept of utility
- ◆ Explain the marginal utility theory of consumer choice
- ◆ Use marginal utility theory to predict the effects of changes in prices and incomes and to explain the paradox of value
- ◆ Describe some new ways of explaining consumer choices

You enjoy sugary drinks and sometimes, perhaps, drink more than is good for your health. What determines our choices about the quantity of sugary drinks we consume?

You know that diamonds are expensive and water is cheap. Doesn't that seem odd? Why do we place a higher value on useless diamonds than on essential-to-life water?

The theory of consumer choice that you're going to study in this chapter answers questions like the ones we've just posed. *Economics in the News* at the end of the chapter applies what you learn to a debate about whether sugary drinks should be taxed to discourage their consumption.

## Consumption Choices

The choices that you make as a buyer of goods and services—your consumption choices—are influenced by many factors. We can summarize them under two broad headings:

- Consumption possibilities
- Preferences

### Consumption Possibilities

Your consumption possibilities are all the things that you can afford to buy. You can afford many different combinations of goods and services, but they are all limited by your income and by the prices that you must pay. For example, you might decide to spend a big part of your income on a gym membership and personal trainer and little on movies and music, or you might spend lots on movies and music and use the free gym at school.

The easiest way to describe consumption possibilities is to consider a model consumer who buys only two items. That's what we'll now do. We'll study the consumption possibilities of Lisa, who buys only movies and pop.

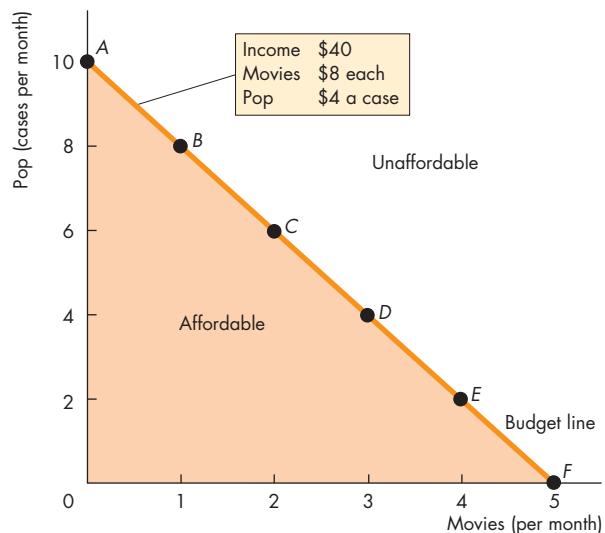
**A Consumer's Budget Line** Consumption possibilities are limited by income and by the prices of movies and pop. When Lisa spends all her income, she reaches the limits to her consumption possibilities. We describe this limit with a **budget line**, which marks the boundary between those combinations of goods and services that a household can afford to buy and those that it cannot afford.

Figure 8.1 illustrates Lisa's consumption possibilities of movies and pop and her budget line. Lisa has an income of \$40 a month, the price of a movie is \$8, and the price of pop is \$4 a case. Rows A through F in the table show six possible ways of allocating \$40 to these two goods. For example, in row A Lisa buys 10 cases of pop and sees no movies; in row F she sees 5 movies and buys no pop; and in row C she sees 2 movies and buys 6 cases of pop.

Points A through F in the graph illustrate the possibilities presented in the table, and the line passing through these points is Lisa's budget line.

The budget line constrains choices: It marks the boundary between what is affordable and unaffordable. Lisa can afford all the points on the budget line and inside it. Points outside the line are unaffordable.

**FIGURE 8.1** Lisa's Budget Line



Possibility	Movies		Pop	
	Quantity	Expenditure (\$)	Cases	Expenditure (\$)
A	0	0	10	40
B	1	8	8	32
C	2	16	6	24
D	3	24	4	16
E	4	32	2	8
F	5	40	0	0

The graph and the table show six possible ways in which Lisa can allocate \$40 to movies and pop. In row C and at point C, she sees 2 movies and buys 6 cases of pop. The line AF is Lisa's budget line and is a boundary between what she can afford and what she cannot afford. Her choices must lie along the line AF or inside the orange area.

#### MyEconLab Animation and Draw Graph

**Changes in Consumption Possibilities** Consumption possibilities change when income or prices change. A rise in income shifts the budget line outward but leaves its slope unchanged. A change in a price changes the slope of the line.\* Our goal is to predict the effects of such changes on consumption choices. To do so, we must determine the choice a consumer makes. The budget line shows what is possible; preferences determine which possibility is chosen. We'll now describe a consumer's preferences.

\*Chapter 9 explains an alternative model of consumer choice, and pp. 203–204 provides some detail on how changes in income and prices change the budget line.

## Preferences

Lisa's income and the prices that she faces limit her consumption choices, but she still has lots of choice. The choice that she makes depends on her **preferences**—a description of her likes and dislikes.

You saw one way that economists use to describe preferences in Chapter 2 (p. 36), the concept of *marginal benefit* and the *marginal benefit curve*. But you also saw in Chapter 5 (p. 108) that a marginal benefit curve is also a demand curve. The goal of a theory of consumer choice is to derive the demand curve from a deeper account of how consumers make their buying plans. That is, we want to *explain what determines demand and marginal benefit*.

To achieve this goal, we need a deeper way of describing preferences. One approach to this problem uses the idea of utility, and defines **utility** as the benefit or satisfaction that a person gets from the consumption of goods and services. We distinguish two utility concepts:

- Total utility
- Marginal utility

**Total Utility** The total benefit that a person gets from the consumption of all the different goods and services is called **total utility**. Total utility depends on the level of consumption—more consumption generally gives more total utility.

To illustrate the concept of total utility, think about Lisa's choices. We tell Lisa that we want to measure her utility from movies and pop. We can use any scale that we wish to measure her total utility and we give her two starting points: (1) We will call the total utility from no movies and no pop zero utility; and (2) We will call the total utility she gets from seeing 1 movie a month 50 units.

We then ask Lisa to tell us, using the same scale, how much she would like 2 movies, and more, up to 10 movies a month. We also ask her to tell us, on the same scale, how much she would like 1 case of pop a month, 2 cases, and more, up to 10 cases a month.

In Table 8.1, the columns headed “Total utility” show Lisa's answers. Looking at those numbers, you can say a lot about how much Lisa likes pop and movies. She says that 1 case of pop gives her 75 units of utility—50 percent more than the utility that she gets from seeing 1 movie. You can also see that her total utility from pop climbs more slowly than her total utility from movies. This difference turns on the second utility concept: *marginal utility*.

**TABLE 8.1** Lisa's Utility from Movies and Pop

Quantity (per month)	Movies		Cases (per month)	Pop	
	Total utility	Marginal utility		Total utility	Marginal utility
0	0	.... 50	0	0	.... 75
1	50	.... 40	1	75	.... 48
2	90	.... 32	2	123	.... 36
3	122	.... 28	3	159	.... 24
4	150	.... 26	4	183	.... 22
5	176	.... 24	5	205	.... 20
6	200	.... 22	6	225	.... 13
7	222	.... 20	7	238	.... 10
8	242	.... 17	8	248	.... 7
9	259	.... 16	9	255	.... 5
10	275		10	260	

**Marginal Utility** We define **marginal utility** as the *change* in total utility that results from a one-unit increase in the quantity of a good consumed.

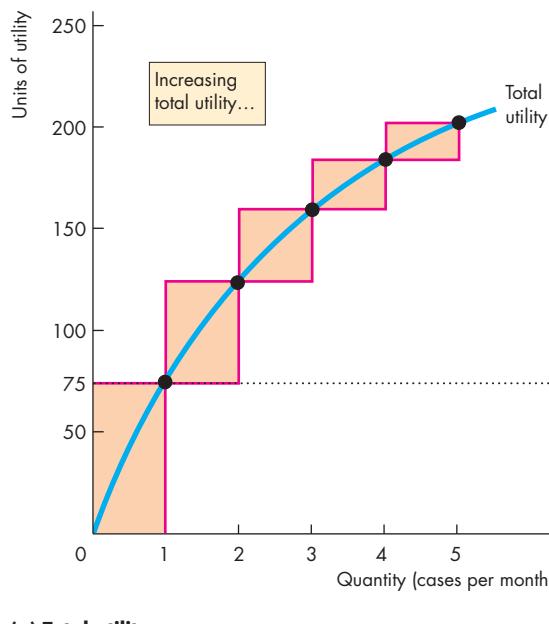
In Table 8.1, the columns headed “Marginal utility” show Lisa's marginal utility from movies and pop. You can see that if Lisa increases the pop she buys from 1 to 2 cases a month, her total utility from pop increases from 75 units to 123 units. For Lisa, the marginal utility from the second case each month is 48 units ( $123 - 75$ ).

The marginal utility numbers appear midway between the quantities of pop because it is the *change* in the quantity she buys from 1 to 2 cases that produces the marginal utility of 48 units.

Marginal utility is *positive*, but it *diminishes* as the quantity of a good consumed increases.

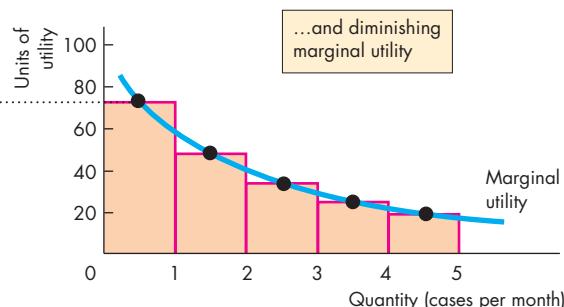
**Positive Marginal Utility** The things that people enjoy and want more of have a positive marginal utility. Some objects and activities can generate negative marginal utility and lower total utility. Two examples are hard labour and polluted air. But all the goods and services that people value and that we are thinking about here have positive marginal utility: Total utility increases as the quantity consumed increases.

**Diminishing Marginal Utility** As Lisa sees more movies, her total utility from movies increases but her marginal utility from movies decreases. Similarly, as she

**FIGURE 8.2** Total Utility and Marginal Utility

(a) Total utility

The figure graphs Lisa's total utility and marginal utility from pop based on the numbers for the first 5 cases of pop a month in Table 8.1. Part (a) shows her total utility—increasing total utility. The bars along the total utility curve show the extra total utility from each additional case of pop—marginal utility. Part (b) shows Lisa's diminishing marginal utility from pop.



(b) Marginal utility

[MyEconLab Animation](#)

consumes more pop, her total utility from pop increases but her marginal utility from pop decreases.

The tendency for marginal utility to decrease as the consumption of a good increases is so general and universal that we give it the status of a *principle*—the principle of **diminishing marginal utility**.

You can see Lisa's diminishing marginal utility by calculating a few numbers. Her marginal utility from pop decreases from 75 units from the first case to 48 units from the second case and to 36 units from the third. Her marginal utility from movies decreases from 50 units for the first movie to 40 units for the second and 32 units for the third. Lisa's marginal utility diminishes as she buys more of each good.

**Your Diminishing Marginal Utility** You've been studying all day and into the evening, and you've been too busy finishing an assignment to shop for pop. A friend drops by with a can of pop. The utility you get from that pop is the marginal utility from your first pop of the day—from *one* can. On another day you've been on a pop binge. You've been working on an assignment, but you've guzzled 10 cans of pop while doing so, and are now totally wired. You are happy enough to have one more can, but the thrill that you get from it is not very large. It is the marginal utility from the *eleventh* can in a day.

**Graphing Lisa's Utility Schedules** Figure 8.2(a) illustrates Lisa's total utility from pop. The more pop Lisa consumes in a month, the more total utility she gets. Her total utility curve slopes upward.

Figure 8.2(b) illustrates Lisa's marginal utility from pop. It is a graph of the marginal utility numbers in Table 8.1. This graph shows Lisa's diminishing marginal utility from pop. Her marginal utility curve slopes downward as she consumes more pop.

We've described Lisa's consumption possibilities and preferences. Your next task is to see how Lisa chooses what to consume.

### REVIEW QUIZ

- 1 Explain how a consumer's income and the prices of goods limit consumption possibilities.
- 2 What is utility and how do we use the concept of utility to describe a consumer's preferences?
- 3 What is the distinction between total utility and marginal utility?
- 4 What is the key assumption about marginal utility?

Work these questions in Study Plan 8.1 and get instant feedback. Do a Key Terms Quiz.

[MyEconLab](#)

## Utility-Maximizing Choice

Consumers want to get the most utility possible from their limited resources. They make the choice that maximizes utility. To discover this choice, we combine the constraint imposed by the budget and the consumer's preferences and find the point on the budget line that gives the consumer the maximum attainable utility. Let's find Lisa's utility-maximizing choice.

### A Spreadsheet Solution

Lisa's most direct way of finding the quantities of movies and pop that maximize her utility is to make a table in a spreadsheet with the information and calculations shown in Table 8.2. Let's see what that table tells us.

**Find the Just-Affordable Combinations** Table 8.2 shows the combinations of movies and pop that Lisa can afford and that exhaust her \$40 income. For example, in row A, Lisa buys only pop and at \$4 a case she can buy 10 cases. In row B, Lisa sees 1 movie and buys 8 cases of pop. She spends \$8 on the movie. At \$4 a case, she spends \$32 on pop and can buy 8 cases. The combination in row B just exhausts her \$40. The combinations shown in the table are the same as those plotted on her budget line in Fig. 8.1.

We noted that the budget line shows that Lisa can also afford any combination *inside* the budget line. The quantities in those combinations would be smaller than the ones shown in Table 8.2, and they do not exhaust her \$40. But smaller quantities don't maximize her utility. Why? The marginal utilities of movies and pop are positive, so the more of each that Lisa buys, the more total utility she gets.

**Find the Total Utility for Each Just-Affordable Combination** Table 8.2 shows the total utility that Lisa gets from the just-affordable quantities of movies and pop. The second and third columns show the numbers for movies and the fourth and fifth columns show those for pop. The centre column adds the total utility from movies to the total utility from pop. This number, the total utility from movies *and* pop, is what Lisa wants to maximize.

In row A of the table, Lisa sees no movies and buys 10 cases of pop. She gets no utility from movies and 260 units of utility from pop. Her total utility from movies and pop (the centre column) is 260 units.

**TABLE 8.2** Lisa's Utility-Maximizing Choice

	Movies \$8		Total utility from movies and pop	Pop \$4	
	Quantity (per month)	Total utility		Total utility	Cases (per month)
A	0	0	260	260	10
B	1	50	298	248	8
C	2	90	315	225	6
D	3	122	305	183	4
E	4	150	273	123	2
F	5	176	176	0	0

In row C of the table, Lisa sees 2 movies and buys 6 cases of pop. She gets 90 units of utility from movies and 225 units of utility from pop. Her total utility from movies and pop is 315 units. This combination of movies and pop maximizes Lisa's total utility. That is, given the prices of movies and pop, Lisa's best choice when she has \$40 to spend is to see 2 movies and buy 6 cases of pop.

If Lisa sees 1 movie, she can buy 8 cases of pop, but she gets only 298 units of total utility—17 units less than the maximum attainable. If she sees 3 movies, she can buy only 4 cases of pop. She gets 305 units of total utility—10 units less than the maximum attainable.

**Consumer Equilibrium** We've just described Lisa's consumer equilibrium. A **consumer equilibrium** is a situation in which a consumer has allocated all of his or her available income in the way that maximizes his or her total utility, given the prices of goods and services. Lisa's consumer equilibrium is 2 movies and 6 cases of pop.

To find Lisa's consumer equilibrium, we did something that an economist might do but that a consumer is not likely to do: We measured her total utility from all the affordable combinations of movies and pop and then, by inspection of the numbers, selected the combination that gives the highest total utility. There is a more natural way of finding a consumer's equilibrium—a way that uses the idea that choices are made at the margin, as you first met in Chapter 1. Let's look at this approach.

## Choosing at the Margin

When you go shopping you don't do utility calculations. But you do decide how to allocate your budget, and you do so in a way that you think is best for you. If you could make yourself better off by spending a few more dollars on an extra unit of one item and the same number of dollars less on something else, you would make that change. So, when you've allocated your budget in the best possible way, you can't make yourself better off by spending more on one item and less on others.

**Marginal Utility per Dollar** Economists interpret your best possible choice by using the idea of marginal utility per dollar. *Marginal utility* is the increase in total utility that results from consuming *one more unit* of a good. **Marginal utility per dollar** is the *marginal utility* from a good that results from spending *one more dollar* on it.

The distinction between these two marginal concepts is clearest for a good that is infinitely divisible, such as gasoline. You can buy gasoline by the smallest fraction of a litre and literally choose to spend one more or one less dollar at the pump. The increase in total utility that results from spending one more dollar at the pump is the marginal utility per dollar from gasoline. When you buy a movie ticket or a case of pop, you must spend your dollars in bigger lumps. To buy our marginal movie ticket or case of pop, you must spend the price of one unit and your total utility increases by the marginal utility from that item. So to calculate the marginal utility per dollar for movies (or pop), we must divide marginal utility from the good by its price.

Call the marginal utility from movies  $MU_M$  and the price of a movie  $P_M$ . Then the *marginal utility per dollar from movies* is equal to:

$$MU_M/P_M$$

Call the marginal utility from pop  $MU_P$  and the price of a case of pop  $P_P$ . Then the *marginal utility per dollar from pop* is equal to:

$$MU_P/P_P$$

By comparing the marginal utility per dollar from all the goods that a person buys, we can determine whether the budget has been allocated in the way that maximizes total utility.

Let's see how we use the marginal utility per dollar to define a utility-maximizing rule.

**Utility-Maximizing Rule** A consumer's total utility is maximized by following the rule:

- Spend all the available income.
- Equalize the marginal utility per dollar for all goods.

**Spend All the Available Income** Because more consumption brings more utility, only those choices that exhaust income can maximize utility. For Lisa, combinations of movies and pop that leave her with money to spend don't give her as much total utility as those that exhaust her \$40 per month income.

**Equalize the Marginal Utility per Dollar** The basic idea behind this rule is to move dollars from good *B* to good *A* if doing so increases the utility from good *A* by more than it decreases the utility from good *B*. Such a utility-increasing move is possible if the marginal utility per dollar from good *A* exceeds that from good *B*.

But buying more of good *A* decreases its marginal utility. And buying less of good *B* increases its marginal utility. So by moving dollars from good *B* to good *A*, total utility rises, and the gap between the marginal utilities per dollar gets smaller.

As long as the gap exists—as long as the marginal utility per dollar from good *A* exceeds that from good *B*—total utility can be increased by spending more on *A* and less on *B*. But when enough dollars have been moved from *B* to *A* to make the two marginal utilities per dollar equal, total utility cannot be increased further. Total utility is maximized.

**Lisa's Marginal Calculation** Let's apply the basic idea to Lisa. To calculate Lisa's marginal utility per dollar, we divide her marginal utility numbers for each quantity of each good by the price of the good. The table in Fig. 8.3 shows these calculations for Lisa, and the graph illustrates the situation on Lisa's budget line. The rows of the table are three of her affordable combinations of movies and pop.

**Too Much Pop and Too Few Movies** In row *B*, Lisa sees 1 movie a month and consumes 8 cases of pop a month. Her marginal utility from seeing 1 movie a month is 50 units. Because the price of a movie is \$8, Lisa's marginal utility per dollar from movies is 50 units divided by \$8, or 6.25 units of utility per dollar.

Lisa's marginal utility from pop when she consumes 8 cases of pop a month is 10 units. Because the price of pop is \$4 a case, Lisa's marginal utility

per dollar from pop is 10 units divided by \$4, or 2.50 units of utility per dollar.

When Lisa sees 1 movie and consumes 8 cases of pop a month, her marginal utility per dollar from pop is *less than* her marginal utility per dollar from movies. That is,

$$MU_P/P_P < MU_M/P_M.$$

If Lisa spent an extra dollar on movies and a dollar less on pop, her total utility would increase. She would get 6.25 units from the extra dollar spent on movies and lose 2.50 units from the dollar less spent on pop. Her total utility would increase by 3.75 units ( $6.25 - 2.50$ ).

**Too Little Pop and Too Many Movies** In row *D*, Lisa sees 3 movies a month and consumes 4 cases of pop. Her marginal utility from seeing the third movie a month is 32 units. At a price of \$8 a movie, Lisa's marginal utility per dollar from movies is 32 units divided by \$8, or 4 units of utility per dollar.

Lisa's marginal utility from pop when she buys 4 cases a month is 24 units. At a price of \$4 a case, Lisa's marginal utility per dollar from pop is 24 units divided by \$4, or 6 units of utility per dollar.

When Lisa sees 3 movies and consumes 4 cases of pop a month, her marginal utility per dollar from pop *exceeds* her marginal utility per dollar from movies. That is,

$$MU_P/P_P > MU_M/P_M.$$

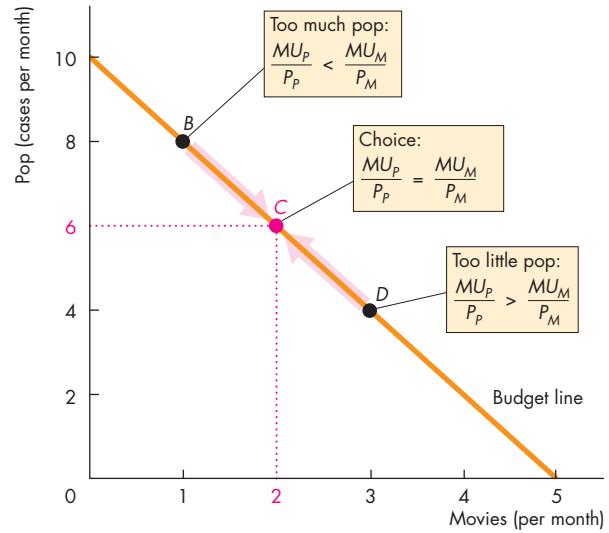
If Lisa spent an extra dollar on pop and a dollar less on movies, her total utility would increase. She would get 6 units from the extra dollar spent on pop and she would lose 4 units from the dollar less spent on movies. Her total utility would increase by 2 units ( $6 - 4$ ).

**Utility-Maximizing Movies and Pop** In Fig. 8.3, if Lisa moves from row *B* to row *C*, she increases the movies she sees from 1 to 2 a month and decreases the pop she consumes from 8 to 6 cases a month. Her marginal utility per dollar from movies falls to 5 and her marginal utility per dollar from pop rises to 5.

Similarly, if Lisa moves from row *D* to row *C*, she decreases the movies she sees from 3 to 2 a month and increases the pop she consumes from 4 to 6 cases a month. Her marginal utility per dollar from movies rises to 5 and her marginal utility per dollar from pop falls to 5.

When Lisa sees 2 movies and consumes 6 cases of pop a month, her marginal utility per dollar from

**FIGURE 8.3** Equalizing Marginal Utilities per Dollar



	Movies (\$8 each)			Pop (\$4 per case)		
	Quantity	Marginal utility	Marginal utility per dollar	Cases	Marginal utility	Marginal utility per dollar
<i>B</i>	1	50	6.25	8	10	2.50
<i>C</i>	2	40	5.00	6	20	5.00
<i>D</i>	3	32	4.00	4	24	6.00

The graph shows Lisa's budget line and identifies three points on it. The rows of the table describe these points.

At point *B* (row *B*), with 1 movie and 8 cases of pop, Lisa's marginal utility per dollar from pop is less than that from movies: Buy less pop and see more movies.

At point *D* (row *D*), with 3 movies and 4 cases of pop, Lisa's marginal utility per dollar from pop is greater than that from movies: Buy more pop and see fewer movies.

At point *C* (row *C*), with 2 movies and 6 cases of pop, Lisa's marginal utility per dollar from pop is equal to that from movies: Lisa's utility is maximized.

#### MyEconLab Animation and Draw Graph

pop *equals* her marginal utility per dollar from movies. That is,

$$MU_P/P_P = MU_M/P_M.$$

Lisa can't move from this allocation of her budget without making herself worse off.

## The Power of Marginal Analysis

The method we've just used to find Lisa's utility-maximizing choice of movies and pop is an example of the power of marginal analysis. Lisa doesn't need a computer and a spreadsheet program to maximize utility. She can achieve this goal by comparing the marginal gain from having more of one good with the marginal loss from having less of another good.

The rule that she follows is simple: If the marginal utility per dollar from movies exceeds the marginal utility per dollar from pop, see more movies and buy less pop; if the marginal utility per dollar from pop exceeds the marginal utility per dollar from movies, buy more pop and see fewer movies.

More generally, if the marginal gain from an action exceeds the marginal loss, take the action. You will meet this principle time and again in your study of economics, and you will find yourself using it when you make your own economic choices, especially when you must make big decisions.

## Revealing Preferences

When we introduced the idea of utility, we arbitrarily chose 50 units as Lisa's total utility from 1 movie, and we pretended that we asked Lisa to tell us how many units of utility she got from different quantities of pop and movies.

You're now about to discover that we don't need to ask Lisa to tell us her preferences. We can figure them out for ourselves by observing what she buys at various prices.

Also, the units in which we measure Lisa's preferences don't matter. Any arbitrary units will work. In this respect, utility is like temperature. Predictions about the freezing point of water don't depend on the temperature scale; and predictions about a household's consumption choice don't depend on the units of utility.

**Lisa's Preferences** In maximizing total utility by making the marginal utility per dollar equal for all goods, the units in which utility is measured do not matter.

You've seen that when Lisa maximizes her total utility, her marginal utility per dollar from pop,  $MU_P/P_P$ , equals her marginal utility per dollar from movies,  $MU_M/P_M$ . That is,

$$MU_P/P_P = MU_M/P_M.$$

Multiply both sides of this equation by the price of pop,  $P_P$ , to obtain

$$MU_P = MU_M \times (P_P/P_M).$$

This equation says that the marginal utility from pop,  $MU_P$ , is equal to the marginal utility from movies,  $MU_M$ , multiplied by the ratio of the price of pop,  $P_P$ , to the price of a movie,  $P_M$ .

The ratio  $P_P/P_M$  is the relative price of pop in terms of movies: It is the number of movies that must be forgone to get 1 case of pop. It is also the opportunity cost of pop. (See Chapter 2, p. 33 and Chapter 3, p. 56.)

For Lisa, when  $P_M = \$8$  and  $P_P = \$4$  we observe that in a month she goes to the movies twice and buys 6 cases of pop. So we know that her  $MU_P$  from 6 cases of pop equals her  $MU_M$  from 2 movies multiplied by  $\$4/\$8$  or 0.5. That is, for Lisa, the marginal utility from 6 cases of pop equals one-half of the marginal utility from 2 movies.

If we observe the choices that Lisa makes at more prices, we can find more rows in her utility schedule. By her choices, Lisa reveals her preferences.

**Units of Utility Don't Matter** Lisa's marginal utility from 6 cases of pop is one-half of her marginal utility from 2 movies. So if the marginal utility from the second movie is 40 units, then the marginal utility from the sixth case of pop is 20 units. But if we call the marginal utility from the second movie 50 units, then the marginal utility from the sixth case of pop is 25 units. The units of utility are arbitrary.

## REVIEW QUIZ

- 1 Why does a consumer spend the entire budget?
- 2 What is the marginal utility per dollar and how is it calculated?
- 3 What two conditions are met when a consumer is maximizing utility?
- 4 Explain why equalizing the marginal utility per dollar for all goods maximizes utility.

Work these questions in Study Plan 8.2 and get instant feedback. Do a Key Terms Quiz.

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You now understand the marginal utility theory of consumer choices. Your next task is to see what the theory predicts.

## Predictions of Marginal Utility Theory

We're now going to use marginal utility theory to make some predictions. You will see that marginal utility theory predicts the law of demand. The theory also predicts that a fall in the price of a substitute of a good decreases the demand for the good and that for a normal good, a rise in income increases demand. All these effects, which in Chapter 3 we simply assumed, are predictions of marginal utility theory.

To derive these predictions, we will study the effects of three events:

- A fall in the price of a movie
- A rise in the price of pop
- A rise in income

### A Fall in the Price of a Movie

With the price of a movie at \$8 and the price of pop at \$4, Lisa is maximizing utility by seeing 2 movies and buying 6 cases of pop each month. Then, with no change in her \$40 income and no change in the price of pop, the price of a movie falls from \$8 to \$4. How does Lisa change her buying plans?

**Finding the New Quantities of Movies and Pop** You can find the effect of a fall in the price of a movie on the quantities of movies and pop that Lisa buys in a three-step calculation:

1. Determine the just-affordable combinations of movies and pop at the new prices.
2. Calculate the new marginal utilities per dollar from the good whose price has changed.
3. Determine the quantities of movies and pop that make their marginal utilities per dollar equal.

**Affordable Combinations** The lower price of a movie means that Lisa can afford more movies or more pop. Table 8.3 shows her new affordable combinations. In row A, if she continues to see 2 movies a month, she can now afford 8 cases of pop; and in row B, if she continues to buy 6 cases of pop, she can now afford 4 movies. Lisa can afford any of the combinations shown in the rows of Table 8.3.

The next step is to find her new marginal utilities per dollar from movies.

**New Marginal Utilities per Dollar from Movies** A person's preferences don't change just because a price has changed. With no change in her preferences, Lisa's marginal utilities in Table 8.3 are the same as those in Table 8.1. But because the price of a movie has changed, the marginal utility *per dollar* from movies changes. In fact, with a halving of the price of a movie from \$8 to \$4, the marginal utility per dollar from movies has doubled.

The numbers in Table 8.3 show Lisa's new marginal utility per dollar from movies for each quantity of movies. The table also shows Lisa's marginal utility per dollar from pop for each quantity.

**Equalizing the Marginal Utilities per Dollar** You can see that if Lisa continues to see 2 movies a month and buy 6 cases of pop, her marginal utility per dollar from movies (row A) is 10 units and her marginal utility per dollar from pop (row B) is 5 units. Lisa is buying too much pop and too few movies. If she spends a dollar more on movies and a dollar less on pop, her total utility increases by 5 units (10 – 5).

If Lisa continues to buy 6 cases of pop and increases the number of movies to 4 (row B), her

**TABLE 8.3** How a Change in the Price of Movies Affects Lisa's Choices

	Movies (\$4 each)			Pop (\$4 per case)		
	Quantity	Marginal utility	Marginal utility per dollar	Cases	Marginal utility	Marginal utility per dollar
<b>A</b>	0	0		10	5	1.25
	1	50	12.50	9	7	1.75
	<b>2</b>	<b>40</b>	<b>10.00</b>	8	10	2.50
<b>B</b>	3	32	8.00	7	13	3.25
	4	28	7.00	<b>6</b>	20	<b>5.00</b>
	5	26	6.50	5	22	5.50
<b>C</b>	<b>6</b>	<b>24</b>	<b>6.00</b>	<b>4</b>	24	<b>6.00</b>
	7	22	5.50	3	36	9.00
	8	20	5.00	2	48	12.00
	9	17	4.25	1	75	18.75
	10	16	4.00	0	0	

marginal utility per dollar from movies falls to 7 units, but her marginal utility per dollar from pop is 5 units. Lisa is still buying too much pop and seeing too few movies. If she spends a dollar more on movies and a dollar less on pop, her total utility increases by 2 units ( $7 - 5$ ).

But if Lisa sees 6 movies and buys 4 cases of pop a month (row C), her marginal utility per dollar from movies (6 units) equals her marginal utility per dollar from pop and she is maximizing utility. If Lisa moves from this allocation of her budget in either direction, her total utility decreases.

Lisa's increased purchases of movies results from a substitution effect—she substitutes the now lower-priced movies for pop—and an income effect—she can afford more movies.

**A Change in the Quantity Demanded** Lisa's increase in the quantity of movies that she sees is a change in the quantity demanded. It is the change in the quantity of movies that she plans to see each month when the price of a movie changes and all other influences on buying plans remain the same. We illustrate a change in the quantity demanded by a movement along a demand curve.

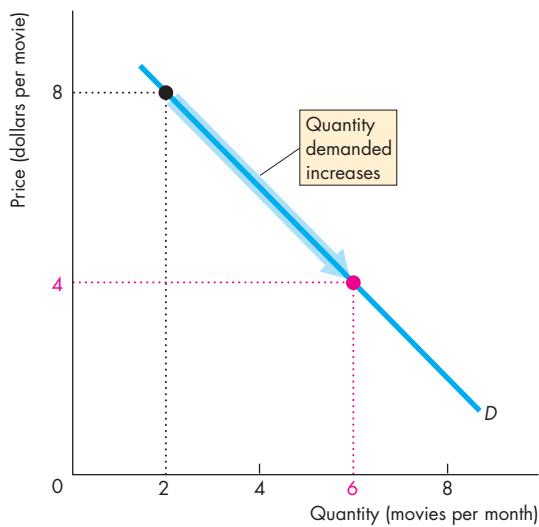
Figure 8.4(a) shows Lisa's demand curve for movies. When the price of a movie is \$8, Lisa sees 2 movies a month. When the price of a movie falls to \$4, she sees 6 movies a month. Lisa moves downward along her demand curve for movies.

The demand curve traces the quantities that maximize utility at each price, with all other influences remaining the same. You can also see that utility-maximizing choices generate a downward-sloping demand curve. Utility maximization with diminishing marginal utility implies the law of demand.

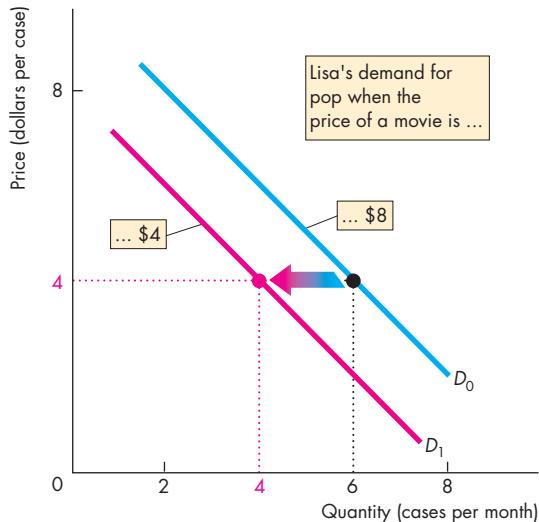
**A Change in Demand** The decrease in the quantity of pop that Lisa buys is the change in the quantity of pop that she plans to buy at a given price of pop when the price of a movie changes. It is a change in her demand for pop. We illustrate a change in demand by a shift of a demand curve.

Figure 8.4(b) shows Lisa's demand curve for pop. The price of pop is fixed at \$4 a case. When the price of a movie is \$8, Lisa buys 6 cases of pop on demand curve  $D_0$ . When the price of a movie falls to \$4, Lisa buys 4 cases of pop on demand curve  $D_1$ . The fall in the price of a movie decreases Lisa's demand for pop. Her demand curve for pop shifts leftward. For Lisa, pop and movies are substitutes.

**FIGURE 8.4** A Fall in the Price of a Movie



(a) Demand for movies



(b) Demand for pop

When the price of a movie falls and the price of pop remains the same, the quantity of movies demanded by Lisa increases, and in part (a), Lisa moves along her demand curve for movies. Also, when the price of a movie falls, Lisa's demand for pop decreases, and in part (b), her demand curve for pop shifts leftward. For Lisa, pop and movies are substitutes.

## A Rise in the Price of Pop

Now suppose that with the price of a movie at \$4, the price of pop rises from \$4 to \$8 a case. How does this price change influence Lisa's buying plans? We find the answer by repeating the three-step calculation with the new price of pop.

Table 8.4 shows Lisa's new affordable combinations. In row A, if she continues to buy 4 cases of pop a month she can afford to see only 2 movies; and in row B, if she continues to see 6 movies a month, she can afford only 2 cases of pop.

Table 8.4 shows Lisa's marginal utility per dollar from pop for each quantity of pop when the price is \$8 a case. The table also shows Lisa's marginal utility per dollar from movies for each quantity.

If Lisa continues to buy 4 cases of pop (row A), her marginal utility per dollar from pop is 3. But she must cut the movies she sees to 2, which increases her marginal utility per dollar from movies to 10. Lisa is buying too much pop and too few movies. If she spends a dollar less on pop and a dollar more on movies, her utility increases by 7 units ( $10 - 3$ ).

But if Lisa sees 6 movies a month and cuts her pop to 2 cases (row B), her marginal utility per dollar from movies (6 units) equals her marginal utility per dollar from pop. She is maximizing utility.

Lisa's decreased purchases of pop results from an income effect—she can afford fewer cases and she buys fewer cases. But she continues to buy the same quantity of movies.

**TABLE 8.4** How a Change in the Price of Pop Affects Lisa's Choices

	Movies (\$4 each)			Pop (\$8 per case)		
	Quantity	Marginal utility	Marginal utility per dollar	Cases	Marginal utility	Marginal utility per dollar
A	0	0	10.00	5	22	2.75
	2	40	10.00	4	24	3.00
	4	28	7.00	3	36	4.50
B	6	24	6.00	2	48	6.00
	8	20	5.00	1	75	9.38
	10	16	4.00	0	0	

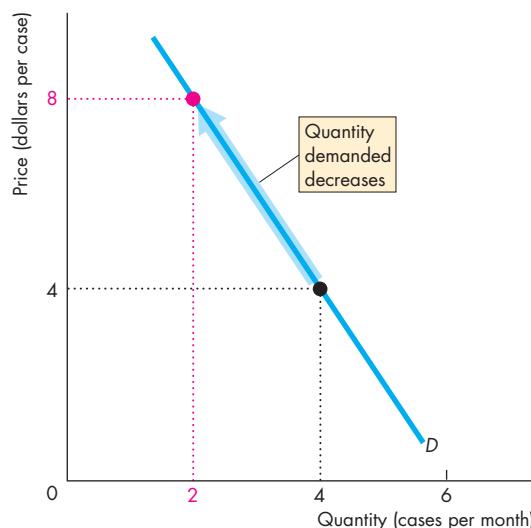
**Lisa's Demand for Pop** Now that we've calculated the effect of a change in the price of pop on Lisa's buying plans when income and the price of movies remain the same, we have found two points on her demand curve for pop: When the price of pop is \$4 a case, Lisa buys 4 cases a month; and when the price of pop is \$8 a case, she buys 2 cases a month.

Figure 8.5 shows these points on Lisa's demand curve for pop. It also shows the change in the quantity of pop demanded when the price of pop rises and all other influences on Lisa's buying plans remain the same.

In this example, Lisa continues to buy the same quantity of movies, but this outcome does not always occur. It is a consequence of Lisa's preferences. With different marginal utilities, she might have decreased or increased the quantity of movies that she sees when the price of pop changes.

You've seen that marginal utility theory predicts the law of demand—the way in which the quantity demanded of a good changes when its price changes. Next, we'll see how marginal utility theory predicts the effect of a change in income on demand.

**FIGURE 8.5** A Rise in the Price of Pop



When the price of pop rises and the price of a movie and Lisa's income remain the same, the quantity of pop demanded by Lisa decreases. Lisa moves along her demand curve for pop.

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## A Rise in Income

Suppose that Lisa's income increases from \$40 to \$56 a month and that the price of a movie is \$4 and the price of pop is \$4 a case. With these prices and with an income of \$40 a month, Lisa sees 6 movies and buys 4 cases of pop a month (Table 8.3). How does the increase in Lisa's income from \$40 to \$56 change her buying plans?

Table 8.5 shows the calculations needed to answer this question. If Lisa continues to see 6 movies a month, she can now afford to buy 8 cases of pop (row A); if she continues to buy 4 cases of pop, she can now afford to see 10 movies (row C).

In row A, Lisa's marginal utility per dollar from movies is greater than her marginal utility per dollar from pop. She is buying too much pop and too few movies. In row C, Lisa's marginal utility per dollar from movies is less than her marginal utility per dollar from pop. She is buying too little pop and too many movies. But in row B, when Lisa sees 8 movies a month and buys 6 cases of pop, her marginal utility per dollar from movies equals that from pop. She is maximizing utility.

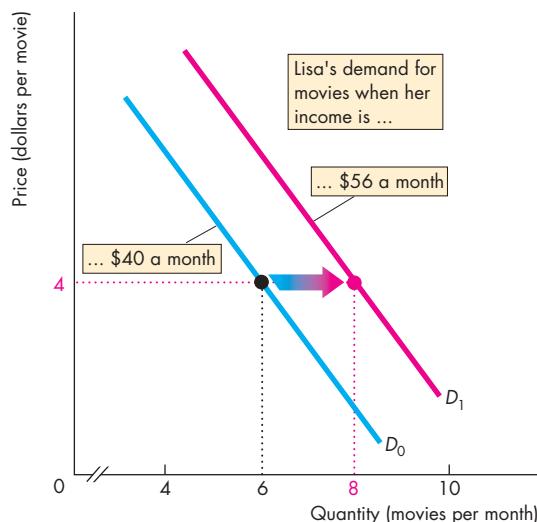
Figure 8.6 shows the effects of the rise in Lisa's income on her demand curves for movies and pop. The price of each good is \$4. When Lisa's income

**TABLE 8.5** Lisa's Choices with an Income of \$56 a Month

	Movies (\$4 each)			Pop (\$4 per case)		
	Quantity	Marginal utility	Marginal utility per dollar	Cases	Marginal utility	Marginal utility per dollar
<b>A</b>	4	28	7.00	10	5	1.25
	5	26	6.50	9	7	1.75
	<b>6</b>	<b>24</b>	<b>6.00</b>	8	10	2.50
	7	22	5.50	7	13	3.25
<b>B</b>	<b>8</b>	20	<b>5.00</b>	<b>6</b>	20	<b>5.00</b>
	9	17	4.25	5	22	5.50
<b>C</b>	10	16	4.00	<b>4</b>	24	<b>6.00</b>

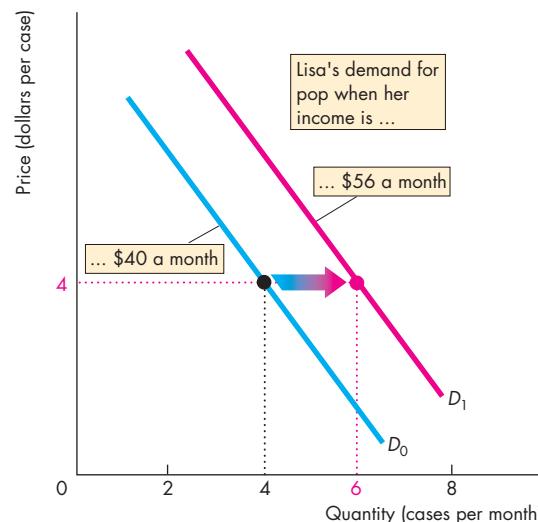
rises to \$56 a month, she sees 2 more movies and buys 2 more cases of pop. Her demand curves for both movies and pop shift rightward—her demand for both movies and pop increases. With a larger income, the consumer always buys more of a *normal* good. For Lisa, movies and pop are normal goods.

**FIGURE 8.6** The Effects of a Rise in Income



**(a) Demand for movies**

When Lisa's income increases, her demand for movies and her demand for pop increase. Lisa's demand curves for



**(b) Demand for pop**

movies, in part (a), and for pop, in part (b), shift rightward. For Lisa, movies and pop are normal goods.

## The Paradox of Value

The price of water is low and the price of a diamond is high, but water is essential to life while diamonds are used mostly for decoration. How can valuable water be so cheap while a relatively useless diamond is so expensive? This so-called *paradox of value* has puzzled philosophers for centuries. Not until the theory of marginal utility had been developed could anyone give a satisfactory answer.

**The Paradox Resolved** The paradox is resolved by distinguishing between *total utility* and *marginal utility*. The total utility that we get from water is enormous. But remember, the more we consume of something, the smaller is its marginal utility.

We use so much water that its marginal utility—the benefit we get from one more glass of water or another 30 seconds in the shower—diminishes to a small value.

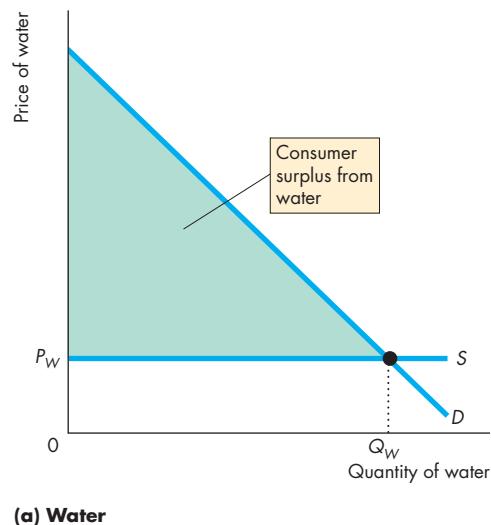
Diamonds, on the other hand, have a small total utility relative to water, but because we buy few diamonds, they have a high marginal utility.

When a household has maximized its total utility, it has allocated its income in the way that makes the marginal utility per dollar equal for all goods. That is, the marginal utility from a good divided by the price of the good is equal for all goods.

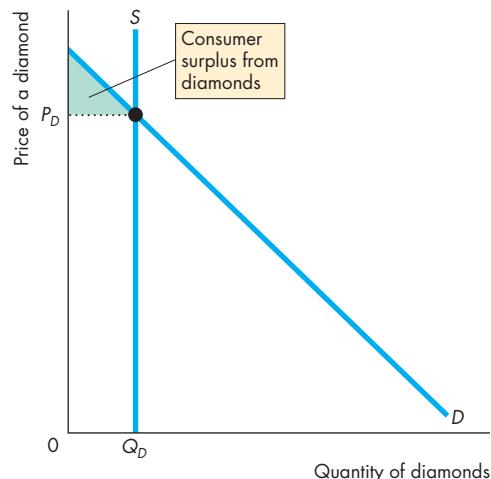
This equality of marginal utilities per dollar holds true for diamonds and water: Diamonds have a high price and a high marginal utility. Water has a low price and a low marginal utility. When the high marginal utility from diamonds is divided by the high price of a diamond, the result is a number that equals the low marginal utility from water divided by the low price of water. The marginal utility per dollar is the same for diamonds and water.

**Value and Consumer Surplus** Another way to think about the paradox of value and illustrate how it is resolved uses *consumer surplus*. Figure 8.7 explains the paradox of value by using this idea. The supply of water in part (a) is perfectly elastic at price  $P_W$ , so the quantity of water consumed is  $Q_W$  and the large green area shows the consumer surplus from water. The supply of diamonds in part (b) is perfectly inelastic at the quantity  $Q_D$ , so the price of a diamond is  $P_D$  and the small green area shows the consumer surplus from diamonds. Water is cheap, but brings a large consumer surplus; diamonds are expensive, but bring a small consumer surplus.

**FIGURE 8.7** The Paradox of Value



(a) Water



(b) Diamonds

Part (a) shows the demand for and supply of water. Supply is perfectly elastic at the price  $P_W$ . At this price, the quantity of water consumed is  $Q_W$  and the large green triangle shows consumer surplus. Part (b) shows the demand for and supply of diamonds. Supply is perfectly inelastic at the quantity  $Q_D$ . At this quantity, the price of a diamond is  $P_D$  and the small green triangle shows consumer surplus. Water is valuable—has a large consumer surplus—but cheap. Diamonds are less valuable than water—have a smaller consumer surplus—but are expensive.

## Temperature: An Analogy

Utility is similar to temperature—both are abstract concepts. You can't *observe* temperature. You can observe water turning to steam if it is hot enough or turning to ice if it is cold enough. You can also construct an instrument—a thermometer—that can help you to predict when such changes will occur. We call the scale on the thermometer *temperature* and we call the units of temperature *degrees*. But like the units of utility, these degree units are arbitrary. We can use Celsius units or Fahrenheit units or some other units.

The concept of utility helps us to make predictions about consumption choices in much the same way that the concept of temperature helps us to make predictions about physical phenomena.

Admittedly, marginal utility theory does not enable us to predict how buying plans change with the same precision that a thermometer enables us to predict when water will turn to ice or steam. But the theory provides important insights into buying plans and has some powerful implications. It helps us to understand why people buy more of a good or service when its price falls and why people buy more of most goods when their incomes increase. It also resolves the paradox of value.

We're going to end this chapter by looking at some new ways of studying individual economic choices and consumer behaviour.



## REVIEW QUIZ

- 1 When the price of a good falls and the prices of other goods and a consumer's income remain the same, explain what happens to the consumption of the good whose price has fallen and to the consumption of other goods.
- 2 Elaborate on your answer to the previous question by using demand curves. For which good does demand change and for which good does the quantity demanded change?
- 3 If a consumer's income increases and if all goods are normal goods, explain how the quantity bought of each good changes.
- 4 What is the paradox of value and how is the paradox resolved?
- 5 What are the similarities between utility and temperature?

Work these questions in Study Plan 8.3 and get instant feedback.

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## Economics in Action

### Maximizing Utility from Recorded Music

In 2012, Americans spent \$7 billion on recorded music, down from more than \$14 billion in 2000. But the combined quantity of discs and downloads bought increased from 1 billion in 2000 to 1.6 billion in 2012 and the average price of a unit of recorded music fell from \$14.00 to \$3.90.

The average price fell because the mix of formats bought changed dramatically. In 2001, we bought 900 million CDs; in 2012, we bought only 211 million CDs and downloaded almost 1.4 billion music files. Figure 1 shows the longer history of the changing formats of recorded music.

The music that we buy isn't just one good—it is several goods. Singles and albums are different goods; downloads and discs are different goods; and downloads to a computer and downloads to a cellphone are different goods. There are five major categories, and the table shows the quantities of each that we bought in 2011 (excluding DVDs and cassettes).

Format	Singles (millions in 2011)	Albums (millions in 2011)
Disc	211	241
Download	1,400	105
Mobile	116	—

Source of data: Recording Industry Association of America.

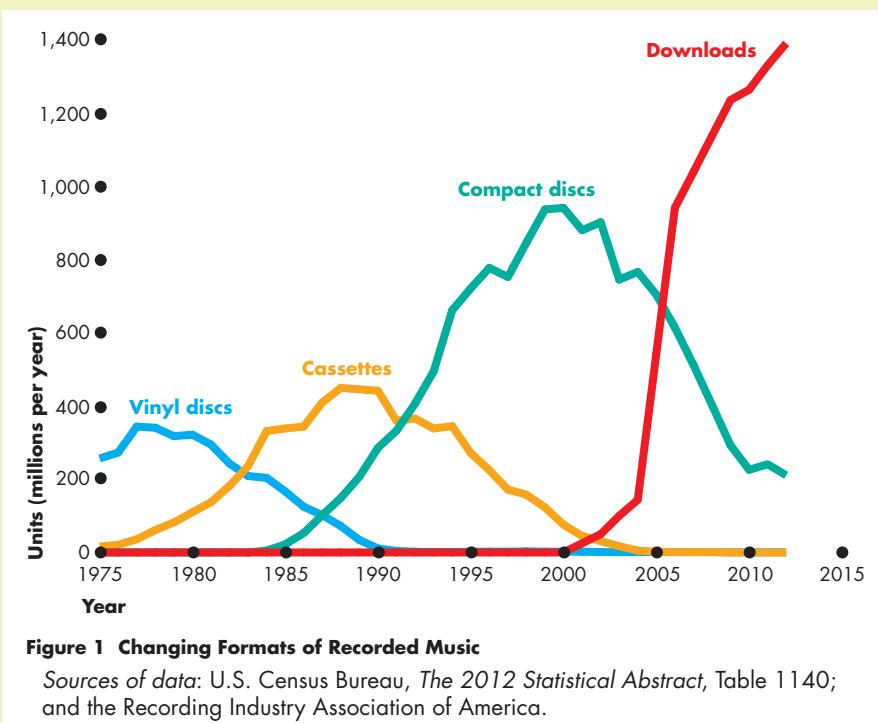
Most people buy all their music in digital form, but many still buy physical CDs and some people buy both downloads and CDs.

We get utility from the singles and albums that we buy, and the more songs and albums we have, the more utility we get. But our marginal utility from songs and albums decreases as the quantity that we own increases.

We also get utility from convenience. A song that we can buy with a mouse click and play with the spin of a wheel is more convenient both to buy and to use than a song on a CD. The convenience of songs downloaded over the Internet means that, song for song, we get more utility from a song downloaded than we get from a song on a physical CD.

But most albums are still played at home on a CD player. So for most people, a physical CD is a more convenient medium for delivering an album. Album for album, people on average get more utility from a CD than from a download.

When we decide how many singles and albums to

**Figure 1** Changing Formats of Recorded Music

Sources of data: U.S. Census Bureau, *The 2012 Statistical Abstract*, Table 1140; and the Recording Industry Association of America.

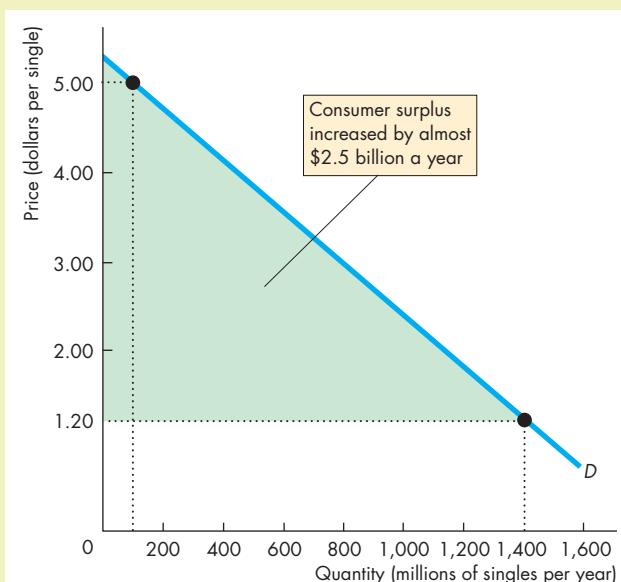
In the 1970s, recorded music came on vinyl discs. Cassettes gradually replaced vinyl, then compact discs (CDs) gradually replaced cassettes, and today, digital files downloaded to computers and mobile devices are replacing physical CDs.

download and how many to buy on CD, we compare the marginal utility per dollar from each type of music in each format. We make the marginal utility per dollar from each type of music in each format equal, as the equations below show.

The market for single downloads has created an enormous consumer surplus. Figure 2 shows the demand curve for singles. One point on the demand curve is the 2001 price and quantity—100 million singles were bought at an average price of \$5.00. Another point on the demand curve is that for 2012—1,400 million singles downloaded at \$1.20 each.

If the demand curve has not shifted and is linear (assumed here), we can calculate the increase in consumer surplus generated by the fall in the price and the increase in the quantity demanded. The green area of the figure shows this increase in consumer surplus.

Consumer surplus increases by  $(\$5.00 - \$1.20) = \$3.80$  on the first 100 million and by  $\$3.80 \times 1,300/2$  on the additional 1,300 singles. So the increase in consumer surplus is \$2.85 billion.

**Figure 2** The Demand for Singles

$$\frac{MU_{\text{single downloads}}}{P_{\text{single downloads}}} = \frac{MU_{\text{album downloads}}}{P_{\text{album downloads}}} = \frac{MU_{\text{physical singles}}}{P_{\text{physical singles}}} = \frac{MU_{\text{physical albums}}}{P_{\text{physical albums}}} = \frac{MU_{\text{mobile}}}{P_{\text{mobile}}}$$

$$\frac{MU_{\text{single downloads}}}{\$1.20} = \frac{MU_{\text{album downloads}}}{\$10.99} = \frac{MU_{\text{physical singles}}}{\$4.76} = \frac{MU_{\text{physical albums}}}{\$9.99} = \frac{MU_{\text{mobile}}}{\$2.39}$$



## New Ways of Explaining Consumer Choices

When William Stanley Jevons developed marginal utility theory in the 1860s, he would have loved to look inside people's brains and "see" their utility. But he believed that the human brain was the ultimate black box that could never be observed directly. For Jevons, and for most economists today, the purpose of marginal utility theory is to explain our *actions*, not what goes on inside our brains.

Economics has developed over the past 150 years with little help from and paying little attention to advances being made in psychology. Both economics and psychology seek to explain human behaviour, but they have developed different ways of attacking the challenge.

A few researchers *have* paid attention to the potential payoff from exploring economic problems by using the tools of psychology. These researchers, some economists and some psychologists, think that marginal utility theory is based on a view of how people make choices that attributes too much to reason and rationality. They propose an alternative approach based on the methods of psychology.

Other researchers, some economists and some neuroscientists, are using new tools to look inside the human brain and open up Jevons' "black box."

This section provides a very brief introduction to these new and exciting areas of economics. We'll explore the two related research agendas:

- Behavioural economics
- Neuroeconomics

### Behavioural Economics

**Behavioural economics** studies the ways in which limits on the human brain's ability to compute and implement rational decisions influences economic behaviour—both the decisions that people make and the consequences of those decisions for the way markets work.

Behavioural economics starts with observed behaviour. It looks for anomalies—choices that do not seem to be rational. It then tries to account for the anomalies by using ideas developed by psychologists that emphasize features of the human brain that limit rational choice.

In behavioural economics, instead of being rational utility maximizers, people are assumed to have three impediments that prevent rational choice: bounded rationality, bounded willpower, and bounded self-interest.

**Bounded Rationality** Bounded rationality is rationality that is limited by the computing power of the human brain. We can't always work out the rational choice.

For Lisa, choosing between movies and pop, it seems unlikely that she would have much trouble figuring out what to buy. But toss Lisa some uncertainty and the task becomes harder. She's read the reviews of *Iron Man 3* on Fandango, but does she really want to see that movie? How much marginal utility will it give her? Faced with uncertainty, people might use rules of thumb, listen to the views of others, and make decisions based on gut instinct rather than on rational calculation.

**Bounded Willpower** Bounded willpower is the less-than-perfect willpower that prevents us from making a decision that we know, at the time of implementing the decision, we will later regret.

Lisa might be feeling particularly thirsty when she passes a pop vending machine. Under Lisa's rational utility-maximizing plan, she buys her pop at the discount store, where she gets it for the lowest possible price. Lisa has already bought her pop for this month, but it is at home. Spending \$1 on a can now means giving up a movie later this month.

Lisa's rational choice is to ignore the temporary thirst and stick to her plan. But she might not possess the willpower to do so—sometimes she will and sometimes she won't.

**Bounded Self-Interest** Bounded self-interest is the limited self-interest that results in sometimes suppressing our own interests to help others.

A hurricane hits the Florida coast and Lisa, feeling sorry for the victims, donates \$10 to a fundraiser. She now has only \$30 to spend on movies and pop this month. The quantities that she buys are not, according to her utility schedule, the ones that maximize her utility.

The main applications of behavioural economics are in two areas: finance, where uncertainty is a key factor in decision making, and savings, where the future

is a key factor. But one behaviour observed by behavioural economists is more general and might affect your choices. It is called the endowment effect.

**The Endowment Effect** The endowment effect is the tendency for people to value something more highly simply because they own it. If you have allocated your income to maximize utility, then the price you would be willing to accept to give up something that you own (for example, your coffee mug) should be the same as the price you are willing to pay for an identical one.

In experiments, students seem to display the endowment effect: The price they are willing to pay for a coffee mug that is identical to the one they own is less than the price they would be willing to accept to give up the coffee mug that they own. Behavioural economists say that this behaviour contradicts marginal utility theory.

## Neuroeconomics

**Neuroeconomics** is the study of the activity of the human brain when a person makes an economic decision. The discipline uses the observational tools and ideas of neuroscience to obtain a better understanding of economic decisions.

Neuroeconomics is an experimental discipline. In an experiment, a person makes an economic decision and the electrical or chemical activity of the person's brain is observed and recorded using the same type of equipment that neurosurgeons use to diagnose brain disorders.

The observations provide information about which regions of the brain are active at different points in the process of making an economic decision.

Observations show that some economic decisions generate activity in the area of the brain (called the prefrontal cortex) where we store memories, analyze data, and anticipate the consequences of our actions. If people make rational utility-maximizing decisions, it is in this region of the brain that the decision occurs.

But observations also show that some economic decisions generate activity in the region of the brain (called the hippocampus) where we store memories of anxiety and fear. Decisions that are influenced by activity in this part of the brain might not be rational and be driven by fear or panic.

Neuroeconomists are also able to observe the amount of a brain hormone (called dopamine), the quantity of which increases in response to pleasurable events and decreases in response to disappointing events. These observations might one day enable neuroeconomists to actually measure utility and shine a bright light inside what was once believed to be the ultimate black box.

## Controversy

The new ways of studying consumer choice that we've briefly described here are being used more widely to study business decisions and decisions in financial markets, and this type of research is surely going to become more popular.

But behavioural economics and neuroeconomics generate controversy. Most economists hold the view of Jevons that the goal of economics is to explain the decisions that we observe people making and not to explain what goes on inside people's heads.

Most economists would prefer to probe apparent anomalies more deeply and figure out why they are not anomalies after all.

Economists also point to the power of marginal utility theory and its ability to explain consumer choice and demand as well as resolve the paradox of value.

## REVIEW QUIZ

- 1 Define behavioural economics.
- 2 What are the three limitations on human rationality that behavioural economics emphasizes?
- 3 Define neuroeconomics.
- 4 What do behavioural economics and neuroeconomics seek to achieve?

Work these questions in Study Plan 8.4 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

◆ You have now completed your study of the marginal utility theory and learned some new ideas about how people make economic choices. You can see marginal utility theory in action once again in *Economics in the News* on pp. 194–195, where it is used to examine the effects of a tax on big cups of sugary soft drinks.

# Influencing Consumer Choice for Sugary Drinks

## Push for Sugary Drinks Tax Ignites Heated Debate

*Business in Vancouver*

July 23, 2013

Health proponents are urging the B.C. government to implement a “substantial” tax of up to 20% on packaged and fountain drinks that contain high amounts of sugar to curb obesity, particularly among youth.

“Taxes are a component of what is needed for a successful strategy to reduce consumption of sweet drinks,” provincial health officer Perry Kendall told *Business in Vancouver* last week. “It would have to be a substantial tax to alter people’s habits and that would be very controversial, so I don’t know that there’s much political appetite.”

British Columbia Healthy Living Alliance (BCHLA) director Mary Collins told BIV that the tax could be revenue-neutral to government, and therefore be more palatable, if taxes were simultaneously reduced on healthier foods or on other items where the government wants to encourage spending. . . .

Critics of a new sugary-drink tax include Fraser Institute economists who say the government should not interfere with the free market by encouraging or discouraging consumer behaviour. . . .

Canadian Beverage Association president Jim Goetz [said] “Education, not taxation, is the key to combating obesity,” he said. “A tax won’t make people healthier.”

Collins said she supports the government investing to educate youth on healthy eating choices, and she supports its strategy to have guidelines to curb the sale of unhealthy foods and beverages in B.C. schools.

She said education alone is insufficient. . . .

Written by Glen Korstrom. Copyright © 2013. Used by permission of *Business in Vancouver*.

### ESSENCE OF THE STORY

- British Columbia Healthy Living Alliance (BCHLA) director Mary Collins wants the B.C. government to put a 20 percent tax on sugary drinks to decrease their consumption.
- Canadian Beverage Association president Jim Goetz says education, not taxation, is needed to limit consumption of sugary drinks.
- Provincial health officer Perry Kendall says a high tax would be needed to have much effect.
- Economists at the Fraser Institute say the government should not interfere with the free market by taxing sugary drinks.

**MyEconLab** More Economics in the News

## ECONOMIC ANALYSIS

- Concerned that people are choosing to consume more sugary drinks than is healthy, British Columbia Healthy Living Alliance director Mary Collins wants the B.C. government to put a 20 percent tax on sugary drinks to decrease their consumption.
- Consumers choose to buy the quantity of sugary drinks that maximizes utility.
- To do so, they make the marginal utility per dollar for all other goods and services equal to the marginal utility per dollar for sugary drinks. That is:

$$\frac{MU_O}{P_O} = \frac{MU_S}{P_S}$$

- Because of the way in which drinks are sold, there isn't a single price. The table shows some prices in London, Ontario, in May 2014.

Prices of Sugary Drinks		
Size (ounces)	At the movies	At a 7-Eleven
21	3.89	–
32	4.39	0.99
36	4.89 + free refill	–
44	–	2.09
64	5.50	2.49

- These prices tell us that people who buy their drinks in big cups pay a lower price per ounce.
- Because a person who buys a 36-ounce cup gets a free refill, the price of the marginal ounce for that person is zero. With a price of zero, the buyer drinks the quantity at which marginal utility is also zero.
- The suggestions for decreasing the consumption of sugary drinks are ways of raising the price.
- A tax raises the price because the tax is added to the price received by the seller. A ban on large cups raises the price because the price per ounce is higher for small cups than for large cups. Both have a similar outcome.
- Faced with a higher price of sugary drinks, a consumer maximizes utility by consuming a smaller quantity of sugary drinks.
- The reason is that consumer equilibrium becomes:

$$\frac{MU_O}{P_O} = \frac{MU_S}{(P_S + \text{tax})}$$

- When a tax is imposed, the price doesn't rise by the entire amount of the tax, but generally  $P_S + \text{tax}$  is greater than the price before that tax was imposed.

- Because  $P_S + \text{tax}$  is greater than  $P_S$ ,  $MU_S$  must rise to restore the equality of the marginal utilities per dollar. But to increase  $MU_S$ , the quantity of sugary drinks consumed must decrease.
- Figure 1 illustrates and makes clear why consumption of sugary drinks decreases.
- Suppose that with no tax, the budget line is  $BL_0$  and to make the marginal utilities per dollar equal, the consumer buys 60 ounces of drinks and 100 units of other goods and services per day.
- A tax raises the price to  $P_S + \text{tax}$  and the budget line becomes steeper as  $BL_1$ .
- If the consumer continues to drink 60 ounces per day, the quantity of other items bought must fall to 50 units a day.  $MU_O$  rises and

$$\frac{MU_O}{P_O} > \frac{MU_S}{(P_S + \text{tax})}$$

- To restore maximum utility, the consumer buys a smaller quantity of sugary drinks, which increases  $MU_S$ , and a greater quantity of other goods, which decreases  $MU_O$ . A movement up along the budget line  $BL_1$  shows these changes in quantities consumed.
- The consumer substitutes other goods and services for sugary drinks until

$$\frac{MU_O}{P_O} = \frac{MU_S}{(P_S + \text{tax})}$$

- At this point, the consumer is again maximizing utility.

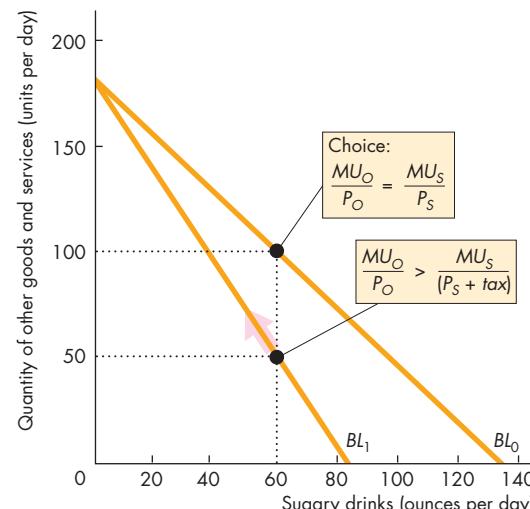


Figure 1 The Effect of a Tax

## SUMMARY

### Key Points

#### Consumption Choices (pp. 178–180)

- A household's consumption choices are determined by its consumption possibilities and preferences.
- A budget line defines a household's consumption possibilities.
- A household's preferences can be described by a utility schedule that lists the total utility and marginal utility derived from various quantities of goods and services consumed.
- The principle of diminishing marginal utility is that the marginal utility from a good or service decreases as consumption of the good or service increases.

Working Problems 1 to 5 will give you a better understanding of consumption choices.

#### Utility-Maximizing Choice (pp. 181–184)

- A consumer's objective is to maximize total utility.
- Total utility is maximized when all the available income is spent and when the marginal utility per dollar from all goods is equal.
- If the marginal utility per dollar for good *A* exceeds that for good *B*, total utility increases if the quantity purchased of good *A* increases and the quantity purchased of good *B* decreases.

Working Problems 6 to 8 will give you a better understanding of a consumer's utility-maximizing choice.

#### Predictions of Marginal Utility Theory (pp. 185–191)

- Marginal utility theory predicts the law of demand. That is, other things remaining the

same, the higher the price of a good, the smaller is the quantity demanded of that good.

- Marginal utility theory also predicts that, other things remaining the same, an increase in the consumer's income increases the demand for a normal good.
- Marginal utility theory resolves the paradox of value.
- Total value is *total* utility or consumer surplus. But price is related to *marginal* utility.
- Water, which we consume in large amounts, has a high total utility and a large consumer surplus, but the price of water is low and the marginal utility from water is low.
- Diamonds, which we buy in small quantities, have a low total utility and a small consumer surplus, but the price of a diamond is high and the marginal utility from diamonds is high.

Working Problems 9 to 13 will give you a better understanding of the predictions of marginal utility theory.

#### New Ways of Explaining Consumer Choices

(pp. 192–193)

- Behavioural economics studies limits on the ability of the human brain to compute and implement rational decisions.
- Bounded rationality, bounded willpower, and bounded self-interest are believed to explain some choices.
- Neuroeconomics uses the ideas and tools of neuroscience to study the effects of economic events and choices inside the human brain.

Working Problems 14 and 15 will give you a better understanding of the new ways of explaining consumer choices.

### Key Terms

Behavioural economics, 192  
 Budget line, 178  
 Consumer equilibrium, 181  
 Diminishing marginal utility, 180

Marginal utility, 179  
 Marginal utility per dollar, 182  
 Neuroeconomics, 193  
 Preferences, 179

### MyEconLab Key Terms Quiz

Total utility, 179  
 Utility, 179



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 8 Study Plan.

Jake has a budget of \$10 per week to spend on song downloads and cookies. The table shows his marginal utility from each good.

Quantity per week	Marginal utility from a song	Marginal utility from a cookie
1	14	20
2	12	16
3	11	12
4	10	8
5	9	4
6	8	3
7	7	2
8	6	1

### Questions

- If the price of a song is \$1 and the price of a cookie is \$2, what are the quantities of songs and cookies that exhaust Jake's budget?
- How does Jake allocate his \$10 between songs and cookies?
- If the price of a song rises to \$2 and the price of a cookie remains at \$2, does Jake buy fewer songs and cookies, or only fewer songs?

### Solutions

- The price of a cookie is twice that of a song, so each additional cookie Jake buys costs him 2 fewer songs—the opportunity cost of a cookie is 2 songs. So Jake can buy either 8 songs and 1 cookie, or 6 songs and 2 cookies, or 4 songs and 3 cookies, or 2 songs and 4 cookies, or 0 songs and 5 cookies.

**Key Point:** To exhaust the budget, all income is spent.

- To find the quantities of songs and cookies that Jake buys, use the fact that to maximize utility, he must make the marginal utility per dollar the same for the two goods.

Make a table in which each row is an affordable combination and that shows the marginal utility for each good. Then calculate the marginal utility per dollar for each row.

The table in the next column shows the calculations. Check the calculation on row *B*, with 4 songs and 3 cookies. The marginal utility of a song is 10 units and because the price of a song is \$1, the marginal utility per dollar is also 10 units.

Songs (\$1 each)			Cookies (\$2 each)		
Quantity	Marginal utility	Marginal utility per dollar	Quantity	Marginal utility	Marginal utility per dollar
A	12	12	4	8	4
B	10	10	3	12	6
C	8	8	2	16	8
D	6	6	1	20	10

The marginal utility of a cookie is 12 units, and because the price of a cookie is \$2, the marginal utility per dollar is 6 units.

Because the marginal utility per dollar from 4 songs exceeds that from 3 cookies, Jake can increase his total utility by buying more songs and fewer cookies.

In the highlighted row *C*, the marginal utilities per dollar are equal and total utility is maximized. So Jake buys 6 songs and 2 cookies to maximize utility.

**Key Point:** Total utility is maximized when the marginal utility per dollar is the same for all goods.

- If the price of a song rises to \$2, the affordable combinations shrink. Jake can now afford combinations of quantities that total 5. The table shows the new combinations that exhaust Jake's budget. It also shows the marginal utility per dollar for each possibility.

Songs (\$2 each)			Cookies (\$2 each)		
Quantity	Marginal utility	Marginal utility per dollar	Quantity	Marginal utility	Marginal utility per dollar
A	14	14	4	8	4
B	12	6	3	12	6
C	5.5	5.5	2	16	8
D	5	5	1	20	10

To maximize his utility, Jake now buys only 2 songs and increases his consumption of cookies to 3 per week in row *B*.

**Key Point:** When the price of a good rises, the utility-maximizing quantity of that good decreases, but the quantity of other goods bought might increase or decrease.



## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 15 in Chapter 8 Study Plan and get instant feedback.

### Consumption Choices (Study Plan 8.1)

Jerry has \$12 a week to spend on yogurt and berries. The price of yogurt is \$2, and berries are \$4 a box.

1. List the combinations of yogurt and berries that Jerry can afford. Draw a graph of his budget line with the quantity of berries plotted on the  $x$ -axis.
2. How do Jerry's consumption possibilities change if, other things remaining the same, (i) the price of berries falls and (ii) Jerry's income increases?

Use the following data to work Problems 3 to 5.

Max has \$35 a day to spend on windsurfing and snorkelling and he can spend as much time as he likes doing them. The price of renting equipment for windsurfing is \$10 an hour and for snorkelling is \$5 an hour. The table shows the total utility Max gets from each activity.

Hours per day	Total utility from windsurfing	Total utility from snorkelling
1	120	40
2	220	76
3	300	106
4	360	128
5	396	140
6	412	150
7	422	158

3. Calculate Max's marginal utility from windsurfing at each number of hours per day. Does Max's marginal utility from windsurfing obey the principle of diminishing marginal utility?
4. Calculate Max's marginal utility from snorkelling at each number of hours per day. Does Max's marginal utility from snorkelling obey the principle of diminishing marginal utility?
5. Which does Max enjoy more: his 6th hour of windsurfing or his 6th hour of snorkelling?

### Utility-Maximizing Choice (Study Plan 8.2)

Use the data in Problem 3 to work Problems 6 to 8.

6. Make a table of the combinations of hours spent windsurfing and snorkelling that Max can afford.
7. Add two columns to your table in Problem 6 and list Max's marginal utility per dollar from windsurfing and from snorkelling.
8. a. To maximize his utility, how many hours a day does Max spend on each activity?

- If Max spent a dollar more on windsurfing and a dollar less on snorkelling than in part (a), how would his total utility change?
- If Max spent a dollar less on windsurfing and a dollar more on snorkelling than in part (a), how would his total utility change?

### Predictions of Marginal Utility Theory (Study Plan 8.3)

Use the data in Problem 3 to work Problems 9 to 13.

9. If the price of renting windsurfing equipment is cut to \$5 an hour, how many hours a day does Max spend on each activity?
10. Draw Max's demand curve for rented windsurfing equipment. Over the price range \$5 to \$10 an hour, is Max's demand elastic or inelastic?
11. How does Max's demand for snorkelling equipment change when the price of windsurfing equipment falls? What is Max's cross elasticity of demand for snorkelling with respect to the price of windsurfing? Are windsurfing and snorkelling substitutes or complements for Max?
12. If Max's income increases from \$35 to \$55 a day, how does his demand for windsurfing equipment change? Is windsurfing a normal good? Explain.
13. If Max's income increases from \$35 to \$55 a day, how does his demand for snorkelling equipment change? Is snorkelling a normal good? Explain.

### New Ways of Explaining Consumer Choices

(Study Plan 8.4)

Use the news clip to work Problems 14 and 15.

**Eating Away the Innings in Baseball's Cheap Seats**  
Baseball and gluttony, two of America's favourite pastimes, are merging, with Major League Baseball stadiums offering all-you-can-eat seats. Some fans try to "set personal records" during their first game, but by the third time in such seats they eat normally.

- Source: *USA Today*, March 6, 2008
14. What conflict might exist between utility-maximization and setting "personal records" for eating? What does the fact that fans eat less at subsequent games indicate about their marginal utility from ballpark food as they consume more?
  15. How can setting personal records for eating be reconciled with marginal utility theory? Which ideas of behavioural economics are consistent with the information in the news clip?

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

### MyEconLab

You can work these problems in MyEconLab if assigned by your instructor.

#### Consumption Choices

16. Tim buys 2 pizzas and sees 1 movie a week when he has \$16 to spend, a movie ticket is \$8, and a pizza is \$4. Draw Tim's budget line. If the price of a movie ticket falls to \$4, describe how Tim's consumption possibilities change.
17. Cindy has \$70 a month to spend, and she can spend as much time as she likes playing golf and tennis. The price of an hour of golf is \$10, and the price of an hour of tennis is \$5. The table shows Cindy's marginal utility from each sport.

Hours per month	Marginal utility from golf	Marginal utility from tennis
1	80	40
2	60	36
3	40	30
4	30	10
5	20	5
6	10	2
7	6	1

Make a table that shows Cindy's affordable combinations of hours playing golf and tennis. If Cindy increases her expenditure to \$100, describe how her consumption possibilities change.

#### Utility-Maximizing Choice

Use the information in Problem 17 to work Problems 18 to 24.

18. a. How many hours of golf and how many hours of tennis does Cindy play to maximize her utility?  
b. Compared to part (a), if Cindy spent a dollar more on golf and a dollar less on tennis, by how much would her total utility change?  
c. Compared to part (a), if Cindy spent a dollar less on golf and a dollar more on tennis, by how much would her total utility change?
19. Explain why, if Cindy equalized the marginal utility per hour of golf and tennis, she would *not* maximize her utility.

#### Predictions of Marginal Utility Theory

- Cindy's tennis club raises its price of an hour of tennis from \$5 to \$10, other things remaining the same.
20. a. List the combinations of hours spent playing golf and tennis that Cindy can now afford and her marginal utility per dollar from golf and from tennis.  
b. How many hours does Cindy now spend playing golf and how many hours does she spend playing tennis?
  21. Use the information in Problem 20 to draw Cindy's demand curve for tennis. Over the price range of \$5 to \$10 an hour of tennis, is Cindy's demand for tennis elastic or inelastic?
  22. Explain how Cindy's demand for golf changed when the price of an hour of tennis increased from \$5 to \$10 in Problem 20. What is Cindy's cross elasticity of demand for golf with respect to the price of tennis? Are tennis and golf substitutes or complements for Cindy?
  23. Cindy loses her math tutoring job and the amount she has to spend on golf and tennis falls from \$70 to \$35 a month. With the price of an hour of golf at \$10 and of tennis at \$5, calculate the change in the hours she spends playing golf. For Cindy, is golf a normal good or an inferior good? Is tennis a normal good or an inferior good?
  24. Cindy takes a Club Med vacation, the cost of which includes unlimited sports activities. With no extra charge for golf and tennis, Cindy allocates a total of 4 hours a day to these activities.
    - a. How many hours does Cindy play golf and how many hours does she play tennis?
    - b. What is Cindy's marginal utility from golf and from tennis?
    - c. Why does Cindy equalize the marginal utilities rather than the marginal utility per dollar from golf and from tennis?
  25. Jim has made his best affordable choice of muffins and coffee. He spends all of his income on 10 muffins at \$1 each and 20 cups of coffee at \$2 each. Now the price of a muffin rises to \$1.50 and the price of coffee falls to \$1.75 a cup.
    - a. Can Jim still buy 10 muffins and 20 coffees?
    - b. If Jim changes the quantities he buys, will he

buy more or fewer muffins and more or less coffee? Explain your answer.

26. Ben spends \$50 a year on 2 bunches of flowers and \$50 a year on 10,000 litres of tap water. Ben is maximizing utility and his marginal utility from water is 0.5 unit per litre.
- Are flowers or water more valuable to Ben?
  - Explain how Ben's expenditure on flowers and water illustrates the paradox of value.

### New Ways of Explaining Consumer Choices

Use the following news clip to work Problems 27 to 29.

#### Putting a Price on Human Life

Researchers at Stanford and the University of Pennsylvania estimated that a healthy human life is worth about \$129,000. Using Medicare records on treatment costs for kidney dialysis as a benchmark, the authors tried to pinpoint the threshold beyond which ensuring another "quality" year of life was no longer financially worthwhile. The study comes amid debate over whether Medicare should start rationing healthcare on the basis of cost effectiveness.

Source: *Time*, June 9, 2008

- Why might Medicare ration healthcare according to treatment that is "financially worthwhile" as opposed to providing as much treatment as is needed by a patient, regardless of costs?
- What conflict might exist between a person's valuation of his or her own life and the rest of society's valuation of that person's life?
- How does the potential conflict between self-interest and the social interest complicate setting a financial threshold for Medicare treatments?

#### Economics in the News

- After you have studied *Economics in the News* (pp. 194–195), answer the following questions.
- If big cups of sugary drinks are banned at restaurants, theatres, and stadiums:
  - How will the price of an ounce of sugary drink change?
  - How will consumers respond to the change in price?

- b. If a tax is imposed on sugary drinks, how does:

- The marginal utility of a sugary drink change?
- The consumer surplus in the market for sugary drinks change?

#### 31. Five Signs You Have Too Much Money

When a bottle of water costs \$38, it's hard not to agree that bottled water is a fool's drink. The drink of choice among image-conscious status seekers and high-end tee-totalers in L.A. is Bling H<sub>2</sub>O. It's not the water that accounts for the cost of the \$38, but the "limited edition" bottle decked out in Swarovski crystals.

Source: CNN, January 17, 2006

- Assuming that the price of a bottle of Bling H<sub>2</sub>O is \$38 in all the major U.S. cities, what might its popularity in Los Angeles reveal about consumers' incomes or preferences in Los Angeles relative to other major U.S. cities?
- Why might the marginal utility from a bottle of Bling H<sub>2</sub>O decrease more rapidly than the marginal utility from ordinary bottled water?

#### 32. How to Buy Happiness. Cheap

On any day, the rich tend to be a bit happier than the poor, but increases in average living standards don't seem to make people happier. The average American's income is up 80% since 1972, but the percentage describing themselves as "very happy" (roughly a third) hasn't changed. As living standards increase, most of us respond by raising our own standards: Things that once seemed luxuries now are necessities and we work harder to buy stuff that satisfies us less and less.

Source: CNN, October 1, 2004

According to the news clip:

- How do widespread increases in living standards influence total utility?
- How do total utility and marginal utility from consumption change over time?



# 9

## POSSIBILITIES, PREFERENCES, AND CHOICES

After studying this chapter,  
you will be able to:

- ◆ Describe a household's budget line and show how it changes when prices or income change
- ◆ Use indifference curves to map preferences and explain the principle of diminishing marginal rate of substitution
- ◆ Predict the effects of changes in prices and income on consumption choices

**The iPad has revolutionized the way we read**

magazines and books and check our grades. Yet the magazine racks and bookstore shelves are still stuffed with traditional printed paper. Similarly, low-priced on-demand movies and DVD rentals have made it easier to watch a movie at home. Yet we're also going to movie theatres in ever-greater numbers.

In this chapter, we're going to study a model that explains the choices we make and applies it to choices about using new and old technologies. At the end of the chapter in *Economics in the News*, we use the model to explain why e-books are taking off and replacing printed books.

## Consumption Possibilities

Consumption choices are limited by income and by prices. A household has a given amount of income to spend and cannot influence the prices of the goods and services it buys. A household's **budget line** describes the limits to its consumption choices.

Let's look at Lisa's budget line.\* Lisa has an income of \$40 a month to spend. She buys two goods: movies and pop. The price of a movie is \$8, and the price of pop is \$4 a case.

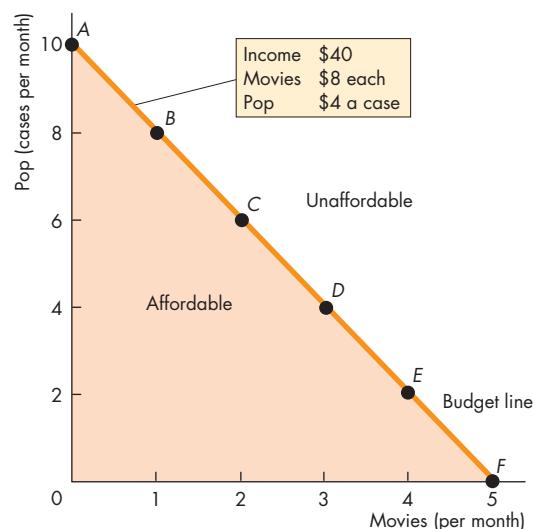
Figure 9.1 shows alternative combinations of movies and pop that Lisa can afford. In row *A*, she sees no movies and buys 10 cases of pop. In row *F*, she sees 5 movies and buys no pop. Both of these combinations of movies and pop exhaust the \$40 available. Check that the combination of movies and pop in each of the other rows also exhausts Lisa's \$40 of income. The numbers in the table and the points *A* through *F* in the graph describe Lisa's consumption possibilities.

**Divisible and Indivisible Goods** Some goods—called divisible goods—can be bought in any quantity desired. Examples are gasoline and electricity. We can best understand household choice if we suppose that all goods and services are divisible. For example, Lisa can see half a movie a month on average by seeing one movie every two months. When we think of goods as being divisible, the consumption possibilities are not only the points *A* through *F* shown in Fig. 9.1, but also all the intermediate points that form the line running from *A* to *F*. This line is Lisa's budget line.

**Affordable and Unaffordable Quantities** Lisa's budget line is a constraint on her choices. It marks the boundary between what is affordable and what is unaffordable. She can afford any point on the line and inside it. She cannot afford any point outside the line. The constraint on her consumption depends on the prices and her income, and the constraint changes when the price of a good or her income changes. To see how, we use a budget equation.

\* If you have studied Chapter 8 on marginal utility theory, you have already met Lisa. This tale of her thirst for pop and zeal for movies will sound familiar to you—up to a point. In this chapter, we're going to explore her budget line in more detail and use a different method for representing preferences—one that does not require the idea of utility.

**FIGURE 9.1** The Budget Line



Consumption possibility	Movies (per month)	Pop (cases per month)
A	0	10
B	1	8
C	2	6
D	3	4
E	4	2
F	5	0

Lisa's budget line shows the boundary between what she can and cannot afford. The rows of the table list Lisa's affordable combinations of movies and pop when her income is \$40, the price of pop is \$4 a case, and the price of a movie is \$8. For example, row *A* tells us that Lisa spends all of her \$40 income when she buys 10 cases of pop and sees no movies. The figure graphs Lisa's budget line. Points *A* through *F* in the graph represent the rows of the table. For divisible goods, the budget line is the continuous line *AF*. To calculate the equation for Lisa's budget line, start with expenditure equal to income:

$$\$4Q_P + \$8Q_M = \$40.$$

Divide by \$4 to obtain

$$Q_P + 2Q_M = 10.$$

Subtract  $2Q_M$  from both sides to obtain

$$Q_P = 10 - 2Q_M.$$

## Budget Equation

We can describe the budget line by using a *budget equation*. The budget equation starts with the fact that

$$\text{Expenditure} = \text{Income}.$$

Expenditure is equal to the sum of the price of each good multiplied by the quantity bought. For Lisa,

$$\begin{aligned}\text{Expenditure} &= (\text{Price of pop} \times \text{Quantity of pop}) \\ &\quad + (\text{Price of a movie} \times \text{Quantity of movies}).\end{aligned}$$

Call the price of pop  $P_P$ , the quantity of pop  $Q_P$ , the price of a movie  $P_M$ , the quantity of movies  $Q_M$ , and income  $Y$ . We can now write Lisa's budget equation as

$$P_P Q_P + P_M Q_M = Y.$$

Or, using the prices Lisa faces, \$4 a case of pop and \$8 a movie, and Lisa's income, \$40, we get

$$4Q_P + 8Q_M = 40.$$

Lisa can choose any quantities of pop ( $Q_P$ ) and movies ( $Q_M$ ) that satisfy this equation. To find the relationship between these quantities, divide both sides of the equation by the price of pop ( $P_P$ ) to get

$$Q_P + \frac{P_M}{P_P} \times Q_M = \frac{Y}{P_P}.$$

Now subtract the term  $(P_M/P_P) \times Q_M$  from both sides of this equation to get

$$Q_P = \frac{\$40}{\$4} - \frac{\$8}{\$4} \times Q_M.$$

For Lisa, income ( $Y$ ) is \$40, the price of a movie ( $P_M$ ) is \$8, and the price of pop ( $P_P$ ) is \$4 a case. So Lisa must choose the quantities of movies and pop to satisfy the equation

$$4Q_P + 8Q_M = 40,$$

or

$$Q_P = 10 - 2Q_M.$$

To interpret the equation, look at the budget line in Fig. 9.1 and check that the equation delivers that budget line. First, set  $Q_M$  equal to zero. The budget equation tells us that  $Q_P$ , the quantity of pop, is  $Y/P_P$ , which is 10 cases. This combination of  $Q_M$  and  $Q_P$  is the one shown in row A of the table in Fig. 9.1. Next set  $Q_M$  equal to 5.  $Q_P$  now equals zero (row F of the table). Check that you can derive the other rows.

The budget equation contains two variables chosen by the household ( $Q_M$  and  $Q_P$ ) and two variables that the household takes as given ( $Y/P_P$  and  $P_M/P_P$ ). Let's look more closely at these variables.

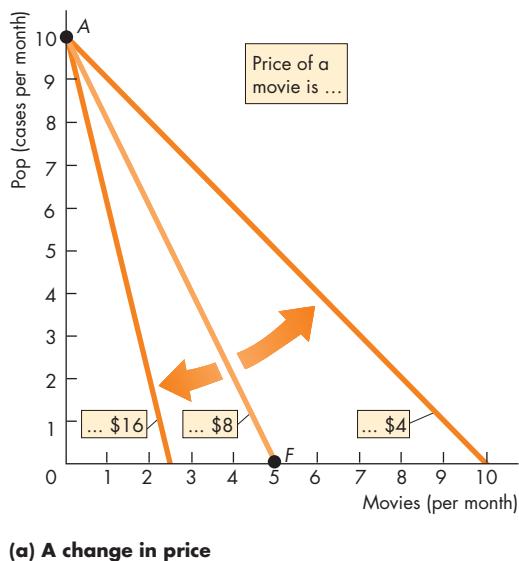
**Real Income** A household's **real income** is its income expressed as a quantity of goods that the household can afford to buy. Expressed in terms of pop, Lisa's real income is  $Y/P_P$ . This quantity is the maximum quantity of pop that she can buy. It is equal to her money income divided by the price of pop. Lisa's money income is \$40 and the price of pop is \$4 a case, so her real income in terms of pop is 10 cases, which is shown in Fig. 9.1 as the point at which the budget line intersects the  $y$ -axis.

**Relative Price** A **relative price** is the price of one good divided by the price of another good. In Lisa's budget equation, the variable  $P_M/P_P$  is the relative price of a movie in terms of pop. For Lisa,  $P_M$  is \$8 a movie and  $P_P$  is \$4 a case, so  $P_M/P_P$  is equal to 2 cases of pop per movie. That is, to see 1 movie, Lisa must give up 2 cases of pop.

You've just calculated Lisa's opportunity cost of seeing a movie. Recall that the opportunity cost of an action is the best alternative forgone. For Lisa to see 1 more movie a month, she must forgo 2 cases of pop. You've also calculated Lisa's opportunity cost of pop. For Lisa to buy 2 more cases of pop a month, she must forgo seeing 1 movie. So her opportunity cost of 2 cases of pop is 1 movie.

The relative price of a movie in terms of pop is the magnitude of the slope of Lisa's budget line. To calculate the slope of the budget line, recall the formula for slope (see the Chapter 1 Appendix): Slope equals the change in the variable measured on the  $y$ -axis divided by the change in the variable measured on the  $x$ -axis as we move along the line. In Lisa's case (Fig. 9.1), the variable measured on the  $y$ -axis is the quantity of pop and the variable measured on the  $x$ -axis is the quantity of movies. Along Lisa's budget line, as pop decreases from 10 to 0 cases, movies increase from 0 to 5. So the magnitude of the slope of the budget line is 10 cases divided by 5 movies, or 2 cases of pop per movie. The magnitude of this slope is exactly the same as the relative price we've just calculated. It is also the opportunity cost of a movie.

**A Change in Prices** When prices change, so does the budget line. The lower the price of the good measured on the  $x$ -axis, other things remaining the same, the flatter is the budget line. For example, if the price of a movie falls from \$8 to \$4, real income

**FIGURE 9.2** Changes in Prices and Income

In part (a), the price of a movie changes. A fall in the price from \$8 to \$4 rotates the budget line outward and makes it flatter. A rise in the price from \$8 to \$16 rotates the budget line inward and makes it steeper.

In part (b), income falls from \$40 to \$20 while the prices of movies and pop remain the same. The budget line shifts leftward, but its slope does not change.

**MyEconLab Animation and Draw Graph**

in terms of pop does not change, but the relative price of a movie falls. The budget line rotates outward and becomes flatter, as Fig. 9.2(a) illustrates. The higher the price of the good measured on the  $x$ -axis, other things remaining the same, the steeper is the budget line. For example, if the price of a movie rises from \$8 to \$16, the relative price of a movie increases. The budget line rotates inward and becomes steeper, as Fig. 9.2(a) illustrates.

**A Change in Income** A change in money income changes real income but does not change the relative price. The budget line shifts, but its slope does not change. An increase in money income increases real income and shifts the budget line rightward. A decrease in money income decreases real income and shifts the budget line leftward.

Figure 9.2(b) shows the effect of a change in money income on Lisa's budget line. The initial budget line when Lisa's income is \$40 is the same as in Fig. 9.1. The new budget line shows how much Lisa can buy if her income falls to \$20 a month. The two budget lines have the same slope because the relative price is the same. The new budget line is closer to the origin because Lisa's real income has decreased.

### REVIEW QUIZ

- 1 What does a household's budget line show?
- 2 How does the relative price and a household's real income influence its budget line?
- 3 If a household has an income of \$40 and buys only bus rides at \$2 each and magazines at \$4 each, what is the equation of the household's budget line?
- 4 If the price of one good changes, what happens to the relative price and the slope of the household's budget line?
- 5 If a household's money income changes and prices do not change, what happens to the household's real income and budget line?

Work these questions in Study Plan 9.1 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

We've studied the limits to what a household can consume. Let's now learn how we can describe preferences and make a map that contains a lot of information about a household's preferences.

## Preferences and Indifference Curves

You are going to discover a very cool idea: that of drawing a map of a person's preferences. A preference map is based on the intuitively appealing idea that people can sort all the possible combinations of goods into three groups: preferred, not preferred, and indifferent. To make this idea more concrete, let's ask Lisa to tell us how she ranks various combinations of movies and pop.

Figure 9.3 shows part of Lisa's answer. She tells us that she currently sees 2 movies and buys 6 cases of pop a month at point *C*. She then lists all the combinations of movies and pop that she says are just as acceptable to her as her current situation. When we plot these combinations of movies and pop, we get the green curve in Fig. 9.3(a). This curve is the key element in a preference map and is called an indifference curve.

An **indifference curve** is a line that shows combinations of goods among which a consumer is *indifferent*. The indifference curve in Fig. 9.3(a) tells us that Lisa is just as happy to see 2 movies and buy 6 cases of pop a month at point *C* as she is to have the combination of movies and pop at point *G* or at any other point along the curve.

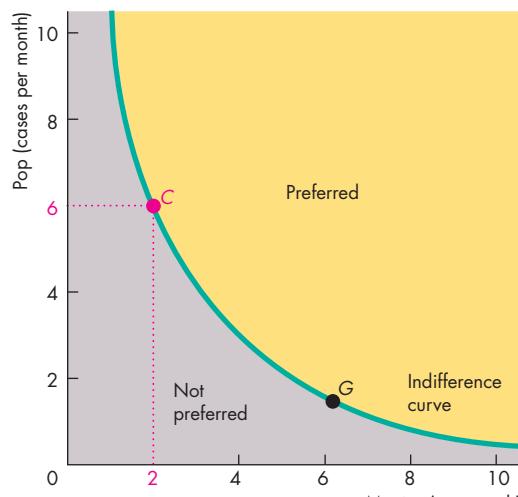
Lisa also says that she prefers all the combinations of movies and pop above the indifference curve in Fig. 9.3(a)—the yellow area—to those on the indifference curve. And she prefers any combination on the indifference curve to any combination in the grey area below the indifference curve.

The indifference curve in Fig. 9.3(a) is just one of a whole family of such curves. This indifference curve appears again in Fig. 9.3(b), labelled  $I_1$ . The curves labelled  $I_0$  and  $I_2$  are two other indifference curves. Lisa prefers any point on indifference curve  $I_2$  to any point on indifference curve  $I_1$ , and she prefers any point on  $I_1$  to any point on  $I_0$ . We refer to  $I_2$  as being a higher indifference curve than  $I_1$  and  $I_1$  as being higher than  $I_0$ .

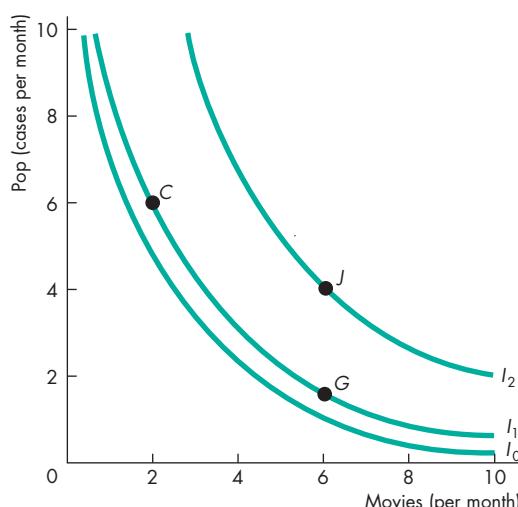
A preference map is a series of indifference curves that resemble the contour lines on a map. By looking at the shape of the contour lines on a map, we can draw conclusions about the terrain. Similarly, by looking at the shape of the indifference curves, we can draw conclusions about a person's preferences.

Let's learn how to "read" a preference map.

**FIGURE 9.3** A Preference Map



(a) An indifference curve



(b) Lisa's preference map

Part (a) shows one of Lisa's indifference curves. She is indifferent between point *C* (with 2 movies and 6 cases of pop) and all other points on the green indifference curve, such as *G*. She prefers points above the indifference curve (in the yellow area) to points on it, and she prefers points on the indifference curve to points below it (in the grey area). Part (b) shows three of the indifference curves— $I_0$ ,  $I_1$ , and  $I_2$ —in Lisa's preference map. She prefers point *J* to point *C* or *G*, and she prefers all the points on  $I_2$  to those on  $I_1$ .

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## Marginal Rate of Substitution

The **marginal rate of substitution** ( $MRS$ ) is the rate at which a person will give up good  $y$  (the good measured on the  $y$ -axis) to get an additional unit of good  $x$  (the good measured on the  $x$ -axis) while remaining indifferent (remaining on the same indifference curve). The magnitude of the slope of an indifference curve measures the marginal rate of substitution.

- If the indifference curve is *steep*, the marginal rate of substitution is *high*. The person is willing to give up a large quantity of good  $y$  to get an additional unit of good  $x$  while remaining indifferent.
- If the indifference curve is *flat*, the marginal rate of substitution is *low*. The person is willing to give up a small amount of good  $y$  to get an additional unit of good  $x$  while remaining indifferent.

Figure 9.4 shows you how to calculate the marginal rate of substitution.

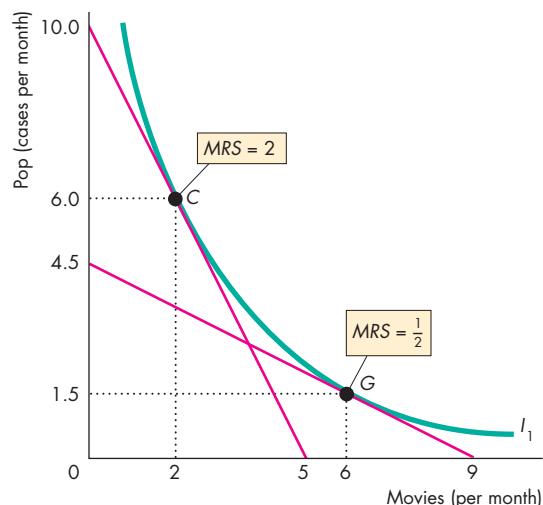
At point  $C$  on indifference curve  $I_1$ , Lisa buys 6 cases of pop and sees 2 movies. Her marginal rate of substitution is the magnitude of the slope of the indifference curve at point  $C$ . To measure this magnitude, place a straight line against, or tangent to, the indifference curve at point  $C$ . Along that line, as the quantity of pop decreases by 10 cases, the number of movies increases by 5—or 2 cases per movie. At point  $C$ , Lisa is willing to give up pop for movies at the rate of 2 cases per movie—a marginal rate of substitution of 2.

At point  $G$  on indifference curve  $I_1$ , Lisa buys 1.5 cases of pop and sees 6 movies. Her marginal rate of substitution is measured by the slope of the indifference curve at point  $G$ . That slope is the same as the slope of the tangent to the indifference curve at point  $G$ . Now, as the quantity of pop decreases by 4.5 cases, the number of movies increases by 9—or 1/2 case per movie. At point  $G$ , Lisa is willing to give up pop for movies at the rate of 1/2 case per movie—a marginal rate of substitution of 1/2.

As Lisa sees more movies and buys less pop, her marginal rate of substitution diminishes.

Diminishing marginal rate of substitution is the key assumption about preferences. A **diminishing marginal rate of substitution** is a general tendency for a person to be willing to give up less of good  $y$  to get one more unit of good  $x$ , while at the same time remaining indifferent as the quantity of  $x$  increases. In Lisa's case, she is less willing to give up pop to see one more movie as the number of movies she sees increases.

**FIGURE 9.4** The Marginal Rate of Substitution



The magnitude of the slope of an indifference curve is called the marginal rate of substitution ( $MRS$ ). The red line at point  $C$  tells us that Lisa is willing to give up 10 cases of pop to see 5 movies. Her marginal rate of substitution at point  $C$  is 10 divided by 5, which equals 2. The red line at point  $G$  tells us that Lisa is willing to give up 4.5 cases of pop to see 9 movies. Her marginal rate of substitution at point  $G$  is 4.5 divided by 9, which equals 1/2.

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### Your Diminishing Marginal Rate of Substitution

Think about your own diminishing marginal rate of substitution. Imagine that in a week, you drink 10 cases of pop and see no movies. Most likely, you are willing to give up a lot of pop so that you can see just 1 movie. But now imagine that in a week, you buy 1 case of pop and see 6 movies. Most likely, you will now not be willing to give up much pop to see a seventh movie. As a general rule, the greater the number of movies you see, the smaller is the quantity of pop you are willing to give up to see one additional movie.

The shape of a person's indifference curves incorporates the principle of the diminishing marginal rate of substitution because the curves are bowed toward the origin. The tightness of the bend of an indifference curve tells us how willing a person is to substitute one good for another while remaining indifferent. Let's look at some examples that make this point clear.

## Degree of Substitutability

Most of us would not regard movies and pop as being *close substitutes*, but they are substitutes. No matter how much you love pop, some increase in the number of movies you see will compensate you for being deprived of a can of pop. Similarly, no matter how much you love going to the movies, some number of cans of pop will compensate you for being deprived of seeing one movie. A person's indifference curves for movies and pop might look something like those for most ordinary goods and services shown in Fig. 9.5(a).

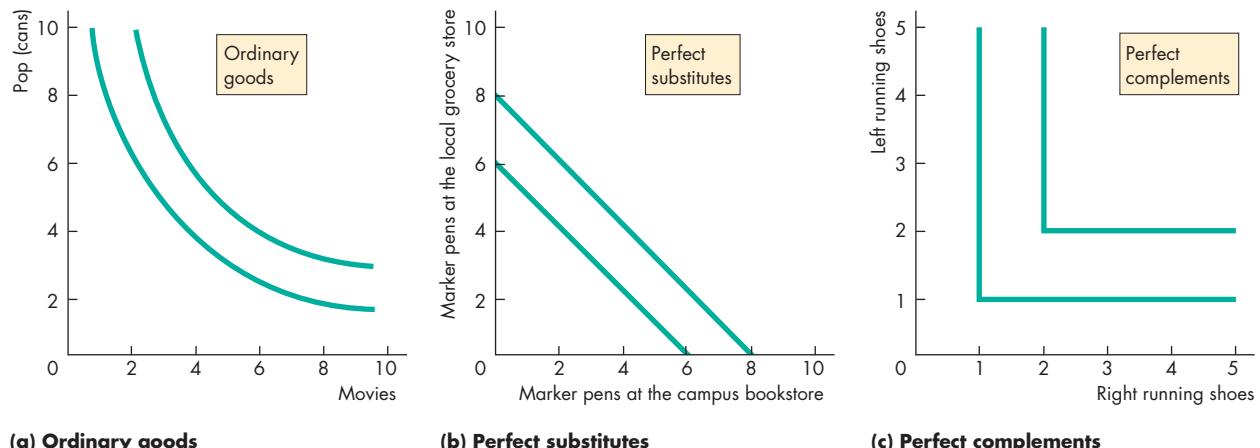
**Close Substitutes** Some goods substitute so easily for each other that most of us do not even notice which we are consuming. The different brands of marker pens and pencils are examples. Most people don't care which brand of these items they use or where they buy them. A marker pen from the campus bookstore is just as good as one from the local grocery store. You would be willing to forgo a pen from the campus store if you could get one more pen from

the local grocery store. When two goods are perfect substitutes, their indifference curves are straight lines that slope downward, as Fig. 9.5(b) illustrates. The marginal rate of substitution is constant.

**Complements** Some goods do not substitute for each other at all. Instead, they are complements. The complements in Fig. 9.5(c) are left and right running shoes. Indifference curves of perfect complements are L-shaped. One left running shoe and one right running shoe are as good as one left shoe and two right shoes. Having two of each is preferred to having one of each, but having two of one and one of the other is no better than having one of each.

The extreme cases of perfect substitutes and perfect complements shown here don't often happen in reality, but they do illustrate that the shape of the indifference curve shows the degree of substitutability between two goods. The closer the two goods are to perfect substitutes, the closer the marginal rate of substitution is to being constant (a straight line), rather than diminishing (a curved line). Indifference

**FIGURE 9.5** The Degree of Substitutability



(a) Ordinary goods

(b) Perfect substitutes

(c) Perfect complements

The shape of the indifference curves reveals the degree of substitutability between two goods. Part (a) shows the indifference curves for two ordinary goods: movies and pop. To drink less pop and remain indifferent, one must see more movies. The number of movies that compensates for a reduction in pop increases as less pop is consumed. Part (b) shows the indifference curves for two perfect substitutes. For

the consumer to remain indifferent, one fewer marker pen from the local grocery store must be replaced by one extra marker pen from the campus bookstore. Part (c) shows two perfect complements—goods that cannot be substituted for each other at all. Having two left running shoes with one right running shoe is no better than having one of each. But having two of each is preferred to having one of each.



*"With the pork I'd recommend an Alsatian white or a Coke."*

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Robert Weber from cartoonbank.com. All Rights Reserved.

curves for poor substitutes are tightly curved and lie between the shapes of those shown in Figs. 9.5(a) and 9.5(c).

As you can see in the cartoon, according to the waiter's preferences, Coke and Alsatian white wine are perfect substitutes and each is a complement of pork. We hope the customers agree with him.

## REVIEW QUIZ

- What is an indifference curve and how does a preference map show preferences?
- Why does an indifference curve slope downward and why is it bowed toward the origin?
- What do we call the magnitude of the slope of an indifference curve?
- What is the key assumption about a consumer's marginal rate of substitution?

Work these questions in Study Plan 9.2 and get instant feedback. Do a Key Terms Quiz. [MyEconLab](#)

The two components of the model of household choice are now in place: the budget line and the preference map. We will now use these components to work out a household's choice and to predict how choices change when prices and income change.

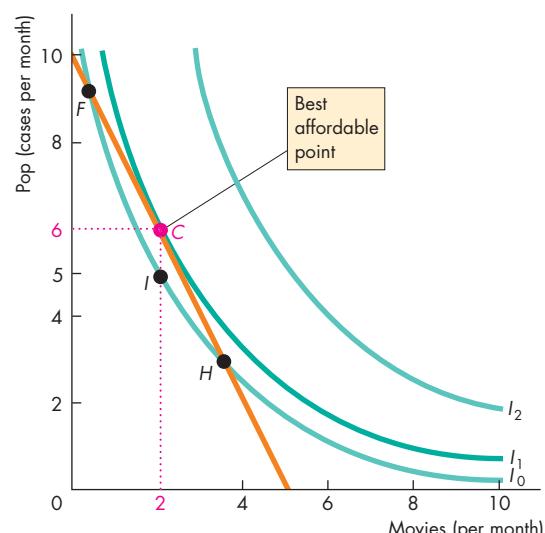
## Predicting Consumer Choices

We are now going to predict the quantities of movies and pop that Lisa chooses to buy. We're also going to see how these quantities change when a price changes or when Lisa's income changes. Finally, we're going to see how the *substitution effect* and the *income effect*, two ideas that you met in Chapter 3 (see p. 57), guarantee that for a normal good, the demand curve slopes downward.

### Best Affordable Choice

When Lisa makes her best affordable choice of movies and pop, she spends all her income and is on her highest attainable indifference curve. Figure 9.6 illustrates this choice: The budget line is from Fig. 9.1 and the indifference curves are from Fig. 9.3(b). Lisa's best affordable choice is 2 movies and 6 cases of pop at point C—the *best affordable point*.

**FIGURE 9.6** The Best Affordable Choice



Lisa's best affordable choice is at point C, the point on her budget line and on her highest attainable indifference curve. At point C, Lisa's marginal rate of substitution between movies and pop (the magnitude of the slope of the indifference curve  $I_1$ ) equals the relative price of movies and pop (the slope of the budget line).

[MyEconLab Animation and Draw Graph](#)

**On the Budget Line** The best affordable point is on the budget line. For every point inside the budget line, such as point  $I$ , there are points on the budget line that Lisa prefers. For example, she prefers all the points on the budget line between  $F$  and  $H$  to point  $I$ , so she chooses a point on the budget line.

**On the Highest Attainable Indifference Curve** Every point on the budget line lies on an indifference curve. For example, points  $F$  and  $H$  lie on the indifference curve  $I_0$ . By moving along her budget line from either  $F$  or  $H$  toward  $C$ , Lisa reaches points on ever-higher indifference curves that she prefers to points  $F$  or  $H$ . When Lisa gets to point  $C$ , she is on the highest attainable indifference curve.

#### Marginal Rate of Substitution Equals Relative Price

At point  $C$ , Lisa's marginal rate of substitution between movies and pop (the magnitude of the slope of the indifference curve) is equal to the relative price of movies and pop (the magnitude of the slope of the budget line). Lisa's willingness to pay for a movie equals her opportunity cost of a movie.

Let's now see how Lisa's choices change when a price changes.

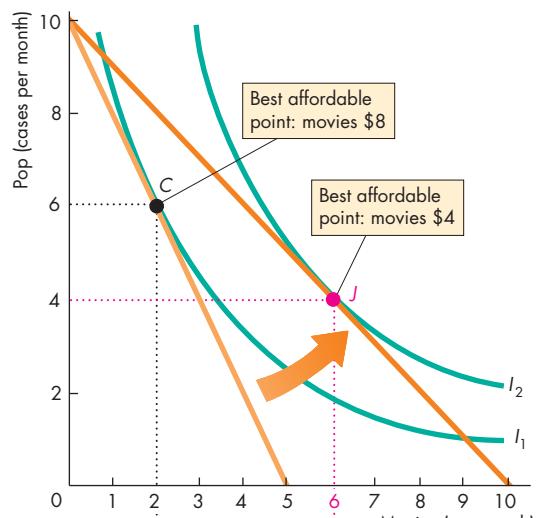
#### A Change in Price

The effect of a change in the price of a good on the quantity of the good consumed is called the **price effect**. We will use Fig. 9.7(a) to work out the price effect of a fall in the price of a movie. We start with the price of a movie at \$8, the price of pop at \$4 a case, and Lisa's income at \$40 a month. In this situation, she buys 6 cases of pop and sees 2 movies a month at point  $C$ .

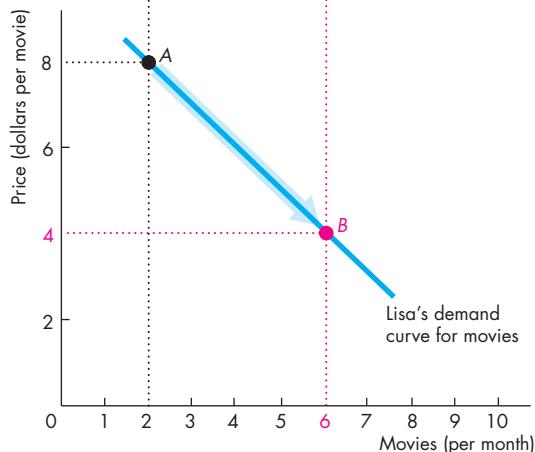
Now suppose that the price of a movie falls to \$4. With a lower price of a movie, the budget line rotates outward and becomes flatter. The new budget line is the darker orange one in Fig. 9.7(a). For a refresher on how a price change affects the budget line, check back to Fig. 9.2(a).

Lisa's best affordable point is now point  $J$ , where she sees 6 movies and drinks 4 cases of pop. Lisa drinks less pop and watches more movies now that movies are cheaper. She cuts her pop purchases from 6 to 4 cases and increases the number of movies she sees from 2 to 6 a month. When the price of a movie falls and the price of pop and her income remain constant, Lisa substitutes movies for pop.

**FIGURE 9.7** Price Effect and Demand Curve



(a) Price effect



(b) Demand curve

Initially, Lisa's best affordable point is  $C$  in part (a). If the price of a movie falls from \$8 to \$4, Lisa's best affordable point is  $J$ . The move from  $C$  to  $J$  is the price effect.

At a price of \$8 a movie, Lisa sees 2 movies a month, at point  $A$  in part (b). At a price of \$4 a movie, she sees 6 movies a month, at point  $B$ . Lisa's demand curve for movies traces out her best affordable quantity of movies as the price of a movie varies.

**MyEconLab Animation**

## Economics in Action

### Best Affordable Choice of Movies and DVDs

Between 2005 and 2014, box-office receipts rose by more than ticket prices, which means that movie-going has increased.

Why has movie-going increased? One answer is that the consumer's experience has improved. Movies in 3-D such as *Godzilla* play better on the big screen than at home. Also, movie theatres are able to charge a higher price for 3-D films and other big hits, which further boosts receipts. But there is another answer, and at first thought an unlikely one: Events in the market for DVD rentals have impacted going to the movies. To see why, let's look at the recent history of the DVD rentals market.

Back in 2005, Blockbuster was the main player and the price of a DVD rental was around \$4 a night. Redbox was a fledgling. It had started earlier in the United States with just 140 kiosks in selected McDonald's restaurants. But Redbox expanded rapidly and in 2014 had outlets in Loblaws and Petro-Canada gas stations renting DVDs at a price of \$2 a night. Blockbuster was history.

The easy access to DVDs at \$2 a night transformed the markets for movie watching and the figure shows why.

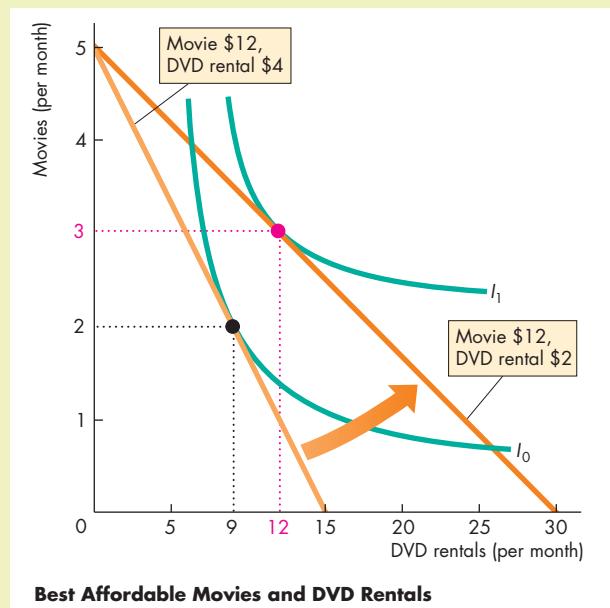
A student has a budget of \$60 a month to allocate to movies. To keep the story clear, we'll suppose that it cost \$12 to go to a movie in both 2005 and 2014. The price of a DVD rental in 2005 was \$4, so the student's budget line is the one that runs from 5 movies on the  $y$ -axis to 15 DVD rentals on the  $x$ -axis. The



student's best affordable point is 9 rentals and 2 movies a month.

In 2014, the price of a rental falls to \$2 a night but the price of a movie ticket remains at \$12. So the budget line rotates outward. The student's best affordable point is now at 12 rentals and 3 movies a month. (This student loves movies!)

Many other things changed between 2005 and 2014 that influenced the markets for movies and DVD rentals, but the fall in the price of a DVD rental was the biggest influence.



**The Demand Curve** In Chapter 3, we asserted that the demand curve slopes downward. We can now derive a demand curve from a consumer's budget line and indifference curves. By doing so, we can see that the law of demand and the downward-sloping demand curve are consequences of a consumer's choosing her or his best affordable combination of goods.

To derive Lisa's demand curve for movies, lower the price of a movie and find her best affordable point at different prices. We've just done this for two movie prices in Fig. 9.7(a). Figure 9.7(b) highlights these two prices and two points that lie on Lisa's demand curve for movies. When the price of a movie is \$8, Lisa sees 2 movies a month at point A. When the price falls to \$4, she increases the number of movies she sees to 6 a month at point B. The demand curve is made up of these two points plus all the other points that tell us Lisa's best affordable quantity of movies at each movie price, with the price of pop and Lisa's income remaining the same. As you can see, Lisa's demand curve for movies slopes downward—the lower the price of a movie, the more movies she sees. This is the law of demand.

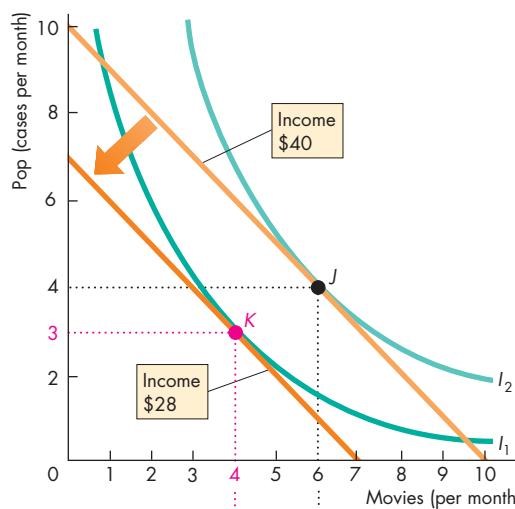
Next, let's see how Lisa changes her purchases of movies and pop when her income changes.

## A Change in Income

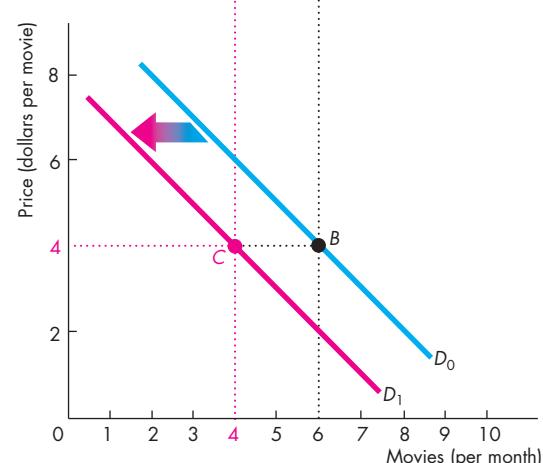
The effect of a change in income on buying plans is called the **income effect**. Let's work out the income effect by examining how buying plans change when income changes and prices remain constant. Figure 9.8 shows the income effect when Lisa's income falls. With an income of \$40, the price of a movie at \$4, and the price of pop at \$4 a case, Lisa's best affordable point is J—she buys 6 movies and 4 cases of pop. If her income falls to \$28, her best affordable point is K—she sees 4 movies and buys 3 cases of pop. When Lisa's income falls, she buys less of both goods. Movies and pop are normal goods.

**The Demand Curve and the Income Effect** A change in income leads to a shift in the demand curve, as shown in Fig. 9.8(b). With an income of \$40, Lisa's demand curve for movies is  $D_0$ , the same as in Fig. 9.7(b). But when her income falls to \$28, she plans to see fewer movies at each price, so her demand curve shifts leftward to  $D_1$ .

**FIGURE 9.8** Income Effect and Change in Demand



(a) Income effect



(b) Demand curve for movies

A change in income shifts the budget line, changes the best affordable point, and changes demand.

In part (a), when Lisa's income decreases from \$40 to \$28, she sees fewer movies and buys less pop.

In part (b), when Lisa's income is \$40, her demand curve for movies is  $D_0$ . When Lisa's income falls to \$28, her demand curve for movies shifts leftward to  $D_1$ . For Lisa, going to the movies is a normal good. Her demand for movies decreases because she now sees fewer movies at each price.

## Substitution Effect and Income Effect

For a normal good, a fall in its price *always* increases the quantity bought. We can prove this assertion by dividing the price effect into two parts:

- Substitution effect
- Income effect

Figure 9.9(a) shows the price effect, and Figs. 9.9(b) and 9.9(c) show the two parts into which we separate the price effect.

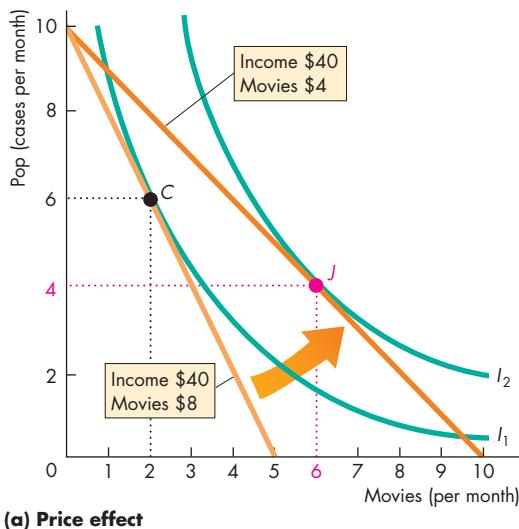
**Substitution Effect** The **substitution effect** is the effect of a change in price on the quantity bought when the consumer (hypothetically) remains indifferent between the original situation and the new one. To work out Lisa's substitution effect when the price of a movie falls, we must lower her income by enough to keep her on the same indifference curve as before.

Figure 9.9(a) shows the price effect of a fall in the price of a movie from \$8 to \$4. The number of movies increases from 2 to 6 a month. When the price falls, suppose (hypothetically) that we cut Lisa's income to \$28. What's special about \$28? It is the

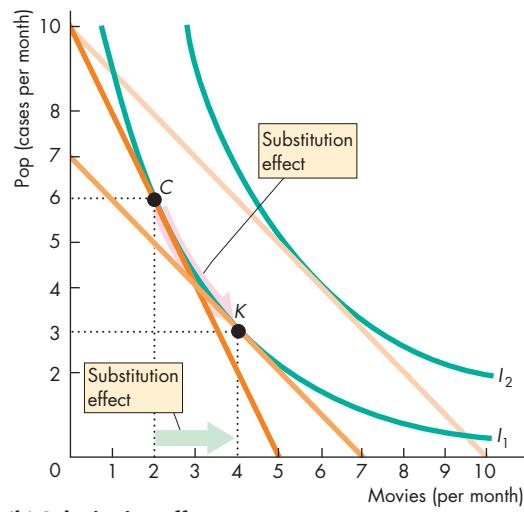
income that is just enough, at the new price of a movie, to keep Lisa's best affordable point on the same indifference curve ( $I_1$ ) as her original point  $C$ . Lisa's budget line is now the medium orange line in Fig. 9.9(b). With the lower price of a movie and a smaller income, Lisa's best affordable point is  $K$ . The move from  $C$  to  $K$  along indifference curve  $I_1$  is the substitution effect of the price change. The substitution effect of the fall in the price of a movie is an increase in the quantity of movies from 2 to 4. The direction of the substitution effect never varies: When the relative price of a good falls, the consumer substitutes more of that good for the other good.

**Income Effect** To calculate the substitution effect, we gave Lisa a \$12 pay cut. To calculate the income effect, we give Lisa back her \$12. The \$12 increase in income shifts Lisa's budget line outward, as shown in Fig. 9.9(c). The slope of the budget line does not change because both prices remain the same. This change in Lisa's budget line is similar to the one illustrated in Fig. 9.8. As Lisa's budget line shifts outward, her consumption possibilities expand and her best afford-

**FIGURE 9.9** Substitution Effect and Income Effect



When the price of a movie falls from \$8 to \$4, Lisa moves from point  $C$  to point  $J$  in part (a). The price effect is an increase in the number of movies from 2 to 6 a month. This price effect is separated into a substitution effect in part (b) and an income effect in part (c).



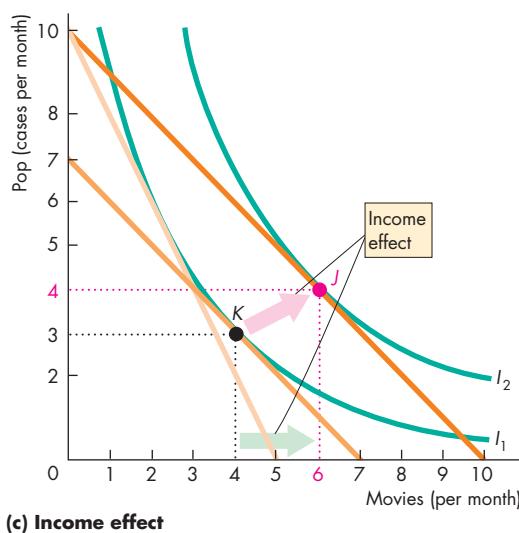
To isolate the substitution effect, we confront Lisa with the new price but keep her on her original indifference curve,  $I_1$ . The substitution effect is the move from  $C$  to  $K$  along indifference curve  $I_1$ —an increase from 2 to 4 movies a month.

able point becomes  $J$  on indifference curve  $I_2$ . The move from  $K$  to  $J$  is the income effect of the price change.

As Lisa's income increases, she sees more movies. For Lisa, a movie is a normal good. For a normal good, the income effect *reinforces* the substitution effect. Because the two effects work in the same direction, we can be sure that the demand curve slopes downward. But some goods are inferior goods. What can we say about the demand for an inferior good?

**Inferior Goods** Recall that an *inferior good* is a good for which *demand decreases* when *income increases*. For an inferior good, the income effect is negative, which means that a lower price does not inevitably lead to an increase in the quantity demanded. The substitution effect of a fall in the price increases the quantity demanded, but the negative income effect works in the opposite direction and offsets the substitution effect to some degree. The key question is to what degree.

If the negative income effect *equals* the positive substitution effect, a fall in price leaves the quantity bought the same. When a fall in price leaves the



(c) Income effect

To isolate the income effect, we confront Lisa with the new price of movies but increase her income so that she can move from the original indifference curve,  $I_1$ , to the new one,  $I_2$ . The income effect is the move from  $K$  to  $J$ —an increase from 4 to 6 movies a month.

**MyEconLab Animation and Draw Graph**

quantity demanded unchanged, the demand curve is vertical and demand is perfectly inelastic.

If the negative income effect is *smaller than* the positive substitution effect, a fall in price increases the quantity bought and the demand curve still slopes downward like that for a normal good. But the demand for an inferior good might be less elastic than that for a normal good.

If the negative income effect *exceeds* the positive substitution effect, a fall in the price *decreases* the quantity bought and the demand curve *slopes upward*. This case does not appear to occur in the real world.

You can apply the indifference curve model that you've studied in this chapter to explain the changes in the way we buy recorded music, see movies, and make all our other consumption choices. We allocate our budgets to make our best affordable choices. Changes in prices and incomes change our best affordable choices and change consumption patterns.

## REVIEW QUIZ

- When a consumer chooses the combination of goods and services to buy, what is she or he trying to achieve?
- Explain the conditions that are met when a consumer has found the best affordable combination of goods to buy. (Use the terms *budget line*, *marginal rate of substitution*, and *relative price* in your explanation.)
- If the price of a normal good falls, what happens to the quantity demanded of that good?
- Into what two effects can we divide the effect of a price change?
- For a normal good, does the income effect reinforce the substitution effect or does it partly offset the substitution effect?

Work these questions in Study Plan 9.3 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

◆ *Economics in the News* on pp. 214–215 applies the theory of household choice to explain how people chose whether to buy their books in electronic or paper format and why e-books boomed in 2011.

In the chapters that follow, we study the choices that firms make in their pursuit of profit and how those choices determine the supply of goods and services and the demand for productive resources.

# Paper Books Versus e-Books

## e-Book Sales Surging in Canada but Print Sales Still Tops

CBC News

October 10, 2012

Surging e-book sales now represent an estimated 16.3 percent of the overall book market in Canada, a figure that caught even some industry watchers by surprise.

A new report by the non-profit industry group BookNet Canada finds more and more people are buying e-books, and when they do purchase hardcovers and paperbacks they are increasingly getting them outside of conventional book stores.

The trends are outlined in a first-of-its-kind report by BookNet, which is based on several consumer surveys conducted over the first half of the year. The results are considered accurate within 3.1 percentage points, 19 times out of 20.

“The sheer volume and the amount of change that’s happened in the last couple of years is a big surprise.”

“We were a little taken aback—even though we are in the industry and on the technology side of the industry—at just the sheer quantity of the shift in behaviour in regards to digital and online [shopping],” said BookNet CEO Noah Genner.

“We all knew it was happening ... but just the sheer volume and the amount of change that’s happened in the last couple of years is a big surprise.”

The report suggests one in three Canadians is a regular book buyer and purchases an average of 2.8 titles per month.

While e-book sales are growing, print sales still dominate, with paperbacks representing an estimated 56.7 percent of the market and hardcovers making up 23.6 percent. ...

The average e-book was \$7.44, the average hardcover was \$19.09 and the average paperback was \$12.18. ...

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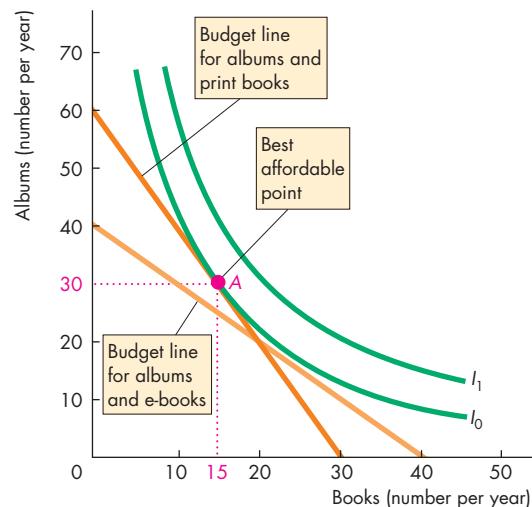


### ESSENCE OF THE STORY

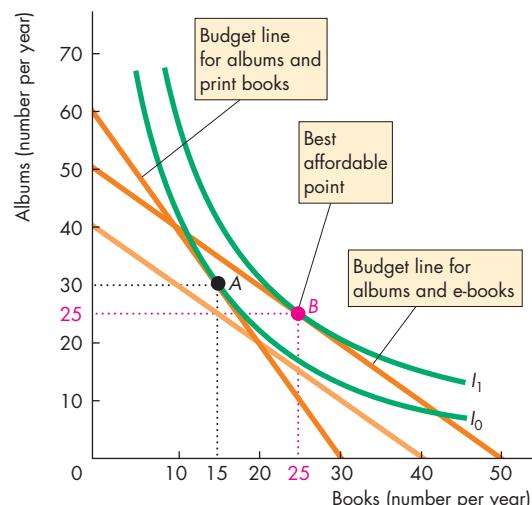
- Sales of e-books represent an estimated 16.3 percent of the Canadian book market.
- One in three Canadians is a regular book buyer and purchases an average of 2.8 titles per month.
- Print sales still dominate, with paperbacks representing an estimated 56.7 percent of the market and hardcovers making up 23.6 percent.
- The average price of an e-book was \$7.44.
- The average price of a hardcover was \$19.09 and the average price of a paperback was \$12.18.

## ECONOMIC ANALYSIS

- Sales of e-books are rapidly growing because of the choices that millions of consumers are making. One of these consumers is Andy.
- Andy loves reading, but he also enjoys music. His budget for books and music is limited. So he must choose among the many alternative combinations of books and albums that he can afford.
- Figure 1 shows Andy's indifference curves for books (of all types) and albums.
- Andy's annual budget for albums and books is \$600. The price of an album is \$10, the price of a print book is \$20, and the price of an e-book is \$10.
- Figure 1 shows two budget lines: one if Andy buys print books and albums and another if he buys e-books and albums.
- In Fig. 1, the price of an e-book reader is \$200. Andy must spend this amount on a reader if he is to buy e-books, which leaves him with \$400 for albums and e-books. If he buys 15 e-books, he can afford 25 albums  $[(15 \times \$10) + (25 \times \$10) = \$400]$ .
- If Andy buys print books and albums, he can afford 15 print books and 30 albums  $[(15 \times \$20) + (30 \times \$10) = \$600]$ .
- This combination is Andy's best affordable choice—15 print books and 30 albums shown at point A. Andy doesn't buy e-books.
- Now the price of an e-book reader falls, and today Andy can buy a reader that previously cost \$200 for \$100.
- Figure 2 shows what happens to Andy's budget line and his choices.
- If Andy buys print books and albums, nothing changes. He can still afford 15 print books and 30 albums  $[(15 \times \$20) + (30 \times \$10) = \$600]$ .
- But if he buys e-books, his situation has changed. After spending \$100 on an e-book reader, Andy is left with \$500 for albums and e-books. If he buys 15 e-books he can now afford 35 albums  $[(15 \times \$10) + (35 \times \$10) = \$500]$ .
- Andy can now afford more albums if he buys the same number of books that he bought when the reader cost \$200. But that's not Andy's best affordable combination of albums and books.
- The price of an e-book is lower than the price of a print book, so for Andy the relative price of a book has fallen and he can benefit by substituting books for albums.



**Figure 1 When the Price of a Reader Is \$200**



**Figure 2 When the Price of a Reader Is \$100**

- Andy moves along his budget line to the point at which his marginal rate of substitution of books for albums equals the relative price.
- This point occurs at B where Andy buys 25 e-books and 25 albums  $[(25 \times \$10) + (25 \times \$10) = \$500]$ .
- The surge in e-book sales is the consequence of Andy and other rational consumers responding to the incentive of a change in relative prices and, in particular, a fall in the price of an e-book reader.

## SUMMARY

### Key Points

#### Consumption Possibilities (pp. 202–204)

- The budget line is the boundary between what a household can and cannot afford, given its income and the prices of goods.
- The point at which the budget line intersects the  $y$ -axis is the household's real income in terms of the good measured on that axis.
- The magnitude of the slope of the budget line is the relative price of the good measured on the  $x$ -axis in terms of the good measured on the  $y$ -axis.
- A change in the price of one good changes the slope of the budget line. A change in income shifts the budget line but does not change its slope.

Working Problems 1 to 5 will give you a better understanding of consumption possibilities.

#### Preferences and Indifference Curves (pp. 205–208)

- A consumer's preferences can be represented by indifference curves. The consumer is indifferent among all the combinations of goods that lie on an indifference curve.
- A consumer prefers any point above an indifference curve to any point on it and prefers any point on an indifference curve to any point below it.
- The magnitude of the slope of an indifference curve is called the marginal rate of substitution.
- The marginal rate of substitution diminishes as consumption of the good measured on the  $y$ -axis

decreases and consumption of the good measured on the  $x$ -axis increases.

Working Problems 6 and 7 will give you a better understanding of preferences and indifference curves.

#### Predicting Consumer Choices (pp. 208–213)

- A household consumes at its best affordable point. This point is on the budget line and on the highest attainable indifference curve and has a marginal rate of substitution equal to relative price.
- The effect of a price change (the price effect) can be divided into a substitution effect and an income effect.
- The substitution effect is the effect of a change in price on the quantity bought when the consumer (hypothetically) remains indifferent between the original choice and the new choice.
- The substitution effect always results in an increase in consumption of the good whose relative price has fallen.
- The income effect is the effect of a change in income on consumption.
- For a normal good, the income effect reinforces the substitution effect. For an inferior good, the income effect works in the opposite direction to the substitution effect.

Working Problems 8 to 11 will give you a better understanding of predicting consumer choices.

### Key Terms

Budget line, 202

Diminishing marginal rate of substitution, 206

Income effect, 211

Indifference curve, 205

Marginal rate of substitution, 206

Price effect, 209

Real income, 203

### MyEconLab Key Terms Quiz

Relative price, 203

Substitution effect, 212



## WORKED PROBLEM

**MyEconLab**

You can work this problem in Chapter 9 Study Plan.

Wendy drinks 10 sugary drinks and 4 smoothies a week. Smoothies are \$5 each and sugary drinks were \$2 each. This week, things are different: The government has slapped a tax on sugary drinks and their price has doubled to \$4. But it's not all bad news for Wendy. The government has also revised the income tax, so Wendy's drinks budget has increased. She can now just afford to buy her usual 10 sugary drinks and 4 smoothies a week.

### Questions

- What was Wendy's drinks budget last week and what is it this week?
- What was Wendy's opportunity cost of a sugary drink last week and what is it this week?
- Does Wendy buy 10 sugary drinks and 4 smoothies this week? Explain.
- Is Wendy better off this week than last week? Explain.

### Solutions

- To find Wendy's drinks budget, use the fact that Income (available for drinks) = Expenditure.  

$$\text{Expenditure} = (\text{Price of a sugary drink} \times \text{Quantity of sugary drinks}) + (\text{Price of a smoothie} \times \text{Quantity of smoothies}).$$

Last week, her income was  $(\$2 \times 10) + (\$5 \times 4) = \$40$ .  
This week, her income is  $(\$4 \times 10) + (\$5 \times 4) = \$60$ .

**Key Point:** Income limits expenditure and expenditure equals price multiplied by quantity, summed over the goods consumed.

- Wendy's opportunity cost of a sugary drink is the number of smoothies she must forgo to get 1 sugary drink. Wendy's opportunity cost equals the relative price of a sugary drink, which is the price of a sugary drink divided by the price of a smoothie.  
Last week, Wendy's opportunity cost of a sugary drink was  $\$2 \div \$5 = 2/5$  or 0.4 smoothies.  
This week, it is  $\$4 \div \$5 = 4/5$  or 0.8 smoothies.

**Key Point:** A relative price is an opportunity cost.

- Wendy does not buy 10 sugary drinks and 4 smoothies this week because it is not her best affordable choice.

At her best affordable choice, Wendy's marginal rate of substitution (*MRS*) between sugary drinks and smoothies is equal to the relative price of sugary drinks and smoothies.

Last week, when she chose 10 sugary drinks and 4 smoothies, her *MRS* was 0.4, equal to last week's relative price of 0.4 smoothies per sugary drink. This week, the relative price is 0.8 smoothies per sugary drink, so Wendy changes her choice to make her *MRS* equal 0.8.

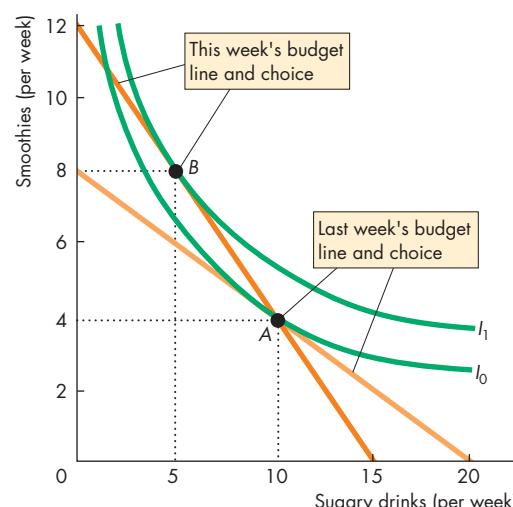
To increase her *MRS* from 0.4 to 0.8, Wendy buys fewer sugary drinks and more smoothies. We know how she changes her choice but not the new quantities she buys. To get the quantities, we would need to know Wendy's preferences as described by her indifference curves.

**Key Point:** When the relative price of a good rises, the consumer buys less of that good to make the *MRS* increase to equal the higher relative price.

- Wendy is better off! She can still buy her last week's choice but, at that choice, she is not at her best affordable point. So by buying more smoothies, she moves along her budget line to a higher indifference curve at which *MRS* equals 0.8.

**Key Point:** When both income and the relative price of a good change so that the old choice is still available, the consumer's best affordable choice changes.

### Key Figure



**MyEconLab** Interactive Animation



## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 11 in Chapter 9 Study Plan and get instant feedback.

### Consumption Possibilities (Study Plan 9.1)

Use the following data to work Problems 1 and 2. Sara's income is \$12 a week. The price of popcorn is \$3 a bag, and the price of a smoothie is \$3.

1. Calculate Sara's real income in terms of smoothies. Calculate her real income in terms of popcorn. What is the relative price of smoothies in terms of popcorn? What is the opportunity cost of a smoothie?
2. Calculate the equation for Sara's budget line (with bags of popcorn on the left side). Draw a graph of Sara's budget line with the quantity of smoothies on the  $x$ -axis. What is the slope of Sara's budget line? What determines its value?

Use the following data to work Problems 3 and 4.

Sara's income falls from \$12 to \$9 a week, while the price of popcorn is unchanged at \$3 a bag and the price of a smoothie is unchanged at \$3.

3. What is the effect of the fall in Sara's income on her real income in terms of (a) smoothies and (b) popcorn?
4. What is the effect of the fall in Sara's income on the relative price of a smoothie in terms of popcorn? What is the slope of Sara's new budget line if it is drawn with smoothies on the  $x$ -axis?
5. Sara's income is \$12 a week. The price of popcorn rises from \$3 to \$6 a bag, and the price of a smoothie is unchanged at \$3. Explain how Sara's budget line changes with smoothies on the  $x$ -axis.

### Preferences and Indifference Curves (Study Plan 9.2)

6. Draw figures that show your indifference curves for the following pairs of goods:
  - Right gloves and left gloves
  - Coca-Cola and Pepsi
  - Desktop computers and laptop computers
  - Strawberries and ice cream

For each pair, are the goods perfect substitutes, perfect complements, substitutes, complements, or unrelated?

7. Discuss the shape of the indifference curve for each of the following pairs of goods:
  - Orange juice and smoothies
  - Baseballs and baseball bats
  - Left running shoe and right running shoe
  - Eyeglasses and contact lenses

Explain the relationship between the shape of the indifference curve and the marginal rate of substitution as the quantities of the two goods change.

### Predicting Consumer Choices (Study Plan 9.3)

Use the following data to work Problems 8 and 9. Pam has made her best affordable choice of cookies and granola bars. She spends all of her weekly income on 30 cookies at \$1 each and 5 granola bars at \$2 each. Next week, she expects the price of a cookie to fall to 50¢ and the price of a granola bar to rise to \$5.

8. a. Will Pam be able to buy and want to buy 30 cookies and 5 granola bars next week?
- b. Which situation does Pam prefer: cookies at \$1 and granola bars at \$2, or cookies at 50¢ and granola bars at \$5?
9. a. If Pam changes how she spends her weekly income, will she buy more or fewer cookies and more or fewer granola bars?
- b. When the prices change next week, will there be an income effect, a substitution effect, or both at work?

Use the following news clip to work Problems 10 and 11.

### Boom Time for “Gently Used” Clothes

Most retailers are blaming the economy for their poor sales, but one store chain that sells used name-brand children's clothes, toys, and furniture is boldly declaring that an economic downturn can actually be a boon for its business. Last year, the company took in \$20 million in sales, up 5% from the previous year.

Source: CNN, April 17, 2008

10. a. According to the news clip, is used clothing a normal good or an inferior good? If the price of used clothing falls and income remains the same, explain how the quantity of used clothing bought changes.
- b. Describe the substitution effect and the income effect that occur.
11. Use a graph of a family's indifference curves for used clothing and other goods. Then draw two budget lines to show the effect of a fall in income on the quantity of used clothing purchased.

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### Consumption Possibilities

Use the following data to work Problems 12 to 15.

Marc has a budget of \$20 a month to spend on root beer and DVDs. The price of root beer is \$5 a bottle, and the price of a DVD is \$10.

12. What is the relative price of root beer in terms of DVDs? What is the opportunity cost of a bottle of root beer?
13. Calculate Marc's real income in terms of root beer. Calculate his real income in terms of DVDs.
14. Calculate the equation for Marc's budget line (with the quantity of root beer on the left side).
15. Draw a graph of Marc's budget line with the quantity of DVDs on the  $x$ -axis. What is the slope of Marc's budget line? What determines its value?

Use the following data to work Problems 16 to 19.

Amy has \$20 a week to spend on coffee and cake. The price of coffee is \$4 a cup, and the price of cake is \$2 a slice.

16. Calculate Amy's real income in terms of cake. Calculate the relative price of cake in terms of coffee.
17. Calculate the equation for Amy's budget line (with cups of coffee on the left side).
18. If Amy's income increases to \$24 a week and the prices of coffee and cake remain unchanged, describe the change in her budget line.
19. If the price of cake doubles while the price of coffee remains at \$4 a cup and Amy's income remains at \$20, describe the change in her budget line.

Use the following news clip to work Problems 20 and 21.

### Gas Prices Straining Budgets

With gas prices rising, many people say they are staying in and scaling back spending to try to keep within their budget. They are driving as little as possible, cutting back on shopping and eating out, and reducing other discretionary spending.

Source: CNN, February 29, 2008

20. a. Sketch a budget line for a household that spends its income on only two goods:

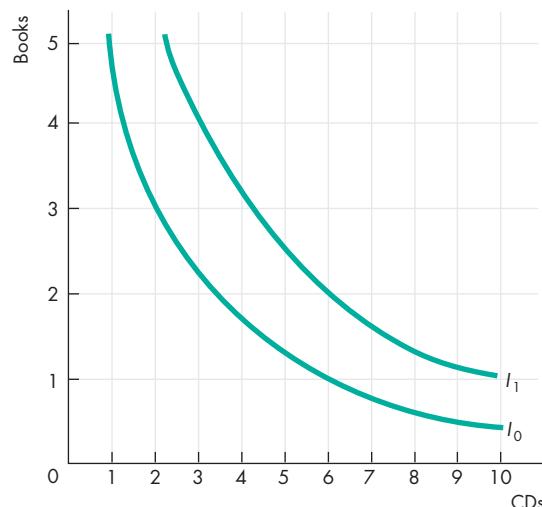
gasoline and restaurant meals. Identify the combinations of gasoline and restaurant meals that are affordable and those that are unaffordable.

- b. Sketch a second budget line to show how a rise in the price of gasoline changes the affordable and unaffordable combinations of gasoline and restaurant meals. Describe how the household's consumption possibilities change.
21. How does a rise in the price of gasoline change the relative price of a restaurant meal? How does a rise in the price of gasoline change real income in terms of restaurant meals?

### Preferences and Indifference Curves

Use the following information to work Problems 22 and 23.

Rashid buys only books and CDs, and the figure shows his preference map.



22. a. If Rashid chooses 3 books and 2 CDs, what is his marginal rate of substitution?
- b. If Rashid chooses 2 books and 6 CDs, what is his marginal rate of substitution?
23. Do Rashid's indifference curves display diminishing marginal rate of substitution? Explain why or why not.

#### 24. You May Be Paid More (or Less) Than You Think

It's so hard to put a price on happiness, isn't it? But if you've ever had to choose between a job you like and a better-paying one that you like less, you probably wished some economist would tell you how much job satisfaction is worth. Trust in management is by far the biggest component to consider. Say you get a new boss and your trust in management goes up a bit (say, up 1 point on a 10-point scale). That's like getting a 36-percent pay raise. In other words, that increased level of trust will boost your level of overall satisfaction in life by about the same amount as a 36-percent raise would.

Source: CNN, March 29, 2006

- Measure trust in management on a 10-point scale, measure pay on the same 10-point scale, and think of them as two goods. Sketch an indifference curve (with trust on the  $x$ -axis) that is consistent with the news clip.
- What is the marginal rate of substitution between trust in management and pay according to this news clip?
- What does the news clip imply about the principle of diminishing marginal rate of substitution? Is that implication likely to be correct?

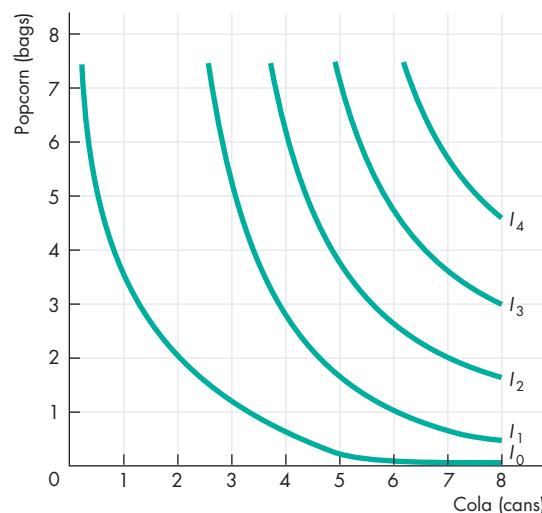
#### Predicting Consumer Choices

Use the following data to work Problems 25 and 26. Jim has made his best affordable choice of muffins and coffee. He spends all of his income on 10 muffins at \$1 each and 20 cups of coffee at \$2 each. Now the price of a muffin rises to \$1.50 and the price of coffee falls to \$1.75 a cup.

- Will Jim now be able and want to buy 10 muffins and 20 coffees?
  - Which situation does Jim prefer: muffins at \$1 and coffee at \$2 a cup, or muffins at \$1.50 and coffee at \$1.75 a cup?
- If Jim changes the quantities that he buys, will he buy more or fewer muffins and more or less coffee? Explain your answer.
  - When the prices change, will there be an income effect, a substitution effect, or both at work? Explain your answer.

Use the following data and figure to work Problems 27 to 29.

Sara's income is \$12 a week. The price of popcorn is \$3 a bag, and the price of cola is \$1.50 a can. The figure shows Sara's preference map for popcorn and cola.



- What quantities of popcorn and cola does Sara buy? What is Sara's marginal rate of substitution at the point at which she consumes?
- Suppose that the price of cola rises from \$1.50 to \$3.00 a can while the price of popcorn and Sara's income remain the same. What quantities of cola and popcorn does Sara now buy? What are two points on Sara's demand curve for cola? Draw Sara's demand curve.
- Suppose that the price of cola rises from \$1.50 to \$3.00 a can while the price of popcorn and Sara's income remain the same.
  - What is the substitution effect of this price change, and what is the income effect of the price change?
  - Is cola a normal good or an inferior good? Explain.

#### Economics in the News

- After you have studied *Economics in the News* on pp. 214–215, answer the following questions.
  - How do you buy books?
  - Sketch your budget line for books and other goods.
  - Sketch your indifference curves for books and other goods.
  - Identify your best affordable point.

# Making the Most of Life

The powerful forces of demand and supply shape the fortunes of families, businesses, nations, and empires in the same unrelenting way that the tides and winds shape rocks and coastlines. You saw in Chapters 3 through 7 how these forces raise and lower prices, increase and decrease quantities bought and sold, cause revenues to fluctuate, and send resources to their most valuable uses.

These powerful forces begin quietly and privately with the choices that each one of us makes. Chapters 8 and 9 probe these individual choices, offering two alternative approaches to explaining both consumption plans and the allocation of time. These explanations of consumption plans can also explain “non-economic” choices, such as whether to marry and how many children to have. In a sense, there are no non-economic choices. If there is scarcity, there must be choice, and economics studies all choices.

The earliest economists (Adam Smith and his contemporaries) did not have a very deep understanding of households’ choices. It was not until the nineteenth century that progress was made in this area when Jeremy Bentham (below) introduced the concept of utility and applied it to the study of human choices. Today, Steven Levitt, whom you will meet on the following page, is one of the most influential students of human behaviour.

*Jeremy Bentham (1748–1832), who lived in London, was the son and grandson of lawyers and was himself trained as a barrister. But Bentham rejected the opportunity to maintain the family tradition and, instead, spent his life as a writer, activist, and Member of Parliament in the pursuit of rational laws that would bring the greatest happiness to the greatest number of people.*

*Bentham, whose embalmed body is preserved to this day in a glass cabinet in the University of London, was the first person to use the concept of utility to explain human choices. But in Bentham’s day, the distinction between explaining and prescribing was not a sharp one, and Bentham was ready to use his ideas to tell people how they ought to behave. He was one of the first to propose pensions for the retired, guaranteed employment, minimum wages, and social benefits such as free education and free medical care.*

## PART THREE

### UNDERSTANDING HOUSEHOLDS’ CHOICES

*“... It is the greatest happiness of the greatest number that is the measure of right and wrong.”*

**JEREMY BENTHAM**  
*Fragment on Government*





TALKING WITH

**Steven D. Levitt\***

I think of economics as being primarily about a way of looking at the world and a set of tools for thinking clearly.

STEVEN D. LEVITT is William B. Ogden Distinguished Service Professor of Economics at the University of Chicago. Born in Minneapolis, he was an undergraduate at Harvard and a graduate student at MIT. Among his many honours, he was recently awarded the John Bates Clark Medal, given to the best economist under 40.

Professor Levitt has studied an astonishingly wide range of human choices and their outcomes. He has examined the effects of policing on crime, shown that real estate agents get a higher price when they sell their own homes than when they sell other people's, devised a test to detect cheating teachers, and studied the choices of drug dealers and gang members. Much of this research has been popularized in *Freakonomics* (Steven D. Levitt and Stephen J. Dubner, HarperCollins, 2005). What unifies this apparently diverse body of research is the use of natural experiments. Professor Levitt has an incredible ability to find just the right set of events and the data the events have generated to enable him to isolate the effect he's looking for.

Michael Parkin and Robin Bade talked with Steven Levitt about his work and what economists have discovered about how people respond to incentives.

#### *Why did you become an economist?*

As a freshman in college, I took introductory economics. All the ideas made perfect sense to me—it was the way I naturally thought. My friends were befuddled. I thought, “This is the field for me!”

#### *The idea of rational choice made at the margin lies at the heart of economics. Would you say that your work generally supports that idea or challenges it? Can you provide some examples?*

I don't like the word “rational” in this context. I think economists model agents as being rational just for convenience. What really matters is whether people respond to incentives. My work very much supports the idea that humans in all types of circumstances respond strongly to incentives. I've seen it with drug dealers, auto thieves, sumo wrestlers, real estate agents, and elementary school teachers, just to name a few examples.

Drug dealers, for instance, want to make money, but they also want to avoid being arrested or even killed. In the data we have on drug sellers, we see that when the drug trade is more lucrative, dealers are willing to take greater risks of arrest to carve out a share of the market. ... Sumo wrestlers, on the other hand, care mostly about their official ranking. Sometimes matches occur where one wrestler has more to lose or gain than the other wrestler. We find that sumo wrestlers make corrupt deals to make sure the wrestler who wins is the one who needs to win.

#### *Why is an economist interested in crime and cheating?*

I think of economics as being primarily about a way of looking at the world and a set of tools for thinking clearly. The topics you apply these tools to are unlimited. That is why I think economics has been so powerful. If you understand economics and use the tools wisely, you will be a better business person, doctor, public servant, parent.

\* Read the full interview with Steven Levitt in [MyEconLab](#).

# 10

## ORGANIZING PRODUCTION

After studying this chapter,  
you will be able to:

- ◆ Explain the economic problem that all firms face
- ◆ Distinguish between technological efficiency and economic efficiency
- ◆ Define and explain the principal–agent problem
- ◆ Distinguish among different types of markets
- ◆ Explain why markets coordinate some economic activities and why firms coordinate others

In 1990, a British scientist named Tim Berners-Lee invented the World Wide Web, a remarkable idea that paved the way for the creation of thousands of profitable firms among which are Facebook, Twitter, Google, Amazon, and eBay.

What are the decisions that firms must make?

That's the question you study in this chapter. In *Economics in the News* at the end of the chapter, we'll look at some decisions made by Facebook and Google in the Internet advertising market.



## The Firm and Its Economic Problem

The 2 million firms in Canada differ in size and in the scope of what they do, but they all perform the same basic economic functions. Each **firm** is an institution that hires factors of production and organizes those factors to produce and sell goods and services. Our goal is to predict firms' behaviour. To do so, we need to know a firm's goal and the constraints it faces. We start with the goal.

### The Firm's Goal

When economists ask entrepreneurs what they are trying to achieve, they get many different answers. Some talk about making a high-quality product, others about business growth, others about market share, others about the job satisfaction of their workforce, and an increasing number today talk about social and environmental responsibility. All of these goals are pursued by firms, but they are not the fundamental goal: They are the means to that goal.

A firm's goal is to maximize profit. A firm that does not seek to maximize profit is either eliminated or taken over by a firm that does seek that goal.

What is the profit that a firm seeks to maximize? To answer this question, we'll look at Campus Sweaters, Inc., a small producer of knitted sweaters owned and operated by Cindy.

### Accounting Profit

In 2012, Campus Sweaters received \$400,000 for the sweaters it sold and paid out \$80,000 for wool, \$20,000 for utilities, \$120,000 for wages, \$5,000 for the lease of a computer, and \$5,000 in interest on a bank loan. These expenses total \$230,000, so Campus Sweaters had a cash surplus of \$170,000.

To measure the profit of Campus Sweaters, Cindy's accountant subtracted \$20,000 for the depreciation of buildings and knitting machines from the \$170,000 cash surplus. *Depreciation* is the fall in the value of a firm's capital. To calculate depreciation, accountants use Canada Revenue Agency rules, which are based on standards established by the accounting profession. Using these rules, Cindy's accountant calculated that Campus Sweaters made a profit of \$150,000 in 2012.

### Economic Accounting

Accountants measure a firm's profit to ensure that the firm pays the correct amount of income tax and to show its investors how their funds are being used.

Economists measure a firm's profit to enable them to predict the firm's decisions, and the goal of these decisions is to maximize *economic profit*. **Economic profit** is equal to total revenue minus total cost, with total cost measured as the *opportunity cost of production*.

### A Firm's Opportunity Cost of Production

The *opportunity cost* of any action is the highest-valued alternative forgone. The *opportunity cost of production* is the value of the best alternative use of the resources that a firm uses in production.

A firm's opportunity cost of production is the value of real alternatives forgone. We express opportunity cost in money units so that we can compare and add up the value of the alternatives forgone.

A firm's opportunity cost of production is the sum of the cost of using resources:

- Bought in the market
- Owned by the firm
- Supplied by the firm's owner

**Resources Bought in the Market** A firm incurs an opportunity cost when it buys resources in the market. The amount spent on these resources is an opportunity cost of production because the firm could have bought different resources to produce some other good or service. For Campus Sweaters, the resources bought in the market are wool, utilities, labour, a leased computer, and a bank loan. The \$230,000 spent on these items in 2012 could have been spent on something else, so it is an opportunity cost of producing sweaters.

**Resources Owned by the Firm** A firm incurs an opportunity cost when it uses its own capital. The cost of using capital owned by the firm is an opportunity cost of production because the firm could sell the capital that it owns and rent capital from another firm. When a firm uses its own capital, it implicitly rents it from itself. In this case, the firm's opportunity cost of using the capital it owns is called the **implicit rental rate** of capital. The implicit rental rate of capital has two components: economic depreciation and forgone interest.

**Economic Depreciation** Accountants measure *depreciation*, the fall in the value of a firm's capital, using formulas that are unrelated to the change in the market value of capital. **Economic depreciation** is the fall in the *market value* of a firm's capital over a given period. It equals the market price of the capital at the beginning of the period minus the market price of the capital at the end of the period.

Suppose that Campus Sweaters could have sold its buildings and knitting machines on January 1, 2012, for \$400,000 and that it can sell the same capital on December 31, 2012, for \$375,000. The firm's economic depreciation during 2012 is \$25,000 ( $\$400,000 - \$375,000$ ). This forgone \$25,000 is an opportunity cost of production.

**Forgone Interest** The funds used to buy capital could have been used for some other purpose, and in their next best use, they would have earned interest. This forgone interest is an opportunity cost of production.

Suppose that Campus Sweaters used \$300,000 of its own funds to buy capital. If the firm invested its \$300,000 in bonds instead of a knitting factory (and rented the capital it needs to produce sweaters), it would have earned \$15,000 a year in interest. This forgone interest is an opportunity cost of production.

**Resources Supplied by the Firm's Owner** A firm's owner might supply *both* entrepreneurship and labour.

**Entrepreneurship** The factor of production that organizes a firm and makes its decisions might be supplied by the firm's owner or by a hired entrepreneur. The return to entrepreneurship is profit, and the profit that an entrepreneur earns *on average* is called **normal profit**. Normal profit is the cost of entrepreneurship and is an opportunity cost of production.

If Cindy supplies entrepreneurial services herself, and if the normal profit she can earn on these services is \$45,000 a year, this amount is an opportunity cost of production at Campus Sweaters.

**Owner's Labour Services** In addition to supplying entrepreneurship, the owner of a firm might supply labour but not take a wage. The opportunity cost of the owner's labour is the wage income forgone by not taking the best alternative job.

If Cindy supplies labour to Campus Sweaters, and if the wage she can earn on this labour at another firm is \$55,000 a year, this amount of wages forgone is an opportunity cost of production at Campus Sweaters.

## Economic Accounting: A Summary

Table 10.1 summarizes the economic accounting. Campus Sweaters' total revenue is \$400,000; its opportunity cost of production is \$370,000; and its economic profit is \$30,000.

Cindy's personal income is the \$30,000 of economic profit plus the \$100,000 that she earns by supplying resources to Campus Sweaters.

## Decisions

To achieve the objective of maximum economic profit, a firm must make five decisions:

1. What to produce and in what quantities
2. How to produce
3. How to organize and compensate its managers and workers
4. How to market and price its products
5. What to produce itself and buy from others

In all these decisions, a firm's actions are limited by the constraints that it faces. Your next task is to learn about these constraints.

**TABLE 10.1** Economic Accounting

Item	Amount
<b>Total Revenue</b>	<b>\$400,000</b>
<i>Cost of Resources Bought in Market</i>	
Wool	\$80,000
Utilities	20,000
Wages	120,000
Computer lease	5,000
Bank interest	5,000
	<u>\$230,000</u>
<i>Cost of Resources Owned by Firm</i>	
Economic depreciation	\$25,000
Forgone interest	15,000
	<u>\$40,000</u>
<i>Cost of Resources Supplied by Owner</i>	
Cindy's normal profit	\$45,000
Cindy's forgone wages	55,000
	<u>\$100,000</u>
<b>Opportunity Cost of Production</b>	
	<b>\$370,000</b>
<b>Economic Profit</b>	
	<b><u>\$30,000</u></b>

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## The Firm's Constraints

Three features of a firm's environment limit the maximum economic profit it can make. They are:

- Technology constraints
- Information constraints
- Market constraints

**Technology Constraints** Economists define technology broadly. A **technology** is any method of producing a good or service. Technology includes the detailed designs of machines and the layout of the workplace. It includes the organization of the firm. For example, the shopping mall is one technology for producing retail services. It is a different technology from the catalogue store, which in turn is different from the downtown store.

It might seem surprising that a firm's profit is limited by technology because it seems that technological advances are constantly increasing profit opportunities. Almost every day, we learn about some new technological advance that amazes us. With computers that speak and recognize our own speech and cars that can find the address we need in a city we've never visited, we can accomplish more than ever.

Technology advances over time. But at each point in time, to produce more output and gain more revenue, a firm must hire more resources and incur greater costs. The increase in profit that a firm can achieve is limited by the technology available. For example, by using its current plant and workforce, Ford can produce some maximum number of cars per day. To produce more cars per day, Ford must hire more resources, which increases its costs and limits the increase in profit that it can make by selling the additional cars.

**Information Constraints** We never possess all the information we would like to have to make decisions. We lack information about both the future and the present. For example, suppose you plan to buy a new computer. When should you buy it? The answer depends on how the price is going to change in the future. Where should you buy it? The answer depends on the prices at hundreds of different computer stores. To get the best deal, you must compare the quality and prices in every store. But the opportunity cost of this comparison exceeds the cost of the computer!

A firm is constrained by limited information about the quality and efforts of its workforce, the current

and future buying plans of its customers, and the plans of its competitors. Workers might make too little effort, customers might switch to competing suppliers, and a competitor might enter the market and take some of the firm's business.

To address these problems, firms create incentives to boost workers' efforts even when no one is monitoring them; conduct market research to lower uncertainty about customers' buying plans; and "spy" on each other to anticipate competitive challenges. But these efforts don't eliminate incomplete information and uncertainty, which limit the economic profit that a firm can make.

**Market Constraints** The quantity each firm can sell and the price it can obtain are constrained by its customers' willingness to pay and by the prices and marketing efforts of other firms. Similarly, the resources that a firm can buy and the prices it must pay for them are limited by the willingness of people to work for and invest in the firm. Firms spend billions of dollars a year marketing and selling their products. Some of the most creative minds strive to find the right message that will produce a knockout television advertisement. Market constraints and the expenditures firms make to overcome them limit the profit a firm can make.

## REVIEW QUIZ

- 1 What is a firm's fundamental goal and what happens if the firm doesn't pursue this goal?
- 2 Why do accountants and economists calculate a firm's costs and profit in different ways?
- 3 What are the items that make opportunity cost differ from the accountant's measure of cost?
- 4 Why is normal profit an opportunity cost?
- 5 What are the constraints that a firm faces? How does each constraint limit the firm's profit?

Work these questions in Study Plan 10.1 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

In the rest of this chapter and in Chapters 11 through 14, we study the choices that firms make. You're going to learn how we can predict a firm's decisions as those that maximize profit given the constraints the firm faces. We begin by taking a closer look at a firm's technology constraints.

## Technological and Economic Efficiency

Microsoft employs a large workforce, and most Microsoft workers possess a large amount of human capital. But the firm uses a small amount of physical capital. In contrast, a coal-mining company employs a huge amount of mining equipment (physical capital) and almost no labour. Why? The answer lies in the concept of efficiency. There are two concepts of production efficiency: technological efficiency and economic efficiency. **Technological efficiency** occurs when the firm produces a given output by using the least amount of inputs. **Economic efficiency** occurs when the firm produces a given output at the least cost. Let's explore the two concepts of efficiency by studying an example.

Suppose that there are four alternative techniques for making TVs:

- A. *Robot production.* One person monitors the entire computer-driven process.
- B. *Production line.* Workers specialize in a small part of the job as the emerging TV passes them on a production line.
- C. *Hand-tool production.* A single worker uses a few hand tools to make a TV.
- D. *Bench production.* Workers specialize in a small part of the job but walk from bench to bench to perform their tasks.

Table 10.2 sets out the amounts of labour and capital required by each of these four methods to make 10 TVs a day.

Which of these alternative methods are technologically efficient?

### Technological Efficiency

Recall that *technological efficiency* occurs when the firm produces a given output by using the least amount of inputs. Look at the numbers in the table and notice that method A uses the most capital and the least labour. Method C uses the most labour and the least capital. Method B and method D lie between the two extremes. They use less capital and more labour than method A and less labour but more capital than method C.

Compare methods B and D. Method D requires 100 workers and 10 units of capital to produce 10 TVs. Method B can produce those same 10 TVs by

**TABLE 10.2** Four Ways of Making 10 TVs a Day

<b>Method</b>	<b>Quantities of inputs</b>	
	<b>Labour</b>	<b>Capital</b>
A Robot production	1	1,000
B Production line	10	10
C Hand-tool production	1,000	1
D Bench production	100	10

using 10 workers and the same 10 units of capital. Because method D uses the same amount of capital and more labour than method B, method D is not technologically efficient.

Are any of the other methods not technologically efficient? The answer is no. Each of the other methods is technologically efficient. Method A uses more capital but less labour than method B, and method C uses more labour but less capital than method B.

Which of the methods are economically efficient?

### Economic Efficiency

Recall that *economic efficiency* occurs when the firm produces a given output at the least cost.

Method D, which is technologically inefficient, is also economically inefficient. It uses the same amount of capital as method B but 10 times as much labour, so it costs more. A technologically inefficient method is never economically efficient.

One of the three technologically efficient methods is economically efficient. The other two are economically inefficient. But which method is economically efficient depends on factor prices.

In Table 10.3(a), the wage rate is \$75 per day and the rental rate of capital is \$250 per day. By studying Table 10.3(a), you can see that method B has the lowest cost and is the economically efficient method.

In Table 10.3(b), the wage rate is \$150 a day and the rental rate of capital is \$1 a day. Looking at Table 10.3(b), you can see that method A has the lowest cost and is the economically efficient method. In this case, capital is so cheap relative to labour that the

**TABLE 10.3** The Costs of Different Ways of Making 10 TVs a Day

## (a) Wage rate \$75 per day; Capital rental rate \$250 per day

Method	Inputs		Labour cost (\$75 per day)		Capital cost (\$250 per day)		Total cost
	Labour	Capital					
A	1	1,000	\$75	+	\$250,000	=	\$250,075
B	10	10	750	+	2,500	=	3,250
C	1,000	1	75,000	+	250	=	75,250

## (b) Wage rate \$150 per day; Capital rental rate \$1 per day

Method	Inputs		Labour cost (\$150 per day)		Capital cost (\$1 per day)		Total cost
	Labour	Capital					
A	1	1,000	\$150	+	\$1,000	=	\$1,150
B	10	10	1,500	+	10	=	1,510
C	1,000	1	150,000	+	1	=	150,001

## (c) Wage rate \$1 per day; Capital rental rate \$1,000 per day

Method	Inputs		Labour cost (\$1 per day)		Capital cost (\$1,000 per day)		Total cost
	Labour	Capital					
A	1	1,000	\$1	+	\$1,000,000	=	\$1,000,001
B	10	10	10	+	10,000	=	10,010
C	1,000	1	1,000	+	1,000	=	2,000

method that uses the most capital is the economically efficient method.

In Table 10.3(c), the wage rate is \$1 a day and the rental rate of capital is \$1,000 a day. You can see that method C has the lowest cost and is the economically efficient method. In this case, labour is so cheap relative to capital that the method that uses the most labour is the economically efficient method.

Economic efficiency depends on the relative costs of resources. The economically efficient method is the one that uses a smaller amount of the more expensive resource and a larger amount of the less expensive resource.

A firm that is not economically efficient does not maximize profit. Natural selection favours efficient firms and inefficient firms disappear. Inefficient firms go out of business or are taken over by firms that produce at lower costs.

 **REVIEW QUIZ**

- 1 Is a firm technologically efficient if it uses the latest technology? Why or why not?
- 2 Is a firm economically inefficient if it can cut its costs by producing less? Why or why not?
- 3 Explain the key distinction between technological efficiency and economic efficiency.
- 4 Why do some firms use a lot of capital and small amounts of labour while others use small amounts of capital and a lot of labour?

Work these questions in Study Plan 10.2 and get instant feedback. Do a Key Terms Quiz.

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Next we study the information constraints that firms face and the wide array of organization structures these constraints generate.

## Information and Organization

Each firm organizes the production of goods and services using a combination of two systems:

- Command systems
- Incentive systems

### Command Systems

A **command system** is a method of organizing production that uses a managerial hierarchy. Commands pass downward through the hierarchy, and information passes upward.

The military uses the purest form of command system. A commander-in-chief makes the big decisions about strategic goals. Beneath this highest level, generals organize their military resources. Beneath the generals, successively lower ranks organize smaller and smaller units but pay attention to ever-increasing degrees of detail. At the bottom of the hierarchy are the people who operate weapons systems.

Command systems in firms are not as rigid as those in the military, but they share some similar features. A chief executive officer (CEO) sits at the top of a firm's command system. Senior executives specialize in managing production, marketing, finance, and personnel. Beneath these senior managers are the people who supervise the day-to-day operations of the business, and beneath them are the people who operate the firm's machines and who make and sell the firm's products.

Managers try to be well informed, but they almost always have incomplete information about what is happening in the divisions for which they are responsible. For this reason, firms also use incentive systems.

### Incentive Systems

An **incentive system** is a method of organizing production that uses a market-like mechanism inside the firm. Instead of issuing commands, senior managers create compensation schemes to induce workers to perform in ways that maximize the firm's profit.

Incentive systems operate at all levels in a firm. The compensation plan of a CEO might include a share in the firm's profit, factory floor workers sometimes receive compensation based on the quantity they produce, and salespeople, who spend most of their working time alone, are induced to work hard by being paid a small salary and a large performance-related bonus.

### The Principal-Agent Problem

The **principal-agent problem** is the problem of devising compensation rules that induce an *agent* to act in the best interest of a *principal*. For example, the shareholders of Texaco are *principals*, and the firm's managers are *agents*. The shareholders (the principals) must induce the managers (agents) to act in the shareholders' best interest. Similarly, Mark Zuckerberg (a principal) must induce the designers who are working on the next generation Facebook (agents) to work efficiently.

Agents, whether they are managers or workers, pursue their own goals and often impose costs on a principal. For example, the goal of shareholders of CIBC (principals) is to maximize the firm's profit—its true profit, not some fictitious paper profit. But the firm's profit depends on the actions of its managers (agents), and they have their own goals. Perhaps a bank manager takes a customer to a ball game on the pretense that she is building customer loyalty, when in fact she is simply enjoying on-the-job leisure. This same manager is also a principal, and her tellers are agents. The manager wants the tellers to work hard and attract new customers so that she can meet her operating targets. But the workers slack off and take on-the-job leisure.

### Coping with the Principal-Agent Problem

A principal must create incentives that induce each agent to work in the interests of the principal. Three ways of coping with the principal–agent problem are:

- Ownership
- Incentive pay
- Long-term contracts

**Ownership** By assigning ownership (or part-ownership) of a business to managers or workers, it is sometimes possible to induce a job performance that increases a firm's profits. Part-ownership is quite common for senior managers but less common for workers. For example, WestJet offers its employees an Employee Share Purchase Plan, so most of its employees are owners of the company.

**Incentive Pay** Incentive pay—pay related to performance—is very common. Incentives are based on a variety of performance criteria such as profits, production, or sales targets. Promoting an employee for good performance is another example of the use of incentive pay.

**Long-Term Contracts** Long-term contracts tie the long-term fortunes of managers and workers (agents) to the success of the principal(s)—the owner(s) of the firm. For example, a multiyear employment contract for a CEO encourages that person to take a long-term view and devise strategies that achieve maximum profit over a sustained period.

These three ways of coping with the principal–agent problem give rise to different types of business organization.



## ECONOMICS IN THE NEWS

### Principals and Agents Get It Wrong

#### JPMorgan Pay May Be Clawed Back

In May 2012, JPMorgan Chase announced that traders in London had incurred losses of \$2 billion. CEO Jamie Dimon said the losses arose from a “flawed, complex, poorly reviewed, poorly executed, and poorly monitored” trading strategy. JPMorgan Chase’s stock price fell on the news. One top executive took early retirement. JPMorgan executives and traders are compensated by results with bonus payments in cash and stock options. Dimon said “It’s likely that there will be clawbacks” of compensation.

Sources: AP, Bloomberg, and Reuters, May/June, 2012

#### THE QUESTIONS

- Who are the principals and who are the agents?
- How did JPMorgan try to cope with its principal–agent problem?
- On the occasion reported here, how did JPMorgan get it wrong?
- What role did JPMorgan’s share price play?

#### THE ANSWERS

- The JPMorgan shareholders are principals and Jamie Dimon is their agent.
- Jamie Dimon, as CEO, is a principal and the top executives are agents.
- JPMorgan top executives are principals, and the traders who incurred the losses are agents.
- JPMorgan tried to cope with the principal–agent problem by compensating agents with performance bonuses, profit shares through stock options, and with the possibility of clawbacks for poor performance.
- We don’t know the details but, based on what Jamie Dimon said, it seems that the specific trading activities that incurred a \$2 billion loss were complex and

### Types of Business Organization

The three main types of business organization are:

- Sole proprietorship
- Partnership
- Corporation

**Sole Proprietorship** A *sole proprietorship* is a firm with a single owner—a proprietor—who has unlimited liability. *Unlimited liability* is the legal

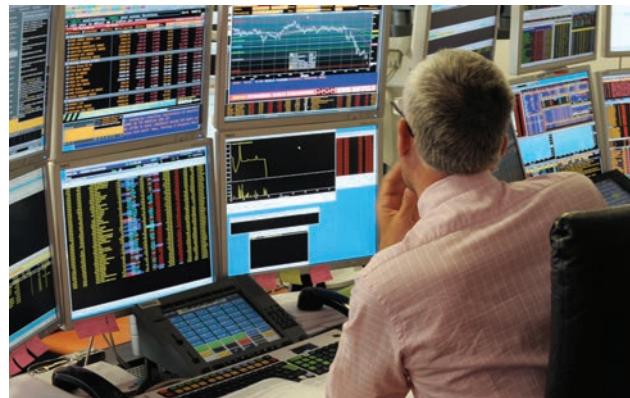


Figure 1 JPMorgan Share Price

not properly understood either by the traders (the agents at the end of the line) or the managers who designed the trading activities.

- The fall in JPMorgan’s share price not only lowered the wealth of shareholders, but also lowered the compensation of Jamie Dimon and the other executives compensated with stock options.

**MyEconLab More Economics in the News**

responsibility for all the debts of a firm up to an amount equal to the entire personal wealth of the owner. Farmers, computer programmers, and artists often operate as sole proprietorships.

The proprietor makes management decisions, receives the firm's profits, and is responsible for its losses. Profits from a sole proprietorship are taxed at the same rate as other sources of the proprietor's personal income.

**Partnership** A *partnership* is a firm with two or more owners who have unlimited liability. Partners must agree on an appropriate management structure and on how to divide the firm's profits among themselves. The profits of a partnership are taxed as the personal income of the owners, but each partner is legally liable for all the debts of the partnership (limited only by the wealth of that individual partner). Liability for the full debts of the partnership is called *joint unlimited liability*. Most law firms are partnerships.

**Corporation** A *corporation* is a firm owned by one or more limited liability shareholders. *Limited liability* means that the owners have legal liability only

for the value of their initial investment. This limitation of liability means that if the corporation becomes bankrupt, its owners do not use their personal wealth to pay the corporation's debts.

Corporations' profits are taxed independently of shareholders' incomes. Shareholders pay a capital gains tax on the profit they earn when they sell a stock for a higher price than they paid for it. Corporate stocks generate capital gains when a corporation retains some of its profit and reinvests it in profitable activities. So retained earnings are taxed twice because the capital gains they generate are taxed. Dividend payments are also taxed but at a lower rate than other sources of income.

### Pros and Cons of Different Types of Firms

The different types of business organization arise from firms trying to cope with the principal–agent problem. Each type has advantages in particular situations and because of its special advantages, each type continues to exist. Each type of business organization also has disadvantages. Table 10.4 summarizes the pros and cons of the different types of firms.

**TABLE 10.4** The Pros and Cons of Different Types of Firms

Type of Firm	Pros	Cons
<b>Sole Proprietorship</b>	<ul style="list-style-type: none"> <li>■ Easy to set up</li> <li>■ Simple decision making</li> <li>■ Profits taxed only once as owner's income</li> </ul>	<ul style="list-style-type: none"> <li>■ Bad decisions not checked; no need for consensus</li> <li>■ Owner's entire wealth at risk</li> <li>■ Firm dies with owner</li> <li>■ Cost of capital and labour is high relative to that of a corporation</li> </ul>
<b>Partnership</b>	<ul style="list-style-type: none"> <li>■ Easy to set up</li> <li>■ Diversified decision making</li> <li>■ Can survive withdrawal of partner</li> <li>■ Profits taxed only once as owners' incomes</li> </ul>	<ul style="list-style-type: none"> <li>■ Achieving consensus may be slow and expensive</li> <li>■ Owners' entire wealth at risk</li> <li>■ Withdrawal of partner may create capital shortage</li> <li>■ Cost of capital and labour is high relative to that of a corporation</li> </ul>
<b>Corporation</b>	<ul style="list-style-type: none"> <li>■ Owners have limited liability</li> <li>■ Large-scale, low-cost capital available</li> <li>■ Professional management not restricted by ability of owners</li> <li>■ Perpetual life</li> <li>■ Long-term labour contracts cut labour costs</li> </ul>	<ul style="list-style-type: none"> <li>■ Complex management structure can make decisions slow and expensive</li> <li>■ Retained profits taxed twice: as company profit and as shareholders' capital gains</li> </ul>

## Economics in Action

### The Size Distribution of Firms in Canada

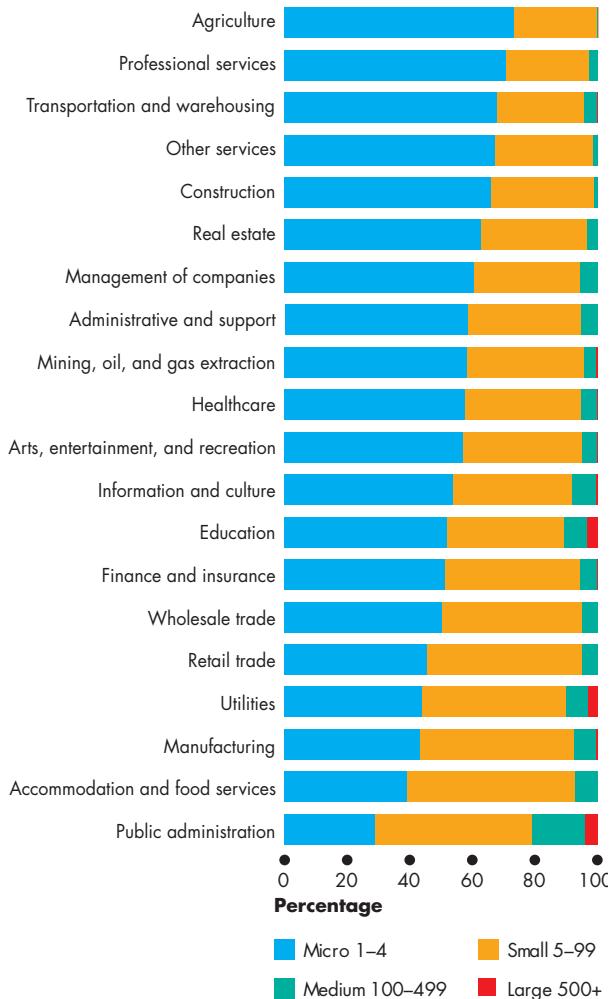
Industry Canada counts the number of establishments in the Canadian economy and classifies them by size measured by the number of employees. An establishment is not the same as a firm. Some firms operate several, or even many, establishments. For example, Loblaw Companies Limited operates 1,690 grocery stores across Canada. So one large firm operates many small establishments. Keep this fact in mind as you review the data in the figure.

Most establishments in Canada (58 percent of the total) are very small and employ fewer than 5 people. Most of the rest (38 percent of the total) employ between 5 and 99 people. Only 4 percent of establishments employ more than 100 people, and only 2,700 establishments (0.3 percent of the total) employ more than 500 people.

The figure shows the distribution of the size of establishments across major industry classes. Most of the largest establishments, shown by the red bars, are found in public administration (government), utilities, and education. Manufacturing, information and culture, and mining, oil, and gas extraction also have some large establishments.

Micro establishments, shown by the blue bars, dominate in agriculture (a group that includes forestry, fishing, and hunting) and professional services, which includes lawyers, accountants, and other types of professional and scientific services.

Most firms in Canada today, regardless of size, are corporations. Many of the very small firms that employ fewer than 5 people find it advantageous to incorporate.



**Establishments by Number of Employees**

Source of data: Statistics Canada.



### REVIEW QUIZ

- 1 Explain the distinction between a command system and an incentive system.
- 2 What is the principal–agent problem? What are three ways in which firms try to cope with it?
- 3 What are the three types of firms? Explain the major advantages and disadvantages of each.

Work these questions in Study Plan 10.3 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

You've now seen how technology constraints and information constraints influence the way firms operate. You've seen why some firms operate with a large amount of labour and human capital and a small amount of physical capital. You've also seen how firms use a mixture of command and incentive systems and employ different types of business organization to cope with the principal–agent problem.

Your next task is to look at the variety of market situations in which firms operate and classify the different market environments in which firms do business.

## ◆ Markets and the Competitive Environment

The markets in which firms operate vary a great deal. Some are highly competitive, and profits in these markets are hard to come by. Some appear to be almost free from competition, and firms in these markets earn large profits. Some markets are dominated by fierce advertising campaigns in which each firm seeks to persuade buyers that it has the best products. And some markets display the character of a strategic game.

Economists identify four market types:

1. Perfect competition
2. Monopolistic competition
3. Oligopoly
4. Monopoly

**Perfect competition** arises when there are many firms, each selling an identical product, many buyers, and no restrictions on the entry of new firms into the industry. The many firms and buyers are all well informed about the prices of the products of each firm in the industry. The worldwide markets for wheat, corn, rice, and other grain crops are examples of perfect competition.

**Monopolistic competition** is a market structure in which a large number of firms compete by making similar but slightly different products. Making a product

slightly different from the product of a competing firm is called **product differentiation**. Product differentiation gives a firm in monopolistic competition an element of market power. The firm is the sole producer of the particular version of the good in question. For example, in the market for pizzas, hundreds of firms make their own version of the perfect pizza. Each of these firms is the sole producer of a particular brand. Differentiated products are not necessarily different products. What matters is that consumers perceive them to be different. For example, different brands of potato chips and ketchup might be almost identical but be perceived by consumers to be different.

**Oligopoly** is a market structure in which a small number of firms compete. Computer software, airplane manufacture, and international air transportation are examples of oligopolistic industries. Oligopolies might produce almost identical products, such as the colas produced by Coke and Pepsi. Or they might produce differentiated products, such as Boeing and Airbus aircraft.

**Monopoly** arises when there is one firm, which produces a good or service that has no close substitutes and in which the firm is protected by a barrier preventing the entry of new firms. In some places, gas, electricity, cable television, and water suppliers are local monopolies—monopolies restricted to a given location. Microsoft Corporation, the software developer that created Windows, the operating system for the personal computer, is an example of a global monopoly.



Perfect competition is the most extreme form of competition. Monopoly is the most extreme absence of competition. The other two market types fall between these extremes.

Many factors must be taken into account to determine which market structure describes a particular real-world market. One of these factors is the extent to which a small number of firms dominates the market. To measure this feature of markets, economists use indexes called measures of concentration. Let's look at these measures.

### Measures of Concentration

Economists use two measures of concentration:

- The four-firm concentration ratio
- The Herfindahl-Hirschman Index

**The Four-Firm Concentration Ratio** The **four-firm concentration ratio** is the percentage of the value of sales accounted for by the four largest firms in an industry. The range of the concentration ratio is from almost zero for perfect competition to 100 percent for monopoly. This ratio is the main measure used to assess market structure.

Table 10.5 shows two calculations of the four-firm concentration ratio: one for tire makers and one for

printers. In this example, 14 firms produce tires. The largest four have 80 percent of the sales, so the four-firm concentration ratio is 80 percent. In the printing industry, with 1,004 firms, the largest four firms have only 0.5 percent of the sales, so the four-firm concentration ratio is 0.5 percent.

A low concentration ratio indicates a high degree of competition, and a high concentration ratio indicates an absence of competition. A monopoly has a concentration ratio of 100 percent—the largest (and only) firm has 100 percent of the sales. A four-firm concentration ratio that exceeds 60 percent is regarded as an indication of a market that is highly concentrated and dominated by a few firms in an oligopoly. A ratio of less than 60 percent is regarded as an indication of a competitive market.

**The Herfindahl-Hirschman Index** The **Herfindahl-Hirschman Index**—also called the HHI—is the square of the percentage market share of each firm summed over the largest 50 firms (or summed over all the firms if there are fewer than 50) in a market. For example, if there are four firms in a market and the market shares of the firms are 50 percent, 25 percent, 15 percent, and 10 percent, the Herfindahl-Hirschman Index is:

$$\text{HHI} = 50^2 + 25^2 + 15^2 + 10^2 = 3,450.$$

**TABLE 10.5** Calculating the Four-Firm Concentration Ratio

Tire makers		Printers	
Firm	Sales (millions of dollars)	Firm	Sales (millions of dollars)
Top, Inc.	200	Fran's	2.5
ABC, Inc.	250	Ned's	2.0
Big, Inc.	150	Tom's	1.8
XYZ, Inc.	100	Jill's	1.7
Largest 4 firms	700	Largest 4 firms	8.0
Other 10 firms	175	Other 1,000 firms	1,592.0
Industry	<u>875</u>	Industry	<u>1,600.0</u>

#### Four-firm concentration ratios:

$$\text{Tire makers: } \frac{700}{875} \times 100 = 80 \text{ percent}$$

$$\text{Printers: } \frac{8}{1,600} \times 100 = 0.5 \text{ percent}$$

## Economics in Action

### Concentration in the Canadian Economy

Statistics Canada calculates and publishes data showing the four-firm concentration ratio for each industry in Canada. The bars in the figure show the four-firm concentration ratio.

Sugar production is highly concentrated and almost a monopoly. Other industries that have a high degree of concentration produce tobacco, beer, tires, and soft drinks and ice. These industries are oligopolies.

Industries that produce clothing, bakery items, textiles, fabrics, boats, and printing have low concentration measures and are highly competitive.

Industries that produce women's and girls' shirts, pharmaceutical products, and wooden windows and doors are moderately concentrated. These industries are examples of monopolistic competition.

Concentration measures are useful indicators of the degree of competition in a market, but they must be supplemented by other information to determine the structure of the market.

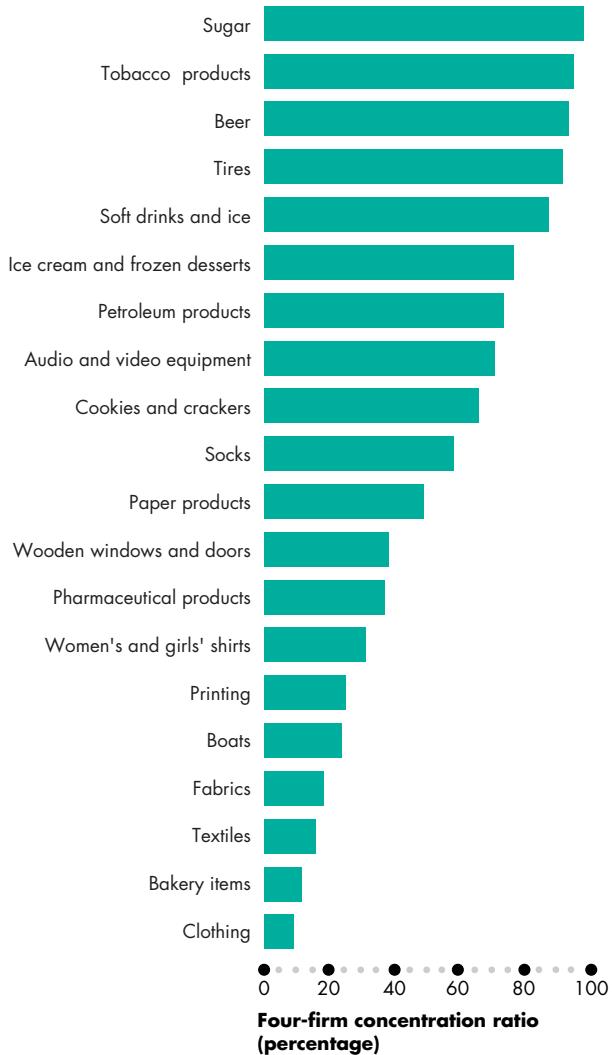
Newspapers and automobiles are examples of how the concentration measures give a misleading reading of the degree of competition.

Most newspapers are local. They serve a single city or even a smaller area. So despite the low concentration measure, newspapers are concentrated in their own local areas.

Automobiles are traded internationally and foreign cars are freely imported into Canada. Despite the high concentration measure, the automobile industry is competitive.

In perfect competition, the HHI is small. For example, if each of the largest 50 firms in an industry has a market share of 0.1 percent, then the HHI is  $0.1^2 \times 50$ , which equals 0.5. At the other extreme in a monopoly, the HHI is 10,000. There is only one firm and it has 100 percent of the market:  $100^2 = 10,000$ .

The HHI can be used to classify markets across a spectrum of types. A market in which the HHI is less than 1,500 is regarded as being competitive.



Concentration Measures in Canada

Source of data: Statistics Canada.

A market in which the HHI lies between 1,500 and 2,500 is regarded as being moderately competitive—a form of monopolistic competition. But a market in which the HHI exceeds 2,500 is regarded as being uncompetitive and a potential matter of concern for regulators.

Table 10.6 summarizes the characteristics of the types of market structure, along with the measures of concentration and some examples of each type.

**TABLE 10.6** Market Structure

Characteristics	Perfect competition	Monopolistic competition	Oligopoly	Monopoly
Number of firms in industry	Many	Many	Few	One
Product	Identical	Differentiated	Either identical or differentiated	No close substitutes
Barriers to entry	None	None	Moderate	High
Firm's control over price	None	Some	Considerable	Considerable or regulated
Concentration ratio	0	Low	High	100
HHI (approx. ranges)	Close to 0	Less than 2,500	More than 2,500	10,000
Examples	Wheat, corn	Food, clothing	Computer chips	Local water supply

### Limitations of a Concentration Measure

The three main limitations of using only concentration measures as determinants of market structure are their failure to take proper account of:

- The geographical scope of the market
- Barriers to entry and firm turnover
- The correspondence between a market and an industry

**Geographical Scope of the Market** Concentration measures take a national view of the market. Many goods are sold in a *national* market, but some are sold in a *regional* market and some in a *global* one. The concentration measures for newspapers are low, indicating competition, but in most cities the newspaper industry is highly concentrated. The concentration measures for automobiles are high, indicating little competition, but the three biggest North American car makers compete with foreign car makers in a highly competitive global market.

**Barriers to Entry and Firm Turnover** Some markets are highly concentrated but entry is easy and the turnover of firms is large. For example, small towns have few restaurants, but no restrictions hinder a new restaurant from opening and many attempt to do so.

Also, a market with only a few firms might be competitive because of *potential entry*. The few firms in a market face competition from the many potential firms that will enter the market if economic profit opportunities arise.

**Market and Industry Correspondence** To calculate concentration ratios, Statistics Canada classifies each firm as being in a particular industry. But markets do not always correspond closely to industries for three reasons.

First, markets are often narrower than industries. For example, the pharmaceutical industry, which has a low concentration ratio, operates in many separate markets for individual products—for example, measles vaccine and AIDS-fighting drugs. These drugs do not compete with each other, so this industry, which looks competitive, includes firms that are monopolies (or near monopolies) in markets for individual drugs.

Second, most firms make several products. For example, Westinghouse makes electrical equipment and, among other things, gas-fired incinerators and plywood. So this one firm operates in at least three separate markets, but Statistics Canada classifies Westinghouse as being in the electrical goods and equipment industry. The fact that Westinghouse competes with other producers of plywood does not show

## Economics in Action

### A Competitive Environment

How competitive are markets in North America? Do most firms operate in competitive markets, in monopolistic competition, in oligopoly, or in monopoly markets?

The data needed to answer these questions are hard to get. The last attempt to answer the questions, in a study by William G. Shepherd, an economics professor at the University of Massachusetts at Amherst, covered the years from 1939 to 1980. The figure shows what he discovered.

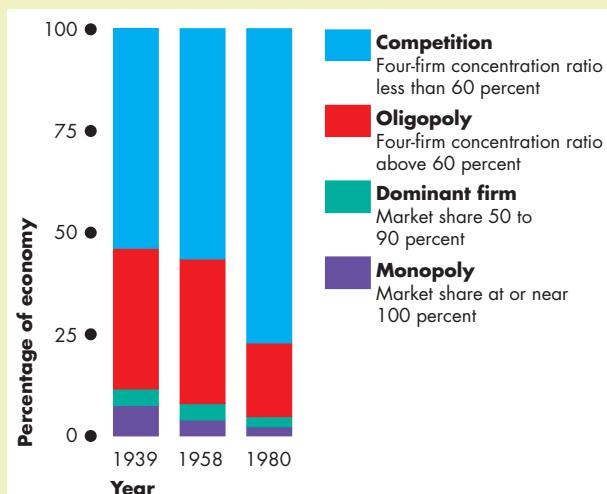
In 1939, three-quarters of the value of goods and services bought and sold in North America were traded in markets that are essentially competitive—markets that are almost perfect competition or monopolistic competition. Monopoly and the dominance of a single firm accounted for about 5 percent of sales. Oligopoly, which is found mainly in manufacturing, accounted for about 18 percent of sales.

Over the period studied, the economy became increasingly competitive. The percentage of output sold by firms operating in competitive markets (blue bars) has expanded, and the percentage of output sold by firms operating in oligopoly markets (red bars) has shrunk the most.

up in the concentration numbers for the plywood market.

Third, firms switch from one market to another depending on profit opportunities. For example, Canadian Pacific, Ltd., which today produces hotel services, forest products, coal and petroleum products, as well as rail services, has diversified from being just a railroad company. Publishers of newspapers, magazines, and textbooks are today rapidly diversifying into Internet and multimedia products. These switches among markets show that there is much scope for entering and exiting a market, and so measures of concentration have limited usefulness.

Despite their limitations, concentration measures do provide a basis for determining the degree of competition in a market when they are combined with information about the geographical scope of the market, barriers to entry, and the extent to which large, multiproduct firms straddle a variety of markets.



#### The Market Structure of the U.S. Economy

Source of data: William G. Shepherd, "Causes of Increased Competition in the U.S. Economy, 1939–1980," *Review of Economics and Statistics*, Vol. 64, No. 4, November 1982, pp. 613–626. Copyright © 1982 by the President and Fellows of Harvard College. Used by permission of MIT Press.

But also during the past decades, the North American economy has become much more exposed to competition from the rest of the world. The data used by William G. Shepherd don't capture this international competition, so the data probably underestimate the degree of true competition in the economy.

## REVIEW QUIZ

- 1 What are the four market types? Explain the distinguishing characteristics of each.
- 2 What are the two measures of concentration? Explain how each measure is calculated.
- 3 Under what conditions do the measures of concentration give a good indication of the degree of competition in a market?
- 4 Is the Canadian economy competitive? Is it becoming more competitive or less competitive?

Work these questions in Study Plan 10.4 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

You now know the variety of market types and how we identify them. Our final question in this chapter is: What determines the things that firms decide to buy from other firms rather than produce for themselves?



## Produce or Outsource? Firms and Markets

To produce a good or service, even a simple one such as a shirt, factors of production must be hired and their activities coordinated. To produce a good as complicated as an iPhone, an enormous range of specialist factors of production must be coordinated.

Factors of production can be coordinated either by firms or markets. We'll describe these two ways of organizing production and then see why firms play a crucial role in achieving an efficient use of resources.

### Firm Coordination

Firms hire labour, capital, and land, and by using a mixture of command systems and incentive systems (see p. 229) organize and coordinate their activities to produce goods and services.

*Firm coordination* occurs when you take your car to the garage for an oil change, brake check, and service. The garage owner hires a mechanic, buys tools, and coordinates all the activities that get your car serviced. Firms also coordinate the production of cornflakes, golf clubs, and a host of other items.

### Market Coordination

Markets coordinate production by adjusting prices and making the decisions of buyers and sellers of factors of production and components consistent.

*Market coordination* occurs to produce a rock concert. A promoter books a stadium, rents some stage equipment, hires some audio and video recording engineers and technicians, and engages some rock groups, a superstar, a publicity agent, and a ticket agent. The promoter sells tickets to thousands of rock fans, audio rights to a recording company, and video and broadcasting rights to a television network. All these transactions take place in markets that coordinate the buying and selling of this huge variety of factors of production.

Outsourcing, buying parts or products from other firms, is another example of market coordination. Dell outsources the production of all the components of its computers. Automakers outsource the production of windshields, windows, transmission systems, engines, tires, and many other auto parts. Apple outsources the entire production of iPods, iPads, and iPhones.

### Why Firms?

What determines whether a firm or a market coordinates a particular set of activities? How does a firm decide whether to buy an item from another firm or manufacture it itself? The answer is cost. Taking account of the opportunity cost of time as well as the costs of the other inputs, a firm uses the method that costs least. In other words, it uses the economically efficient method.

If a task can be performed at a lower cost by markets than by a firm, markets will do the job, and any attempt to set up a firm to replace such market activity will be doomed to failure.

Firms coordinate economic activity when a task can be performed more efficiently by a firm than by markets. In such a situation, it is profitable to set up a firm. Firms are often more efficient than markets as coordinators of economic activity because they can achieve:

- Lower transactions costs
- Economies of scale
- Economies of scope
- Economies of team production

**Transactions Costs** Firms eliminate transactions costs. **Transactions costs** are the costs that arise from finding someone with whom to do business, of reaching an agreement about the price and other aspects of the exchange, and of ensuring that the terms of the agreement are fulfilled. Market transactions require buyers and sellers to get together and to negotiate the terms and conditions of their trading. Sometimes, lawyers have to be hired to draw up contracts. A broken contract leads to still more expense. A firm can lower such transactions costs by reducing the number of individual transactions undertaken.

Imagine getting your car fixed using market coordination. You hire a mechanic to diagnose the problems and make a list of the parts and tools needed to fix them. You buy the parts from several dealers, rent the tools from ABC Rentals, hire an auto mechanic, return the tools, and pay your bills. You can avoid all these transactions and the time they cost you by letting your local garage fix the car.

**Economies of Scale** When the cost of producing a unit of a good falls as its output rate increases, **economies of scale** exist. An automaker experiences economies of scale because as the scale of production increases, the firm can use cost-saving equipment and

## Economics in Action

### Apple Doesn't Make the iPhone!

Apple designed the iPhone and markets it, but Apple doesn't manufacture it. Why? Apple wants to produce the iPhone at the lowest possible cost. Apple achieves its goal by assigning the production task to more than 30 firms, some of which are listed in the table opposite. These 30 firms produce the components in Asia, Europe, and North America and then the components are assembled in its sleek, iconic case by Foxconn and Quanta in Taiwan.

Most electronic products—TVs, DVD players, iPods and iPads, and personal computers—are produced in a similar way to the iPhone with a combination of firm and market coordination. Hundreds of little-known firms compete fiercely to get their components into well-known consumer products.

Altus Technology	Taiwan
Balda	Germany
Broadcom	United States
Cambridge Silicon Radio	UK
Catcher	Taiwan
Cyntec	Taiwan
Delta Electronics	Taiwan
Epson	Japan
Foxconn	Taiwan
Infineon Technologies	Germany
Intel	United States
Largan Precision	Taiwan
Lite-On	Taiwan
Marvell	United States
Micron	United States
National Semiconductor	United States
Novatek	Taiwan
Primax	Taiwan
Quanta	Taiwan
Samsung	Korea
Sanyo	Japan
Sharp	Japan
Taiwan Semiconductor	Taiwan
TMD	Japan



highly specialized labour. An automaker that produces only a few cars a year must use hand-tool methods that are costly. Economies of scale arise from specialization and the division of labour that can be reaped more effectively by firm coordination rather than market coordination.

**Economies of Scope** A firm experiences **economies of scope** when it uses specialized (and often expensive) resources to produce a *range of goods and services*. For example, Toshiba uses its designers and specialized equipment to make the hard drive for the iPod. But it makes many different types of hard drives and other related products. As a result, Toshiba produces the iPod hard drive at a lower cost than a firm making only the iPod hard drive could achieve.

**Economies of Team Production** A production process in which the individuals in a group specialize in mutually supportive tasks is *team production*. Sports provide the best examples of team activity. In baseball, some team members specialize in pitching and others in fielding. In hockey and football, some team members specialize in defence and some in offence.

The production of goods and services offers many examples of team activity. For example, production lines in a TV manufacturing plant work most efficiently when individual activity is organized in teams, each worker specializing in a few tasks. You can also think of an entire firm as being a team. The team has buyers of raw materials and other inputs, production workers, and salespeople. Each individual member

of the team specializes, but the value of the output of the team and the profit that it earns depend on the coordinated activities of all the team's members.

Because firms can economize on transactions costs, reap economies of scale and economies of scope, and organize efficient team production, it is firms rather than markets that coordinate most of our economic activity.

### REVIEW QUIZ

- 1 What are the two ways in which economic activity can be coordinated?
- 2 What determines whether a firm or markets coordinate production?
- 3 What are the main reasons why firms can often coordinate production at a lower cost than markets can?

Work these questions in Study Plan 10.5 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

◆ *Economics in the News* on pp. 240–241 explores the market for Internet advertising. In the next four chapters, we continue to study firms and the decisions they make. In Chapter 11, we learn about the relationships between cost and output at different output levels. These relationships are common to all types of firms in all types of markets. We then turn to problems that are specific to firms in different types of markets.



# Battling for Markets in Internet Advertising

## Facebook Rolls Out Real-Time Ad Platform

*The Financial Times*

September 13, 2012

Some of the world's largest advertising companies have signed up to Facebook's new real-time advertising platform, in a move that the social network hopes will bolster its revenue streams.

On Thursday, Facebook officially launched the platform, called Facebook Ad Exchange, or FBX, following months of testing. The system allows marketers to bid in real-time to buy ad impressions on the social networking site, and deliver their ads to users based on their immediate web-browsing habits, or linked to current events, such as sports results.

"Real-time marketing is getting to be a really important component of digital advertising," said Rebecca Lieb, an analyst with the Altimeter Group. "We'll see a lot of event-triggered marketing in the upcoming election cycle."

The ads use information gathered from computer browsing histories to target individual Facebook users, and the ad prices fluctuate as in auction-style bidding system. So a user who looks at shoes on a retail site could then see an ad for the same brand when clicking back to Facebook.

The capacity will help Facebook compete more directly with advertising rivals Google and Yahoo, which have long provided real-time bidding to advertisers. . . .

Within one-tenth of a second, the system notifies when an ad space is available, evaluates 2,000 data points to determine the most relevant ad, calculates a price and prompts the ad to appear.

The global real-time bidding sector is estimated to be worth some \$3bn–\$4bn, but industry observers expect this to reach as much as \$20bn by 2015. . . .

Written by Mark Wembridge and April Dembosky. Copyright © 2012. Used under licence from *The Financial Times*. All rights reserved.

### ESSENCE OF THE STORY

- Facebook is under pressure to generate advertising revenue.
- Real-time bidding is widely used for Internet advertising and its market share is growing rapidly.
- Facebook and Google are getting better at capturing user activity.
- A new Facebook system will target ads at the user's current interests.
- Advertisers will bid to get their ads in front of the right users.

[MyEconLab](#) More Economics in the News

## ECONOMIC ANALYSIS

- Like all firms, Facebook and Google aim to maximize profit.
- Facebook provides social networking services and Google provides search services, a variety of other services, and with Google+ is offering a social networking service.
- Facebook and Google face constraints imposed by the market and technology.
- People who use social networks demand their services, and at the latest count Facebook and another 200-odd firms supply social networking services.
- People looking for information demand Internet search services, and Google and more than 100 other firms supply Internet search services.
- The equilibrium price of social networking services and of Internet search services is zero, and the equilibrium quantity of each is the quantity demanded at a zero price.
- Social networking and Internet search providers enjoy economies of scope: They produce advertising services as well as their other service.
- Unlike social networking and search, Internet advertising is a big revenue and profit generator.
- Because the providers of social networking and search know a lot about their users, they can offer advertisers access to potential customers and charge a high price for this precision.
- Google has been enormously successful at delivering advertising based on a user's search activity, and its revenue has grown from \$1 billion in 2003 to \$56 billion in 2013 (see Fig. 1). Google's profit in 2013 was \$13 billion (see Fig. 2).
- Facebook is still learning how to tap its advertising potential and the news article describes its innovation during 2012 of real-time bidding for advertising based on a user's browsing.
- Facebook's revenue is beginning to grow, but by 2013 it had reached only \$8 billion (see Fig. 1).
- Providing a social networking service or search service doesn't guarantee success in generating advertising revenue and profit.
- Yahoo is an example of a firm that hasn't performed as well as its owners would wish.
- As Google and Facebook have seen explosive growth in users and revenues, Yahoo has struggled.

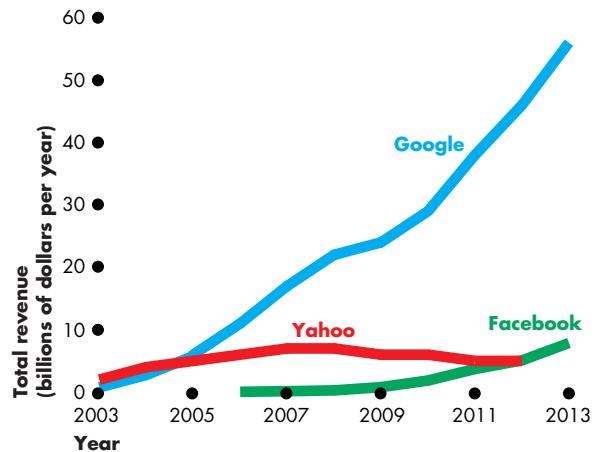


Figure 1 Total Revenue Comparison

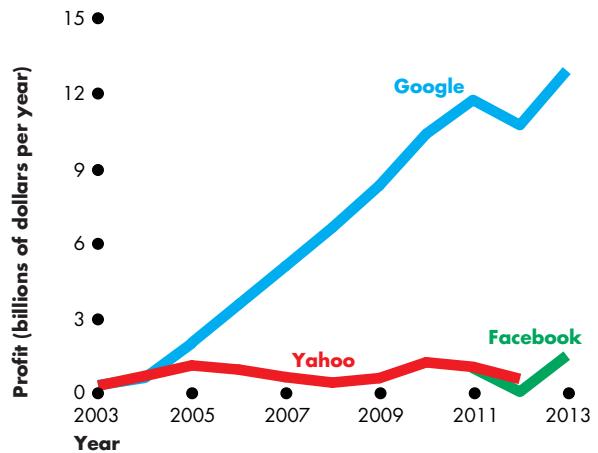


Figure 2 Profit Comparison

- Figure 1 shows that Yahoo's revenue peaked in 2008 and has been falling while Google's has soared and Facebook's has grown to overtake that of Yahoo.
- Figure 2 shows that Yahoo's profit has been flat while Google's has soared. Facebook's profit remains modest.
- The data shown in Figs. 1 and 2 suggest that, so far, Internet search is a more effective tool for generating revenue and profit than social networking. Perhaps Facebook's new revenue model will change that.
- The data also suggest that Facebook's and Google's expansion is tightening the market constraint that Yahoo faces.

## SUMMARY

### Key Points

#### The Firm and Its Economic Problem (pp. 224–226)

- Firms hire and organize factors of production to produce and sell goods and services.
- A firm's goal is to maximize economic profit, which is total revenue minus total cost measured as the opportunity cost of production.
- A firm's opportunity cost of production is the sum of the cost of resources bought in the market, using the firm's own resources, and resources supplied by the firm's owner.
- Normal profit is the opportunity cost of entrepreneurship and is part of the firm's opportunity cost.
- Technology, information, and markets limit the economic profit that a firm can make.

Working Problems 1 and 2 will give you a better understanding of the firm and its economic problem.

#### Technological and Economic Efficiency (pp. 227–228)

- A method of production is technologically efficient when a firm uses the least amount of inputs to produce a given output.
- A method of production is economically efficient when the cost of producing a given output is as low as possible.

Working Problem 3 will give you a better understanding of technological and economic efficiency.

#### Information and Organization (pp. 229–232)

- Firms use a combination of command systems and incentive systems to organize production.
- Faced with incomplete information and uncertainty, firms induce managers and workers to

### Key Terms

Command system, 229

Economic depreciation, 225

Economic efficiency, 227

Economic profit, 224

Economies of scale, 238

Economies of scope, 239

Firm, 224

Four-firm concentration ratio, 234

Herfindahl-Hirschman Index, 234

Implicit rental rate, 224

Incentive system, 229

Monopolistic competition, 233

Monopoly, 233

Normal profit, 225

### MyEconLab Key Terms Quiz

Oligopoly, 233

Perfect competition, 233

Principal-agent problem, 229

Product differentiation, 233

Technological efficiency, 227

Technology, 226

Transactions costs, 238

perform in ways that are consistent with the firms' goals.

- Proprietorships, partnerships, and corporations use ownership, incentive pay, and long-term contracts to cope with the principal–agent problem.

Working Problem 4 will give you a better understanding of information and organization.

#### Markets and the Competitive Environment (pp. 233–237)

- In perfect competition, many sellers offer an identical product to many buyers and entry is free.
- In monopolistic competition, many sellers offer slightly different products to many buyers and entry is free.
- In oligopoly, a small number of sellers compete and barriers to entry limit the number of firms.
- In monopoly, one firm produces an item that has no close substitutes and the firm is protected by a barrier to entry that prevents the entry of competitors.

Working Problems 5 and 6 will give you a better understanding of markets and the competitive environment.

#### Produce or Outsource? Firms and Markets

(pp. 238–239)

- Firms coordinate economic activities when they can perform a task more efficiently—at lower cost—than markets can.
- Firms economize on transactions costs and achieve the benefits of economies of scale, economies of scope, and economies of team production.

Working Problem 7 will give you a better understanding of firms and markets.



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 10 Study Plan.

Mike operates a bike retail store and repair shop, Mike's Bikes.

*Some data about the firm and industry:*

- Last year, the market value of the firm's showroom and workshop increased from \$600,000 to \$675,000; the market value of the inventory of unsold bikes decreased from \$400,000 to \$320,000; and the market value of the firm's tools remained constant at \$5,000.
- The firm paid manufacturers \$770,000 for bikes.
- The cost of electricity and IT services was \$25,000.
- The wages paid to shop assistants were \$50,000.
- Mike is the firm's entrepreneur. He also works part-time at a bike manufacturer that pays \$40 per hour. The manufacturer wants Mike to work full-time, but instead he does repairs at Mike's Bikes for 10 hours a week.
- Normal profit in bike retailing is \$40,000 per year.
- The interest rate is 5 percent per year.

### Questions

1. What was the cost of the resources Mike's Bikes bought in the marketplace last year?
2. What was Mike's Bikes' opportunity cost of using resources owned by the firm last year?
3. What was Mike's Bikes' opportunity cost of using resources supplied by Mike last year?
4. What was Mike's Bikes' opportunity cost of production last year?

### Solutions

1. The firm bought bikes for \$770,000; electricity and IT services for \$25,000; and paid wages to shop assistants of \$50,000. The total cost of these resources bought in the marketplace was \$845,000.

**Key Point:** The cost of resources bought in the market is the total amount paid for them.

2. The resources owned by Mike's Bikes are the tools, the inventory of bikes, and the showroom and workshop.

The opportunity cost of using these resources is economic depreciation and forgone interest.

Economic depreciation is the change in the market value of the firm's resources. The market value of the inventory of bikes fell by \$80,000 but the market value of the showroom and workshop

increased by \$75,000, so the total economic depreciation was \$80,000 – \$75,000, or \$5,000.

Forgone interest is the interest that could be earned on the market value of the firm's resources. That value is \$675,000 (showroom and workshop), \$320,000 (bikes), and \$5,000 (tools), which total \$1,000,000. The interest forgone is 5 percent of the \$1,000,000, which equals \$50,000.

So the opportunity cost of using resources owned by the firm was \$5,000 + \$50,000, or \$55,000.

**Key Point:** The cost of using resources owned by the firm is part of the firm's opportunity costs.

3. The resources supplied by Mike are his entrepreneurial services and his labour. The opportunity cost of his entrepreneurial services is normal profit of \$40,000 and of his labour is \$20,000 (10 hours a week at his opportunity cost of \$40 per hour, for 50 weeks). These two items total \$60,000.

**Key Point:** The cost of using resources supplied by the owner is part of the firm's opportunity costs.

4. The opportunity cost of production is the sum of the components of the opportunity cost of the resources used: \$845,000 + \$55,000 + \$60,000. So the opportunity cost of production last year was \$960,000.

**Key Point:** The firm's opportunity cost of production is the sum of the cost of all the resources used.

### Key Table

Item	Amount
<i>Cost of Resources Bought in Market</i>	
Bikes	\$770,000
Electricity and IT services	25,000
Wages	<u>50,000</u>
	\$845,000
<i>Cost of Resources Owned by Firm</i>	
Economic depreciation	\$5,000
Forgone interest	<u>50,000</u>
	\$55,000
<i>Cost of Resources Supplied by Owner</i>	
Mike's normal profit	\$40,000
Mike's forgone wages	<u>20,000</u>
	\$60,000
<i>Opportunity Cost of Production</i>	
	<u><u>\$960,000</u></u>

**MyEconLab Interactive Animation**



## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 7 in Chapter 10 Study Plan and get instant feedback.

### The Firm and Its Economic Problem (Study Plan 10.1)

1. One year ago, Jack and Jill set up a vinegar-bottling firm (called JJVB). Use the following data to calculate JJVB's opportunity cost of production during its first year of operation:
  - Jack and Jill put \$50,000 of their own money into the firm and bought equipment for \$30,000.
  - They hired one worker at \$20,000 a year.
  - Jack quit his old job, which paid \$30,000 a year, and worked full-time for JJVB.
  - Jill kept her old job, which paid \$30 an hour, but gave up 500 hours of leisure a year to work for JJVB.
  - JJVB bought \$10,000 of goods and services.
  - The market value of the equipment at the end of the year was \$28,000.
  - Jack and Jill have a \$100,000 home loan on which they pay interest of 6 percent a year.
2. Joe, who has no skills, no job experience, and no alternative employment, runs a shoeshine stand. Other operators of shoeshine stands earn \$10,000 a year. Joe pays rent of \$2,000 a year, and his total revenue is \$15,000 a year. Joe spent \$1,000 on equipment and used his credit card to buy it. The interest on a credit card balance is 20 percent a year. At the end of the year, Joe was offered \$500 for his business and all its equipment. Calculate Joe's opportunity cost of production and his economic profit.

### Technological and Economic Efficiency (Study Plan 10.2)

3. Four ways of laundering 100 shirts are:

Method	Labour (hours)	Capital (machines)
A	1	10
B	5	8
C	20	4
D	50	1

- a. Which methods are technologically efficient?
- b. Which method is economically efficient if the hourly wage rate and the implicit rental rate of capital are (i) wage rate \$1, rental rate \$100; (ii) wage rate \$5, rental rate \$50; and (iii) wage rate \$50, rental rate \$5?

### Information and Organization (Study Plan 10.3)

#### 4. Executive Pay

Executive compensation, based on performance, can theoretically constrain pay, but companies are paying their top executives more and more. The median compensation of a CEO in 2013 was \$13.9 million, up 9 percent from 2012.

Source: CNBC, April 28, 2014

What is the economic problem that CEO compensation schemes are designed to solve? Would paying executives with shares of the company's stock align their interests with shareholders?

### Markets and the Competitive Environment

#### (Study Plan 10.4)

5. Sales of the firms in the tattoo industry are:

Firm	Sales (dollars per year)
Bright Spots	450
Freckles	325
Love Galore	250
Native Birds	200
Other 15 firms	800

Calculate the four-firm concentration ratio.

What is the structure of the tattoo industry?

#### 6. GameStop Racks Up the Points

No retailer has more cachet among gamers than GameStop. For now, only Walmart has a larger share—21.3% last year. GameStop's share was 21.1% last year, and may well overtake Walmart this year. But if new women gamers prefer shopping at Target to GameStop, Walmart and Target might erode GameStop's market share.

Source: *Fortune*, June 9, 2008

Estimate a range for the four-firm concentration ratio and the HHI for the game market based on the data provided in this news clip.

### Produce or Outsource? Firms and Markets

#### (Study Plan 10.5)

7. FedEx contracts independent truck operators to pick up and deliver its packages and pays them on the volume of packages carried. Why doesn't FedEx buy more trucks and hire more drivers? What incentive problems might arise from this arrangement?

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### The Firm and Its Economic Problem

Use the following data to work Problems 8 and 9.

Lee is a computer programmer who earned \$35,000 in 2011. But on January 1, 2012, Lee opened a body board manufacturing business. At the end of the first year of operation, he submitted the following information to his accountant:

- He stopped renting out his cottage for \$3,500 a year and used it as his factory. The market value of the cottage increased from \$70,000 to \$71,000.
  - He spent \$50,000 on materials, phone, etc.
  - He leased machines for \$10,000 a year.
  - He paid \$15,000 in wages.
  - He used \$10,000 from his savings account, which earns 5 percent a year interest.
  - He borrowed \$40,000 at 10 percent a year.
  - He sold \$160,000 worth of body boards.
  - Normal profit is \$25,000 a year.
8. Calculate Lee's opportunity cost of production and his economic profit.
9. Lee's accountant recorded the depreciation on his cottage during 2012 as \$7,000. According to the accountant, what profit did Lee make?
10. In 2011, Toni taught music and earned \$20,000. She also earned \$4,000 by renting out her basement. On January 1, 2012, she quit teaching, stopped renting out her basement, and began to use it as the office for her new Web site design business. She took \$2,000 from her savings account to buy a computer. During 2012, she paid \$1,500 for the lease of a Web server and \$1,750 for high-speed Internet service. She received a total revenue from Web site designing of \$45,000 and earned interest at 5 percent a year on her savings account balance. Normal profit is \$55,000 a year. At the end of 2012, Toni could have sold her computer for \$500. Calculate Toni's opportunity cost of production and her economic profit in 2012.
11. **The Colvin Interview: Chrysler**

The key driver of profitability will be that the focus of the company isn't on profitability. Our focus is on the customer. If we can find a way to give customers what they want better than anybody else, then what can stop us?

Source: *Fortune*, April 14, 2008

a. In spite of what Chrysler's vice chairman and co-president claims, why is Chrysler's focus actually on profitability?

b. What would happen to Chrysler if it didn't focus on maximizing profit, but instead focused its production and pricing decisions to "give customers what they want"?

### 12. Must Watches

Stocks too volatile? Bonds too boring? Then try an alternative investment—one you can wear on your wrist. The typical return on a watch over five to ten years is roughly 10%. You could do better in an index fund, but what other investment is so wearable?

Source: *Fortune*, April 14, 2008

- a. What is the cost of buying a watch?
- b. What is the opportunity cost of owning a watch?
- c. Does owning a watch create an economic profit opportunity?

### Technological and Economic Efficiency

Use the following data to work Problems 13 and 14.

Four methods of completing a tax return and the time taken by each method are with a PC, 1 hour; with a pocket calculator, 12 hours; with a pocket calculator and paper and pencil, 12 hours; and with a pencil and paper, 16 hours. The PC and its software cost \$1,000, the pocket calculator costs \$10, and the pencil and paper cost \$1.

- 13. Which, if any, of the methods is technologically efficient?
- 14. Which method is economically efficient if the wage rate is (i) \$5 an hour, (ii) \$50 an hour, and (iii) \$500 an hour?

### 15. A Medical Sensation

Hospitals are buying da Vinci surgical robots. Surgeons, sitting comfortably at a da Vinci console, can use various robotic attachments to perform even the most complex procedures.

Source: *Fortune*, April 28, 2008

- a. Assume that performing a surgery with a surgical robot requires fewer surgeons and nurses. Is using the surgical robot technologically efficient?

- b. What additional information would you need to be able to say that switching to surgical robots is economically efficient for a hospital?

### Information and Organization

16. Loblaw has more than 1,000 stores from coast to coast, more than 140,000 employees, and total revenues of close to \$30 billion. Penny and David Chapman run the family-owned Chapman's Ice Cream in Markdale, Ontario, which employs local people and supplies Loblaw with ice cream.
- How does Loblaw coordinate its activities? Is it likely to use mainly a command system or also incentive systems? Explain.
  - How do you think Penny and David Chapman coordinate the activities of Chapman's Ice Cream? Are they likely to use mainly a command system or also incentive systems? Why?
  - Describe, compare, and contrast the principal–agent problems faced by Loblaw and Chapman's Ice Cream. How might these firms cope with their principal–agent problems?

### 17. Where Does Google Go Next?

Google gives its engineers one day a week to work on whatever project they want. A couple of colleagues did what many of the young geniuses do at Google: They came up with a cool idea. At Google, you often end up with a laissez-faire mess instead of resource allocation.

Source: *Fortune*, May 26, 2008

- Describe Google's method of organizing production with their software engineers.
- What are the potential gains and opportunity costs associated with this method?

### Markets and the Competitive Environment

18. Market shares of chocolate makers are:

Firm	Market share (percent)
Truffles, Inc.	25
Magic, Inc.	20
Mayfair, Inc.	15
All Natural, Inc.	15
Gold, Inc.	15
Bond, Inc.	10

- Calculate the Herfindahl-Hirschman Index.
- What is the structure of the chocolate industry?

### Produce or Outsource? Firms and Markets

Use the following information to work Problems 19 to 21.

Two leading design firms, Astro Studios of San Francisco and Hers Experimental Design Laboratory, Inc. of Osaka, Japan, worked with Microsoft to design the Xbox 360 video game console. IBM, ATI, and SiS designed the Xbox 360's hardware. Three firms—Flextronics, Wistron, and Celestica—manufactured the Xbox 360 at their plants in China and Taiwan.

- Why do you think Microsoft works with a large number of other firms, rather than performing all the required tasks itself?
- What are the roles of transaction costs, economies of scale, economies of scope, and economies of team production in the design, manufacture, and marketing of the Xbox?
- Why do you think the Xbox is designed in the United States and Japan but built in China?

### Economics in the News

- After you have studied *Economics in the News* on pp. 240–241, answer the following questions.
  - What products do Facebook and Google sell?
  - In what types of markets do Facebook and Google compete?
  - How do social networks and Internet search providers generate revenue?
  - What is special about social networking sites that make them attractive to advertisers?
  - What is special about Internet search providers that make them attractive to advertisers?
  - What technological changes might increase the profitability of social networks compared to Internet search providers?



# 11

## OUTPUT AND COSTS

After studying this chapter,  
you will be able to:

- ◆ Distinguish between the short run and the long run
- ◆ Explain and illustrate a firm's short-run product curves
- ◆ Explain and derive a firm's short-run cost curves
- ◆ Explain and derive a firm's long-run average cost curve

Behind the scenes of your favourite Starbucks coffee shop, many economic decisions have been made that affect the firm's cost of production. Starbucks has decided how much to produce, how many people to employ, and how much and what type of equipment to use. How does a firm make these decisions?

We are going to answer this question in this chapter. And in *Economics in the News* at the end of the chapter, we'll look at how recent expansion decisions by Starbucks affect the firm's production costs. But first, we'll study the costs of a simpler, smaller firm, Campus Sweaters, a (fictional) producer of knitwear.

## Decision Time Frames

People who operate firms make many decisions, and all of their decisions are aimed at achieving one overriding goal: maximum attainable profit. But not all decisions are equally critical. Some decisions are big ones. Once made, they are costly (or impossible) to reverse. If such a decision turns out to be incorrect, it might lead to the failure of the firm. Other decisions are small. They are easily changed. If one of these decisions turns out to be incorrect, the firm can change its actions and survive.

The biggest decision that an entrepreneur makes is in what industry to establish a firm. For most entrepreneurs, their background knowledge and interests drive this decision. But the decision also depends on profit prospects—on the expectation that total revenue will exceed total cost.

Cindy has decided to set up Campus Sweaters. She has also decided the most effective method of organizing the firm. But she has not decided the quantity to produce, the factors of production to hire, or the price to charge for sweaters.

Decisions about the quantity to produce and the price to charge depend on the type of market in which the firm operates. Perfect competition, monopolistic competition, oligopoly, and monopoly all confront the firm with *different* problems. Decisions about *how* to produce a given output do not depend on the type of market in which the firm operates. *All* types of firms in *all* types of markets make similar decisions about how to produce.

The actions that a firm can take to influence the relationship between output and cost depend on how soon the firm wants to act. A firm that plans to change its output rate tomorrow has fewer options than one that plans to change its output rate six months or six years in the future.

To study the relationship between a firm's output decision and its costs, we distinguish between two decision time frames:

- The short run
- The long run

### The Short Run

The **short run** is a time frame in which the quantity of at least one factor of production is fixed. For most firms, capital, land, and entrepreneurship are fixed factors of production and labour is the variable factor of

production. We call the fixed factors of production the firm's *plant*: In the short run, a firm's plant is fixed.

For Campus Sweaters, the fixed plant is its factory building and its knitting machines. For an electric power utility, the fixed plant is its buildings, generators, computers, and control systems.

To increase output in the short run, a firm must increase the quantity of a variable factor of production, which is usually labour. So to produce more output, Campus Sweaters must hire more labour and operate its knitting machines for more hours a day. Similarly, an electric power utility must hire more labour and operate its generators for more hours a day.

Short-run decisions are easily reversed. The firm can increase or decrease its output in the short run by changing the amount of labour it hires.

### The Long Run

The **long run** is a time frame in which the quantities of *all* factors of production can be varied. That is, the long run is a period in which the firm can change its *plant*.

To increase output in the long run, a firm can change its plant as well as the quantity of labour it hires. Campus Sweaters can decide whether to install more knitting machines, use a new type of machine, reorganize its management, or hire more labour. Long-run decisions are *not* easily reversed. Once a plant decision is made, the firm usually must live with it for some time. To emphasize this fact, we call the past expenditure on a plant that has no resale value a **sunk cost**. A sunk cost is irrelevant to the firm's current decisions. The only costs that influence its current decisions are the short-run cost of changing its labour inputs and the long-run cost of changing its plant.

### REVIEW QUIZ

- 1 Distinguish between the short run and the long run.
- 2 Why is a sunk cost irrelevant to a firm's current decisions?

Work these questions in Study Plan 11.1 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

We're going to study costs in the short run and the long run. We begin with the short run and describe a firm's technology constraint.

## Short-Run Technology Constraint

To increase output in the short run, a firm must increase the quantity of labour employed. We describe the relationship between output and the quantity of labour employed by using three related concepts:

1. Total product
2. Marginal product
3. Average product

These product concepts can be illustrated either by product schedules or by product curves. Let's look first at the product schedules.

### Product Schedules

Table 11.1 shows some data that describe Campus Sweaters' total product, marginal product, and average product. The numbers tell us how the quantity of sweaters produced increases as Campus Sweaters employs more workers. The numbers also tell us about the productivity of the labour that Campus Sweaters employs.

Focus first on the columns headed "Labour" and "Total product." **Total product** is the maximum output that a given quantity of labour can produce. You can see from the numbers in these columns that as Campus Sweaters employs more labour, total product increases. For example, when 1 worker is employed, total product is 4 sweaters a day, and when 2 workers are employed, total product is 10 sweaters a day. Each increase in employment increases total product.

The **marginal product** of labour is the increase in total product that results from a one-unit increase in the quantity of labour employed, with all other inputs remaining the same. For example, in Table 11.1, when Campus Sweaters increases employment from 2 to 3 workers and does not change its capital, the marginal product of the third worker is 3 sweaters—total product increases from 10 to 13 sweaters.

Average product tells how productive workers are on average. The **average product** of labour is equal to total product divided by the quantity of labour employed. For example, in Table 11.1, the average product of 3 workers is 4.33 sweaters per worker—13 sweaters a day divided by 3 workers.

If you look closely at the numbers in Table 11.1, you can see some patterns. As Campus Sweaters hires

**TABLE 11.1** Total Product, Marginal Product, and Average Product

	Labour (workers per day)	Total product (sweaters per day)	Marginal product (sweaters per additional worker)	Average product (sweaters per worker)
A	0	0	..... 4	
B	1	4	..... 6	4.00
C	2	10	..... 3	5.00
D	3	13	..... 2	4.33
E	4	15	..... 1	3.75
F	5	16		3.20

Total product is the total amount produced. Marginal product is the change in total product that results from a one-unit increase in labour. For example, when labour increases from 2 to 3 workers a day (row C to row D), total product increases from 10 to 13 sweaters a day. The marginal product of going from 2 to 3 workers is 3 sweaters. Average product is total product divided by the quantity of labour employed. For example, the average product of 3 workers is 4.33 sweaters per worker (13 sweaters a day divided by 3 workers).

more labour, marginal product increases initially, and then begins to decrease. For example, marginal product increases from 4 sweaters a day for the first worker to 6 sweaters a day for the second worker and then decreases to 3 sweaters a day for the third worker. Average product also increases at first and then decreases. You can see the relationships between the quantity of labour hired and the three product concepts more clearly by looking at the product curves.

### Product Curves

The product curves are graphs of the relationships between employment and the three product concepts you've just studied. They show how total product, marginal product, and average product change as employment changes. They also show the relationships among the three concepts. Let's look at the product curves.

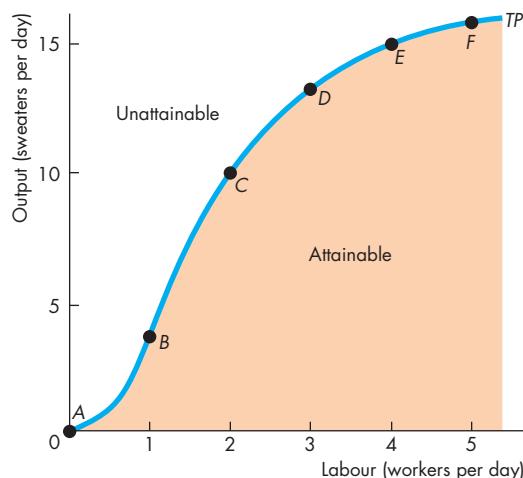
## Total Product Curve

Figure 11.1 shows Campus Sweaters' total product curve,  $TP$ , which is a graph of the total product schedule. Points  $A$  through  $F$  correspond to rows  $A$  through  $F$  in Table 11.1. To graph the entire total product curve, we vary labour by hours rather than whole days.

Notice the shape of the total product curve. As employment increases from zero to 1 worker a day, the curve becomes steeper. Then, as employment increases to 3, 4, and 5 workers a day, the curve becomes less steep.

The total product curve is similar to the *production possibilities frontier* (explained in Chapter 2). It separates the attainable output levels from those that are unattainable. All the points that lie above the curve are unattainable. Points that lie below the curve, in the orange area, are attainable, but they are inefficient—they use more labour than is necessary to produce a given output. Only the points *on* the total product curve are technologically efficient.

**FIGURE 11.1** Total Product Curve



The total product curve,  $TP$ , is based on the data in Table 11.1. The total product curve shows how the quantity of sweaters produced changes as the quantity of labour employed changes. For example, 2 workers can produce 10 sweaters a day (point  $C$ ). Points  $A$  through  $F$  on the curve correspond to the rows of Table 11.1. The total product curve separates attainable outputs from unattainable outputs. Points below the  $TP$  curve are inefficient.

[MyEconLab Animation](#)

## Marginal Product Curve

Figure 11.2 shows Campus Sweaters' marginal product of labour. Part (a) reproduces the total product curve from Fig. 11.1 and part (b) shows the marginal product curve,  $MP$ .

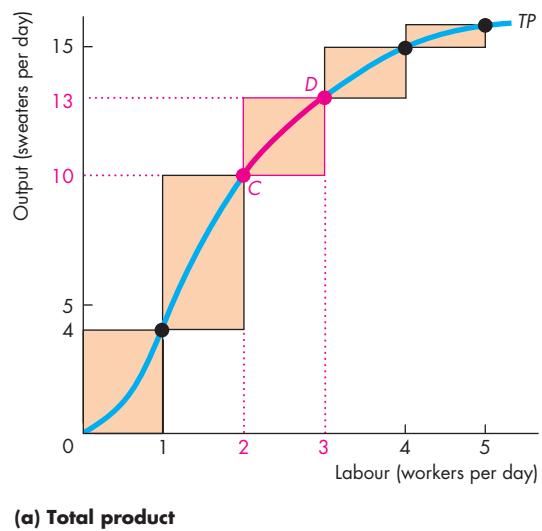
In part (a), the orange bars illustrate the marginal product of labour. The height of a bar measures marginal product. Marginal product is also measured by the slope of the total product curve. Recall that the slope of a curve is the change in the value of the variable measured on the  $y$ -axis—output—divided by the change in the variable measured on the  $x$ -axis—labour—as we move along the curve. A one-unit increase in labour, from 2 to 3 workers, increases output from 10 to 13 sweaters, so the slope from point  $C$  to point  $D$  is 3 sweaters per additional worker, the same as the marginal product we've just calculated.

Again varying the amount of labour in the smallest units possible, we can draw the marginal product curve shown in Fig. 11.2(b). The *height* of this curve measures the *slope* of the total product curve at a point. Part (a) shows that an increase in employment from 2 to 3 workers increases output from 10 to 13 sweaters (an increase of 3). The increase in output of 3 sweaters appears on the  $y$ -axis of part (b) as the marginal product of going from 2 to 3 workers. We plot that marginal product at the midpoint between 2 and 3 workers. Notice that the marginal product shown in Fig. 11.2(b) reaches a peak at 1.5 workers, and at that point, marginal product is 6 sweaters per additional worker. The peak occurs at 1.5 workers because the total product curve is steepest when employment increases from 1 worker to 2 workers.

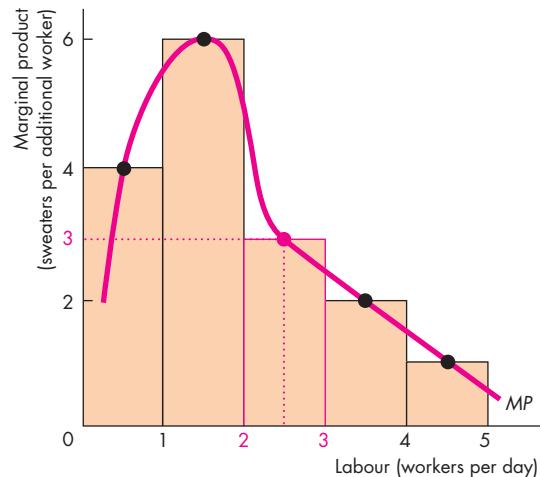
The total product and marginal product curves differ across firms and types of goods. GM's product curves are different from those of Hydro One's, whose curves in turn are different from those of Campus Sweaters. But the shapes of the product curves are similar because almost every production process has two features:

- Increasing marginal returns initially
- Diminishing marginal returns eventually

**Increasing Marginal Returns** Increasing marginal returns occur when the marginal product of an additional worker exceeds the marginal product of the previous worker. Increasing marginal returns arise from increased specialization and division of labour in the production process.

**FIGURE 11.2** Total Product and Marginal Product

(a) Total product



(b) Marginal product

Marginal product is illustrated by the orange bars.

For example, when labour increases from 2 to 3 workers a day, marginal product is the orange bar whose height is 3 sweaters. (Marginal product is shown midway between the quantities of labour to emphasize that marginal product results from *changing* the quantity of labour.) The steeper the slope of the total product curve (*TP*) in part (a), the larger is marginal product (*MP*) in part (b). Marginal product increases to a maximum (in this example when 1.5 workers a day are employed) and then declines—diminishing marginal product.

For example, if Campus Sweaters employs one worker, that person must learn all the aspects of sweater production: running the knitting machines, fixing breakdowns, packaging and mailing sweaters, buying and checking the type and colour of the wool. All these tasks must be performed by that one person.

If Campus Sweaters hires a second person, the two workers can specialize in different parts of the production process and can produce more than twice as much as one worker. The marginal product of the second worker is greater than the marginal product of the first worker. Marginal returns are increasing.

**Diminishing Marginal Returns** Most production processes experience increasing marginal returns initially, but all production processes eventually reach a point of *diminishing* marginal returns. **Diminishing marginal returns** occur when the marginal product of an additional worker is less than the marginal product of the previous worker.

Diminishing marginal returns arise from the fact that more and more workers are using the same capital and working in the same space. As more workers are added, there is less and less for the additional workers to do that is productive. For example, if Campus Sweaters hires a third worker, output increases but not by as much as it did when it hired the second worker. In this case, after two workers are hired, all the gains from specialization and the division of labour have been exhausted. By hiring a third worker, the factory produces more sweaters, but the equipment is being operated closer to its limits. There are even times when the third worker has nothing to do because the machines are running without the need for further attention. Hiring more and more workers continues to increase output but by successively smaller amounts. Marginal returns are diminishing. This phenomenon is such a pervasive one that it is called a “law”—the law of diminishing returns. The **law of diminishing returns** states that

As a firm uses more of a variable factor of production with a given quantity of the fixed factor of production, the marginal product of the variable factor eventually diminishes.

You are going to return to the law of diminishing returns when we study a firm's costs, but before we do that, let's look at the average product of labour and the average product curve.

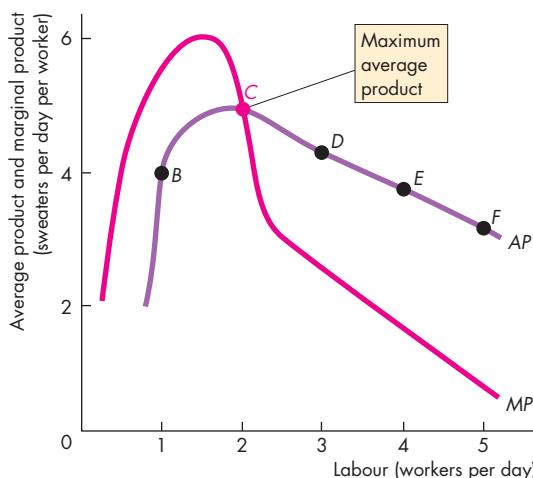
### Average Product Curve

Figure 11.3 illustrates Campus Sweaters' average product of labour and shows the relationship between average product and marginal product. Points *B* through *F* on the average product curve *AP* correspond to those same rows in Table 11.1. Average product increases from 1 to 2 workers (its maximum value at point *C*) but then decreases as yet more workers are employed.

Notice also that average product is largest when average product and marginal product are equal. That is, the marginal product curve cuts the average product curve at the point of maximum average product. For the number of workers at which marginal product exceeds average product, average product is *increasing*. For the number of workers at which marginal product is less than average product, average product is *decreasing*.

The relationship between the average product and marginal product is a general feature of the relationship between the average and marginal values of any variable—even your grades.

**FIGURE 11.3** Average Product



The figure shows the average product of labour and the connection between average product and marginal product. With 1 worker, marginal product exceeds average product, so average product is increasing. With 2 workers, marginal product equals average product, so average product is at its maximum. With more than 2 workers, marginal product is less than average product, so average product is decreasing.

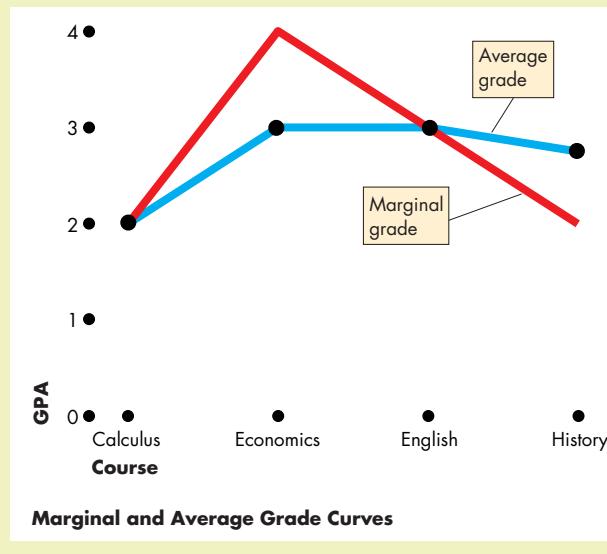
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### Economics in Action

#### How to Pull Up Your Average

Do you want to pull up your average grade? Then make sure that your grade on your next test is better than your current average! Your next test is your marginal test. If your marginal grade exceeds your average grade (like the Economics grade in the figure), your average will rise. If your marginal grade equals your average grade (like the English grade in the figure), your average won't change. If your marginal grade is below your average grade (like the History grade in the figure), your average will fall.

The relationship between your marginal grade and average grade is exactly the same as that between marginal product and average product.



### REVIEW QUIZ

- Explain how the marginal product and average product of labour change as the labour employed increases (a) initially and (b) eventually.
- What is the law of diminishing returns? Why does marginal product eventually diminish?
- Explain the relationship between marginal product and average product.

Work these questions in Study Plan 11.2 and get instant feedback. Do a Key Terms Quiz.

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Campus Sweaters' product curves influence its costs, as you are now going to see.

## Short-Run Cost

To produce more output in the short run, a firm must employ more labour, which means that it must increase its costs. We describe the relationship between output and cost by using three cost concepts:

- Total cost
- Marginal cost
- Average cost

### Total Cost

A firm's **total cost** ( $TC$ ) is the cost of *all* the factors of production it uses. We separate total cost into total *fixed* cost and total *variable* cost.

**Total fixed cost** ( $TFC$ ) is the cost of the firm's fixed factors. For Campus Sweaters, total fixed cost includes the cost of renting knitting machines and *normal profit*, which is the opportunity cost of Cindy's entrepreneurship (see Chapter 10, p. 225). The quantities of fixed factors don't change as output changes, so total fixed cost is the same at all outputs.

**Total variable cost** ( $TVC$ ) is the cost of the firm's variable factors. For Campus Sweaters, labour is the variable factor, so this component of cost is its wage bill. Total variable cost changes as output changes.

Total cost is the sum of total fixed cost and total variable cost. That is,

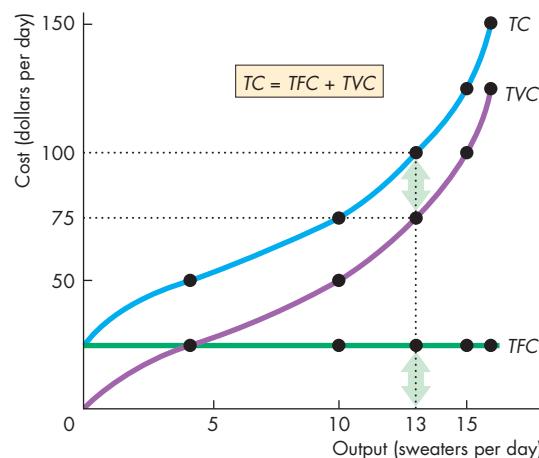
$$TC = TFC + TVC.$$

The table in Fig. 11.4 shows total costs. Campus Sweaters rents one knitting machine for \$25 a day, so its  $TFC$  is \$25. To produce sweaters, the firm hires labour, which costs \$25 a day.  $TVC$  is the number of workers multiplied by \$25. For example, to produce 13 sweaters a day, in row D, the firm hires 3 workers and  $TVC$  is \$75.  $TC$  is the sum of  $TFC$  and  $TVC$ , so to produce 13 sweaters a day,  $TC$  is \$100. Check the calculations in the other rows of the table.

Figure 11.4 shows Campus Sweaters' total cost curves, which graph total cost against output. The green  $TFC$  curve is horizontal because total fixed cost (\$25 a day) does not change when output changes. The purple  $TVC$  curve and the blue  $TC$  curve both slope upward because to increase output, more labour must be employed, which increases total variable cost. Total fixed cost equals the vertical distance between the  $TVC$  and  $TC$  curves.

Let's now look at a firm's marginal cost.

**FIGURE 11.4** Total Cost Curves



Labour (workers per day)	Output (sweaters per day)	Total fixed cost ( $TFC$ )	Total variable cost ( $TVC$ )	Total cost ( $TC$ )
		(dollars per day)		
A	0	25	0	25
B	1	25	25	50
C	2	25	50	75
D	3	25	75	100
E	4	25	100	125
F	5	25	125	150

Campus Sweaters rents a knitting machine for \$25 a day, so this cost is the firm's total fixed cost. The firm hires workers at a wage rate of \$25 a day, and this cost is its total variable cost. For example, in row D, Campus Sweaters employs 3 workers and its total variable cost is  $3 \times \$25$ , which equals \$75. Total cost is the sum of total fixed cost and total variable cost. For example, when Campus Sweaters employs 3 workers, total cost is \$100—total fixed cost of \$25 plus total variable cost of \$75.

The graph shows Campus Sweaters' total cost curves. Total fixed cost is constant—the  $TFC$  curve is a horizontal line. Total variable cost increases as output increases, so the  $TVC$  curve and the  $TC$  curve increase as output increases. The vertical distance between the  $TC$  curve and the  $TVC$  curve equals total fixed cost, as illustrated by the two arrows.

## Marginal Cost

Figure 11.4 shows that total variable cost and total cost increase at a decreasing rate at small outputs but eventually, as output increases, total variable cost and total cost increase at an increasing rate. To understand this pattern in the change in total cost as output increases, we need to use the concept of *marginal cost*.

A firm's **marginal cost** is the increase in total cost that results from a one-unit increase in output. We calculate marginal cost as the increase in total cost divided by the increase in output. The table in Fig. 11.5 shows this calculation. When, for example, output increases from 10 sweaters to 13 sweaters, total cost increases from \$75 to \$100. The change in output is 3 sweaters, and the change in total cost is \$25. The marginal cost of one of those 3 sweaters is  $(\$25 \div 3)$ , which equals \$8.33.

Figure 11.5 graphs the marginal cost data in the table as the red marginal cost curve, *MC*. This curve is U-shaped because when Campus Sweaters hires a second worker, marginal cost decreases, but when it hires a third, a fourth, and a fifth worker, marginal cost successively increases.

At small outputs, marginal cost decreases as output increases because of greater specialization and the division of labour. But as output increases further, marginal cost eventually increases because of the *law of diminishing returns*. The law of diminishing returns means that the output produced by each additional worker is successively smaller. To produce an additional unit of output, ever more workers are required, and the cost of producing the additional unit of output—marginal cost—must eventually increase.

Marginal cost tells us how total cost changes as output increases. The final cost concept tells us what it costs, on average, to produce a unit of output. Let's now look at Campus Sweaters' average costs.

## Average Cost

There are three average costs of production:

1. Average fixed cost
2. Average variable cost
3. Average total cost

**Average fixed cost** (*AFC*) is total fixed cost per unit of output. **Average variable cost** (*AVC*) is total variable cost per unit of output. **Average total cost** (*ATC*) is total cost per unit of output. The average cost

concepts are calculated from the total cost concepts as follows:

$$TC = TFC + TVC.$$

Divide each total cost term by the quantity produced, *Q*, to get

$$\frac{TC}{Q} = \frac{TFC}{Q} + \frac{TVC}{Q},$$

or

$$ATC = AFC + AVC.$$

The table in Fig. 11.5 shows the calculation of average total cost. For example, in row C, output is 10 sweaters. Average fixed cost is  $(\$25 \div 10)$ , which equals \$2.50, average variable cost is  $(\$50 \div 10)$ , which equals \$5.00, and average total cost is  $(\$75 \div 10)$ , which equals \$7.50. Note that average total cost is equal to average fixed cost (\$2.50) plus average variable cost (\$5.00).

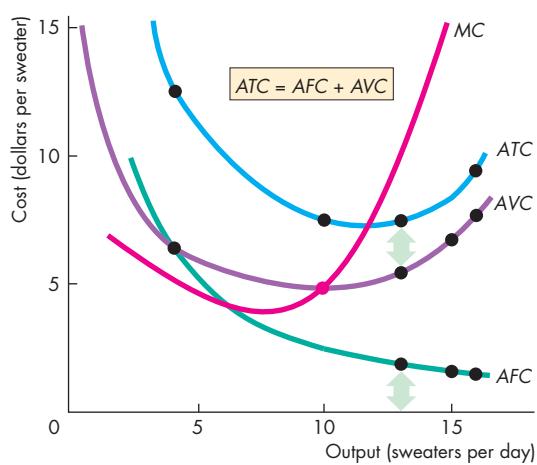
Figure 11.5 shows the average cost curves. The green average fixed cost curve (*AFC*) slopes downward. As output increases, the same constant total fixed cost is spread over a larger output. The blue average total cost curve (*ATC*) and the purple average variable cost curve (*AVC*) are U-shaped. The vertical distance between the average total cost and average variable cost curves is equal to average fixed cost—as indicated by the two arrows. That distance shrinks as output increases because average fixed cost declines with increasing output.

## Marginal Cost and Average Cost

The marginal cost curve (*MC*) intersects the average variable cost curve and the average total cost curve *at their minimum points*. When marginal cost is less than average cost, average cost is decreasing, and when marginal cost exceeds average cost, average cost is increasing. This relationship holds for both the *ATC* curve and the *AVC* curve. It is another example of the relationship you saw in Fig. 11.3 for average product and marginal product and in your average and marginal grades.

## Why the Average Total Cost Curve Is U-Shaped

Average total cost is the sum of average fixed cost and average variable cost, so the shape of the *ATC* curve

**FIGURE 11.5** Marginal Cost and Average Costs

Marginal cost is calculated as the change in total cost divided by the change in output. When output increases from 4 to 10 sweaters, an increase of 6 sweaters, total cost increases by \$25. Marginal cost is  $\$25 \div 6$ , which is \$4.17.

Each average cost concept is calculated by dividing the related total cost by output. When 10 sweaters are produced, AFC is \$2.50 ( $\$25 \div 10$ ), AVC is \$5.00 ( $\$50 \div 10$ ), and ATC is \$7.50 ( $\$75 \div 10$ ).

The graph shows that the MC curve is U-shaped and intersects the AVC curve and the ATC curve at their minimum points. The average fixed cost curve (AFC) is downward sloping. The ATC curve and AVC curve are U-shaped. The vertical distance between the ATC curve and the AVC curve is equal to average fixed cost, as illustrated by the two arrows.

Labour (workers per day)	Output (sweaters per day)	Total fixed cost (TFC)	Total variable cost (TVC)	Total cost (TC)	Marginal cost (MC)	Average fixed cost (AFC)	Average variable cost (AVC)	Average total cost (ATC)
		(dollars per day)	(dollars per day)	(dollars per day)	(dollars per additional sweater)	(dollars per sweater)	(dollars per sweater)	(dollars per sweater)
A	0	25	0	25	..... 6.25	—	—	—
B	1	25	25	50	..... 4.17	6.25	6.25	12.50
C	2	25	50	75	..... 8.33	2.50	5.00	7.50
D	3	25	75	100	..... 12.50	1.92	5.77	7.69
E	4	25	100	125	..... 25.00	1.67	6.67	8.33
F	5	25	125	150	..... 1.56	1.56	7.81	9.38

### MyEconLab Animation and Draw Graph

combines the shapes of the AFC and AVC curves. The U shape of the ATC curve arises from the influence of two opposing forces:

1. Spreading total fixed cost over a larger output
2. Eventually diminishing returns

When output increases, the firm spreads its total fixed cost over a larger output and so its average fixed cost decreases—its AFC curve slopes downward.

Diminishing returns means that as output increases, ever-larger amounts of labour are needed to produce an additional unit of output. So as output increases, average variable cost decreases initially

but eventually increases, and the AVC curve slopes upward. The AVC curve is U-shaped.

The shape of the ATC curve combines these two effects. Initially, as output increases, both average fixed cost and average variable cost decrease, so average total cost decreases. The ATC curve slopes downward.

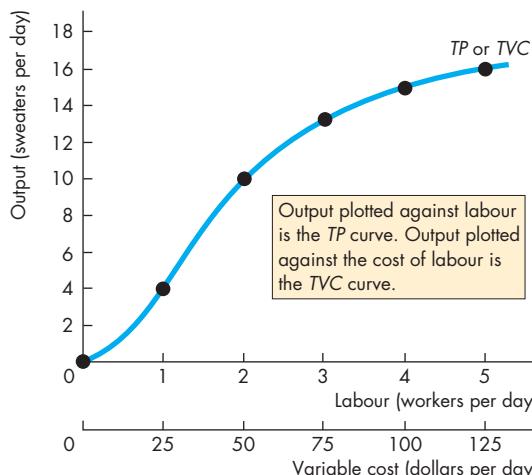
But as output increases further and diminishing returns set in, average variable cost starts to increase. With average fixed cost decreasing more quickly than average variable cost is increasing, the ATC curve continues to slope downward. Eventually, average variable cost starts to increase more quickly than average fixed cost decreases, so average total cost starts to increase. The ATC curve slopes upward.

## Cost Curves and Product Curves

The technology that a firm uses determines its costs. A firm's cost curves come directly from its product curves. You've used this link in the tables in which we have calculated total cost from the total product schedule and information about the prices of the factors of production. We're now going to get a clearer view of the link between the product curves and the cost curves. We'll look first at the link between total cost and total product and then at the links between the average and marginal product and cost curves.

**Total Product and Total Variable Cost** Figure 11.6 shows the links between the firm's total product curve,  $TP$ , and its total variable cost curve,  $TVC$ . The graph is a bit unusual in two ways. First, it measures two variables on the  $x$ -axis—labour and variable cost. Second, it graphs the  $TVC$  curve but with variable cost on the  $x$ -axis and output on the  $y$ -axis. The graph can show labour and cost on the  $x$ -axis because variable cost is proportional to labour. One worker costs \$25 a day. Graphing output against labour gives the  $TP$  curve and graphing variable cost against output gives the  $TVC$  curve.

**FIGURE 11.6** Total Product and Total Variable Cost



The figure shows the total product curve,  $TP$ , as a graph of output (sweaters per day) plotted against labour (workers per day). It also shows the total variable cost curve,  $TVC$ , as a graph of total variable cost (dollars per day) against output. The only difference between the  $TVC$  curve here and that in Fig. 11.4 is that we've switched the  $x$ -axis and  $y$ -axis.

## ECONOMICS IN THE NEWS

### Checkout Cost Curves

#### Human Cashiers Still Trump Self-Checkouts for Most Grocers

Self-checkout machines, now in service for about two decades, were supposed to reduce costs, but grocery stores still rely mostly on cashiers.

Source: *Canadian Grocer*, March 28, 2014

### DATA AND ASSUMPTIONS

A grocery store paid \$20,000 to install 5 worker-operated checkout lines. With a life of 9 years and operating for 10 hours a day, these machines have an *implicit rental rate* of \$1.00 an hour. Checkout clerks can be hired for \$10 an hour. The total product schedule (checkouts per hour) for this store is:

Checkout clerks	1	2	3	4	5
Checkouts per hour	12	22	30	36	40

Another grocery store has converted to all self-checkout. It paid \$100,000 to install a 5-line self-operated system. With a 5-year life and operating for 10 hours a day, the system has an *implicit rental rate* of \$7.00 an hour. It hires checkout assistants to help customers at \$10 an hour—the same wage as paid to checkout clerks. The total product schedule for this store is:

Checkout assistants	1	1	1	2
Checkouts per hour	12	22	30	36

That is, one checkout assistant can help shoppers check out up to a rate of 30 an hour and a second assistant can boost output to 36 an hour. (Shoppers using self-checkout aren't as quick as clerks, so the fastest rate at which this store can check out customers is 36 an hour.)

### THE PROBLEM

- Which checkout system has the lower average total cost ( $ATC$ )? Which system has the lower marginal cost ( $MC$ )? Sketch the  $ATC$  and  $MC$  curves for the two systems.

### THE SOLUTION

- Start with the worker-operated checkout system. Fixed cost is \$1.00 per hour and variable cost is \$10.00 per clerk. So the total cost schedule is:

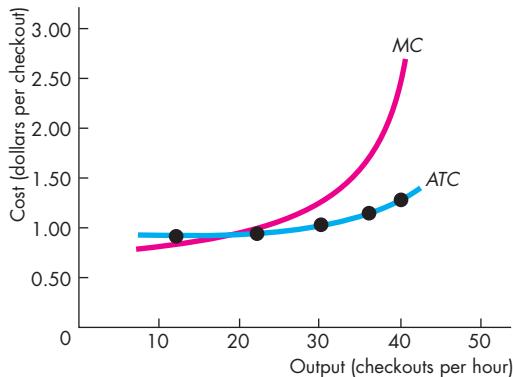
Checkout clerks	1	2	3	4	5
Checkouts per hour	12	22	30	36	40
Total cost ( $TC$ ) per hour	11	21	31	41	51



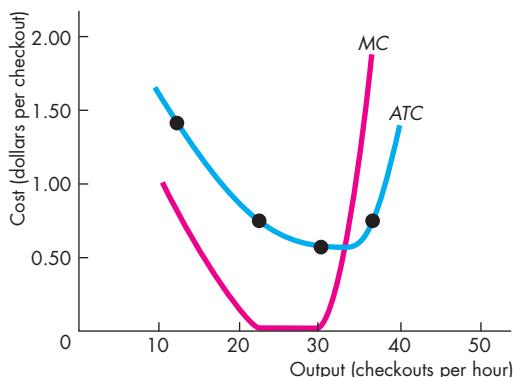
- Calculate  $MC$  as the change in  $TC$  divided by the change in output (change in number of checkouts) and calculate  $ATC$  as  $TC$  divided by output to get:

Checkouts per hour	12	22	30	36	40
Marginal cost ( $MC$ )	0.83	1.00	1.25	1.67	2.50
Average total cost ( $ATC$ )	0.92	0.95	1.03	1.14	1.28

- Figure 1 graphs the  $MC$  and  $ATC$  values at each output rate.



**Figure 1 Operator Checkout**



**Figure 2 Self-Checkout**

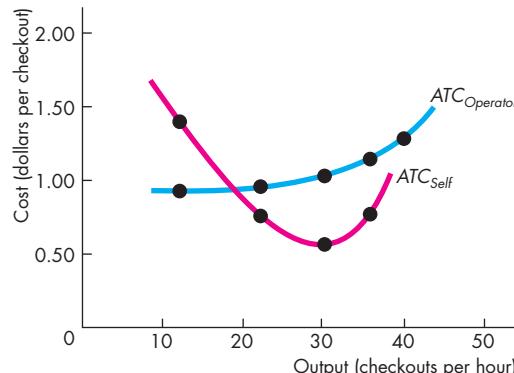
- Now do similar calculations for the self-checkout system. Fixed cost is \$7.00 per hour and variable cost is \$10.00 per clerk hour. So the total cost schedule is:

Checkout assistants	1	1	1	2
Checkouts per hour	12	22	30	36
Total cost ( $TC$ ) per hour	17	17	17	27

- Calculate  $MC$  and  $ATC$  in the same way as before to get

Checkouts per hour	12	22	30	36
Marginal cost ( $MC$ )	0.83	0	0	1.67
Average total cost ( $ATC$ )	1.42	0.77	0.57	0.75

- Figure 2 graphs the  $MC$  and  $ATC$  values at each output rate.
- Figure 3 compares the  $ATC$  of the two systems. You can see that the self-checkout system has higher  $ATC$  at low output rates and lower  $ATC$  at higher output rates. The reason is that self-checkout has a higher fixed cost and lower variable cost than the worker-operated system.



**Figure 3 ATC Compared**

**Average and Marginal Product and Cost** Figure 11.7 shows the links between the firm's average and marginal product curves and its average and marginal cost curves. The upper graph shows the average product curve,  $AP$ , and the marginal product curve,  $MP$ —like those in Fig. 11.3. The lower graph shows the average variable cost curve,  $AVC$ , and the marginal cost curve,  $MC$ —like those in Fig. 11.5.

As labour increases up to 1.5 workers a day (upper graph), output increases to 6.5 sweaters a day (lower graph). Marginal product and average product rise and marginal cost and average variable cost fall. At the point of maximum marginal product, marginal cost is at a minimum.

As labour increases from 1.5 workers to 2 workers a day (upper graph), output increases from 6.5 sweaters to 10 sweaters a day (lower graph). Marginal product falls and marginal cost rises, but average product continues to rise and average variable cost continues to fall. At the point of maximum average product, average variable cost is at a minimum. As labour increases further, output increases. Average product diminishes and average variable cost increases.

### Shifts in the Cost Curves

The position of a firm's short-run cost curves depends on two factors:

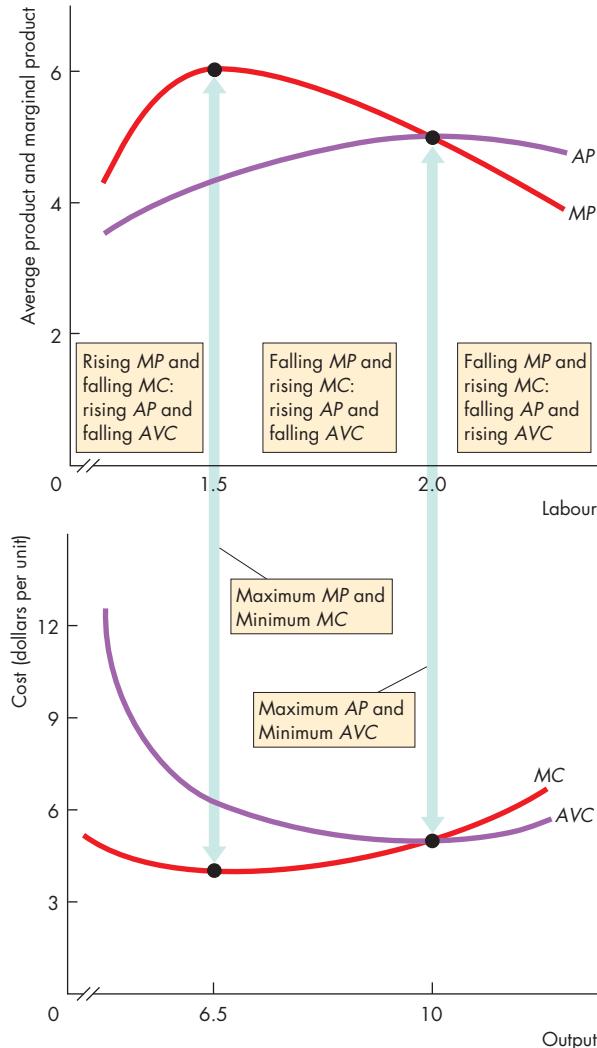
- Technology
- Prices of factors of production

**Technology** A technological change that increases productivity increases the marginal product and average product of labour. With a better technology, the same factors of production can produce more output, so the technological advance lowers the costs of production and shifts the cost curves downward.

For example, advances in robot production techniques have increased productivity in the automobile industry. As a result, the product curves of Ford, GM, and Chrysler have shifted upward and their cost curves have shifted downward. But the relationships between their product curves and cost curves have not changed. The curves are still linked in the way shown in Figs. 11.6 and 11.7.

Often, as in the case of robots producing cars, a technological advance results in a firm using

**FIGURE 11.7** Average and Marginal Product Curves and Cost Curves



A firm's  $MP$  curve is linked to its  $MC$  curve. If, as the firm increases its labour from 0 to 1.5 workers a day, the firm's marginal product rises, its marginal cost falls. If marginal product is at a maximum, marginal cost is at a minimum. If, as the firm hires more labour, its marginal product diminishes, its marginal cost rises.

A firm's  $AP$  curve is linked to its  $AVC$  curve. If, as the firm increases its labour to 2 workers a day, its average product rises, its average variable cost falls. If average product is at a maximum, average variable cost is at a minimum. If, as the firm hires more labour, its average product diminishes, its average variable cost rises.

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**TABLE 11.2** A Compact Glossary of Costs

Term	Symbol	Definition	Equation
Fixed cost		Cost that is independent of the output level; cost of a fixed factor of production	
Variable cost		Cost that varies with the output level; cost of a variable factor of production	
Total fixed cost	TFC	Cost of the fixed factors of production	
Total variable cost	TVC	Cost of the variable factors of production	
Total cost	TC	Cost of all factors of production	$TC = TFC + TVC$
Output (total product)	TP	Total quantity produced (output Q)	
Marginal cost	MC	Change in total cost resulting from a one-unit increase in total product	$MC = \Delta TC \div \Delta Q$
Average fixed cost	AFC	Total fixed cost per unit of output	$AFC = TFC \div Q$
Average variable cost	AVC	Total variable cost per unit of output	$AVC = TVC \div Q$
Average total cost	ATC	Total cost per unit of output	$ATC = AFC + AVC$

more capital, a fixed factor, and less labour, a variable factor. Another example is the use of ATMs by banks to dispense cash. ATMs, which are fixed capital, have replaced tellers, which are variable labour. Such a technological change decreases total cost but increases fixed costs and decreases variable cost. This change in the mix of fixed cost and variable cost means that at small outputs, average total cost might increase, while at large outputs, average total cost decreases.

**Prices of Factors of Production** An increase in the price of a factor of production increases the firm's costs and shifts its cost curves. How the curves shift depends on which factor price changes.

An increase in rent or some other component of *fixed* cost shifts the *TFC* and *AFC* curves upward and shifts the *TC* curve upward but leaves the *AVC* and *TVC* curves and the *MC* curve unchanged. For example, if the interest expense paid by a trucking company increases, the fixed cost of transportation services increases.

An increase in wages, gasoline, or another component of *variable* cost shifts the *TVC* and *AVC* curves upward and shifts the *MC* curve upward but leaves

the *AFC* and *TFC* curves unchanged. For example, if truck drivers' wages or the price of gasoline increases, the variable cost and marginal cost of transportation services increase.

You've now completed your study of short-run costs. All the concepts that you've met are summarized in a compact glossary in Table 11.2.

## REVIEW QUIZ

- 1 What relationships do a firm's short-run cost curves show?
- 2 How does marginal cost change as output increases (a) initially and (b) eventually?
- 3 What does the law of diminishing returns imply for the shape of the marginal cost curve?
- 4 What is the shape of the *AFC* curve and why does it have this shape?
- 5 What are the shapes of the *AVC* curve and the *ATC* curve and why do they have these shapes?

Work these questions in Study Plan 11.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

## Long-Run Cost

We are now going to study the firm's long-run costs. In the long run, a firm can vary both the quantity of labour and the quantity of capital, so in the long run, all the firm's costs are variable.

The behaviour of long-run cost depends on the firm's *production function*, which is the relationship between the maximum output attainable and the quantities of both labour and capital.

### The Production Function

Table 11.3 shows Campus Sweaters' production function. The table lists total product schedules for four different quantities of capital. The quantity of capital identifies the plant size. The numbers for plant 1 are for a factory with 1 knitting machine—the case we've just studied. The other three plants have 2, 3, and 4 machines. If Campus Sweaters uses plant 2 with 2 knitting machines, the various amounts of labour can produce the outputs shown in the second column of the table. The other two columns show the outputs of yet larger quantities of capital. Each column of the table could be graphed as a total product curve for each plant.

**Diminishing Returns** Diminishing returns occur with each of the four plant sizes as the quantity of labour increases. You can check that fact by calculating the marginal product of labour in each of the plants with 2, 3, and 4 machines. With each plant size, as the firm increases the quantity of labour employed, the marginal product of labour (eventually) diminishes.

### Diminishing Marginal Product of Capital

Diminishing returns also occur with each quantity of labour as the quantity of capital increases. You can check that fact by calculating the marginal product of capital at a given quantity of labour. The *marginal product of capital* is the change in total product divided by the change in capital when the quantity of labour is constant—equivalently, the change in output resulting from a one-unit increase in the quantity of capital. For example, if Campus Sweaters has 3 workers and increases its capital from 1 machine to 2 machines, output increases from 13 to 18 sweaters a day. The marginal product of the second machine is 5 sweaters a day. If Campus Sweaters continues to employ 3 workers

**TABLE 11.3** The Production Function

Labour (workers per day)	Output (sweaters per day)			
	Plant 1	Plant 2	Plant 3	Plant 4
1	4	10	13	15
2	10	15	18	20
3	13	18	22	24
4	15	20	24	26
5	16	21	25	27
<b>Knitting machines (number)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

The table shows the total product data for four quantities of capital (plant sizes). The greater the plant size, the larger is the output produced by any given quantity of labour. For a given plant size, the marginal product of labour diminishes as more labour is employed. For a given quantity of labour, the marginal product of capital diminishes as the quantity of capital used increases.

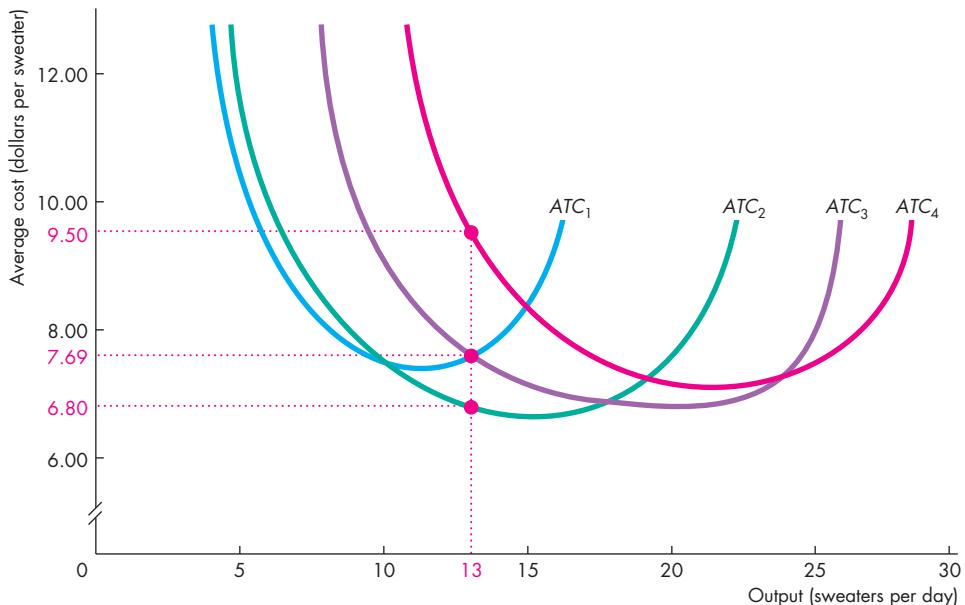
and increases the number of machines from 2 to 3, output increases from 18 to 22 sweaters a day. The marginal product of the third machine is 4 sweaters a day, down from 5 sweaters a day for the second machine.

Let's now see what the production function implies for long-run costs.

### Short-Run Cost and Long-Run Cost

As before, Campus Sweaters can hire workers for \$25 a day and rent knitting machines for \$25 a day. Using these factor prices and the data in Table 11.3, we can calculate the average total cost and graph the *ATC* curves for factories with 1, 2, 3, and 4 knitting machines. We've already studied the costs of a factory with 1 machine in Figs. 11.4 and 11.5. In Fig. 11.8, the average total cost curve for that case is  $ATC_1$ . Figure 11.8 also shows the average total cost curve for a factory with 2 machines,  $ATC_2$ , with 3 machines,  $ATC_3$ , and with 4 machines,  $ATC_4$ .

You can see, in Fig. 11.8, that the plant size has a big effect on the firm's average total cost.

**FIGURE 11.8** Short-Run Costs of Four Different Plants

The figure shows short-run average total cost curves for four different quantities of capital at Campus Sweaters. The firm can produce 13 sweaters a day with 1 knitting machine on  $ATC_1$  or with 3 knitting machines on  $ATC_3$  for an average cost of \$7.69 a sweater. The firm can produce 13 sweaters a day by using 2 machines on  $ATC_2$  for \$6.80 a sweater or by using 4 machines on  $ATC_4$  for \$9.50 a sweater.

If the firm produces 13 sweaters a day, the least-cost method of production, the *long-run method*, is with 2 machines on  $ATC_2$ .

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In Fig. 11.8, two things stand out:

1. Each short-run  $ATC$  curve is U-shaped.
2. For each short-run  $ATC$  curve, the larger the plant, the greater is the output at which average total cost is at a minimum.

Each short-run  $ATC$  curve is U-shaped because, as the quantity of labour increases, its marginal product initially increases and then diminishes. This pattern in the marginal product of labour, which we examined in some detail for the plant with 1 knitting machine on pp. 254–255, occurs at all plant sizes.

The minimum average total cost for a larger plant occurs at a greater output than it does for a smaller plant because the larger plant has a higher total fixed cost and therefore, for any given output, a higher average fixed cost.

Which short-run  $ATC$  curve a firm operates on depends on the plant it has. In the long run, the firm can choose its plant and the plant it chooses is the one that enables it to produce its planned output at the lowest average total cost.

To see why, suppose that Campus Sweaters plans to produce 13 sweaters a day. In Fig. 11.8, with 1 machine, the average total cost curve is  $ATC_1$  and

the average total cost of 13 sweaters a day is \$7.69 a sweater. With 2 machines, on  $ATC_2$ , average total cost is \$6.80 a sweater. With 3 machines, on  $ATC_3$ , average total cost is \$7.69 a sweater, the same as with 1 machine. Finally, with 4 machines, on  $ATC_4$ , average total cost is \$9.50 a sweater.

The economically efficient plant for producing a given output is the one that has the lowest average total cost. For Campus Sweaters, the economically efficient plant to use to produce 13 sweaters a day is the one with 2 machines.

In the long run, Cindy chooses the plant that minimizes average total cost. When a firm is producing a given output at the least possible cost, it is operating on its *long-run average cost curve*.

The **long-run average cost curve** is the relationship between the lowest attainable average total cost and output when the firm can change both the plant it uses and the quantity of labour it employs.

The long-run average cost curve is a planning curve. It tells the firm the plant and the quantity of labour to use at each output to minimize average cost. Once the firm chooses a plant, the firm operates on the short-run cost curves that apply to that plant.

## The Long-Run Average Cost Curve

Figure 11.9 shows how a long-run average cost curve is derived. The long-run average cost curve *LRAC* consists of pieces of the four short-run *ATC* curves. For outputs up to 10 sweaters a day, average total cost is the lowest on *ATC*<sub>1</sub>. For outputs between 10 and 18 sweaters a day, average total cost is the lowest on *ATC*<sub>2</sub>. For outputs between 18 and 24 sweaters a day, average total cost is the lowest on *ATC*<sub>3</sub>. And for outputs in excess of 24 sweaters a day, average total cost is the lowest on *ATC*<sub>4</sub>. The piece of each *ATC* curve with the lowest average total cost is highlighted in dark blue in Fig. 11.9. This dark blue scallop-shaped curve made up of the pieces of the four *ATC* curves is the *LRAC* curve.

## Economies and Diseconomies of Scale

**Economies of scale** are features of a firm's technology that make average total cost *fall* as output increases. When economies of scale are present, the *LRAC* curve slopes downward. In Fig. 11.9, Campus Sweaters has economies of scale for outputs up to 15 sweaters a day.

Greater specialization of both labour and capital is the main source of economies of scale. For example,

if GM produces 100 cars a week, each worker must perform many different tasks and the capital must be general-purpose machines and tools. But if GM produces 10,000 cars a week, each worker specializes in a small number of tasks, uses task-specific tools, and becomes highly proficient.

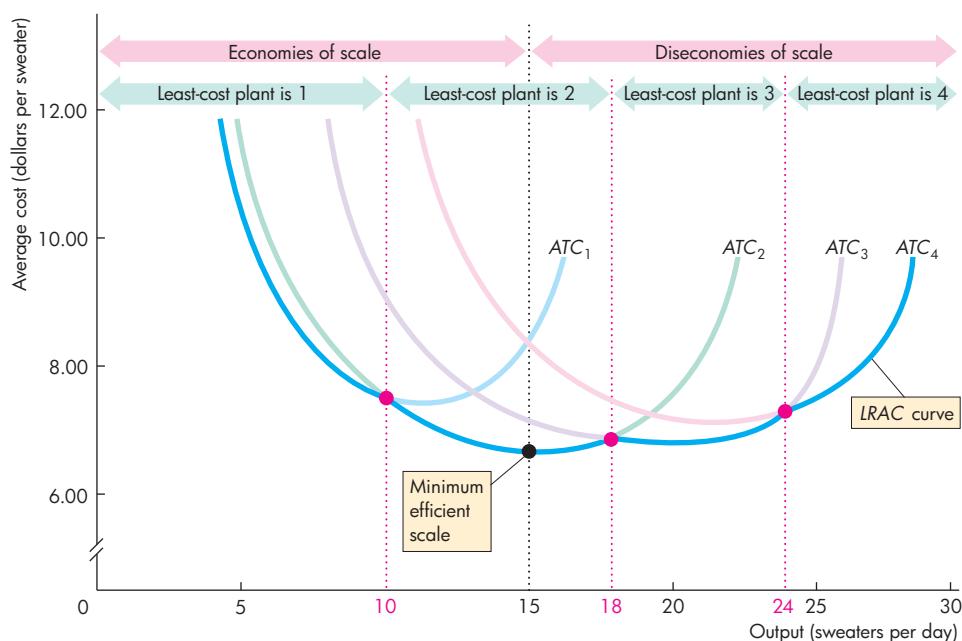
**Diseconomies of scale** are features of a firm's technology that make average total cost *rise* as output increases. When diseconomies of scale are present, the *LRAC* curve slopes upward. In Fig. 11.9, Campus Sweaters experiences diseconomies of scale at outputs greater than 15 sweaters a day.

The challenge of managing a large enterprise is the main source of diseconomies of scale.

**Constant returns to scale** are features of a firm's technology that keep average total cost constant as output increases. When constant returns to scale are present, the *LRAC* curve is horizontal.

**Economies of Scale at Campus Sweaters** The economies of scale and diseconomies of scale at Campus Sweaters arise from the firm's production function in Table 11.3. With 1 machine and 1 worker, the firm produces 4 sweaters a day. With 2 machines and 2 workers, total cost doubles but

**FIGURE 11.9** Long-Run Average Cost Curve



The long-run average cost curve traces the lowest attainable *ATC* when both labour and capital change. The green arrows highlight the output range over which each plant achieves the lowest *ATC*. Within each range, to change the quantity produced, the firm changes the quantity of labour it employs.

Along the *LRAC* curve, economies of scale occur if average cost falls as output increases; diseconomies of scale occur if average cost rises as output increases. Minimum efficient scale is the output at which average cost is lowest, 15 sweaters a day.

**MyEconLab Animation**

## Economics in Action

### Produce More to Cut Cost

Why do GM, Ford, and the other automakers have expensive equipment lying around that isn't fully used? You can answer this question with what you've learned in this chapter.

The basic answer is that auto production enjoys economies of scale. A larger output rate brings a lower long-run average cost—the firm's *LRAC* curve slopes downward.

An auto producer's average total cost curves look like those in the figure. To produce 20 vehicles an hour, the firm installs the plant with the short-run average total cost curve  $ATC_1$ . The average cost of producing a vehicle is \$20,000.

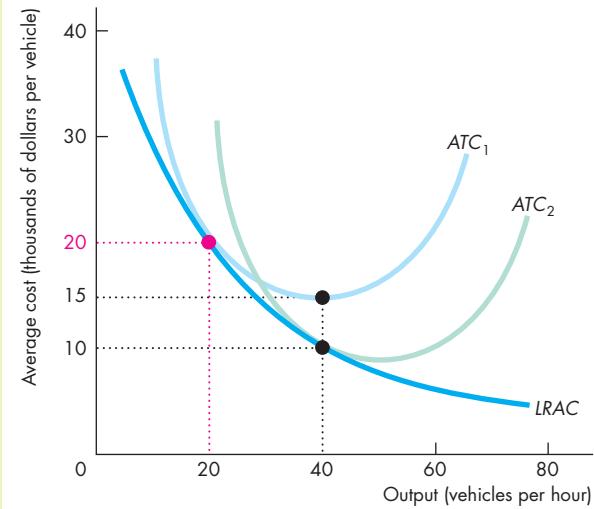
Producing 20 vehicles an hour doesn't use the plant at its lowest possible average total cost. If the firm could sell enough cars for it to produce 40 vehicles an hour, the firm could use its current plant and produce at an average cost of \$15,000 a vehicle.

But if the firm planned to produce 40 vehicles an hour, it would not stick with its current plant. The firm would install a bigger plant with the short-run average total cost curve  $ATC_2$ , and produce 40 vehicles an hour for \$10,000 a car.

output more than doubles to 15 sweaters a day, so average cost decreases and Campus Sweaters experiences economies of scale. With 4 machines and 4 workers, total cost doubles again but output less than doubles to 26 sweaters a day, so average cost increases and the firm experiences diseconomies of scale.

**Minimum Efficient Scale** A firm's **minimum efficient scale** is the *smallest* output at which long-run average cost reaches its lowest level. At Campus Sweaters, the minimum efficient scale is 15 sweaters a day.

The minimum efficient scale plays a role in determining market structure. In a market in which the minimum efficient scale is small relative to market demand, the market has room for many firms, and the market is competitive. In a market in which the minimum efficient scale is large relative to market demand, only a small number of firms, and possibly only one firm, can make a profit and the market is either an oligopoly or monopoly. We will return to this idea in the next four chapters.



Automobile Plant Average Cost Curves

## REVIEW QUIZ

- 1 What does a firm's production function show and how is it related to a total product curve?
- 2 Does the law of diminishing returns apply to capital as well as labour? Explain why or why not.
- 3 What does a firm's *LRAC* curve show? How is it related to the firm's short-run *ATC* curves?
- 4 What are economies of scale and diseconomies of scale? How do they arise? What do they imply for the shape of the *LRAC* curve?
- 5 What is a firm's minimum efficient scale?

Work these questions in Study Plan 11.4 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

**◆ Economics in the News** on pp. 264–265 applies what you've learned about a firm's cost curves. It looks at Starbucks' cost curves and explains how increasing plant size by adding stores can lower average total cost.

# Expanding Capacity at Starbucks

## Starbucks Canada to Open 150 New Outlets, Biggest Expansion Ever

*Financial Post*

February 8, 2013

Thanks in part to Target, Starbucks Canada will be undertaking the biggest expansion effort in its history this year, with plans to open more than 150 new locations across the country. ...

The subsidiary of Seattle-based Starbucks Corp. will open outlets inside many of the 124 Target locations opening in Canada in 2013 beginning next month — but the exact number is still a secret, Starbucks Canada president Annie Young-Scrivner said Friday.

The growth is also a response to [the] company's successful bid to tap into the Canadian palate with its burgeoning Blonde roast coffee in a way that it had not before, bringing a host of new customers through its doors, she said in an interview on Friday. ...

After the first nine months, Blonde grew to represent 12% of Starbucks Canada brewed coffee sales. Since the company began a sampling and marketing push last month in Canada, the lighter blend now accounts for 20% of those sales. Typically 38% of Starbucks Canada customers drink dark roast and 42% drink medium roast, she said. "Some people thought our roast was too dark before. We had a lot of customers who would come to us for their lattes, but would go somewhere else for their coffee. I think our mix will continue to shift more towards the Blonde roast." ...

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### ESSENCE OF THE STORY

- Starbucks plans to open more than 150 new locations across Canada.
- Many of the new outlets will be inside Target stores.
- Starbucks has expanded its number of customers with a successful Blonde roast coffee variety.
- Canadians prefer lighter roasts, and Starbucks expects continued growth of business with an ongoing shift towards the Blonde roast.

[MyEconLab More Economics in the News](#)

## ECONOMIC ANALYSIS

- Starbucks can increase output by hiring more labour, or by increasing its plant size. Or it can both increase its plant size and hire more labour.
- Starbucks can increase its plant size by either replacing an existing café with a larger one, or expanding the number of cafés.
- The decision turns on comparing costs, and Starbucks has figured that it minimizes cost by expanding the number of cafés and hiring more labour.
- We don't know Starbucks' costs, but we can gain insight into the firm's decision with an example.
- The table shows an assumed total product schedule for a Starbucks café. It also shows Starbucks' total cost ( $TC$ ), marginal cost ( $MC$ ), and average total cost, ( $ATC$ ).
- Figure 1 graphs the marginal cost and average total cost curves.
- If Starbucks wants to increase production in a café to above 1,000 coffees per day, marginal cost rises sharply.
- But if Starbucks opens a new café, a given quantity of labour can produce a greater output.
- With a bigger capacity, fixed cost increases, so at low output levels, average total cost also increases.
- But at higher output levels, because average fixed cost decreases, average total cost also decreases.
- Figure 2 shows Starbucks original  $ATC$  curve,  $ATC_0$ , and the new  $ATC$  curve,  $ATC_1$ , which shows average total cost when the firm has added one more café.

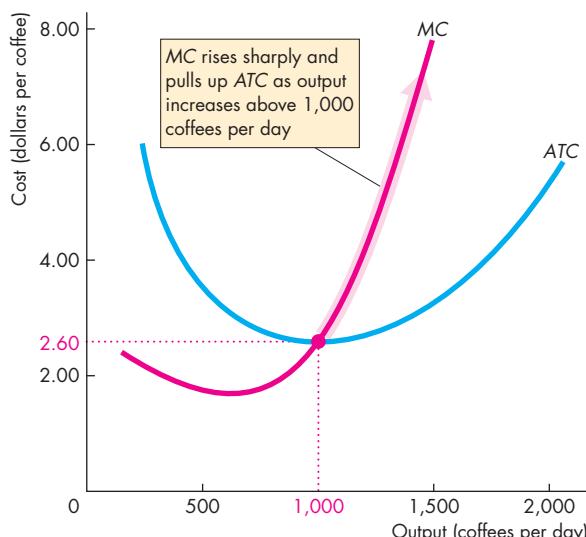


Figure 1 Starbucks' Short-Run Cost Curves

	Labour (workers per day)	Output (coffees per day)	Total cost (TC) (dollars per day)	Marginal cost (MC) (dollars per coffee)	Average total cost (ATC) (dollars per coffee)
A	0	0	1,000	—	—
B	10	400	1,800	2.00	4.50
C	20	1,000	2,600	1.33	2.60
D	30	1,300	3,400	2.67	2.62
E	40	1,500	4,200	4.00	2.80
F	50	1,600	5,000	8.00	3.13

- Increasing output with a larger plant size avoids the sharply rising marginal cost of the original café.
- In this example, Starbucks can now hire more labour to operate two cafés and average total cost falls as output increases above 1,000 coffees per day.
- Figure 2 also shows Starbucks' long-run average cost curve ( $LRAC$ ).
- If the firm wants to expand output yet further and avoid the rising costs along  $ATC_1$ , it can open additional cafés and move along its long-run average cost curve.

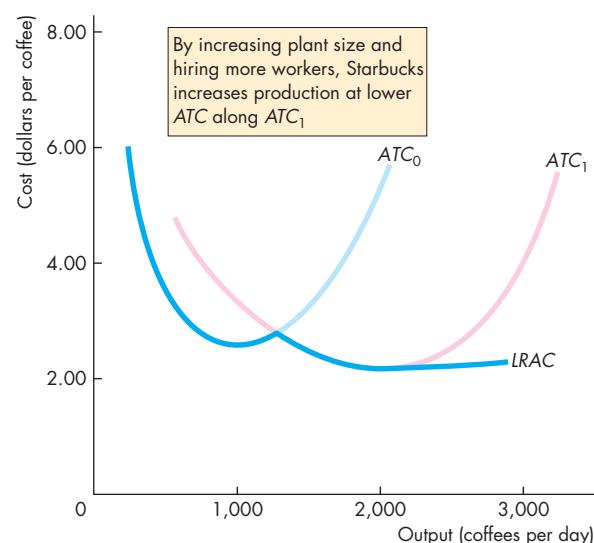


Figure 2 Starbucks' Long-Run Cost Curve



## SUMMARY

### Key Points

#### Decision Time Frames (p. 248)

- In the short run, the quantity of at least one factor of production is fixed and the quantities of the other factors of production can be varied.
- In the long run, the quantities of all factors of production can be varied.

Working Problem 1 will give you a better understanding of a firm's decision time frames.

#### Short-Run Technology Constraint (pp. 249–252)

- A total product curve shows the quantity a firm can produce with a given quantity of capital and different quantities of labour.
- Initially, the marginal product of labour increases as the quantity of labour increases, because of increased specialization and the division of labour.
- Eventually, marginal product diminishes because an increasing quantity of labour must share a fixed quantity of capital—the law of diminishing returns.
- Initially, average product increases as the quantity of labour increases, but eventually average product diminishes.

Working Problems 2 to 6 will give you a better understanding of a firm's short-run technology constraint.

#### Short-Run Cost (pp. 253–259)

- As output increases, total fixed cost is constant, and total variable cost and total cost increase.
- As output increases, average fixed cost decreases and average variable cost, average total cost, and marginal cost decrease at low outputs and increase at high outputs. These cost curves are U-shaped.

Working Problems 7 to 11 will give you a better understanding of a firm's short-run cost.

#### Long-Run Cost (pp. 260–263)

- A firm has a set of short-run cost curves for each different plant. For each output, the firm has one least-cost plant. The larger the output, the larger is the plant that will minimize average total cost.
- The long-run average cost curve traces out the lowest attainable average total cost at each output when both capital and labour inputs can be varied.
- With economies of scale, the long-run average cost curve slopes downward. With diseconomies of scale, the long-run average cost curve slopes upward.

Working Problems 12 to 14 will give you a better understanding of a firm's long-run cost.

### Key Terms

- Average fixed cost, 254
- Average product, 249
- Average total cost, 254
- Average variable cost, 254
- Constant returns to scale, 262
- Diminishing marginal returns, 251
- Diseconomies of scale, 262

- Economies of scale, 262
- Law of diminishing returns, 251
- Long run, 248
- Long-run average cost curve, 261
- Marginal cost, 254
- Marginal product, 249
- Minimum efficient scale, 263

### MyEconLab Key Terms Quiz

- Short run, 248
- Sunk cost, 248
- Total cost, 253
- Total fixed cost, 253
- Total product, 249
- Total variable cost, 253

## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 11 Study Plan.

The table provides data about a firm's short-run cost. It shows the firm's total cost,  $TC$ , when output is zero, and marginal cost,  $MC$ , at four levels of output.

Output	MC	TC	TFC	TVC	ATC	AFC	AVC
0		\$12	?	?			
1	\$10		?	?	?	?	?
2	\$2		?	?	?	?	?
3	\$6		?	?	?	?	?
4	\$22		?	?	?	?	?

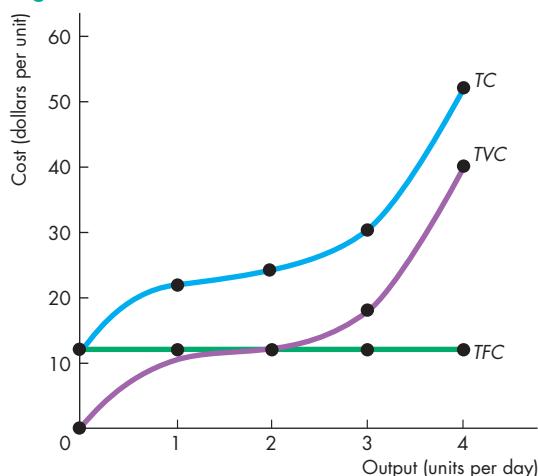
### Questions

- Fill in the cells marked “?” to record the firm's costs:  $TC$ ,  $TFC$ ,  $TVC$ ,  $ATC$ ,  $AFC$ , and  $AVC$  at each output.
- Draw a graph of the total cost curves, and a graph of the average and marginal cost curves.

### Solutions

- Begin by using the fact that marginal cost,  $MC$ , is the change in total cost,  $TC$ , when output increases by 1 unit. This fact means that  $TC$  at 1 unit equals  $TC$  at zero units plus  $MC$  of the first unit.  $TC$  is \$12 at zero and  $MC$  of the first unit is \$10, so  $TC$  at 1 unit equals \$22. The rest of the  $TC$  column is calculated in the same way. For example,  $TC$  at 4 units is \$52, which equals \$30 + \$22.

### Key Figure



(a) Total Cost Curves

- $TFC$  equals  $TC$  at zero output, so you can fill in the  $TFC$  column as \$12 at each quantity of output.
- Because  $TC = TFC + TVC$ , you can fill in the  $TVC$  column as  $TVC = TC - TFC$ . For example, at 1 unit of output,  $TVC = \$22 - \$12 = \$10$ .
- Average cost equals  $TC \div \text{output}$ , so to fill in the  $ATC$ ,  $AFC$ , and  $AVC$  columns, divide the numbers for  $TC$ ,  $TFC$ , and  $TVC$  by the output level. For example,  $ATC$  at 3 units of output is  $\$30 \div 3 = \$10$ .

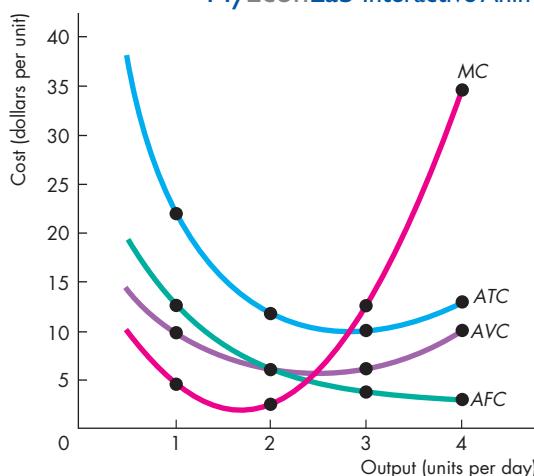
Output	MC	TC	TFC	TVC	ATC	AFC	AVC
0		\$12	\$12	\$0			
1	\$10	\$22	\$12	\$10	\$22	\$12	\$10
2	\$2	\$24	\$12	\$12	\$12	\$6	\$6
3	\$6	\$30	\$12	\$18	\$10	\$4	\$6
4	\$22	\$52	\$12	\$40	\$13	\$3	\$10

**Key Point:** Given a firm's total cost at zero output and its marginal cost at each output, by using the relationships among the cost concepts, we can calculate the total costs and the average costs at each output.

- The key figure (a) graphs the total cost curves and the key figure (b) graphs the marginal and average cost curves.

**Key Point:** The marginal cost curve intersects the average cost curves at their minimum points.

### MyEconLab Interactive Animation



(b) Average and Marginal Cost Curves



## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 14 in Chapter 11 Study Plan and get instant feedback.

### Decision Time Frames (Study Plan 11.1)

- Which of the following news items involves a short-run decision and which involves a long-run decision? Explain.

**January 31, 2008:** Starbucks will open 75 more stores abroad than originally predicted, for a total of 975.

**February 25, 2008:** For three hours on Tuesday, Starbucks will shut down every single one of its 7,100 stores so that baristas can receive a refresher course.

**June 2, 2008:** Starbucks replaces baristas with vending machines.

**July 18, 2008:** Starbucks is closing 616 stores by the end of March.

### Short-Run Technology Constraint (Study Plan 11.2)

Use the following table to work Problems 2 to 6. The table sets out Sue's Surfboards' total product schedule.

Labour (workers per week)	Output (surfboards per week)
1	30
2	70
3	120
4	160
5	190
6	210
7	220

- Draw the total product curve.
- Calculate the average product of labour and draw the average product curve.
- Calculate the marginal product of labour and draw the marginal product curve.
- a. Over what output range does Sue's Surfboards enjoy the benefits of increased specialization and division of labour?  
b. Over what output range does the firm experience diminishing marginal product of labour?  
c. Over what output range does the firm experience an increasing average product of labour but a diminishing marginal product of labour?
- Explain how it is possible for a firm to experience simultaneously an increasing *average* product but a diminishing *marginal* product.

### Short-Run Cost (Study Plan 11.3)

Use the following data to work Problems 7 to 11. Sue's Surfboards, in Problem 2, hires workers at \$500 a week and its total fixed cost is \$1,000 a week.

- Calculate total cost, total variable cost, and total fixed cost of each output in the table. Plot these points and sketch the short-run total cost curves.
- Calculate average total cost, average fixed cost, average variable cost, and marginal cost of each output in the table. Plot these points and sketch the short-run average and marginal cost curves.
- Illustrate the connection between Sue's *AP*, *MP*, *AVC*, and *MC* curves in graphs like those in Fig. 11.7.
- Sue's Surfboards rents a factory. If the rent rises by \$200 a week and other things remain the same, how do Sue's Surfboards' short-run average cost curves and marginal cost curve change?
- Workers at Sue's Surfboards negotiate a wage increase of \$100 a week per worker. If other things remain the same, explain how Sue's Surfboards' short-run average cost curves and marginal cost curve change.

### Long-Run Cost (Study Plan 11.4)

Use the following data to work Problems 12 to 14. Jackie's Canoe Rides rents canoes at \$100 per day and pays \$50 per day for each canoe operator it hires. The table shows the firm's production function.

Labour (workers per day)	Output (rides per day)			
	Plant 1	Plant 2	Plant 3	Plant 4
10	20	40	55	65
20	40	60	75	85
30	65	75	90	100
40	75	85	100	110
Canoes	10	20	30	40

- Graph the *ATC* curves for Plant 1 and Plant 2. Explain why these *ATC* curves differ.
- Graph the *ATC* curves for Plant 3 and Plant 4. Explain why these *ATC* curves differ.
- a. On Jackie's *LRAC* curve, what is the average cost of producing 40, 75, and 85 rides a week?  
b. What is Jackie's minimum efficient scale?  
c. Does Jackie's production function feature economies of scale or diseconomies of scale?



## ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### Decision Time Frames

#### 15. A Bakery on the Rise

Some 500 customers a day line up to buy Avalon's breads, scones, muffins, and coffee. Staffing and management are concerns. Avalon now employs 35 and plans to hire 15 more. Its payroll will climb by 30 percent to 40 percent. The new CEO has executed an ambitious agenda that includes the move to a larger space, which will increase the rent from \$3,500 to \$10,000 a month.

Source: CNN, March 24, 2008

- Which of Avalon's decisions described in the news clip is a short-run decision and which is a long-run decision?
- Why is Avalon's long-run decision riskier than its short-run decision?

#### 16. The Sunk-Cost Fallacy

You have good tickets to a basketball game an hour's drive away. There's a blizzard raging outside, and the game is being televised. You can sit warm and safe at home and watch it on TV, or you can bundle up, dig out your car, and go to the game. What do you do?

Source: *Slate*, September 9, 2005

- What type of cost is your expenditure on tickets?
- Why is the cost of the ticket irrelevant to your current decision about whether to stay at home or go to the game?

### Short-Run Technology Constraint

#### 17. Terri runs a rose farm. One worker produces 1,000 roses a week; hiring a second worker doubles her total product; hiring a third worker doubles her output again; hiring a fourth worker increased her total product but by only 1,000 roses. Construct Terri's marginal product and average product schedules. Over what range of workers do marginal returns increase?

### Short-Run Cost

#### 18. Use the events described in the news clip in Problem 15. By how much will Avalon's short-run decision increase its total variable cost? By how much will Avalon's long-run decision increase its monthly total fixed cost? Sketch Avalon's short-run ATC curve before and after the events described in the news clip.

19. Bill's Bakery has a fire and Bill loses some of his cost data. The bits of paper that he recovers after the fire provide the information in the following table (all the cost numbers are dollars).

TP	AFC	AVC	ATC	MC
10	120	100	220	80
20	<b>A</b>	<b>B</b>	150	90
30	40	90	130	130
40	30	<b>C</b>	<b>D</b>	<b>E</b>
50	24	108	132	

Bill asks you to come to his rescue and provide the missing data in the five spaces identified as **A**, **B**, **C**, **D**, and **E**.

Use the following table to work Problems 20 and 21. ProPainters hires students at \$250 a week to paint houses. It leases equipment at \$500 a week. The following table sets out its total product schedule.

Labour (students)	Output (houses painted per week)
1	2
2	5
3	9
4	12
5	14
6	15

- If ProPainters paints 12 houses a week, calculate its total cost, average total cost, and marginal cost. At what output is average total cost a minimum?
- Explain why the gap between ProPainters' total cost and total variable cost is the same no matter how many houses are painted.
- For Pepsi, a Business Decision with Social Benefits

PepsiCo has done a deal with 300 small Mexican farmers close to their two factories to buy corn at a guaranteed price. PepsiCo saves transportation costs and the use of local farms assures it access to the type of corn best suited to its products and processes. "That gives us great leverage because corn prices don't fluctuate so much, but

transportation costs do," said Pedro Padierna, president of PepsiCo in Mexico.

Source: *The New York Times*, February 21, 2011

- How do fluctuations in the price of corn and in transportation costs influence PepsiCo's short-run cost curves?
- How does the deal with the farmers to avoid fluctuations in costs benefit PepsiCo?

### Long-Run Cost

Use the table in Problem 20 and the following information to work Problems 23 and 24.

If ProPainters doubles the number of students it hires and doubles the amount of equipment it leases, it experiences diseconomies of scale.

- Explain how the *ATC* curve with one unit of equipment differs from that when ProPainters uses double the amount of equipment.
- Explain what might be the source of the diseconomies of scale that ProPainters experiences.

Use the following information to work Problems 25 to 27.

The table shows the production function of Bonnie's Balloon Rides. Bonnie's pays \$500 a day for each balloon it rents and \$25 a day for each balloon operator it hires.

Labour (workers per day)	Output (rides per day)			
	Plant 1	Plant 2	Plant 3	Plant 4
10	6	10	13	15
20	10	15	18	20
30	13	18	22	24
40	15	20	24	26
50	16	21	25	27
Balloons (number)	1	2	3	4

- Graph the *ATC* curves for Plant 1 and Plant 2. Explain why these *ATC* curves differ.
- Graph the *ATC* curves for Plant 3 and Plant 4. Explain why these *ATC* curves differ.
- a. On Bonnie's *LRAC* curve, what is the average cost of producing 15 rides and 18 rides a day?  
b. Explain how Bonnie's uses its long-run average cost curve to decide how many balloons to rent.

### Economics in the News

28. After you have studied *Economics in the News* on pp. 264–265, answer the following questions.

- Explain the distinction between the short run and the long run and identify when Starbucks would want to make each type of change.
- Explain economies of scale. How does Starbucks reap economies of scale in the example on p. 265?
- Draw a graph to illustrate Starbucks' cost curves as it opens more and more cafés in Target stores.
- Explain why Starbucks is opening cafés in Target stores rather than stand alone cafés.

29. **Starbucks Unit Brews Up Self-Serve Espresso Bars**

Coinstar has installed automated, self-serve espresso kiosks in grocery stores. Kiosks cost just under \$40,000 each and Coinstar provides maintenance. The self-serve kiosk removes the labour costs of having a barista serve Starbucks' coffee, and store personnel refill the machine.

Source: MSNBC, June 1, 2008

- What is Coinstar's total fixed cost of operating one self-serve kiosk? What are its variable costs of providing coffee at a self-serve kiosk?
- Assume that a coffee machine operated by a barista costs less than \$40,000. Explain how the fixed costs, variable costs, and total costs of barista-served and self-served coffee differ.
- Sketch the marginal cost and average cost curves implied by your answer to part (b).

Use the following news clip to work Problems 30 and 31.

### Gap Will Focus on Smaller-Scale Stores

Gap has too many stores that are 12,500 square feet. The target store size is 6,000 square feet to 10,000 square feet, so Gap plans to combine previously separate concept stores. Some Gap body, adult, maternity, baby, and kids stores will be combined in one store.

Source: CNN, June 10, 2008

- Thinking of a Gap store as a production plant, explain why Gap is making a decision to reduce the size of its stores. Is Gap's decision a long-run decision or a short-run decision?
- How might Gap take advantage of economies of scale by combining concept stores into one store?



# 12

## PERFECT COMPETITION

After studying this chapter,  
you will be able to:

- ◆ Define perfect competition
- ◆ Explain how a firm makes its output decision
- ◆ Explain how price and output are determined in perfect competition
- ◆ Explain why firms enter and leave a market
- ◆ Predict the effects of technological change in a competitive market
- ◆ Explain why perfect competition is efficient

A million “apps” have been created for smartphones and tablets. Most of these apps are the work of individuals in intense competition with each other. No single app writer can influence the price of an app, but each writer can and must decide how many hours to work and how many apps to produce.

In this chapter, we study producers who, like small app developers, are in intense competition—in *perfect competition*. At the end of the chapter, in *Economics in the News*, we apply the perfect competition model to the highly competitive market in apps.

## What Is Perfect Competition?

The firms that you study in this chapter face the force of raw competition. We call this extreme form of competition perfect competition. **Perfect competition** is a market in which

- Many firms sell identical products to many buyers.
- There are no restrictions on entry into the market.
- Established firms have no advantage over new ones.
- Sellers and buyers are well informed about prices.

Farming, fishing, wood pulping and paper milling, the manufacture of paper cups and shopping bags, grocery and fresh flower retailing, photo finishing, lawn services, plumbing, painting, dry cleaning, and laundry services are all examples of highly competitive industries.

### How Perfect Competition Arises

Perfect competition arises if the minimum efficient scale of a single producer is small relative to the market demand for the good or service. In this situation, there is room in the market for many firms. A firm's *minimum efficient scale* is the smallest output at which long-run average cost reaches its lowest level. (See Chapter 11, p. 262.)

In perfect competition, each firm produces a good that has no unique characteristics, so consumers don't care which firm's good they buy.

### Price Takers

Firms in perfect competition are price takers. A **price taker** is a firm that cannot influence the market price because its production is an insignificant part of the total market.

Imagine that you are a wheat farmer in Manitoba. You have 500 hectares planted—which sounds like a lot. But compared to the millions of hectares across the Canadian prairies and the U.S. mid-west as well as the millions more in Argentina, Australia, and Ukraine, your 500 hectares are just a drop in the ocean. Nothing makes your wheat any better than any other farmer's, and all the buyers of wheat know the price at which they can do business.

If the market price of wheat is \$300 a tonne, then that is the highest price you can get for your wheat. Ask for \$310 and no one will buy from you. Offer it for \$290 and you'll be sold out in a flash and have given away \$10 a tonne. You take the market price.

### Economic Profit and Revenue

A firm's goal is to maximize *economic profit*, which is equal to total revenue minus total cost. Total cost is the *opportunity cost* of production, which includes *normal profit*. (See Chapter 10, p. 225.)

A firm's **total revenue** equals the price of its output multiplied by the number of units of output sold (price  $\times$  quantity). **Marginal revenue** is the change in total revenue that results from a one-unit increase in the quantity sold. Marginal revenue is calculated by dividing the change in total revenue by the change in the quantity sold.

Figure 12.1 illustrates these revenue concepts. In part (a), the market demand curve, *D*, and market supply curve, *S*, determine the market price. The market price is \$25 a sweater. Campus Sweaters is just one of many producers of sweaters, so the best it can do is to sell its sweaters for \$25 each.

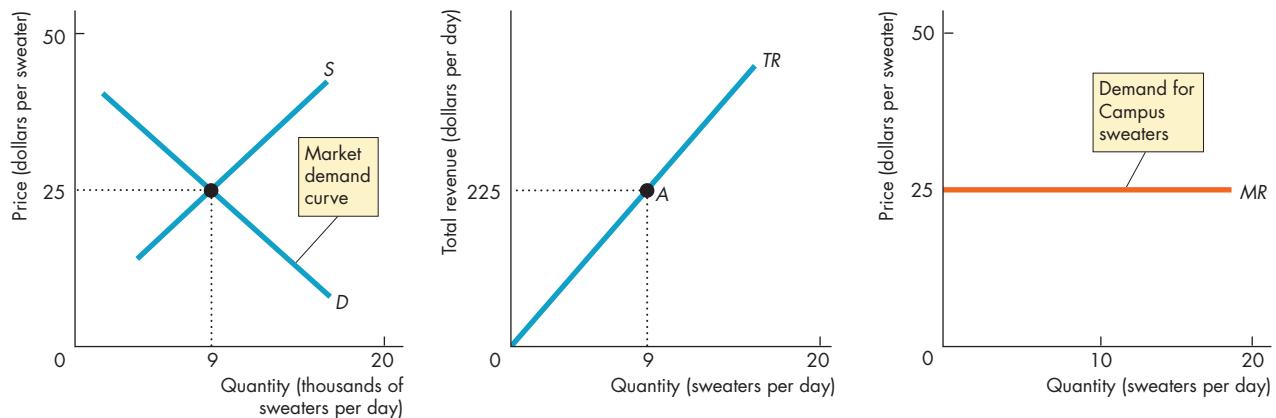
**Total Revenue** Total revenue is equal to the price multiplied by the quantity sold. In the table in Fig. 12.1, if Campus Sweaters sells 9 sweaters, its total revenue is \$225 ( $9 \times \$25$ ).

Figure 12.1(b) shows the firm's total revenue curve (*TR*), which graphs the relationship between total revenue and the quantity sold. At point *A* on the *TR* curve, the firm sells 9 sweaters and has a total revenue of \$225. Because each additional sweater sold brings in a constant amount—\$25—the total revenue curve is an upward-sloping straight line.

**Marginal Revenue** Marginal revenue is the change in total revenue that results from a one-unit increase in quantity sold. In the table in Fig. 12.1, when the quantity sold increases from 8 to 9 sweaters, total revenue increases from \$200 to \$225, so marginal revenue is \$25 a sweater.

Because the firm in perfect competition is a price taker, the change in total revenue that results from a one-unit increase in the quantity sold equals the market price. *In perfect competition, the firm's marginal revenue equals the market price.* Figure 12.1(c) shows the firm's marginal revenue curve (*MR*) as the horizontal line at the market price.

**Demand for the Firm's Product** The firm can sell any quantity it chooses at the market price. So the demand curve for the firm's product is a horizontal line at the market price, the same as the firm's marginal revenue curve.

**FIGURE 12.1** Demand, Price, and Revenue in Perfect Competition

In part (a), market demand and market supply determine the market price (and quantity). Part (b) shows the firm's total revenue curve ( $TR$ ). Point A corresponds to the second row of the table—Campus Sweaters sells 9 sweaters at \$25 a sweater, so total revenue is \$225. Part (c) shows the firm's marginal revenue curve ( $MR$ ). This curve is also the demand curve for the firm's sweaters. The demand for sweaters from Campus Sweaters is perfectly elastic at the market price of \$25 a sweater.

### MyEconLab Animation

A horizontal demand curve illustrates a perfectly elastic demand, so the demand for the firm's product is perfectly elastic. A sweater from Campus Sweaters is a *perfect substitute* for a sweater from any other factory. But the *market* demand for sweaters is *not* perfectly elastic: Its elasticity depends on the substitutability of sweaters for other goods and services.

## The Firm's Decisions

The goal of the competitive firm is to maximize economic profit, given the constraints it faces. To achieve its goal, a firm must decide:

1. How to produce at minimum cost
2. What quantity to produce
3. Whether to enter or exit a market

You've already seen how a firm makes the first decision. It does so by operating with the plant that minimizes long-run average cost—by being on its

long-run average cost curve. We'll now see how the firm makes the other two decisions. We start by looking at the firm's output decision.

## REVIEW QUIZ

- 1 Why is a firm in perfect competition a price taker?
- 2 In perfect competition, what is the relationship between the demand for the firm's output and the market demand?
- 3 In perfect competition, why is a firm's marginal revenue curve also the demand curve for the firm's output?
- 4 What decisions must a firm make to maximize profit?

Work these questions in Study Plan 12.1 and get instant feedback. Do a Key Terms Quiz.

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## The Firm's Output Decision

A firm's cost curves (total cost, average cost, and marginal cost) describe the relationship between its output and costs (see Chapter 11, pp. 253–259). And a firm's revenue curves (total revenue and marginal revenue) describe the relationship between its output and revenue (pp. 272–273). From the firm's cost curves and revenue curves, we can find the output that maximizes the firm's economic profit.

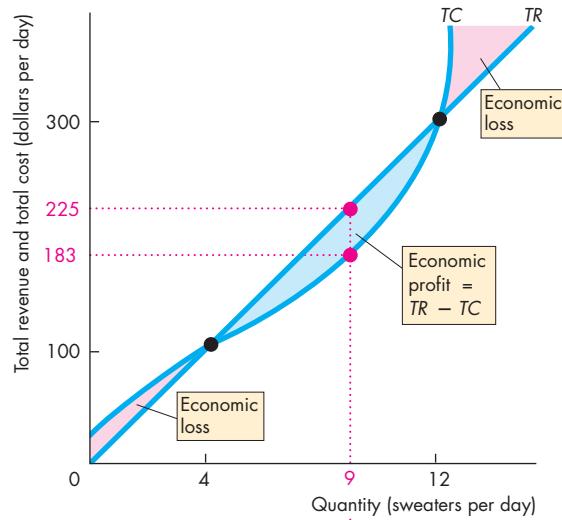
Figure 12.2 shows how to do this for Campus Sweaters. The table lists the firm's total revenue and total cost at different outputs, and part (a) of the figure shows the firm's total revenue curve,  $TR$ , and total cost curve,  $TC$ . These curves are graphs of numbers in the first three columns of the table.

Economic profit equals total revenue minus total cost. The fourth column of the table in Fig. 12.2 shows the economic profit made by Campus Sweaters, and part (b) of the figure graphs these numbers as its economic profit curve,  $EP$ .

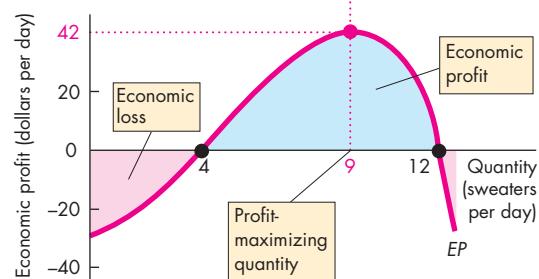
Campus Sweaters maximizes its economic profit by producing 9 sweaters a day: Total revenue is \$225, total cost is \$183, and economic profit is \$42. No other output rate achieves a larger profit.

At outputs of less than 4 sweaters and more than 12 sweaters a day, Campus Sweaters would incur an economic loss. At either 4 or 12 sweaters a day, Campus Sweaters would make zero economic profit, called a *break-even point*.

**FIGURE 12.2** Total Revenue, Total Cost, and Economic Profit



(a) Revenue and cost



(b) Economic profit and loss

Quantity (Q) (sweaters per day)	Total revenue (TR) (dollars)	Total cost (TC) (dollars)	Economic profit (TR - TC) (dollars)
0	0	22	-22
1	25	45	-20
2	50	66	-16
3	75	85	-10
4	100	100	0
5	125	114	11
6	150	126	24
7	175	141	34
8	200	160	40
9	225	183	42
10	250	210	40
11	275	245	30
12	300	300	0
13	325	360	-35

The table lists Campus Sweaters' total revenue, total cost, and economic profit. Part (a) graphs the total revenue and total cost curves, and part (b) graphs economic profit.

Campus Sweaters makes maximum economic profit, \$42 a day ( $\$225 - \$183$ ), when it produces 9 sweaters a day. At outputs of 4 sweaters and 12 sweaters a day, Campus Sweaters makes zero economic profit—these are break-even points. At an output less than 4 sweaters and greater than 12 sweaters a day, Campus Sweaters incurs an economic loss.

## Marginal Analysis and the Supply Decision

Another way to find the profit-maximizing output is to use marginal analysis, which compares marginal revenue,  $MR$ , with marginal cost,  $MC$ . As output increases, the firm's marginal revenue is constant but its marginal cost eventually increases.

If marginal revenue exceeds marginal cost ( $MR > MC$ ), then the revenue from selling one more unit exceeds the cost of producing it and an increase in output increases economic profit. If marginal revenue is less than marginal cost ( $MR < MC$ ), then the revenue from selling one more unit is less than the cost of producing that unit and a *decrease* in output *increases* economic profit. If marginal revenue equals marginal cost ( $MR = MC$ ), then the revenue from selling one more unit equals the cost incurred to produce that unit. Economic profit is maximized and either an increase or a decrease in output decreases economic profit.

Figure 12.3 illustrates these propositions. If Campus Sweaters increases its output from 8 sweaters to 9 sweaters a day, marginal revenue (\$25) exceeds marginal cost (\$23), so by producing the 9th sweater economic profit increases by \$2 from \$40 to \$42 a day. The blue area in the figure shows the increase in economic profit when the firm increases production from 8 to 9 sweaters per day.

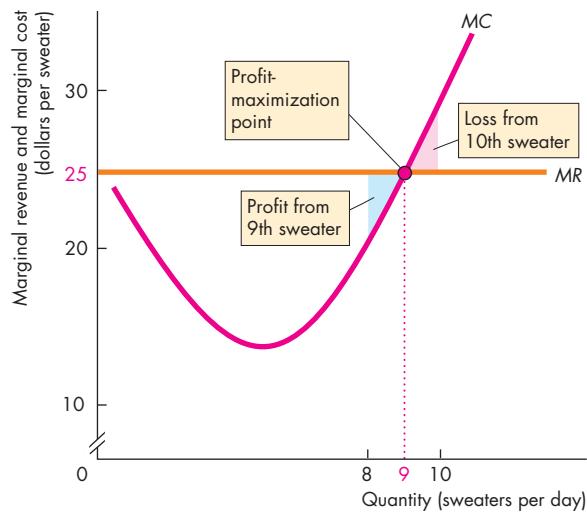
If Campus Sweaters increases its output from 9 sweaters to 10 sweaters a day, marginal revenue (\$25) is less than marginal cost (\$27), so by producing the 10th sweater, economic profit decreases. The last column of the table shows that economic profit decreases from \$42 to \$40 a day. The red area in the figure shows the economic loss that arises from increasing production from 9 to 10 sweaters a day.

Campus Sweaters maximizes economic profit by producing 9 sweaters a day, the quantity at which marginal revenue equals marginal cost.

A firm's profit-maximizing output is its quantity supplied at the market price. The quantity supplied at a price of \$25 a sweater is 9 sweaters a day. If the price were higher than \$25 a sweater, the firm would increase production. If the price were lower than \$25 a sweater, the firm would decrease production. These profit-maximizing responses to different market prices are the foundation of the law of supply:

Other things remaining the same, the higher the market price of a good, the greater is the quantity supplied of that good.

**FIGURE 12.3** Profit-Maximizing Output



Quantity (Q) (sweaters per day)	Total revenue (TR) (dollars)	Marginal revenue (MR) (dollars per additional sweater)	Total cost (TC) (dollars)	Marginal cost (MC) (dollars per additional sweater)	Economic profit (TR - TC) (dollars)
7	175	..... 25	141	..... 19	34
8	200	..... 25	160	..... 23	40
9	225	..... 25	183	..... 27	42
10	250	..... 25	210	..... 35	40
11	275		245		30

The firm maximizes profit by producing the output at which marginal revenue equals marginal cost and marginal cost is increasing. The table and figure show that marginal cost equals marginal revenue and economic profit is maximized when Campus Sweaters produces 9 sweaters a day. The table shows that if Campus Sweaters increases output from 8 to 9 sweaters, marginal cost is \$23, which is less than the marginal revenue of \$25. If output increases from 9 to 10 sweaters, marginal cost is \$27, which exceeds the marginal revenue of \$25. If marginal revenue exceeds marginal cost, an increase in output increases economic profit. If marginal revenue is less than marginal cost, an increase in output decreases economic profit. If marginal revenue equals marginal cost, economic profit is maximized.

## Temporary Shutdown Decision

You've seen that a firm maximizes profit by producing the quantity at which marginal revenue (price) equals marginal cost. But suppose that at this quantity, price is less than average total cost. In this case, the firm incurs an economic loss. Maximum profit is a loss (a minimum loss). What does the firm do?

If the firm expects the loss to be permanent, it goes out of business. But if it expects the loss to be temporary, the firm must decide whether to shut down temporarily and produce no output, or to keep producing. To make this decision, the firm compares the loss from shutting down with the loss from producing and takes the action that minimizes its loss.

**Loss Comparisons** A firm's economic loss equals total fixed cost,  $TFC$ , plus total variable cost minus total revenue. Total variable cost equals average variable cost,  $AVC$ , multiplied by the quantity produced,  $Q$ , and total revenue equals price,  $P$ , multiplied by the quantity  $Q$ . So:

$$\text{Economic loss} = TFC + (AVC - P) \times Q.$$

If the firm shuts down, it produces no output ( $Q = 0$ ). The firm has no variable costs and no revenue but it must pay its fixed costs, so its economic loss equals total fixed cost.

If the firm produces, then in addition to its fixed costs, it incurs variable costs. But it also receives revenue. Its economic loss equals total fixed cost—the loss when shut down—plus total variable cost minus total revenue. If total variable cost exceeds total revenue, this loss exceeds total fixed cost and the firm shuts down. Equivalently, if average variable cost exceeds price, this loss exceeds total fixed cost and the firm shuts down.

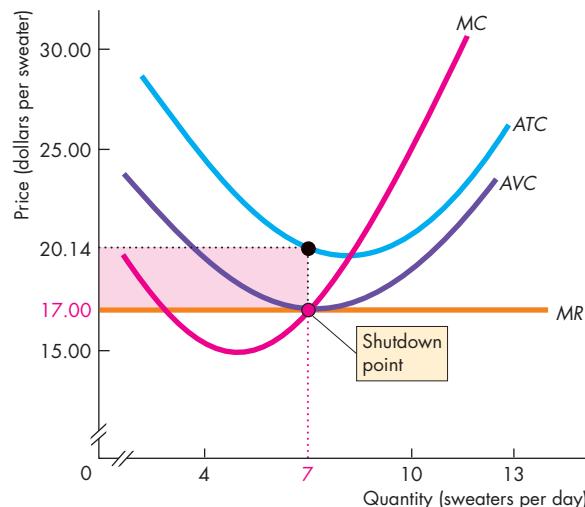
**The Shutdown Point** A firm's **shutdown point** is the price and quantity at which it is indifferent between producing and shutting down. The shutdown point occurs at the price and the quantity at which average variable cost is a minimum. At the shutdown point, the firm is minimizing its loss and its loss equals total fixed cost. If the price falls below minimum average variable cost, the firm shuts down temporarily and continues to incur a loss equal to total fixed cost. At prices above minimum average variable cost but below average total cost, the firm produces the loss-minimizing output and incurs a loss, but a loss that is less than total fixed cost.

Figure 12.4 illustrates the firm's shutdown decision and the shutdown point that we've just described for Campus Sweaters.

The firm's average variable cost curve is  $AVC$  and the marginal cost curve is  $MC$ . Average variable cost has a minimum of \$17 a sweater when output is 7 sweaters a day. The  $MC$  curve intersects the  $AVC$  curve at its minimum. (We explained this relationship in Chapter 11; see pp. 254–255.)

The figure shows the marginal revenue curve  $MR$  when the price is \$17 a sweater, a price equal to minimum average variable cost. Marginal revenue equals marginal cost at 7 sweaters a day, so this quantity maximizes economic profit (minimizes economic loss). The  $ATC$  curve shows that the firm's average total cost of producing 7 sweaters a day is \$20.14 a sweater. The firm incurs a loss equal to \$3.14 a sweater on 7 sweaters a day, so its loss is \$22 a day. The table in Fig. 12.2 shows that Campus Sweaters' loss equals its total fixed cost.

**FIGURE 12.4** The Shutdown Decision



The shutdown point is at minimum average variable cost. At a price below minimum average variable cost, the firm shuts down and produces no output. At a price equal to minimum average variable cost, the firm is indifferent between shutting down and producing no output or producing the output at minimum average variable cost. Either way, the firm minimizes its economic loss and incurs a loss equal to total fixed cost.

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## The Firm's Supply Curve

A perfectly competitive firm's supply curve shows how its profit-maximizing output varies as the market price varies, other things remaining the same. The supply curve is derived from the firm's marginal cost curve and average variable cost curves. Figure 12.5 illustrates the derivation of the supply curve.

When the price *exceeds* minimum average variable cost (more than \$17), the firm maximizes profit by producing the output at which marginal cost equals price. If the price rises, the firm increases its output—it moves up along its marginal cost curve.

When the price is *less* than minimum average variable cost (less than \$17 a sweater), the firm maximizes profit by temporarily shutting down and producing no output. The firm produces zero output at all prices below minimum average variable cost.

When the price *equals* minimum average variable cost, the firm maximizes profit *either* by temporarily shutting down and producing no output *or* by producing the output at which average variable cost is a minimum—the shutdown point,  $T$ . The firm never produces a quantity between zero and the quantity at the shutdown point  $T$  (a quantity greater than zero and less than 7 sweaters a day).

The firm's supply curve in Fig. 12.5(b) runs along the  $y$ -axis from a price of zero to a price equal to minimum average variable cost, jumps to point  $T$ , and then, as the price rises above minimum average variable cost, follows the marginal cost curve.



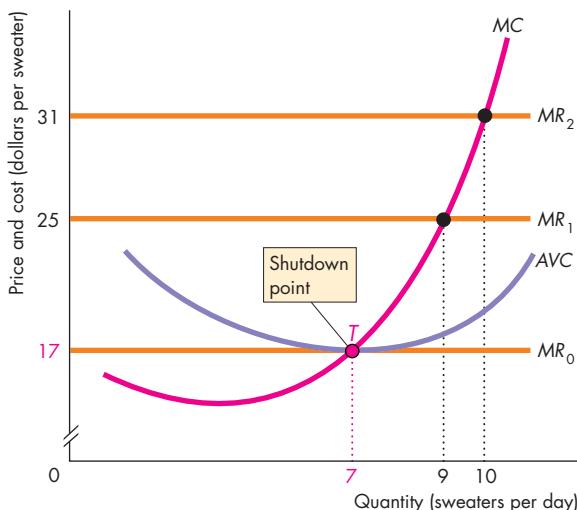
### REVIEW QUIZ

- 1 Why does a firm in perfect competition produce the quantity at which marginal cost equals price?
- 2 What is the lowest price at which a firm produces an output? Explain why.
- 3 What is the relationship between a firm's supply curve, its marginal cost curve, and its average variable cost curve?

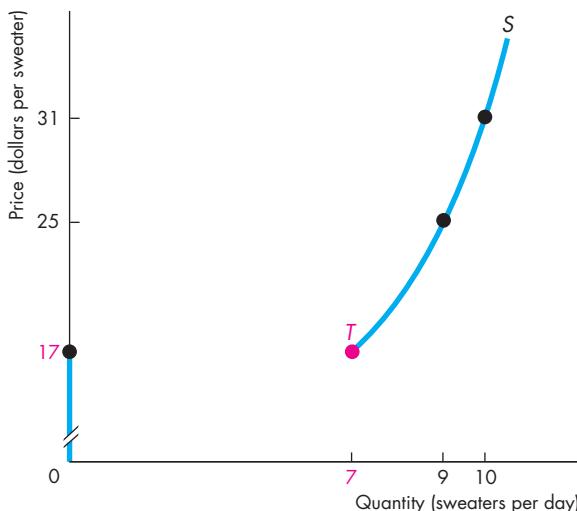
Work these questions in Study Plan 12.2 and get instant feedback. Do a Key Terms Quiz. [MyEconLab](#)

So far, we've studied a single firm in isolation. We've seen that the firm's profit-maximizing decision depends on the market price, which it takes as given. How is the market price determined? Let's find out.

**FIGURE 12.5** A Firm's Supply Curve



(a) Marginal cost and average variable cost



(b) Campus Sweaters' short-run supply curve

Part (a) shows the firm's profit-maximizing output at various market prices. At \$25 a sweater, it produces 9 sweaters, and at \$17 a sweater, it produces 7 sweaters. At all prices below \$17 a sweater, Campus Sweaters produces nothing. Its shutdown point is  $T$ . Part (b) shows the firm's supply curve—the quantity of sweaters it produces at each price. Its supply curve is made up of the marginal cost curve at all prices above minimum average variable cost and the vertical axis at all prices below minimum average variable cost.

[MyEconLab Animation and Draw Graph](#)

## Output, Price, and Profit in the Short Run

To determine the price and quantity in a perfectly competitive market, we need to know how market demand and market supply interact. We start by studying a perfectly competitive market in the short run. The short run is a situation in which the number of firms is fixed.

### Market Supply in the Short Run

The **short-run market supply curve** shows the quantity supplied by all the firms in the market at each price when each firm's plant and the number of firms remain the same.

You've seen how an individual firm's supply curve is determined. The market supply curve is derived from the individual supply curves. The quantity supplied by the market at a given price is the sum of the quantities supplied by all the firms in the market at that price.

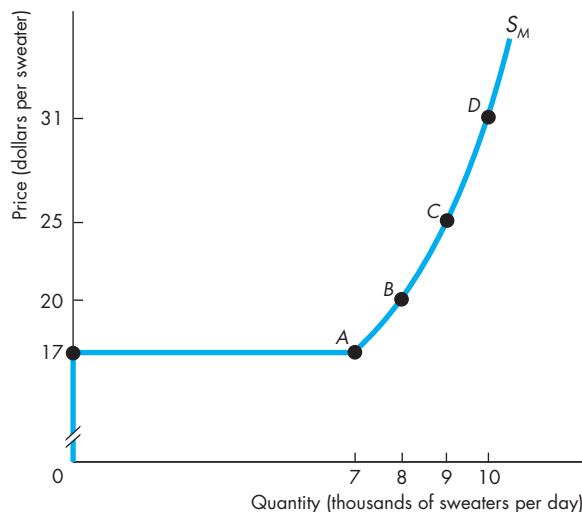
Figure 12.6 shows the supply curve for the competitive sweater market. In this example, the market consists of 1,000 firms exactly like Campus Sweaters. At each price, the quantity supplied by the market is 1,000 times the quantity supplied by a single firm.

The table in Fig. 12.6 shows the firm's and the market's supply schedules and how the market supply curve is constructed. At prices below \$17 a sweater, every firm in the market shuts down; the quantity supplied by the market is zero. At \$17 a sweater, each firm is indifferent between shutting down and producing nothing or operating and producing 7 sweaters a day. Some firms will shut down, and others will supply 7 sweaters a day. The quantity supplied by each firm is *either* 0 or 7 sweaters, and the quantity supplied by the market is *between* 0 (all firms shut down) and 7,000 (all firms produce 7 sweaters a day each).

The market supply curve is a graph of the market supply schedules, and the points on the supply curve *A* through *D* represent the rows of the table.

To construct the market supply curve, we sum the quantities supplied by all the firms at each price. Each of the 1,000 firms in the market has a supply schedule like Campus Sweaters. At prices below \$17 a sweater, the market supply curve runs along the *y*-axis. At \$17 a sweater, the market supply curve is horizontal—supply is perfectly elastic. As the price

**FIGURE 12.6** Short-Run Market Supply Curve



	Price (dollars per sweater)	Quantity supplied by Campus Sweaters (sweaters per day)	Quantity supplied by market (sweaters per day)
A	17	0 or 7	0 to 7,000
B	20	8	8,000
C	25	9	9,000
D	31	10	10,000

The market supply schedule is the sum of the supply schedules of all the individual firms. A market that consists of 1,000 identical firms has a supply schedule similar to that of one firm, but the quantity supplied by the market is 1,000 times as large as that of the one firm (see the table). The market supply curve is  $S_M$ . Points *A*, *B*, *C*, and *D* correspond to the rows of the table. At the shutdown price of \$17 a sweater, each firm produces either 0 or 7 sweaters a day and the quantity supplied by the market is between 0 and 7,000 sweaters a day. The market supply is perfectly elastic at the shutdown price.

**MyEconLab Animation**

rises above \$17 a sweater, each firm increases its quantity supplied and the quantity supplied by the market increases by 1,000 times that of one firm.

## Short-Run Equilibrium

Market demand and short-run market supply determine the market price and market output. Figure 12.7(a) shows a short-run equilibrium. The short-run supply curve,  $S$ , is the same as  $S_M$  in Fig. 12.6. If the market demand curve is  $D_1$ , the market price is \$20 a sweater. Each firm takes this price as given and produces its profit-maximizing output, which is 8 sweaters a day. Because the market has 1,000 identical firms, the market output is 8,000 sweaters a day.

## A Change in Demand

Changes in demand bring changes to short-run market equilibrium. Figure 12.7(b) shows these changes.

If demand increases and the demand curve shifts rightward to  $D_2$ , the market price rises to \$25 a sweater. At this price, each firm maximizes profit by increasing its output to 9 sweaters a day. The market output increases to 9,000 sweaters a day.

If demand decreases and the demand curve shifts leftward to  $D_3$ , the market price falls to \$17. At this

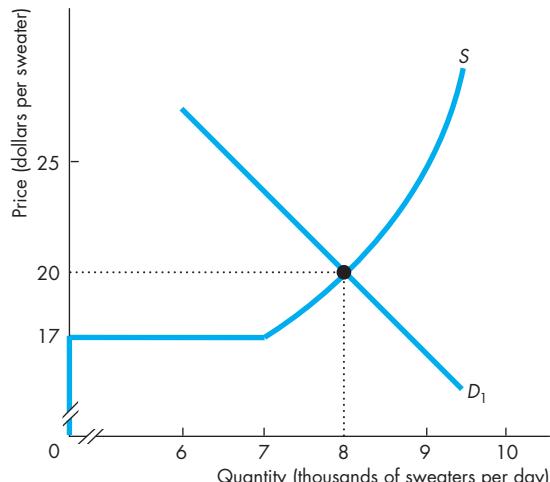
price, each firm maximizes profit by decreasing its output. If each firm produces 7 sweaters a day, the market output decreases to 7,000 sweaters a day.

If the demand curve shifts farther leftward than  $D_3$ , the market price remains at \$17 a sweater because the market supply curve is horizontal at that price. Some firms continue to produce 7 sweaters a day, and others temporarily shut down. Firms are indifferent between these two activities, and whichever they choose, they incur an economic loss equal to total fixed cost. The number of firms continuing to produce is just enough to satisfy the market demand at a price of \$17 a sweater.

## Profits and Losses in the Short Run

In short-run equilibrium, although the firm produces the profit-maximizing output, it does not necessarily end up making an economic profit. It might do so, but it might alternatively break even or incur an economic loss. Economic profit (or loss) per sweater is price,  $P$ , minus average total cost,  $ATC$ . So economic profit (or loss) is  $(P - ATC) \times Q$ . If price equals

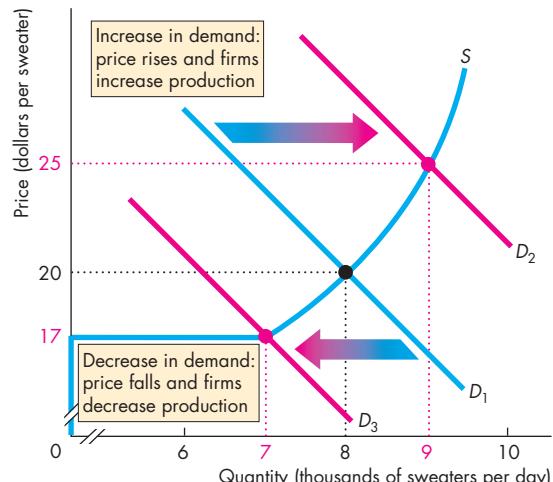
**FIGURE 12.7** Short-Run Equilibrium



**(a) Equilibrium**

In part (a), the market supply curve is  $S$  and the market demand curve is  $D_1$ . The market price is \$20 a sweater. At this price, each firm produces 8 sweaters a day and the market produces 8,000 sweaters a day.

In part (b), if the market demand increases to  $D_2$ , the price rises to \$25 a sweater. Each firm produces 9 sweaters



**(b) Change in equilibrium**

a day and market output is 9,000 sweaters. If market demand decreases to  $D_3$ , the price falls to \$17 a sweater and each firm decreases its output. If each firm produces 7 sweaters a day, the market output is 7,000 sweaters a day.

average total cost, a firm breaks even—the entrepreneur makes normal profit. If price exceeds average total cost, a firm makes an economic profit. If price is less than average total cost, a firm incurs an economic loss. Figure 12.8 shows these three possible short-run profit outcomes for Campus Sweaters. These outcomes correspond to the three different levels of market demand that we've just examined.

### Three Possible Short-Run Outcomes

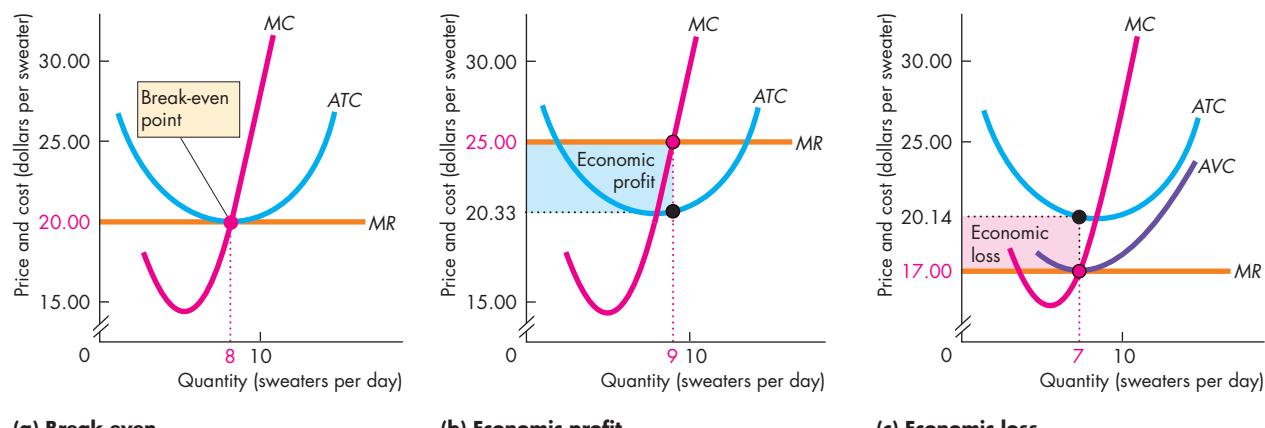
Figure 12.8(a) corresponds to the situation in Fig. 12.7(a) where the market demand is  $D_1$ . The equilibrium price of a sweater is \$20 and the firm produces 8 sweaters a day. Average total cost is \$20 a sweater. Price equals average total cost ( $ATC$ ), so the firm breaks even (makes zero economic profit).

Figure 12.8(b) corresponds to the situation in Fig. 12.7(b) where the market demand is  $D_2$ . The equilibrium price of a sweater is \$25 and the firm produces 9 sweaters a day. Here, price exceeds average total cost, so the firm makes an economic profit. Its economic profit is \$42 a day, which equals \$4.67 per sweater ( $\$25.00 - \$20.33$ ) multiplied by 9, the

profit-maximizing number of sweaters produced. The blue rectangle shows this economic profit. The height of that rectangle is profit per sweater, \$4.67, and the length is the quantity of sweaters produced, 9 a day. So the area of the rectangle is economic profit of \$42 a day.

Figure 12.8(c) corresponds to the situation in Fig. 12.7(b) where the market demand is  $D_3$ . The equilibrium price of a sweater is \$17. Here, the price is less than average total cost, so the firm incurs an economic loss. Price and marginal revenue are \$17 a sweater, and the profit-maximizing (in this case, loss-minimizing) output is 7 sweaters a day. Total revenue is \$119 a day ( $7 \times \$17$ ). Average total cost is \$20.14 a sweater, so the economic loss is \$3.14 per sweater ( $\$20.14 - \$17.00$ ). This loss per sweater multiplied by the number of sweaters is \$22. The red rectangle shows this economic loss. The height of that rectangle is economic loss per sweater, \$3.14, and the length is the quantity of sweaters produced, 7 a day. So the area of the rectangle is the firm's economic loss of \$22 a day. If the price dips below \$17 a sweater, the firm temporarily shuts down and incurs an economic loss equal to total fixed cost.

**FIGURE 12.8** Three Short-Run Outcomes for the Firm



**(a) Break even**

**(b) Economic profit**

**(c) Economic loss**

In the short run, the firm might break even (make zero economic profit), make an economic profit, or incur an economic loss. In part (a), the price equals minimum average total cost. At the profit-maximizing output, the firm breaks even and makes zero economic profit. In part (b), the market price is \$25 a sweater. At the profit-maximizing output,

the price exceeds average total cost and the firm makes an economic profit, which is equal to the area of the blue rectangle. In part (c), the market price is \$17 a sweater. At the profit-maximizing output, the price is below minimum average total cost and the firm incurs an economic loss, which is equal to the area of the red rectangle.

## Economics in Action

### Production Cutback and Temporary Shutdown

Motor Coach Industries (MCI) employs about 1,000 workers at its Winnipeg plant, where it has been building coaches for more than 70 years. In February 2008, the firm delivered some bad news to labour union head Glen Tomchak: The plant would shut down for a week in April and some workers would be permanently laid off.

MCI officials said that in the current state of the U.S. economy, the demand for coaches was down and prices were depressed.

We can explain this temporary shutdown using the analysis you've learned in this chapter. The shutdown occurred because total revenue was insufficient to cover total variable cost.

The firm's permanent cut in its workforce can be explained by the same analysis. The fall in the price of a coach decreased the profit-maximizing quantity of coaches and MCI cut the quantity of labour employed.



### REVIEW QUIZ

- 1 How do we derive the short-run market supply curve in perfect competition?
- 2 In perfect competition, when market demand increases, explain how the price of the good and the output and profit of each firm changes in the short run.
- 3 In perfect competition, when market demand decreases, explain how the price of the good and the output and profit of each firm changes in the short run.

Work these questions in Study Plan 12.3 and get instant feedback. Do a Key Terms Quiz. [MyEconLab](#)

## ◆ Output, Price, and Profit in the Long Run

In short-run equilibrium, a firm might make an economic profit, incur an economic loss, or break even. Although each of these three situations is a short-run equilibrium, only one of them is a long-run equilibrium. The reason is that in the long run, firms can enter or exit the market.

### Entry and Exit

Entry occurs in a market when new firms come into the market and the number of firms increases. Exit occurs when existing firms leave a market and the number of firms decreases.

Firms respond to economic profit and economic loss by either entering or exiting a market. New firms enter a market in which existing firms are making an economic profit. Firms exit a market in which they are incurring an economic loss. Temporary economic profit and temporary economic loss don't trigger entry and exit. It's the prospect of persistent economic profit or loss that triggers entry and exit.

Entry and exit change the market supply, which influences the market price, the quantity produced by each firm, and its economic profit (or loss).

If firms enter a market, supply increases and the market supply curve shifts rightward. The increase in supply lowers the market price and eventually eliminates economic profit. When economic profit reaches zero, entry stops.

If firms exit a market, supply decreases and the market supply curve shifts leftward. The market price rises and economic loss decreases. Eventually, economic loss is eliminated and exit stops.

To summarize:

- New firms enter a market in which existing firms are making an economic profit.
- As new firms enter a market, the market price falls and the economic profit of each firm decreases.
- Firms exit a market in which they are incurring an economic loss.
- As firms leave a market, the market price rises and the economic loss incurred by the remaining firms decreases.
- Entry and exit stop when firms make zero economic profit.

## A Closer Look at Entry

The sweater market has 800 firms with cost curves like those in Fig. 12.9(a). The market demand curve is  $D$ , the market supply curve is  $S_1$ , and the price is \$25 a sweater in Fig. 12.9(b). Each firm produces 9 sweaters a day and makes an economic profit.

This economic profit is a signal for new firms to enter the market. As entry takes place, supply increases and the market supply curve shifts rightward toward  $S^*$ . As supply increases with no change in demand, the market price gradually falls from \$25 to \$20 a sweater. At this lower price, each firm makes zero economic profit and entry stops.

Entry results in an increase in market output, but each firm's output *decreases*. Because the price falls, each firm moves down its supply curve and produces less. Because the number of firms increases, the market produces more.

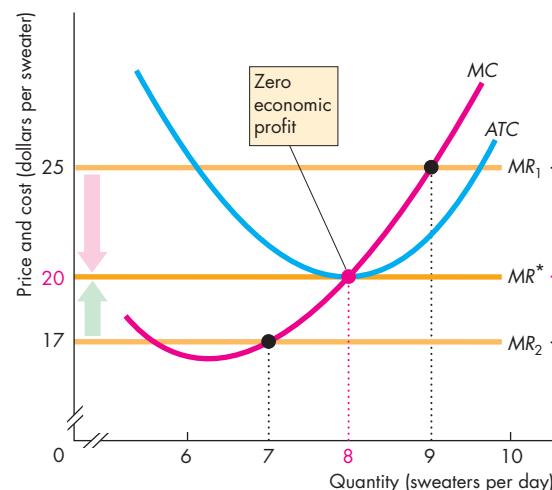
## A Closer Look at Exit

The sweater market has 1,200 firms with cost curves like those in Fig. 12.9(a). The market demand curve is  $D$ , the market supply curve is  $S_2$ , and the price is \$17 a sweater in Fig. 12.9(b). Each firm produces 7 sweaters a day and incurs an economic loss.

This economic loss is a signal for firms to exit the market. As exit takes place, supply decreases and the market supply curve shifts leftward toward  $S^*$ . As supply decreases with no change in demand, the market price gradually rises from \$17 to \$20 a sweater. At this higher price, losses are eliminated, each firm makes zero economic profit, and exit stops.

Exit results in a decrease in market output, but each firm's output *increases*. Because the price rises, each firm moves up its supply curve and produces more. Because the number of firms decreases, the market produces less.

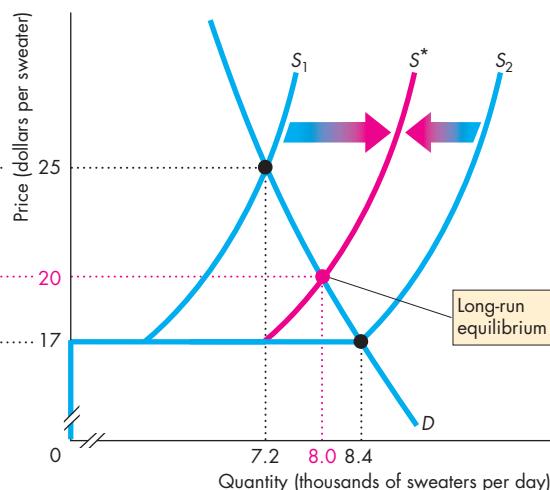
**FIGURE 12.9** Entry, Exit, and Long-Run Equilibrium



(a) Campus Sweaters

Each firm has cost curves like those of Campus Sweaters in part (a). The market demand curve is  $D$  in part (b).

When the market supply curve in part (b) is  $S_1$ , the price is \$25 a sweater. In part (a), each firm produces 9 sweaters a day and makes an economic profit. Profit triggers the entry of new firms, and as new firms enter, the market supply curve shifts rightward, from  $S_1$  toward  $S^*$ . The price falls from \$25 to \$20 a sweater, and the quantity produced increases from 7,200 to 8,000 sweaters. Each firm decreases its output to 8 sweaters a day and its economic profit falls to zero.



(b) The sweater market

When the market supply curve is  $S_2$ , the price is \$17 a sweater. In part (a), each firm produces 7 sweaters a day and incurs an economic loss. Loss triggers exit, and as firms exit, the market supply curve shifts leftward, from  $S_2$  toward  $S^*$ . The price rises from \$17 to \$20 a sweater, and the quantity produced decreases from 8,400 to 8,000 sweaters. Each firm increases its output from 7 to 8 sweaters a day and its economic profit rises to zero.

## Economics in Action

### Entry and Exit

An example of entry and falling prices occurred during the 1980s and 1990s in the personal computer market. When IBM introduced its first PC in 1981, IBM had little competition. The price was \$7,000 (about \$16,850 in today's money) and IBM made a large economic profit selling the new machine.

Observing IBM's huge success, new firms such as Gateway, NEC, Dell, and a host of others entered the market with machines that were technologically identical to IBM's. In fact, they were so similar that they came to be called "clones." The massive wave of entry into the personal computer market increased the market supply and lowered the price. The economic profit for all firms decreased.

Today, a \$400 computer is vastly more powerful than its 1981 ancestor that cost 42 times as much.

The same PC market that saw entry during the 1980s and 1990s has seen some exit more recently. In 2001, IBM, the firm that first launched the PC, announced that it was exiting the market. The intense competition from Gateway, NEC, Dell, and others that entered the market following IBM's lead has lowered the price and eliminated the economic profit. So IBM now concentrates on servers and other parts of the computer market.

IBM exited the PC market because it was incurring economic losses. Its exit decreased market supply and made it possible for the remaining firms in the market to make zero economic profit.

International Harvester, a manufacturer of farm equipment, provides another example of exit. For decades, people associated the name "International Harvester" with tractors, combines, and other farm machines. But International Harvester wasn't the only maker of farm equipment. The market became intensely competitive, and the firm began to incur economic losses. Now the firm has a new name, Navistar International, and it doesn't make tractors any more. After years of economic losses and shrinking revenues, it got out of the farm-machine business in 1985 and started to make trucks.

International Harvester exited because it was incurring an economic loss. Its exit decreased supply and made it possible for the remaining firms in the market to break even.



### Long-Run Equilibrium

You've now seen how economic profit induces entry, which in turn eliminates the profit. You've also seen how economic loss induces exit, which in turn eliminates the loss.

When economic profit and economic loss have been eliminated and entry and exit have stopped, a competitive market is in *long-run equilibrium*.

You've seen how a competitive market adjusts toward its long-run equilibrium. But a competitive market is rarely *in* a state of long-run equilibrium. Instead, it is constantly and restlessly evolving toward long-run equilibrium. The reason is that the market is constantly bombarded with events that change the constraints that firms face.

Markets are constantly adjusting to keep up with changes in tastes, which change demand, and changes in technology, which change costs.

In the next sections, we're going to see how a competitive market reacts to changing tastes and technology and how the market guides resources to their highest-valued use.

### REVIEW QUIZ

- 1 What triggers entry in a competitive market? Describe the process that ends further entry.
- 2 What triggers exit in a competitive market? Describe the process that ends further exit.

Work these questions in Study Plan 12.4 and get instant feedback.  
**MyEconLab**

## Changes in Demand and Supply as Technology Advances

The arrival of high-speed Internet service increased the demand for personal computers and the demand for music and movie downloads. At the same time, the arrival of these technologies decreased the demand for the retail services of record stores.

What happens in a competitive market when the demand for its product changes? The perfect competition model can answer this question.

### An Increase in Demand

Producers of computer components are in long-run equilibrium making zero economic profit when the arrival of the high-speed Internet brings an increase in the demand for computers and the components from which they are built. The equilibrium price of a component rises and producers make economic profits. New firms start to enter the market. Supply

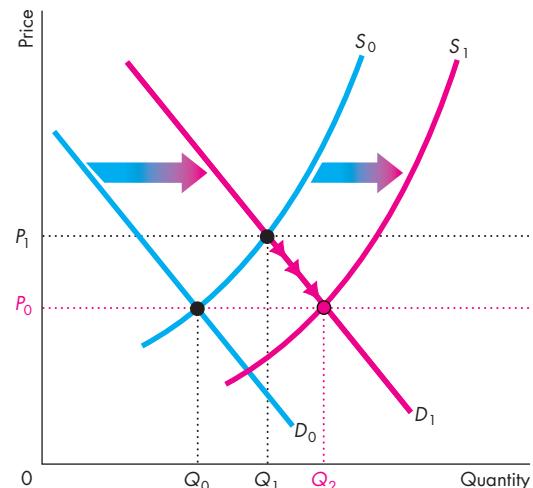
increases and the price stops rising and then begins to fall. Eventually, enough firms have entered for the supply and the increased demand to be in balance at a price that enables the firms in the market to return to zero economic profit—long-run equilibrium.

Figure 12.10 illustrates the process. In the market in part (a), demand is  $D_0$ , supply is  $S_0$ , price is  $P_0$ , and market output is  $Q_0$ . At the firm in part (b), profit is maximized with marginal revenue,  $MR_0$ , equal to marginal cost,  $MC$ , at output  $q_0$ . Economic profit is zero.

Market demand increases and the demand curve shifts rightward to  $D_1$ , in Fig. 12.10(a). The price rises to  $P_1$ , and the quantity supplied increases from  $Q_0$  to  $Q_1$  as the market moves up along its short-run supply curve  $S_0$ . In Fig. 12.10(b), the firm maximizes profit by producing  $q_1$ , where marginal revenue  $MR_1$  equals  $MC$ . The market is now in short-run equilibrium in which each firm makes an economic profit.

The economic profit brings entry and short-run supply increases—the market supply curve starts to shift rightward. The increase in supply lowers the

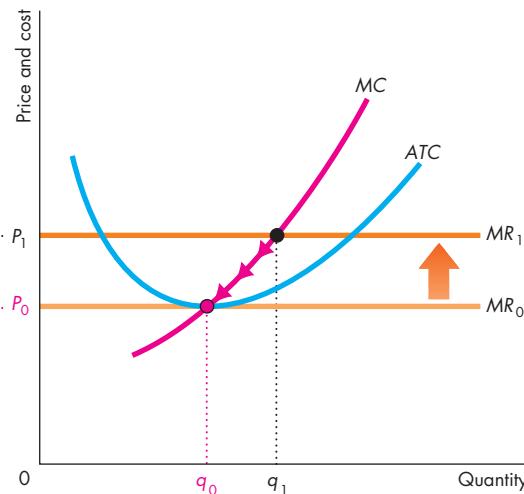
**FIGURE 12.10 An Increase in Demand**



**(a) Market**

A market starts out in long-run competitive equilibrium. Part (a) shows the market demand curve  $D_0$ , the market supply curve  $S_0$ , the market price  $P_0$ , and the equilibrium quantity  $Q_0$ . Each firm sells its output at the price  $P_0$ , so its marginal revenue curve is  $MR_0$  in part (b). Each firm produces  $q_0$  and makes zero economic profit.

Market demand increases from  $D_0$  to  $D_1$  in part (a) and the market price rises to  $P_1$ . Each firm maximizes profit by increasing its output to  $q_1$  in part (b), and the market



**(b) Firm**

output increases to  $Q_1$  in part (a). Firms now make economic profits. New firms enter the market, and as they do so, the market supply curve gradually shifts rightward, from  $S_0$  toward  $S_1$ . This shift gradually lowers the market price from  $P_1$  back to  $P_0$ . While the price is above  $P_0$ , firms make economic profits, so new firms keep entering the market. Once the price has returned to  $P_0$ , each firm makes zero economic profit and there is no incentive for firms to enter. Each firm produces  $q_0$ , and the market output is  $Q_2$ .

price and firms decrease output—move down along their marginal cost or supply curve in Fig. 12.10(b).

Eventually, entry shifts the supply curve to  $S_1$  in Fig. 12.10(a). The market price has returned to its original level,  $P_0$ . At this price, each firm produces  $q_0$ , the same as the quantity produced before the increase in demand. Market output is  $Q_2$  in a long-run equilibrium.

The difference between the initial long-run equilibrium and the new long-run equilibrium is the number of firms in the market. An increase in demand has increased the number of firms. In the

process of moving from the initial equilibrium to the new one, each firm makes an economic profit.

## A Decrease in Demand

A *decrease* in demand triggers a similar response to the one you've just studied but in the opposite direction. A decrease in demand brings a lower price, economic losses, and exit. Exit decreases supply, which raises the price to its original level and economic profit returns to zero in a new long-run equilibrium. *Economics in the News* below looks at an example.



## ECONOMICS IN THE NEWS

### Record Stores Exit

#### Sam the Record Man Finally Signs Off

The iconic Toronto landmark Sam the Record Man is finally closing its doors—a victim of the vagaries of the retail record business and declining CD sales thanks to the Internet.

Source: *Toronto Star*, May 30, 2007

#### THE PROBLEM

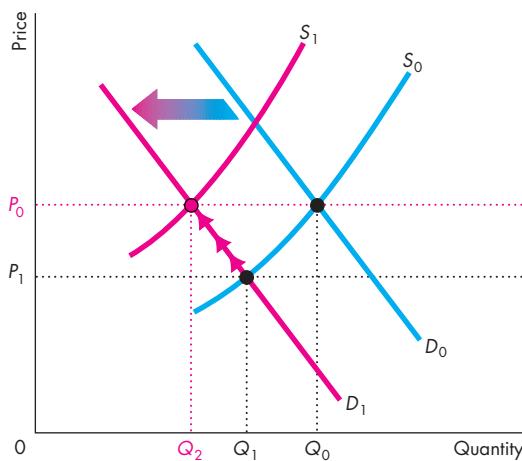
Provide a graphical analysis to explain why Sam the Record man exited the market and the effects of exit on the market for record store services.

#### THE SOLUTION

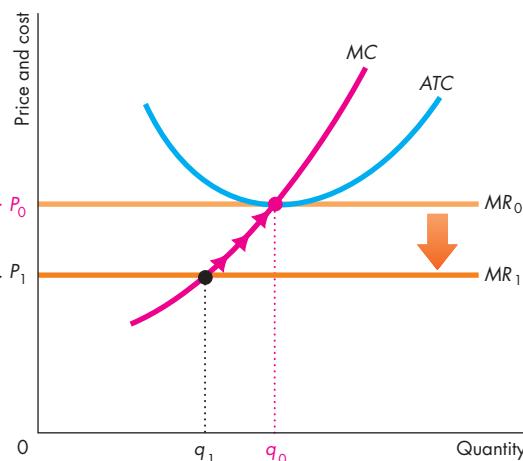
- With demand  $D_0$  and supply  $S_0$ ,  $Q_0$  customers are served at a price  $P_0$  in part (a) of Fig. 1.
- With marginal revenue  $MR_0$  and marginal cost  $MC$ , a record store serves  $q_0$  customers in long-run equilibrium in part (b) of Fig. 1.



- Demand decreases to  $D_1$ , the price falls to  $P_1$ , and marginal revenue falls to  $MR_1$ . Customers decrease to  $q_1$  (and  $Q_1$ ) and stores incur economic losses.
- Faced with economic loss, Sam the Record Man (and other stores) exit, and the market supply decreases to  $S_1$ .
- The decrease in supply raises the price and firms' remaining return to zero economic profit.



(a) Market



(b) Individual record store

Figure 1 The Market for Record Store Services

## Technological Advances Change Supply

We've studied the effects of technological change on demand, and to isolate those effects we've kept the individual firm's cost curves unchanged. But new technologies also lower production costs. We now study those effects of advancing technology.

Starting from a long-run equilibrium, when a new technology becomes available that lowers production costs, the first firms to use it make economic profit. But as more firms begin to use the new technology, market supply increases and the price falls. At first, new-technology firms continue to make positive economic profits, so more enter. But firms that continue to use the old technology incur economic losses. Why? Initially they were making zero economic profit and now with the lower price they incur economic losses. So old-technology firms exit.

Eventually, all the old-technology firms have exited and enough new-technology firms have entered to increase the market supply to a level that lowers the price to equal the minimum average total cost using the new technology. In this situation, all the firms, all of which are now new-technology firms, are making zero economic profit.

Figure 12.11 illustrates the process that we've just described. Part (a) shows the market demand and supply curves and market equilibrium. Part (b) shows the cost and revenue curves for a firm using the original old technology. Initially these are the only firms. Part (c) shows the cost and revenue curves for a firm using a new technology after it becomes available.

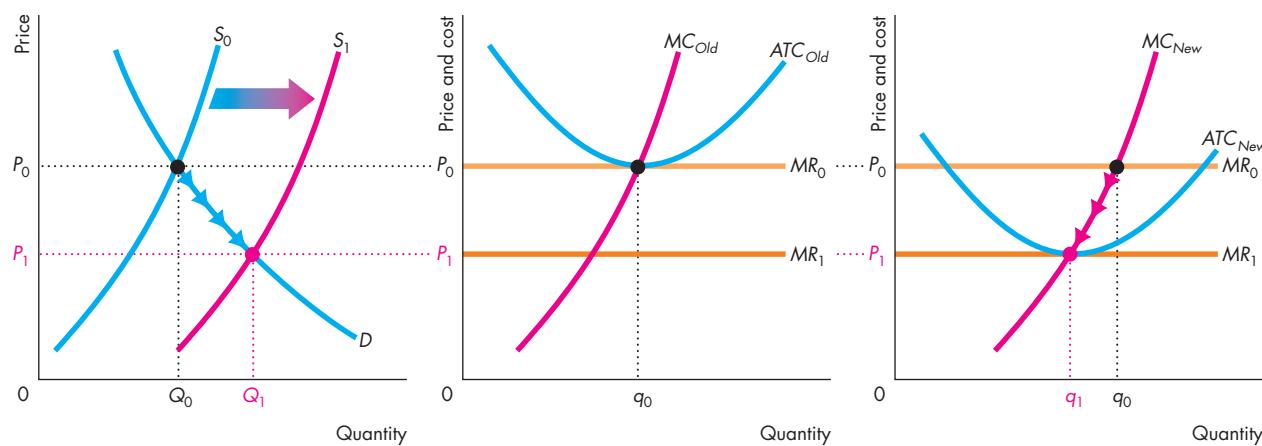
In part (a), the demand curve is  $D$  and initially the supply curve is  $S_0$ , so the price is  $P_0$  and the equilibrium quantity is  $Q_0$ .

In part (b), marginal revenue is  $MR_0$  and each firm produces  $q_0$  where  $MR_0$  equals  $MC_{Old}$ . Economic profit is zero and firms are producing at minimum average total cost on the curve  $ATC_{Old}$ .

When a new technology becomes available, average total cost and marginal cost of production fall, and firms that use the new technology produce with the average total cost curve  $ATC_{New}$  and marginal cost curve  $MC_{New}$  in part (c).

When one firm adopts the new technology, it is too small to influence supply, so the price remains at  $P_0$  and the firm makes an economic profit. But economic profit brings entry of new-technology firms. Market supply increases and the price falls.

**FIGURE 12.11 A Technological Advance Lowers Production Costs**



**(a) Market**

In part (a), the demand curve is  $D$  and initially the supply curve is  $S_0$ . The price is  $P_0$  and the equilibrium quantity is  $Q_0$ . In part (b), marginal revenue is  $MR_0$  and each firm produces  $q_0$  where  $MR_0$  equals  $MC_{Old}$ . Economic profit is zero.

A new technology becomes available with lower costs of  $ATC_{New}$  and  $MC_{New}$  in part (c). A firm that uses this technology produces  $q_1$  where  $MR_0$  equals  $MC_{New}$ .

As more firms use this technology, market supply increases and the price falls. With price below  $P_0$  and

**(b) Old-technology firm**

above  $P_1$ , old-technology firms incur economic losses and exit and new-technology firms make economic profits and new firms enter the market.

In the new long-run equilibrium, the old-technology firms have gone. New-technology firms increase the market supply to  $S_1$ . The price falls to  $P_1$ , marginal revenue is  $MR_1$ , and each firm produces  $q_1$  where  $MR_1$  equals  $MC_{New}$ .

**(c) New-technology firm**



## ECONOMICS IN THE NEWS

### The Falling Cost of Sequencing DNA

#### Company Announces Low-Cost DNA Decoding Machine

Life Technologies Corp. announced it has developed a \$149,000 machine that can decode a person's DNA in a day, at a long-sought price goal of \$1,000, making a person's genome useful for medical care.

Source: *USA Today*, January 11, 2012

#### SOME DATA

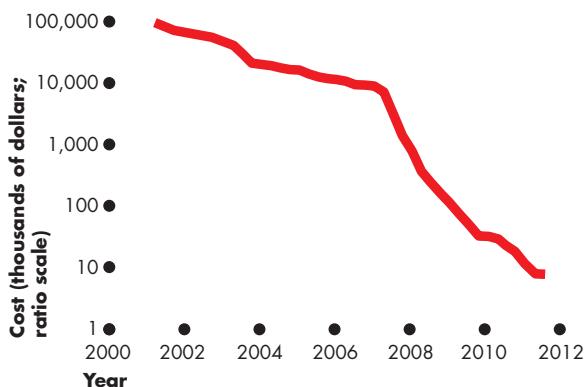
The graph shows how the cost of sequencing a person's entire genome has fallen. Life Technologies (in the news clip) is one of around 40 firms competing to develop a machine that can lower that cost from the current \$5,000 to \$1,000 or less. Many dozens of firms operate DNA sequencing machines and sell their services in a competitive market.

#### THE QUESTIONS

- What are the competitive markets in the news clip?
- Are any of these markets in long-run equilibrium?
- Are any firms in these markets likely to be making an economic profit?
- Are any of the firms in these markets likely to be incurring an economic loss?
- Are these markets likely to be experiencing entry, exit, or both? If both, which is likely to be greater?
- Who gains from the advances in DNA sequencing technology in the short run and in the long run: producers, or consumers, or both?

With price below  $P_0$ , old-technology firms incur an economic loss and exit. With price above  $P_1$ , new-technology firms make an economic profit and enter. When a new long-run equilibrium is achieved, the old-technology firms have gone. The number of new-technology firms that have entered have shifted the supply curve to  $S_1$ . The price is  $P_1$ , marginal revenue is  $MR_1$ , and each firm in Fig. 12.11(c) produces  $q_1$  using the new technology where  $MR_1$  equals  $MC_{New}$ .

Technological change brings only temporary gains to producers. But the lower prices and better products that technological advances bring are permanent gains for consumers.



**Figure 1 Cost per Genome**

Source of data: National Human Genome Research Institute.

#### THE ANSWERS

- The markets are for DNA sequencing machines and for DNA sequencing services.
- With massive ongoing technological change, neither market is likely to be in long-run equilibrium.
- Firms using the latest technology are likely to be making economic profit.
- Firms using the older technology are likely to be incurring economic loss.
- New-technology firms are entering and old-technology firms are exiting, but with a falling price, there is more entry than exit.
- In the short run, firms gain from higher profit and consumers gain from the lower price. In the long run, economic profit will be zero but consumers will continue to gain from the low price.

**MyEconLab More Economics in the News**

## REVIEW QUIZ

Describe what happens to output, price, and economic profit in the short run and in the long run in a competitive market following:

- 1 An increase in demand
- 2 A decrease in demand
- 3 The adoption of a new technology that lowers production costs

Work these questions in Study Plan 12.5 and get instant feedback.

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## Competition and Efficiency

You've seen how firms in perfect competition decide the quantity to produce in the short run and in the long run. You've also seen how these individual decisions determine the market supply that interacts with market demand to determine the equilibrium price and quantity.

We're now going to use what you've learned to gain a deeper understanding of why competition achieves an efficient allocation of resources.

### Efficient Use of Resources

Resource use is efficient when we produce the goods and services that people value most highly (see Chapter 2, pp. 35–37, and Chapter 5, p. 112). If it is possible to make someone better off without anyone else becoming worse off, resources are *not* being used efficiently. For example, suppose we produce a computer that no one wants and no one will ever use and, at the same time, some people are clamouring for more video games. If we produce fewer computers and reallocate the unused resources to produce more video games, some people will be better off and no one will be worse off. So the initial resource allocation was inefficient.

We can test whether resources are allocated efficiently by comparing marginal social benefit and marginal social cost. In the computer and video games example, the marginal social benefit of a video game exceeds its marginal social cost; the marginal social cost of a computer exceeds its marginal social benefit. So by producing fewer computers and more video games, we move resources toward a higher-valued use.

### Choices, Equilibrium, and Efficiency

We can use what you have learned about the decisions of consumers and firms and equilibrium in a competitive market to describe an efficient use of resources.

**Choices** Consumers allocate their budgets to get the most value possible out of them. We derive a consumer's demand curve by finding how the best budget allocation changes as the price of a good changes. So consumers get the most value out of their resources at all points along their demand curves. If the people who consume a good or service are the

only ones who benefit from it, then the market demand curve measures the benefit to the entire society and is the marginal social benefit curve.

Competitive firms produce the quantity that maximizes profit. We derive the firm's supply curve by finding the profit-maximizing quantity at each price. So firms get the most value out of their resources at all points along their supply curves. If the firms that produce a good or service bear all the costs of producing it, then the market supply curve measures the marginal cost to the entire society and the market supply curve is the marginal social cost curve.

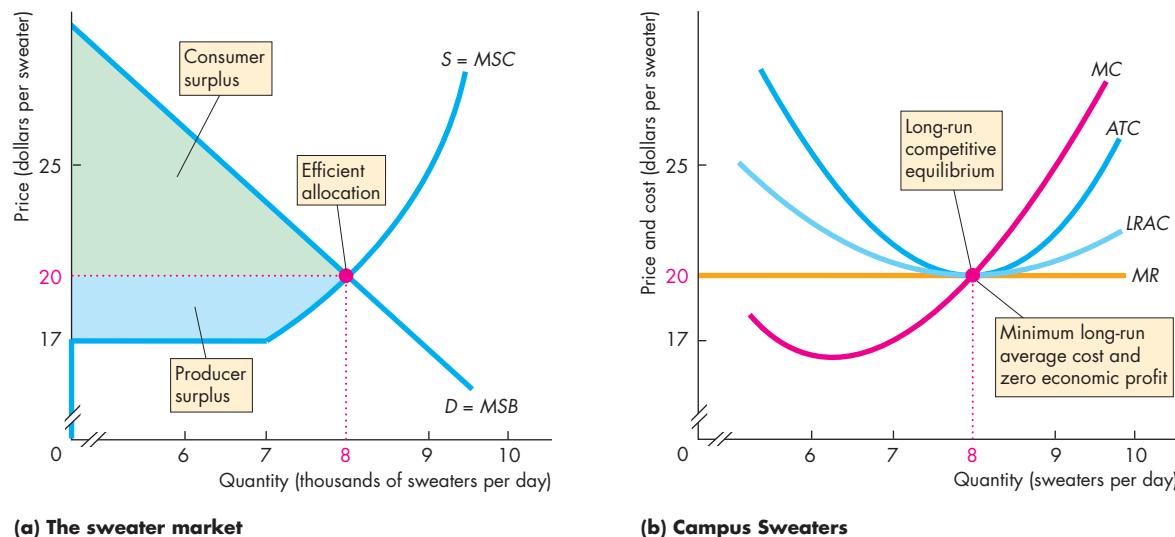
**Equilibrium and Efficiency** Resources are used efficiently when marginal social benefit equals marginal social cost. Competitive equilibrium achieves this efficient outcome because, with no externalities, price equals marginal social benefit for consumers, and price equals marginal social cost for producers.

The gains from trade are the sum of consumer surplus and producer surplus. The gains from trade for consumers are measured by *consumer surplus*, which is the area below the demand curve and above the price paid. (See Chapter 5, p. 109.) The gains from trade for producers are measured by *producer surplus*, which is the area above the supply curve and below the price received. (See Chapter 5, p. 111.) The total gains from trade equals *total surplus*—the sum of consumer surplus and producer surplus. When the market for a good or service is in equilibrium, the gains from trade are maximized.

**Efficiency in the Sweater Market** Figure 12.12 illustrates the efficiency of perfect competition in the sweater market. Part (a) shows the market, and part (b) shows Campus Sweaters.

In part (a), consumers get the most value from their budgets at all points on the market demand curve,  $D = MSB$ . Producers get the most value from their resources at all points on the market supply curve,  $S = MSC$ . At the equilibrium quantity and price, marginal social benefit equals marginal social cost, and resources are allocated efficiently. Consumer surplus is the green area, producer surplus is the blue area, and *total surplus* (the sum of producer surplus and consumer surplus) is maximized.

In part (b) Campus Sweaters (and every other firm) makes zero economic profit, and each firm has the plant that enables it to produce at the lowest possible average total cost. Consumers are as well off as

**FIGURE 12.12** Efficiency of Perfect Competition

(a) The sweater market

In part (a), market demand,  $D$ , and market supply,  $S$ , determine the equilibrium price and quantity. Consumers have made the best available choices on the demand curve, and firms are producing at least cost on the supply curve.

(b) Campus Sweaters

Marginal social benefit,  $MSB$ , equals marginal social cost,  $MSC$ , so resources are used efficiently. In part (b), Campus Sweaters produces at the lowest possible long-run average total cost and makes zero economic profit.

### MyEconLab Animation and Draw Graph

possible because the good cannot be produced at a lower cost and the equilibrium price equals that least possible cost.

When firms in perfect competition are away from long-run equilibrium, either entry or exit moves the market toward the situation depicted in Fig. 12.12. During this process, the market is efficient because marginal social benefit equals marginal social cost. But it is only in long-run equilibrium that economic profit is driven to zero and consumers pay the lowest feasible price.

 You've now completed your study of perfect competition. *Economics in the News* on pp. 290–291 gives you an opportunity to use what you have learned to understand the market for smartphone and tablet computer “apps.”

Although many markets approximate the model of perfect competition, many do not. In Chapter 13, we study markets at the opposite extreme of market power: monopoly. Then in the following chapters we'll study markets that lie between perfect competition

### REVIEW QUIZ

- 1 State the conditions that must be met for resources to be allocated efficiently.
- 2 Describe the choices that consumers make and explain why consumers are efficient on the market demand curve.
- 3 Describe the choices that producers make and explain why producers are efficient on the market supply curve.
- 4 Explain why resources are used efficiently in a competitive market.

Work these questions in Study Plan 12.6 and get instant feedback.

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and monopoly. In Chapter 14, we study monopolistic competition and in Chapter 15, we study oligopoly. When you have completed this study, you'll have a toolkit that will enable you to understand the variety of real-world markets.



# Perfect Competition in Smartphone Apps

## From Zero to 75 Billion in Six Years

When Apple launched its App Store in July 2008, it had 10 million downloads in the first weekend. That number grew to 100 million in the first two months, 500 million in the first six months, and 1 billion in the first nine months. By mid-2014, downloads hit 75 billion and were growing at 800 apps per second.

At its launch, the store had just 552 apps, but within six months that number had grown to 15,000 and the pace of growth accelerated. Total apps passed the million mark in October 2013 and hit 1.2 million by mid-2014 and continue to grow at a pace of 25,000 to 30,000 new apps a month.

As the app market grew, so did the number of app developers, which had reached 6.1 million by mid-2013 and 9 million by June 2014.

Developers began to see cash flowing in. Although Apple takes a 30 percent cut, it had paid developers \$1 billion by June 2010, \$10 billion by June 2013, and \$13 billion by June 2014.

Google's app store opened three months later than Apple's, but it grew even more spectacularly to top 1.3 million apps in 2014.

Most apps (62 percent) are free, and of those that are not free the most common price is 99 cents. But one gaming app costs \$999.99.

Games represent 18 percent of apps and education another 11 percent.

Sources of information: Sarah Perez, "iTunes App Store Now Has 1.2 Million Apps, Has Seen 75 Billion Downloads to Date," *Tech Crunch*, June 2, 2014; Chuck Jones, "Apple's App Store About to Hit 1 Million Apps," *Forbes*, December 11 2013; [apps-world.net](http://apps-world.net), July 11, 2013; and [statistica.com](http://statistica.com), August 28, 2014.

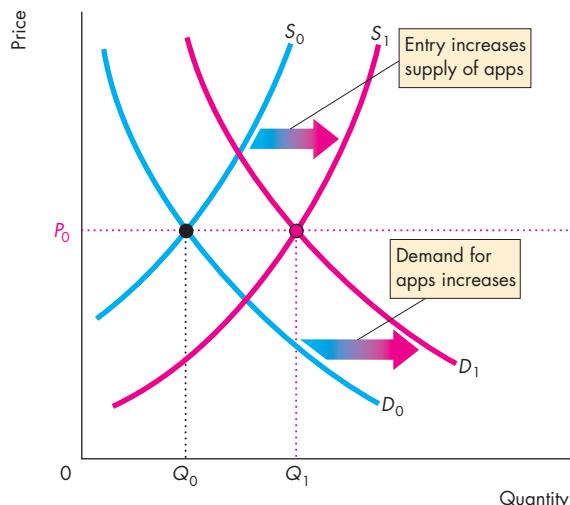


### ESSENCE OF THE STORY

- Apple has 1.2 million apps, a number that is growing by 25,000 to 30,000 per month.
- 75 billion apps have been downloaded.
- Nine million people have registered as Apple app developers, up from 6.1 million a year earlier.
- Apple has paid \$13 billion to app developers.
- App prices range from zero (for 62 percent of apps) to \$999.99, and the most common price is 99 cents.
- Google (Android) apps are also growing and its store offers 1.3 million apps.

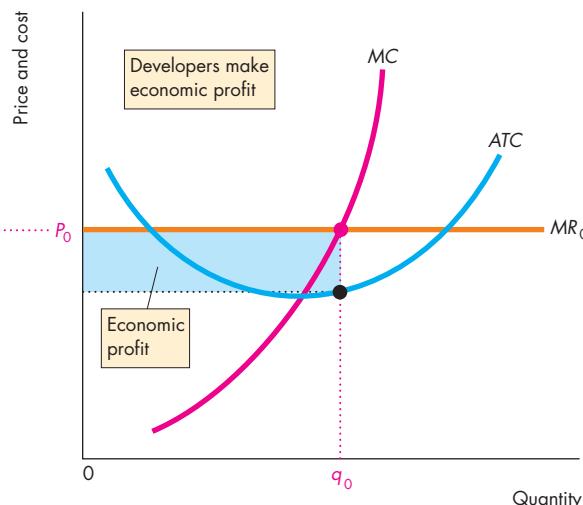
## ECONOMIC ANALYSIS

- The iPhone, iPad, and Android smartphones and tablet computers have created a large demand for apps.
- Although apps are not like corn or sweaters and come in thousands of varieties, the market for apps is highly competitive and we can use the perfect competition model to explain what is happening in that market.
- The market began to operate in 2008, when the first app developers got to work using a software development kit made available by Apple.
- During 2009 through 2014, the number of iPhones and Android smartphones increased dramatically. By the end of 2013, 420 million iPhones and 750 million Android phones had been sold.
- The increase in the number of devices in use increased the demand for apps.
- Thousands of developers, most of them individuals, saw a profit opportunity and got to work creating apps. Their entry into the market increased the supply of apps.
- But the demand for apps kept growing and despite the entry of more developers, profit opportunities remained.
- Figure 1 illustrates the market for apps. In 2013, the demand for apps was  $D_0$  and the supply was  $S_0$ . The equilibrium price was  $P_0$  and the quantity was  $Q_0$ .



**Figure 1** The Market for Apps

- Figure 2 illustrates the cost and revenue curves of an individual app developer. With marginal revenue  $MR$  and marginal cost  $MC$ , the developer maximizes profit by producing an app that sells  $q_0$  units.
- Average total cost of an app (on the  $ATC$  curve) is less than the price, so the developer makes an economic profit.
- Economic profit brings entry, so in Fig. 1, supply increases in 2014 to  $S_1$ . But the demand for apps also keeps increasing and in 2014 the demand curve is  $D_1$ .
- The equilibrium quantity increases to  $Q_1$ , and this quantity is produced by an increased number of developers—each producing  $q_0$  units and each continuing to make an economic profit.
- The developer's cost curves in Fig. 2 are unchanged, but as development tools improve, development costs will fall and the cost curves will shift downward, which will further increase supply.
- At some future date, market supply will increase by enough to eliminate economic profit and the market for apps will be in long-run equilibrium. That date is unknown but likely will be a long way off.



**Figure 2** An Individual App Developer

## SUMMARY

### Key Points

#### What Is Perfect Competition? (pp. 272–273)

- In perfect competition, many firms sell identical products to many buyers; there are no restrictions on entry; sellers and buyers are well informed about prices.
- A perfectly competitive firm is a price taker.
- A perfectly competitive firm's marginal revenue always equals the market price.

Working Problem 1 will give you a better understanding of perfect competition.

#### The Firm's Output Decision (pp. 274–277)

- The firm produces the output at which marginal revenue (price) equals marginal cost.
- In short-run equilibrium, a firm can make an economic profit, incur an economic loss, or break even.
- If price is less than minimum average variable cost, the firm temporarily shuts down.
- At prices below minimum average variable cost, a firm's supply curve runs along the  $y$ -axis; at prices above minimum average variable cost, a firm's supply curve is its marginal cost curve.

Working Problems 2 to 5 will give you a better understanding of a firm's output decision.

#### Output, Price, and Profit in the Short Run (pp. 278–281)

- The market supply curve shows the sum of the quantities supplied by each firm at each price.
- Market demand and market supply determine price.
- A firm might make a positive economic profit, a zero economic profit, or incur an economic loss.

Working Problem 6 will give you a better understanding of output, price, and profit in the short run.

### Key Terms

Marginal revenue, 272

Perfect competition, 272

Price taker, 272

Short-run market supply curve, 278

Shutdown point, 276

Total revenue, 272

### MyEconLab Key Terms Quiz

#### Output, Price, and Profit in the Long Run (pp. 281–283)

- Economic profit induces entry and economic loss induces exit.
- Entry increases supply and lowers price and profit. Exit decreases supply and raises price and profit.
- In long-run equilibrium, economic profit is zero. There is no entry or exit.

Working Problem 7 will give you a better understanding of output, price, and profit in the long run.

#### Changes in Demand and Supply as Technology Advances (pp. 284–287)

- A permanent increase in demand leads to a larger market output and a larger number of firms. A permanent decrease in demand leads to a smaller market output and a smaller number of firms.
- New technologies lower the cost of production, increase supply, and in the long run lower the price and increase the quantity.

Working Problem 8 will give you a better understanding of changes in demand and supply as technology advances.

#### Competition and Efficiency (pp. 288–289)

- Resources are used efficiently when we produce goods and services in the quantities that people value most highly.
- Perfect competition achieves an efficient allocation. In long-run equilibrium, consumers pay the lowest possible price and marginal social benefit equals marginal social cost.

Working Problem 9 will give you a better understanding of competition and efficiency.



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 12 Study Plan.

The table provides data on a market demand schedule (top two rows) and a firm's average and marginal cost schedules (bottom four rows).

Price $P$ (\$)	24	20	16	12	8
Quantity	3,000	4,000	5,000	6,000	7,000
<i>Firm's output</i>	1	2	3	4	5
$MC$ (\$)	11.00	11.13	12.00	13.63	16.00
$ATC$ (\$)	13.50	12.25	12.00	12.19	12.70
$AVC$ (\$)	11.25	11.13	11.25	11.63	12.25

### Questions

- What is the firm's shutdown point?
- If there are 1,000 identical firms in the market, what is the market price and quantity?
- With 1,000 firms, will firms enter or exit?
- What is the long-run equilibrium price, quantity, and number of firms?

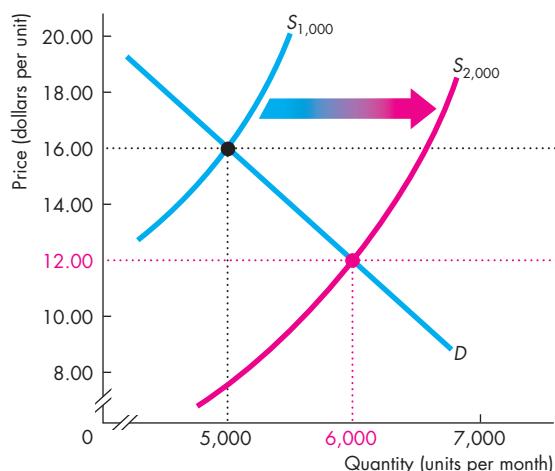
### Solutions

- The firm will stop producing if the market price falls below minimum  $AVC$ . In the table,  $AVC$  is at a minimum of \$11.13 when 2 units are produced, so that is the shutdown point.

**Key Point:** A firm shuts down if the market price is less than minimum  $AVC$ .

- The first step is to find the market supply schedule. The firm supplies the quantity at which

### Key Figure



(a) Market

marginal cost equals market price and its supply curve is its  $MC$  curve above the shutdown point. The market supply curve is the sum of the 1,000 firms' supply curves. For example, at a price ( $MC$ ) of \$12, the quantity supplied is 3,000 units—one point on the supply curve.

The second step is to find the price at which the quantity supplied by 1,000 firms equals quantity demanded. When the price ( $MC$ ) is \$16, each firm produces 5 units, so the quantity supplied by the market is 5,000 units. At \$16, the quantity demanded is 5,000 units, so the market price is \$16 and the quantity is 5,000 units.

**Key Point:** Each firm supplies the quantity at which marginal cost equals market price.

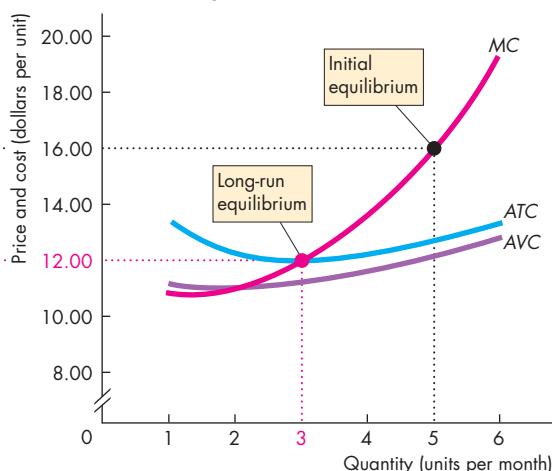
- Firms will enter if the price exceeds  $ATC$  and exit if the price is below  $ATC$ . In the equilibrium above,  $P$  is \$16 and  $ATC$  is \$12.70, so firms enter.

**Key Point:** Firms enter when  $P > ATC$ .

- In long-run equilibrium, economic profit is zero, so  $P = ATC$ . Firms maximize profit, so  $P = MC$ . This outcome occurs at minimum  $ATC$ . From the table, minimum  $ATC$  is \$12 and the firm's output is 3 units. At \$12, 6,000 units are demanded, so firms enter until this quantity is supplied. The number of firms increases to 2,000 (6,000 units divided by 3 units per firm).

**Key Point:** In long-run equilibrium, economic profit is zero and the market price equals minimum  $ATC$ .

### MyEconLab Interactive Animation



(b) Individual firm



## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 9 in Chapter 12 Study Plan and get instant feedback.

### What Is Perfect Competition? (Study Plan 12.1)

- Lin's makes fortune cookies. Anyone can make and sell fortune cookies, so there are dozens of producers. All fortune cookies are the same and buyers and sellers know this fact. In what type of market does Lin's operate? What determines the price of fortune cookies? What determines Lin's marginal revenue?

### The Firm's Output Decision (Study Plan 12.2)

Use the following table to work Problems 2 to 4. Pat's Pizza Kitchen is a price taker and the table shows its costs of production.

Output (pizzas per hour)	Total cost (dollars per hour)
0	10
1	21
2	30
3	41
4	54
5	69

- Calculate Pat's profit-maximizing output and economic profit if the market price is (i) \$14 a pizza, (ii) \$12 a pizza, and (iii) \$10 a pizza.
- What is Pat's shutdown point and what is Pat's economic profit if it shuts down temporarily?
- Derive Pat's supply curve.
- The market for paper is perfectly competitive and 1,000 firms produce paper. The table sets out the market demand schedule for paper.

Price (dollars per box)	Quantity demanded (thousands of boxes per week)
3.65	500
5.20	450
6.80	400
8.40	350
10.00	300
11.60	250
13.20	200

The table in the next column sets out the costs of each producer of paper.

Calculate the market price, the market output, the quantity produced by each firm, and the firm's economic profit or loss.

Output (boxes per week)	Marginal cost (dollars per additional box)	Average variable cost	Average total cost
		(dollars per box)	
200	6.40	7.80	12.80
250	7.00	7.00	11.00
300	7.65	7.10	10.43
350	8.40	7.20	10.06
400	10.00	7.50	10.00
450	12.40	8.00	10.22
500	20.70	9.00	11.00

### Output, Price, and Profit in the Short Run

(Study Plan 12.3)

- In Problem 5, the market demand decreases and the demand schedule becomes:

Price (dollars per box)	Quantity demanded (thousands of boxes per week)
2.95	500
4.13	450
5.30	400
6.48	350
7.65	300
8.83	250
10.00	200
11.18	150

If firms have the same costs set out in Problem 5, what is the market price and the firm's economic profit or loss in the short run?

### Output, Price, and Profit in the Long Run

(Study Plan 12.4)

- In Problem 5, in the long run what is the market price and the quantity of paper produced? What is the number of firms in the market?

### Changes in Demand and Supply as Technology Advances

(Study Plan 12.5)

- If the market demand for paper remains the same as in Problem 6, calculate the market price, market output, and the economic profit or loss of each firm.

### Competition and Efficiency

(Study Plan 12.6)

- In perfect competition in long-run equilibrium, can consumer surplus or producer surplus be increased? Explain your answer.



## ADDITIONAL PROBLEMS AND APPLICATIONS

### MyEconLab

You can work these problems in MyEconLab if assigned by your instructor.

#### What Is Perfect Competition?

Use the following news clip to work Problems 10 to 12.

##### Money in the Tank

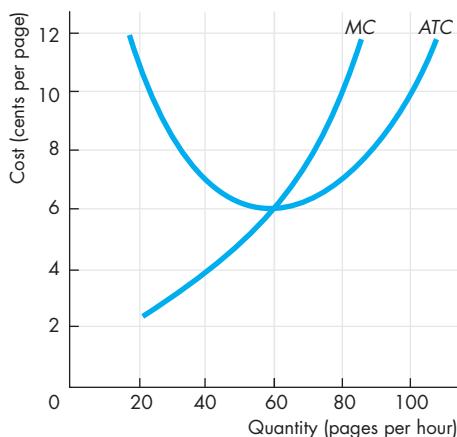
Two gas stations stand on opposite sides of the road: Rutter's Farm Store and Sheetz gas station. Rutter's doesn't even have to look across the highway to know when Sheetz changes its price for a gallon of gas. When Sheetz raises the price, Rutter's pumps are busy. When Sheetz lowers prices, there's not a car in sight. Both gas stations survive, but each has no control over the price.

Source: *The Mining Journal*, May 24, 2008

10. In what type of market do these gas stations operate? What determines the price of gasoline and the marginal revenue from gasoline?
11. Describe the elasticity of demand that each of these gas stations faces.
12. Why does each of these gas stations have so little control over the price of the gasoline it sells?

#### The Firm's Output Decision

13. The figure shows the costs of Quick Copy, one of many copy shops near campus.



If the market price of copying is 10¢ a page, calculate Quick Copy's

- a. Profit-maximizing output
- b. Economic profit
14. The market for smoothies is perfectly competitive. The table in the next column sets out the market demand schedule.

Price (dollars per smoothie)	Quantity demanded (smoothies per hour)
1.90	1,000
2.00	950
2.20	800
2.91	700
4.25	550
5.25	400
5.50	300

Each of the 100 producers of smoothies has the following costs when it uses its least-cost plant:

Output (smoothies per hour)	Marginal cost (dollars per additional smoothie)	Average variable cost	Average total cost
		(dollars per smoothie)	(dollars per smoothie)
3	2.50	4.00	7.33
4	2.20	3.53	6.03
5	1.90	3.24	5.24
6	2.00	3.00	4.67
7	2.91	2.91	4.34
8	4.25	3.00	4.25
9	8.00	3.33	4.44

- a. What is the market price of a smoothie?
- b. What is the market quantity of smoothies?
- c. How many smoothies does each firm sell?
- d. What is the economic profit made or economic loss incurred by each firm?

15. Chevy Volt Production Temporarily Shut Down

GM will temporarily lay off 1,300 employees as the company stops production of the electric car, Chevy Volt, for five weeks. GM had hoped to sell 10,000 Volts last year, but ended up selling just 7,671. It plans to maintain inventory levels by adjusting production to match demand.

Source: *Politico*, March 2, 2012

- a. Explain how the shutdown decision will affect GM Chevy Volt's  $TFC$ ,  $TVC$ , and  $TC$ .
- b. Under what conditions would this shutdown decision maximize Chevy Volt's economic profit (or minimize its loss)? Explain your answer.
- c. Under what conditions will GM start producing the Chevy Volt again? Explain your answer.

### Output, Price, and Profit in the Short Run

**16. Big Drops in Prices for Crops Make It Tough Down on the Farm**

Grain prices have fallen roughly 50 percent from earlier this year. With better-than-expected crop yields, world grain production this year will rise 5 percent from 2007 to a record high.

Source: *USA Today*, October 23, 2008

Why did grain prices fall in 2008? Draw a graph to show that short-run effect on an individual farmer's economic profit.

### Output, Price, and Profit in the Long Run

**17. In Problem 14, do firms enter or exit the market for smoothies in the long run? What is the market price and the equilibrium quantity in the long run?**

**18. In Problem 15, under what conditions would GM stop producing the Chevy Volt and exit the market for electric cars? Explain your answer.**

**19. Exxon Mobil Selling All Its Retail Gas Stations**

Exxon Mobil is not alone among Big Oil exiting the retail gas business, a market where profits have gotten tougher as crude oil prices have risen. Gas station owners say they're struggling to turn a profit because while wholesale gasoline prices have risen sharply, they've been unable to raise pump prices fast enough to keep pace.

Source: *Houston Chronicle*, June 12, 2008

- Is Exxon Mobil making a shutdown or exit decision in the retail gasoline market?
- Under what conditions will this decision maximize Exxon Mobil's economic profit?
- How might Exxon Mobil's decision affect the economic profit of other gasoline retailers?

### Changes in Demand and Supply as Technology Advances

**20. Another DVD Format, but It's Cheaper**

New Medium Enterprises claims that its new system, HD VMD, is equal to Blu-ray's but at \$199 it's cheaper than the \$300 Blu-ray player. The Blu-ray Disc Association says New Medium will fail because it believes that Blu-ray technology will always be more expensive. But mass production will cut the cost of a Blu-ray player to \$90.

Source: *The New York Times*, March 10, 2008

- Explain how technological change in Blu-ray production might support the prediction of

lower prices in the long run. Illustrate your explanation with a graph.

- Even if Blu-ray prices do drop to \$90 in the long run, why might the HD VMD still end up being less expensive at that time?

### Competition and Efficiency

**21. In a perfectly competitive market, each firm maximizes its profit by choosing only the quantity to produce. Regardless of whether the firm makes an economic profit or incurs an economic loss, the short-run equilibrium is efficient. Is the statement true? Explain why or why not.**

### Economics in the News

**22. After you have studied *Economics in the News* on pp. 290–291, answer the following questions.**

- What are the features of the market for apps that make it competitive?
- Does the information provided in the news article suggest that the app market is in long-run equilibrium? Explain why or why not.
- How would an advance in development technology that lowered a developer's costs change the market supply and the developer's marginal revenue, marginal cost, average total cost, and economic profit?
- Illustrate your answer to part (c) with an appropriate graphical analysis.

**23. Smartphones: 2.6 Billion and Rising**

Smartphone subscriptions increased by 40 percent in 2013 to reach 2.6 billion. This number is expected to rise to 5.6 billion by 2019. Emerging markets, especially China and India, provide most of the growth as many people buy their first smartphone.

Source: CNET News, November 11, 2013

- Explain the effects of the increase in global demand for smartphones on the market for smartphones and on an individual smartphone producer in the short run.
- Draw a graph to illustrate your explanation in part (a).
- Explain the long-run effects of the increase in global demand for smartphones on the market for smartphones.



# 13

## MONOPOLY

After studying this chapter,  
you will be able to:

- ◆ Explain how monopoly arises
- ◆ Explain how a single-price monopoly determines its output and price
- ◆ Compare the performance and efficiency of single-price monopoly and competition
- ◆ Explain how price discrimination increases profit
- ◆ Explain how monopoly regulation influences output, price, economic profit, and efficiency

**Google and Microsoft are big players in the markets** for Web search and advertising and for computer operating systems, markets that are obviously not perfectly competitive.

In this chapter, we study markets dominated by one big firm. We call such a market *monopoly*. We study the performance and the efficiency of monopoly and compare it with perfect competition.

In *Economics in the News* at the end of the chapter, we look at the remarkable success of Google and ask whether Google is serving the social interest or violating Canadian, U.S., and European antitrust laws.

## Monopoly and How It Arises

A **monopoly** is a market with a single firm that produces a good or service with no close substitutes and that is protected by a barrier that prevents other firms from entering that market.

### How Monopoly Arises

Monopoly arises for two key reasons:

- No close substitutes
- Barrier to entry

**No Close Substitutes** If a good has a close substitute, even though only one firm produces it, that firm effectively faces competition from the producers of the substitute. A monopoly sells a good or service that has no good substitutes. Tap water and bottled water are close substitutes for drinking, but tap water has no effective substitutes for showering or washing a car and a local public utility that supplies tap water is a monopoly.

**Barrier to Entry** A constraint that protects a firm from potential competitors is called a **barrier to entry**. There are three types of barrier to entry:

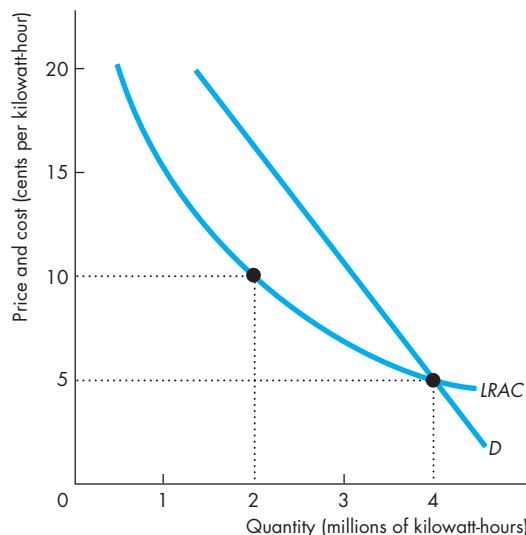
- Natural
- Ownership
- Legal

**Natural Barrier to Entry** A natural barrier to entry creates a **natural monopoly**: a market in which economies of scale enable one firm to supply the entire market at the lowest possible cost. The firms that deliver gas, water, and electricity to our homes are examples of natural monopoly.

Figure 13.1 illustrates a natural monopoly. The market demand curve for electric power is  $D$ , and the long-run average cost curve is  $LRAC$ . Economies of scale prevail over the entire length of the  $LRAC$  curve. At a price of 5 cents per kilowatt-hour, the quantity demanded is 4 million kilowatt-hours and one firm can produce that quantity at a cost of 5 cents per kilowatt-hour. If two firms shared the market equally, it would cost each of them 10 cents per kilowatt-hour to produce a total of 4 million kilowatt-hours.

**Ownership Barrier to Entry** An ownership barrier to entry occurs if one firm owns a significant portion of a key resource. An example of this type of monopoly occurred during the last century when De Beers

**FIGURE 13.1** Natural Monopoly



The market demand curve for electric power is  $D$ , and the long-run average cost curve is  $LRAC$ . Economies of scale exist over the entire  $LRAC$  curve. One firm can distribute 4 million kilowatt-hours at a cost of 5 cents a kilowatt-hour. This same total output costs 10 cents a kilowatt-hour with two firms. One firm can meet the market demand at a lower cost than two or more firms can. The market is a natural monopoly.

**MyEconLab Animation**

controlled up to 90 percent of the world's supply of diamonds. (Today, its share is only 65 percent.)

**Legal Barrier to Entry** A legal barrier to entry creates a **legal monopoly**: a market in which competition and entry are restricted by the granting of a public franchise, government licence, patent, or copyright.

A *public franchise* is an exclusive right granted to a firm to supply a good or service. An example is Canada Post, which has the exclusive right to deliver residential mail. A *government licence* controls entry into particular occupations, professions, and industries. Examples of this type of barrier to entry occur in medicine, law, dentistry, schoolteaching, architecture, and many other professional services. Licensing does not always create a monopoly, but it does restrict competition.

A *patent* is an exclusive right granted to the inventor of a product or service. A *copyright* is an exclusive right granted to the author or composer of a literary, musical, dramatic, or artistic work. Patents and copyrights are

valid for a limited time period that varies from country to country. In Canada, a patent is valid for 20 years. Patents encourage the *invention* of new products and production methods. They also stimulate *innovation*—the use of new inventions—by encouraging inventors to publicize their discoveries and offer them for use under licence. Patents have stimulated innovations in areas as diverse as soybean seeds, pharmaceuticals, memory chips, and video games.

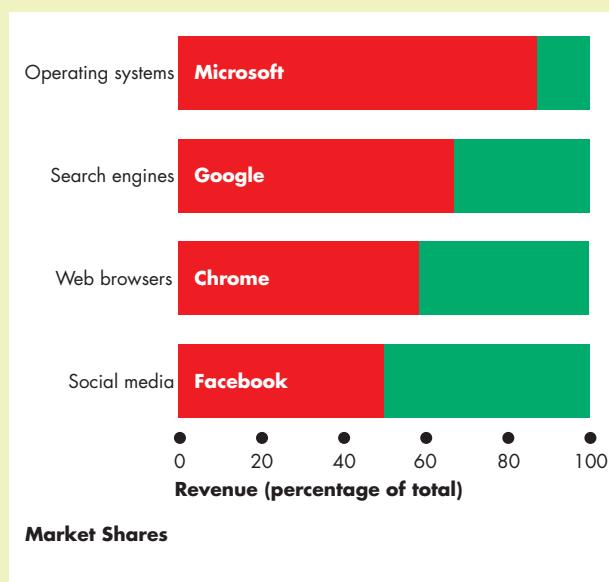
## Economics in Action

### Information-Age Monopolies

Information-age technologies have created three big natural monopolies. These firms have large plant costs but almost zero marginal cost, so they experience economies of scale.

These firms are Microsoft, Google, and Facebook. The operating system of 87 percent of personal computers is some version of Windows; Google performs 67 percent of Internet searches and 58 percent of Web browsing is done using Chrome; and Facebook has a 50 percent share of the social media market.

These same information-age technologies have also destroyed monopolies. FedEx, Purolator, the fax machine, and e-mail have weakened the monopoly of Canada Post; and the satellite dish has weakened the monopoly of cable television companies.



## Monopoly Price-Setting Strategies

A major difference between monopoly and competition is that a monopoly sets its own price. In doing so, the monopoly faces a market constraint: To sell a larger quantity, the monopoly must set a lower price. There are two monopoly situations that create two pricing strategies:

- Single price
- Price discrimination

**Single Price** A **single-price monopoly** is a firm that must sell each unit of its output for the same price to all its customers. De Beers sells diamonds (of a given size and quality) for the same price to all its customers. If it tried to sell at a low price to some customers and at a higher price to others, only the low-price customers would buy from De Beers. Others would buy from De Beers' low-price customers. De Beers is a *single-price monopoly*.

**Price Discrimination** When a firm practises **price discrimination**, it sells different units of a good or service for different prices. Many firms price discriminate. Microsoft sells its Windows and Office software at different prices to different buyers. Computer manufacturers who install the software on new machines, students and teachers, governments, and businesses all pay different prices. Pizza producers offer a second pizza for a lower price than the first one. These are examples of *price discrimination*.

When a firm price discriminates, it looks as though it is doing its customers a favour. In fact, it is charging the highest possible price for each unit sold and making the largest possible profit.

### REVIEW QUIZ

- 1 How does monopoly arise?
- 2 How does a natural monopoly differ from a legal monopoly?
- 3 Distinguish between a price-discriminating monopoly and a single-price monopoly.

Work these questions in Study Plan 13.1 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

We start with a single-price monopoly and see how it makes its decisions about the quantity to produce and the price to charge to maximize its profit.

## A Single-Price Monopoly's Output and Price Decision

To understand how a single-price monopoly makes its output and price decision, we must first study the link between price and marginal revenue.

### Price and Marginal Revenue

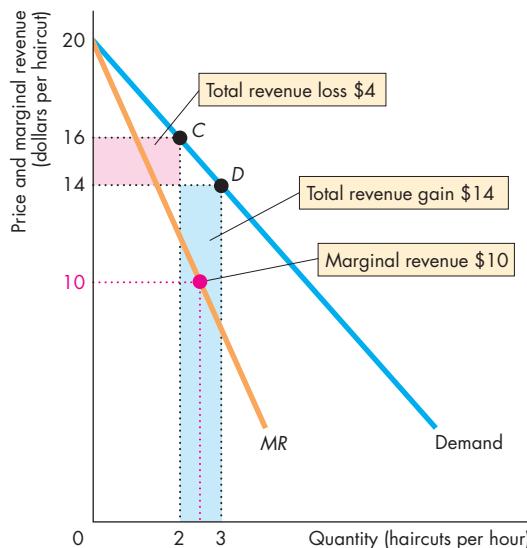
Because in a monopoly there is only one firm, the demand curve facing the firm is the market demand curve. Let's look at Bobbie's Barbershop, the sole supplier of haircuts in Trout River, Newfoundland. The table in Fig. 13.2 shows the market demand schedule. At a price of \$20, Bobbie sells no haircuts. The lower the price, the more haircuts per hour she can sell. For example, at \$12, consumers demand 4 haircuts per hour (row E).

*Total revenue (TR)* is the price (*P*) multiplied by the quantity sold (*Q*). For example, in row D, Bobbie sells 3 haircuts at \$14 each, so total revenue is \$42. *Marginal revenue (MR)* is the change in total revenue ( $\Delta TR$ ) resulting from a one-unit increase in the quantity sold. For example, if the price falls from \$16 (row C) to \$14 (row D), the quantity sold increases from 2 to 3 haircuts. Total revenue increases from \$32 to \$42, so the change in total revenue is \$10. Because the quantity sold increases by 1 haircut, marginal revenue equals the change in total revenue and is \$10. Marginal revenue is placed between the two rows to emphasize that marginal revenue relates to the *change* in the quantity sold.

Figure 13.2 shows the market demand curve and marginal revenue curve (*MR*) and also illustrates the calculation we've just made. Notice that at each level of output, marginal revenue is less than price—the marginal revenue curve lies *below* the demand curve.

Why is marginal revenue *less* than price? It is because when the price is lowered to sell one more unit, two opposing forces affect total revenue. The lower price results in a revenue loss on the original units sold and a revenue gain on the additional quantity sold. For example, at a price of \$16 a haircut, Bobbie sells 2 haircuts (point C). If she cuts the price to \$14, she sells 3 haircuts and has a revenue gain of \$14 on the third haircut. But she now receives only \$14 on each of the first 2 haircuts—\$2 less than before. As a result, she loses \$4 of revenue on the first 2 haircuts. To calculate marginal revenue, she must deduct this amount from the revenue gain of \$14. So marginal revenue is \$10, which is less than the price.

**FIGURE 13.2** Demand and Marginal Revenue



	Price (P) (dollars per haircut)	Quantity demanded (Q) (haircuts per hour)	Total revenue (TR = P × Q) (dollars)	Marginal revenue (MR = ΔTR/ΔQ) (dollars per haircut)
A	20	0	0	.....18
B	18	1	18	.....14
C	<b>16</b>	<b>2</b>	<b>32</b>	.....10
D	<b>14</b>	<b>3</b>	<b>42</b>	.....6
E	12	4	48	.....2
F	10	5	50	

The table shows the demand schedule. Total revenue (*TR*) is price multiplied by quantity sold. For example, in row C, the price is \$16 a haircut, Bobbie sells 2 haircuts, and total revenue is \$32. Marginal revenue (*MR*) is the change in total revenue that results from a one-unit increase in the quantity sold. For example, when the price falls from \$16 to \$14 a haircut, the quantity sold increases from 2 to 3, an increase of 1 haircut, and total revenue increases by \$10. Marginal revenue is \$10. The demand curve and the marginal revenue curve, *MR*, are based on the numbers in the table and illustrate the calculation of marginal revenue when the price falls from \$16 to \$14 a haircut.

**MyEconLab Animation and Draw Graph**

## Marginal Revenue and Elasticity

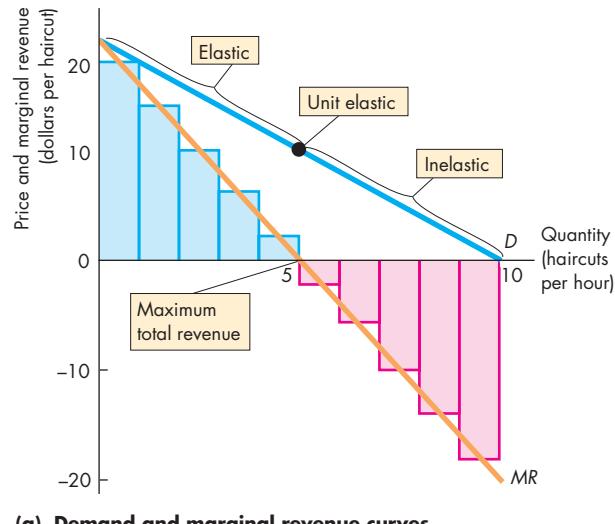
A single-price monopoly's marginal revenue is related to the *elasticity of demand* for its good. The demand for a good can be *elastic* (the elasticity is greater than 1), *inelastic* (the elasticity is less than 1), or *unit elastic* (the elasticity is equal to 1). Demand is *elastic* if a 1 percent fall in the price brings a greater than 1 percent increase in the quantity demanded. Demand is *inelastic* if a 1 percent fall in the price brings a less than 1 percent increase in the quantity demanded. Demand is *unit elastic* if a 1 percent fall in the price brings a 1 percent increase in the quantity demanded. (See Chapter 4, pp. 84–86.)

If demand is elastic, a fall in the price brings an increase in total revenue—the revenue gain from the increase in quantity sold outweighs the revenue loss from the lower price—and marginal revenue is *positive*. If demand is inelastic, a fall in the price brings a decrease in total revenue—the revenue gain from the increase in quantity sold is outweighed by the revenue loss from the lower price—and marginal revenue is *negative*. If demand is unit elastic, total revenue does not change—the revenue gain from the increase in the quantity sold offsets the revenue loss from the lower price—and marginal revenue is *zero*. (See Chapter 4, p. 88.)

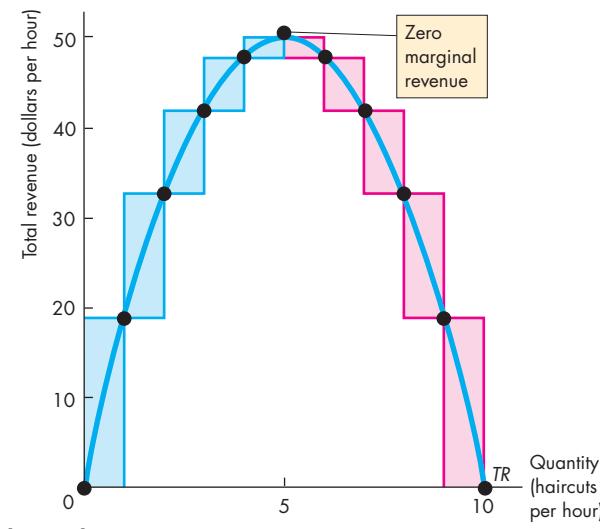
Figure 13.3 illustrates the relationship between marginal revenue, total revenue, and elasticity. As the price gradually falls from \$20 to \$10 a haircut, the quantity demanded increases from 0 to 5 haircuts an hour. Over this output range, marginal revenue is positive in part (a), total revenue increases in part (b), and the demand for haircuts is elastic. As the price falls from \$10 to \$0 a haircut, the quantity of haircuts demanded increases from 5 to 10 an hour. Over this output range, marginal revenue is negative in part (a), total revenue decreases in part (b), and the demand for haircuts is inelastic. When the price is \$10 a haircut, marginal revenue is zero in part (a), total revenue is at a maximum in part (b), and the demand for haircuts is unit elastic.

**In Monopoly, Demand Is Always Elastic** The relationship between marginal revenue and elasticity of demand that you've just discovered implies that a profit-maximizing monopoly never produces an output in the inelastic range of the market demand curve. If it did so, it could charge a higher price, produce a smaller quantity, and increase its profit. Let's now look at a monopoly's price and output decision.

**FIGURE 13.3 Marginal Revenue and Elasticity**



(a) Demand and marginal revenue curves



(b) Total revenue curve

In part (a), the demand curve is  $D$  and the marginal revenue curve is  $MR$ . In part (b), the total revenue curve is  $TR$ . Over the range 0 to 5 haircuts an hour, a price cut increases total revenue, so marginal revenue is positive—as shown by the blue bars. Demand is elastic. Over the range 5 to 10 haircuts an hour, a price cut decreases total revenue, so marginal revenue is negative—as shown by the red bars. Demand is inelastic. At 5 haircuts an hour, total revenue is maximized and marginal revenue is zero. Demand is unit elastic.

**MyEconLab Animation**

## Price and Output Decision

A monopoly sets its price and output at the levels that maximize economic profit. To determine this price and output level, we need to study the behaviour of both cost and revenue as output varies. A monopoly faces the same types of technology and cost constraints as a competitive firm, so its costs (total cost, average cost, and marginal cost) behave just like those of a firm in perfect competition. And a monopoly's revenues (total revenue, price, and marginal revenue) behave in the way we've just described.

Table 13.1 provides information about Bobbie's costs, revenues, and economic profit, and Fig. 13.4 shows the same information graphically.

**Maximizing Economic Profit** You can see in Table 13.1 and Fig. 13.4(a) that total cost ( $TC$ ) and total revenue ( $TR$ ) both rise as output increases, but  $TC$  rises at an increasing rate and  $TR$  rises at a decreasing rate. Economic profit, which equals  $TR$  minus  $TC$ , increases at small output levels, reaches a maximum, and then decreases. The maximum profit (\$12) occurs when Bobbie sells 3 haircuts for \$14 each. If she sells 2 haircuts for \$16 each or 4 haircuts for \$12 each, her economic profit will be only \$8.

**Marginal Revenue Equals Marginal Cost** You can see Bobbie's marginal revenue ( $MR$ ) and marginal cost ( $MC$ ) in Table 13.1 and Fig. 13.4(b).

When Bobbie increases output from 2 to 3 haircuts,  $MR$  is \$10 and  $MC$  is \$6.  $MR$  exceeds  $MC$  by \$4 and Bobbie's profit increases by that amount. If Bobbie increases output from 3 to 4 haircuts,  $MR$  is \$6 and  $MC$  is \$10. In this case,  $MC$  exceeds  $MR$  by \$4, so profit decreases by that amount. When  $MR$  exceeds  $MC$ , profit increases if output increases. When  $MC$  exceeds  $MR$ , profit increases if output decreases. When  $MC$  equals  $MR$ , profit is maximized.

Figure 13.4(b) shows the maximum profit as price (on the demand curve  $D$ ) minus average total cost (on the  $ATC$  curve) multiplied by the quantity produced—the blue rectangle.

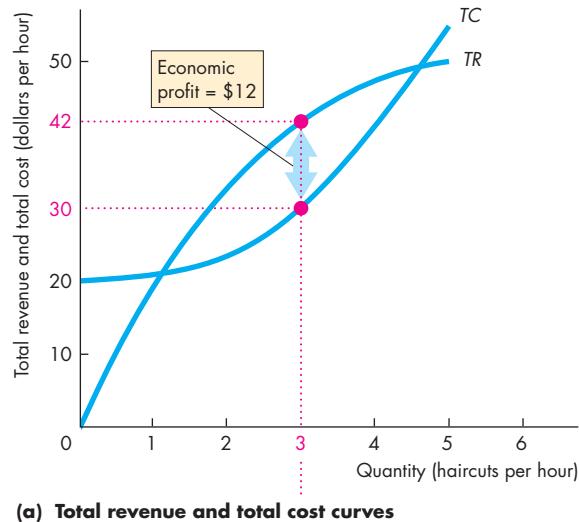
**Maximum Price the Market Will Bear** Unlike a firm in perfect competition, a monopoly influences the price of what it sells. But a monopoly doesn't set the price at the maximum *possible* price. At the maximum possible price, the firm would be able to sell only one unit of output, which in general is less than the profit-maximizing quantity. Rather, a monopoly produces the profit-maximizing quantity and sells that quantity for the highest price it can get.

**TABLE 13.1** A Monopoly's Output and Price Decision

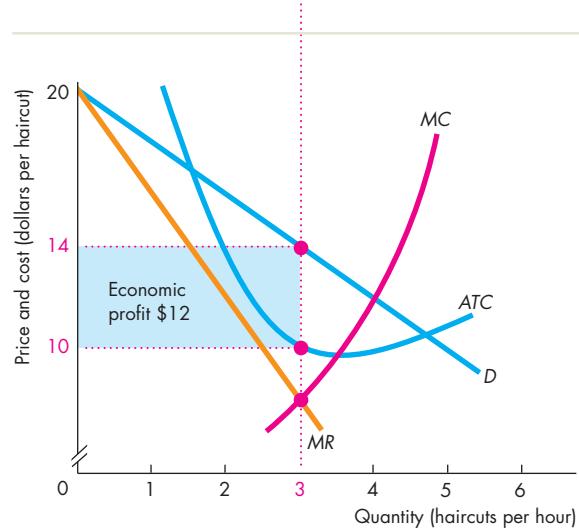
Price ( $P$ ) (dollars per haircut)	Quantity demanded ( $Q$ ) (haircuts per hour)	Total revenue ( $TR = P \times Q$ ) (dollars)	Marginal revenue ( $MR = \Delta TR / \Delta Q$ ) (dollars per haircut)	Total cost ( $TC$ ) (dollars)	Marginal cost ( $MC = \Delta TC / \Delta Q$ ) (dollars per haircut)	Profit ( $TR - TC$ ) (dollars)
20	0	0	..... 18	20	..... 1	-20
18	1	18	..... 14	21	..... 3	-3
16	2	32	..... 10	24	..... 6	+8
<b>14</b>	<b>3</b>	<b>42</b>	..... 6	<b>30</b>	..... 10	<b>+12</b>
12	4	48	..... 2	40	..... 15	+8
10	5	50		55		-5

This table gives the information needed to find the profit-maximizing output and price. Total revenue ( $TR$ ) equals price multiplied by the quantity sold. Profit equals total revenue minus total

cost ( $TC$ ). Profit is maximized when 3 haircuts are sold at a price of \$14 each. Total revenue is \$42, total cost is \$30, and economic profit is \$12 (\$42 – \$30).

**FIGURE 13.4** A Monopoly's Output and Price

(a) Total revenue and total cost curves



(b) Demand and marginal revenue and cost curves

In part (a), economic profit is the vertical distance equal to total revenue ( $TR$ ) minus total cost ( $TC$ ) and it is maximized at 3 haircuts an hour.

In part (b), economic profit is maximized when marginal cost ( $MC$ ) equals marginal revenue ( $MR$ ). The profit-maximizing output is 3 haircuts an hour. The price is determined by the demand curve ( $D$ ) and is \$14 a haircut. The average total cost of a haircut is \$10, so economic profit, the blue rectangle, is \$12—the profit per haircut (\$4) multiplied by 3 haircuts.

All firms maximize profit by producing the output at which marginal revenue equals marginal cost. For a competitive firm, price equals marginal revenue, so price also equals marginal cost. For a monopoly, price exceeds marginal revenue, so price also exceeds marginal cost.

A monopoly charges a price that exceeds marginal cost, but does it always make an economic profit? In Fig. 13.4(b), Bobbie produces 3 haircuts an hour. Her average total cost is \$10 (on the  $ATC$  curve) and her price is \$14 (on the  $D$  curve), so her profit per haircut is \$4 (\$14 minus \$10). Bobbie's economic profit is shown by the area of the blue rectangle, which equals the profit per haircut (\$4) multiplied by the number of haircuts (3), for a total of \$12.

If firms in a perfectly competitive market make a positive economic profit, new firms enter. That does *not* happen in monopoly. Barriers to entry prevent new firms from entering the market, so a monopoly can make a positive economic profit and might continue to do so indefinitely. Sometimes that economic profit is large, as in the international diamond business.

Bobbie makes a positive economic profit. But suppose that Bobbie's landlord increases the rent on her salon. If Bobbie pays an additional \$12 an hour for rent, her fixed cost increases by \$12 an hour. Her marginal cost and marginal revenue don't change, so her profit-maximizing output remains at 3 haircuts an hour. Her profit decreases by \$12 an hour to zero. If Bobbie's salon rent increases by more than \$12 an hour, she incurs an economic loss. If this situation were permanent, Bobbie would go out of business.

## REVIEW QUIZ

- What is the relationship between marginal cost and marginal revenue when a single-price monopoly maximizes profit?
- How does a single-price monopoly determine the price it will charge its customers?
- What is the relationship between price, marginal revenue, and marginal cost when a single-price monopoly is maximizing profit?
- Why can a monopoly make a positive economic profit even in the long run?

Work these questions in Study Plan 13.2 and get instant feedback.

**MyEconLab**

## Single-Price Monopoly and Competition Compared

Imagine a market that is made up of many small firms operating in perfect competition. Then imagine that a single firm buys out all these small firms and creates a monopoly.

What will happen in this market? Will the price rise or fall? Will the quantity produced increase or decrease? Will economic profit increase or decrease? Will either the original competitive situation or the new monopoly situation be efficient?

These are the questions we're now going to answer. First, we look at the effects of monopoly on the price and quantity produced. Then we turn to the questions about efficiency.

### Comparing Price and Output

Figure 13.5 shows the market we'll study. The market demand curve is  $D$ . The demand curve is the same regardless of how the industry is organized. But the supply side and the equilibrium are different in monopoly and competition. First, let's look at the case of perfect competition.

**Perfect Competition** Initially, with many small perfectly competitive firms in the market, the market supply curve is  $S$ . This supply curve is obtained by summing the supply curves of all the individual firms in the market.

In perfect competition, equilibrium occurs where the supply curve and the demand curve intersect. The price is  $P_C$ , and the quantity produced by the industry is  $Q_C$ . Each firm takes the price  $P_C$  and maximizes its profit by producing the output at which its own marginal cost equals the price. Because each firm is a small part of the total industry, there is no incentive for any firm to try to manipulate the price by varying its output.

**Monopoly** Now suppose that this industry is taken over by a single firm. Consumers do not change, so the market demand curve remains the same as in the case of perfect competition. But now the monopoly recognizes this demand curve as a constraint on the price at which it can sell its output. The monopoly's marginal revenue curve is  $MR$ .

The monopoly maximizes profit by producing the quantity at which marginal revenue equals marginal cost. To find the monopoly's marginal cost curve, first

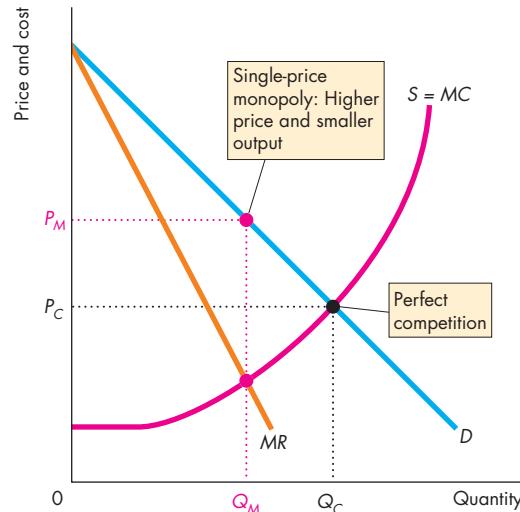
recall that in perfect competition, the market supply curve is the sum of the supply curves of the firms in the industry. Also recall that each firm's supply curve is its marginal cost curve (see Chapter 12, p. 277). So when the market is taken over by a single firm, the competitive market's supply curve becomes the monopoly's marginal cost curve. To remind you of this fact, the supply curve is also labelled  $MC$ .

The output at which marginal revenue equals marginal cost is  $Q_M$ . This output is smaller than the competitive output  $Q_C$ . And the monopoly charges the price  $P_M$ , which is higher than  $P_C$ . We have established that

Compared to a perfectly competitive market, a single-price monopoly produces a smaller output and charges a higher price.

We've seen how the output and price of a monopoly compare with those in a competitive market. Let's now compare the efficiency of the two types of market.

**FIGURE 13.5** Monopoly's Smaller Output and Higher Price



A competitive market produces the quantity  $Q_C$  at price  $P_C$ . A single-price monopoly produces the quantity  $Q_M$  at which marginal revenue equals marginal cost and sells that quantity for the price  $P_M$ . Compared to perfect competition, a single-price monopoly produces a smaller output and charges a higher price.

**MyEconLab Animation**

## Efficiency Comparison

Perfect competition (with no externalities) is efficient. Figure 13.6(a) illustrates the efficiency of perfect competition and serves as a benchmark against which to measure the inefficiency of monopoly. Along the demand and marginal social benefit curve ( $D = MSB$ ), consumers are efficient. Along the supply curve and marginal social cost curve ( $S = MSC$ ), producers are efficient. In competitive equilibrium, the price is  $P_C$ , the quantity is  $Q_C$ , and marginal social benefit equals marginal social cost.

*Consumer surplus* is the green triangle under the demand curve and above the equilibrium price (see Chapter 5, p. 109). *Producer surplus* is the blue area above the supply curve and below the equilibrium price (see Chapter 5, p. 111). Total surplus (consumer surplus and producer surplus) is maximized.

Also, in long-run competitive equilibrium, entry and exit ensure that each firm produces its output at the minimum possible long-run average cost.

To summarize: At the competitive equilibrium, marginal social benefit equals marginal social cost; total surplus is maximized; firms produce at the lowest possible long-run average cost; and resource use is efficient.

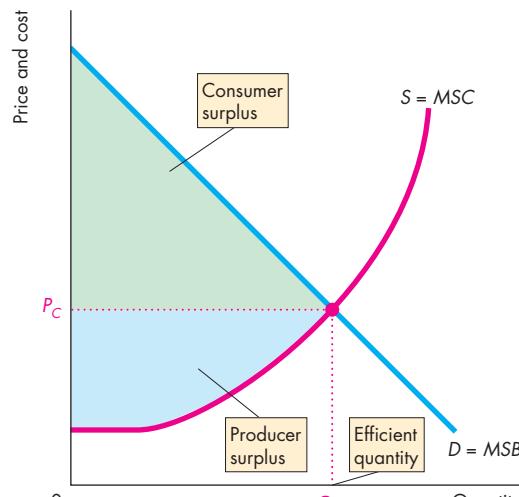
Figure 13.6(b) illustrates the inefficiency of monopoly and the sources of that inefficiency. A monopoly produces  $Q_M$  and sells its output for  $P_M$ . The smaller output and higher price drive a wedge between marginal social benefit and marginal social cost and create a *deadweight loss*. The grey triangle shows the deadweight loss, and its magnitude is a measure of the inefficiency of monopoly.

Consumer surplus shrinks for two reasons. First, consumers lose by having to pay more for the good. This loss to consumers is a gain for monopoly and increases the producer surplus. Second, consumers lose by getting less of the good, and this loss is part of the deadweight loss.

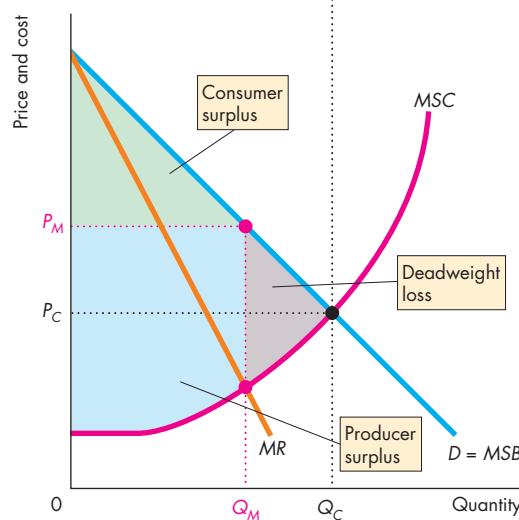
Although the monopoly gains from a higher price, it loses some producer surplus because it produces a smaller output. That loss is another part of the deadweight loss.

A monopoly produces a smaller output than perfect competition and faces no competition, so it does not produce at the lowest possible long-run average cost. As a result, monopoly damages the consumer interest in three ways: A monopoly produces less, increases the cost of production, and raises the price by more than the increased cost of production.

**FIGURE 13.6** Inefficiency of Monopoly



**(a) Perfect competition**



**(b) Monopoly**

In perfect competition in part (a), output is  $Q_C$  and the price is  $P_C$ . Marginal social benefit ( $MSB$ ) equals marginal social cost ( $MSC$ ); total surplus, the sum of consumer surplus (the green triangle) and producer surplus (the blue area), is maximized; and in the long run, firms produce at the lowest possible average cost. Monopoly in part (b) produces  $Q_M$  and raises the price to  $P_M$ . Consumer surplus shrinks, the monopoly gains, and a deadweight loss (the grey triangle) arises.

MyEconLab Animation and Draw Graph

## Redistribution of Surpluses

You've seen that monopoly is inefficient because marginal social benefit exceeds marginal social cost and there is deadweight loss—a social loss. But monopoly also brings a *redistribution* of surpluses.

Some of the lost consumer surplus goes to the monopoly. In Fig. 13.6, the monopoly takes the difference between the higher price,  $P_M$ , and the competitive price,  $P_C$ , on the quantity sold,  $Q_M$ . So the monopoly takes that part of the consumer surplus. This portion of the loss of consumer surplus is not a loss to society. It is a redistribution from consumers to the monopoly producer.

## Rent Seeking

You've seen that monopoly creates a deadweight loss and is inefficient. But the social cost of monopoly can exceed the deadweight loss because of an activity called rent seeking. Any surplus—consumer surplus, producer surplus, or economic profit—is called **economic rent**. The pursuit of wealth by capturing economic rent is called **rent seeking**.

You've seen that a monopoly makes its economic profit by diverting part of consumer surplus to itself—by converting consumer surplus into economic profit. So the pursuit of economic profit by a monopoly is rent seeking. It is the attempt to capture consumer surplus.

Rent seekers pursue their goals in two main ways. They might:

- Buy a monopoly
- Create a monopoly

**Buy a Monopoly** To rent seek by buying a monopoly, a person searches for a monopoly that is for sale at a lower price than the monopoly's economic profit. Trading of taxicab licences is an example of this type of rent seeking. In some cities, taxicabs are regulated. The city restricts both the fares and the number of taxis that can operate so that operating a taxi results in economic profit. A person who wants to operate a taxi must buy a licence from someone who already has one.

People rationally devote time and effort to seeking out profitable monopoly businesses to buy. In the process, they use up scarce resources that could otherwise have been used to produce goods and services. The value of this lost production is part of the social

cost of monopoly. The amount paid for a monopoly is *not* a social cost because the payment transfers an existing producer surplus from the buyer to the seller.

**Create a Monopoly** Rent seeking by creating a monopoly is mainly a political activity. It takes the form of lobbying and trying to influence the political process. Such influence might be sought by making campaign contributions in exchange for legislative support or by indirectly seeking to influence political outcomes through publicity in the media or more direct contacts with politicians and bureaucrats. An example of a monopoly created in this way is the cable television monopoly created and regulated by the Canadian Radio-Television and Telecommunications Commission (CRTC). Another is a regulation that restricts “split-run” magazines. These are regulations that restrict output and increase price.

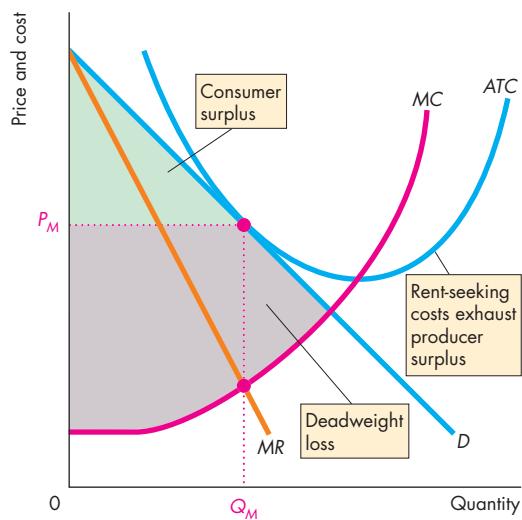
This type of rent seeking is a costly activity that uses up scarce resources. Taken together, firms spend billions of dollars lobbying MPs, MPPs, and bureaucrats in the pursuit of licences and laws that create barriers to entry and establish a monopoly.

## Rent-Seeking Equilibrium

Barriers to entry create monopoly. But there is no barrier to entry into rent seeking. Rent seeking is like perfect competition. If an economic profit is available, a new rent seeker will try to get some of it. And competition among rent seekers pushes up the price that must be paid for a monopoly, to the point at which the rent seeker makes zero economic profit by operating the monopoly. For example, competition for the right to operate a taxi leads to a price of \$300,000 in Toronto and \$200,000 in Montreal for a taxi licence, which is sufficiently high to eliminate the economic profit made by a taxi operator.

Figure 13.7 shows a rent-seeking equilibrium. The cost of rent seeking is a fixed cost that must be added to a monopoly's other costs. Rent seeking and rent-seeking costs increase to the point at which no economic profit is made. The average total cost curve, which includes the fixed cost of rent seeking, shifts upward until it just touches the demand curve. Economic profit is zero. It has been lost in rent seeking.

Consumer surplus is unaffected, but the deadweight loss from monopoly is larger. The deadweight loss now includes the original deadweight loss triangle plus the lost producer surplus, shown by the enlarged grey area in Fig. 13.7.

**FIGURE 13.7** Rent-Seeking Equilibrium

With competitive rent seeking, a single-price monopoly uses all its economic profit to maintain its monopoly. The firm's rent-seeking costs are fixed costs. They add to total fixed cost and to average total cost. The ATC curve shifts upward until, at the profit-maximizing price, the firm breaks even.

[MyEconLab Animation](#)

## REVIEW QUIZ

- 1 Why does a single-price monopoly produce a smaller output and charge more than the price that would prevail if the market were perfectly competitive?
- 2 How does a monopoly transfer consumer surplus to itself?
- 3 Why is a single-price monopoly inefficient?
- 4 What is rent seeking and how does it influence the inefficiency of monopoly?

Work these questions in Study Plan 13.3 and get instant feedback. Do a Key Terms Quiz.

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So far, we've considered only a single-price monopoly. But many monopolies do not operate with a single price. Instead, they price discriminate. Let's now see how a price-discriminating monopoly works.

## Price Discrimination

You encounter *price discrimination*—selling a good or service at a number of different prices—when you travel, go to the movies, get your hair cut, visit an art museum or theme park, or buy pizza. These are all examples of firms with market power, setting the prices of an identical good or service at different levels for different customers.

Not all price *differences* are price *discrimination*: they reflect differences in production costs. For example, real-time meters for electricity enable power utilities to charge a different price at peak-load times than during the night. But it costs more per kilowatt-hour to generate electricity at peak-load times, so this price difference reflects production cost differences and is not price discrimination.

At first sight, price discrimination appears to be inconsistent with profit maximization. Why would a movie theatre allow children to see movies at a discount? Why would a hairdresser charge students and senior citizens less? Aren't these firms losing profit by being nice to their customers? The answer, as you are about to discover, is that price discrimination is profitable: It increases economic profit.

But to be able to price discriminate, the firm must sell a product that cannot be resold; and it must be possible to identify and separate different buyer types.

## Two Ways of Price Discriminating

Firms price discriminate in two broad ways. They discriminate:

- Among groups of buyers
- Among units of a good

**Discriminating Among Groups of Buyers** People differ in the value they place on a good—their marginal benefit and willingness to pay. Some of these differences are correlated with features such as age, employment status, and other easily distinguished characteristics. When such a correlation is present, firms can profit by price discriminating among the different groups of buyers.

For example, salespeople and other business travellers know that a face-to-face sales meeting with a customer might bring a large and profitable order. So for these travellers, the marginal benefit from a trip is large and the price that such a traveller is willing to pay for a trip is high. In contrast, for a leisure

traveller, any of several different trips and even no trip at all are options. So for leisure travellers, the marginal benefit of a trip is small and the price that such a traveller is willing to pay for a trip is low. Because the price that business travellers are willing to pay exceeds what leisure travellers are willing to pay, it is possible for an airline to price discriminate between these two groups and increase its profit. We'll return to this example of price discrimination below.

**Discriminating Among Units of a Good** Everyone experiences diminishing marginal benefit, so if all the units of the good are sold for a single price, buyers end up with a consumer surplus equal to the value they get from each unit minus the price paid for it.

A firm that price discriminates by charging a buyer one price for a single item and a lower price for a second or third item can capture some of the consumer surplus. Buy one pizza and get a second one for a lower price is an example of this type of price discrimination.

### Increasing Profit and Producer Surplus

By getting buyers to pay a price as close as possible to their maximum willingness to pay, a monopoly captures the consumer surplus and converts it into producer surplus. And more producer surplus means more economic profit.

To see why more producer surplus means more economic profit, recall some definitions. With total revenue  $TR$  and total cost  $TC$ ,

$$\text{Economic profit} = TR - TC.$$

Producer surplus is total revenue minus the area under the marginal cost curve. But the area under the marginal cost curve is total *variable* cost,  $TVC$ . So producer surplus equals total revenue minus  $TVC$ , or

$$\text{Producer surplus} = TR - TVC.$$

You can see that the difference between economic profit and producer surplus is the same as the difference between  $TC$  and  $TVC$ . But  $TC$  minus  $TVC$  equals total *fixed* cost,  $TFC$ . So

$$\text{Economic profit} = \text{Producer surplus} - TFC.$$

For a given level of total fixed cost, anything that increases producer surplus also increases economic profit.

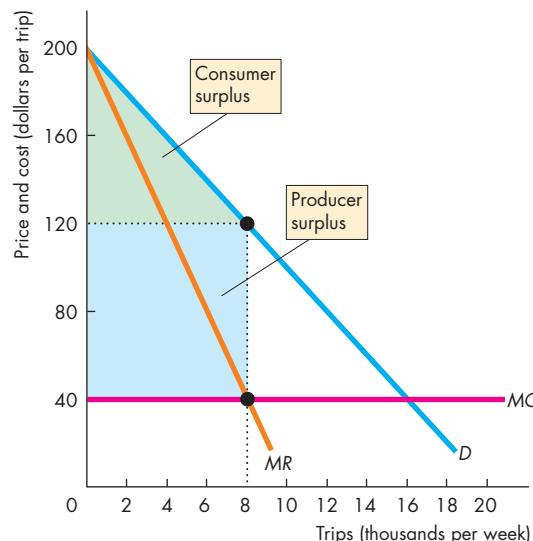
Let's now see how price discrimination works by looking at a price-discriminating airline.

### A Price-Discriminating Airline

Inter-City Airlines has a monopoly on passenger flights between two cities. Figure 13.8 shows the market demand curve,  $D$ , for travel on this route. It also shows Inter-City Airline's marginal revenue curve,  $MR$ , and marginal cost curve,  $MC$ . Inter-City's marginal cost is a constant \$40 per trip. (It is easier to see how price discrimination works for a firm with constant marginal cost.)

**Single-Price Profit Maximization** As a single-price monopoly, Inter-City maximizes profit by producing the quantity of trips at which  $MR$  equals  $MC$ , which is 8,000 trips a week, and charging \$120 a trip. With a marginal cost of \$40 a trip, producer surplus is \$80 a trip, and Inter-City's producer surplus is \$640,000 a week, shown by the area of the blue rectangle. Inter-City's customers enjoy a consumer surplus shown by the area of the green triangle.

**FIGURE 13.8** A Single Price of Air Travel



Inter-City Airlines has a monopoly on an air route with a market demand curve  $D$ . Inter-City's marginal cost,  $MC$ , is \$40 per trip. As a single-price monopoly, Inter-City's marginal revenue curve is  $MR$ . Profit is maximized by selling 8,000 trips a week at \$120 a trip. Producer surplus is \$640,000 a week—the blue rectangle—and Inter-City's customers enjoy a consumer surplus—the green triangle.

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### Discrimination Between Two Types of Travellers

Inter-City surveys its customers and discovers that they are all business travellers. It also surveys people who are *not* its customers and discovers that they are mainly people who travel for leisure. These people travel by bus or car, but would travel by air at a low fare. Inter-City would like to attract some of these travellers and knows that to do so, it must offer a fare below the current \$120 a trip. How can it do that?

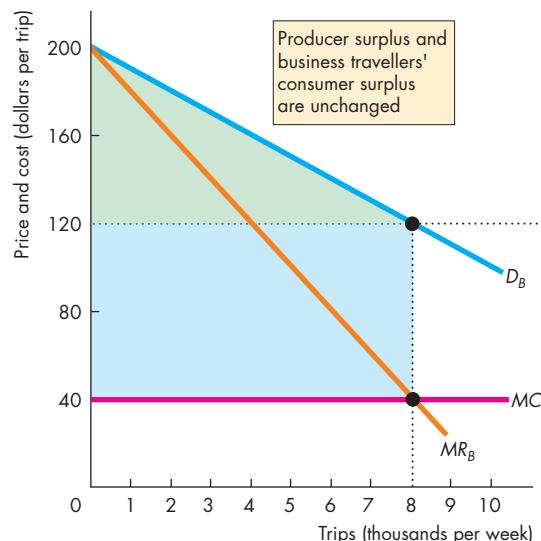
Inter-City digs more deeply into its survey results and discovers that its current customers always plan their travel less than two weeks before departure. In contrast, the people who travel by bus or car know their travel plans at least two weeks ahead of time.

Inter-City sees that it can use what it has discovered about its current and potential new customers to separate the two types of travellers into two markets: one market for business travel and another for leisure travel.

Figure 13.9 shows Inter-City's two markets. Part (a), the market for business travel, is the same as Fig. 13.8. Part (b) shows the market for leisure travel. No leisure traveller is willing to pay the business fare of \$120 a trip, so at that price, the quantity demanded in part (b) is zero. The demand curve  $D_L$  is the demand for travel on this route after satisfying the demand of business travellers. Inter-City's marginal cost remains at \$40 a trip, so its marginal revenue curve is  $MR_L$ . Inter-City maximizes profit by setting the leisure fare at \$80 a trip and attracting 4,000 leisure travellers a week. Inter-City's producer surplus increases by \$160,000 a week—the area of the blue rectangle in Fig. 13.9(b)—and leisure travellers enjoy a consumer surplus—the area of the green triangle.

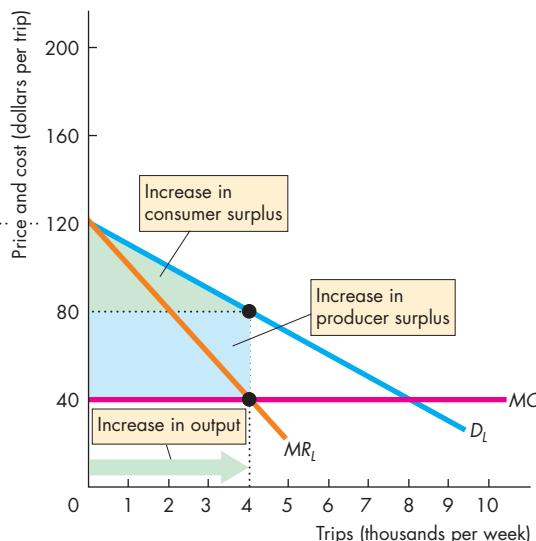
Inter-City announces its new fare schedule: no restrictions, \$120 and 14-day advance purchase, \$80. Inter-City increases its passenger count by 50 percent and increases its producer surplus by \$160,000.

**FIGURE 13.9** Price Discrimination



(a) Business travel

Inter-City separates its market into two types of travel: business travel with no restrictions in part (a) and leisure travel that requires a 14-day advance purchase in part (b). For business travel, the profit-maximizing price is \$120 a trip with 8,000 trips a week. For leisure travel, the profit-maximizing price is \$80 a trip with 4,000 trips a week.



(b) Leisure travel

Inter-City continues to make the same producer surplus on business travel as it did with a single price, and business travellers continue to enjoy the same consumer surplus. But in part (b), Inter-City sells 4,000 trips to leisure travellers, which increases its producer surplus—the blue rectangle—and increases consumer surplus—the green triangle.

### Discrimination Among Several Types of Travellers

Pleased with the success of its price discrimination between business and leisure travellers, Inter-City sees that it might be able to profit even more by dividing its customers into a larger number of types. So it does another customer survey, which reveals that some business travellers are willing to pay \$160 for a fully-refundable, unrestricted ticket while others are willing to pay only \$120 for a nonrefundable ticket. So applying the same principles as it used to discriminate between business and leisure travellers, Inter-City now discriminates between business travellers who want a refundable ticket and those who want a nonrefundable ticket.

Another survey of leisure travellers reveals that they fall into two groups: those who are able to plan 14 days ahead and others who can plan 21 days ahead. So Inter-City discriminates between these two groups with two fares: an \$80 and a \$60 fare.

By offering travellers four different fares, the airline increases its producer surplus and increases its economic profit. But why only four fares? Why not keep looking for ever more traveller types and offer even more fares?

**Perfect Price Discrimination** Firms try to capture an ever larger part of consumer surplus by devising a host of special conditions, each one of which appeals to a tiny segment of the market but at the same time excludes others from taking advantage of a lower price. The more consumer surplus a firm is able to capture, the closer it gets to the extreme case called **perfect price discrimination**, which occurs if a firm can sell each unit of output for the highest price someone is willing to pay for it. In this extreme (hypothetical) case consumer surplus is eliminated and captured as producer surplus.

With perfect price discrimination, something special happens to marginal revenue—the market demand curve becomes the marginal revenue curve. The reason is that when the monopoly cuts the price to sell a larger quantity, it sells only the marginal unit at the lower price. All the other units continue to be sold for the highest price that each buyer is willing to pay. So for the perfect price discriminator, marginal revenue *equals* price and the market demand curve becomes the monopoly's marginal revenue curve.

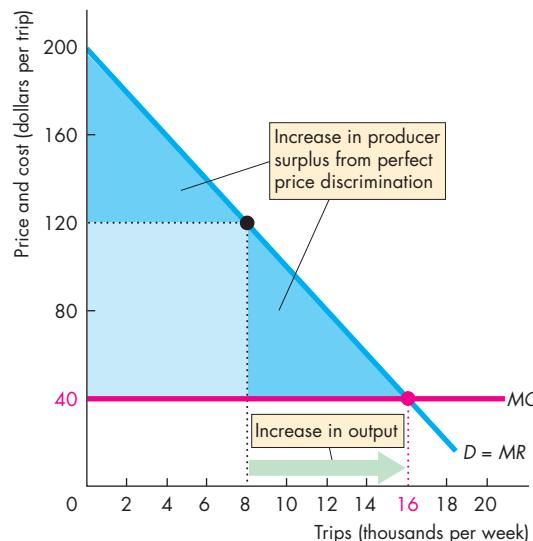
With marginal revenue equal to price, Inter-City can obtain even greater producer surplus by increasing output up to the point at which price (and marginal revenue) equals marginal cost.

So Inter-City seeks new travellers who will not pay as much as \$60 a trip but who will pay more than \$40, its marginal cost. Inter-City offers a variety of vacation specials at different low fares that appeal only to new travellers. Existing customers continue to pay the higher fares and some, with further perks and frills that have no effect on cost, are induced to pay fares going all the way up to \$200 a trip.

With all these special conditions and fares, Inter-City increases its output to the quantity demanded at marginal cost, extracts the entire consumer surplus on that quantity, and maximizes economic profit.

Figure 13.10 shows the outcome with perfect price discrimination and compares it with the single-price monopoly outcome. The range of business-class fares extract the entire consumer surplus from this group. The new leisure-class fares going down to \$40 a trip attract an additional 8,000 travellers and take the entire consumer surplus of leisure travellers. Inter-City makes the maximum possible economic profit.

**FIGURE 13.10** Perfect Price Discrimination



Dozens of fares discriminate among many different types of business travellers, and many new low fares with restrictions appeal to leisure travellers. With perfect price discrimination, the market demand curve becomes Inter-City's marginal revenue curve. Producer surplus is maximized when the lowest fare equals marginal cost. Inter-City sells 16,000 trips and makes the maximum possible economic profit.

**MyEconLab Animation**



*Would it bother you to hear how little I paid for this flight?*

From William Hamilton, "Voodoo Economics," © 1992 by The Chronicle Publishing Company, p. 3.  
Reprinted with permission of Chronicle Books.

### Efficiency and Rent Seeking with Price Discrimination

With perfect price discrimination, output increases to the point at which price equals marginal cost. This output is identical to that of perfect competition. Perfect price discrimination pushes consumer surplus to zero but increases the monopoly's producer surplus to equal the total surplus in perfect competition. With perfect price discrimination, no deadweight loss is created, so perfect price discrimination achieves efficiency.

The more perfectly the monopoly can price discriminate, the closer its output is to the competitive output and the more efficient is the outcome.

But the outcomes of perfect competition and perfect price discrimination differ. First, the distribution of the total surplus is not the same. In perfect competition, total surplus is shared by consumers and producers, while with perfect price discrimination, the monopoly takes it all. Second, because the monopoly takes all the total surplus, rent seeking is profitable.

People use resources in pursuit of economic rent, and the bigger the rents, the more resources are used in pursuing them. With free entry into rent seeking, the long-run equilibrium outcome is that rent seekers use up the entire producer surplus.

Real-world airlines are as creative as Inter-City Airlines, as you can see in the cartoon! Disney Corporation is creative too in extracting consumer surplus, as *Economics in Action* shows.

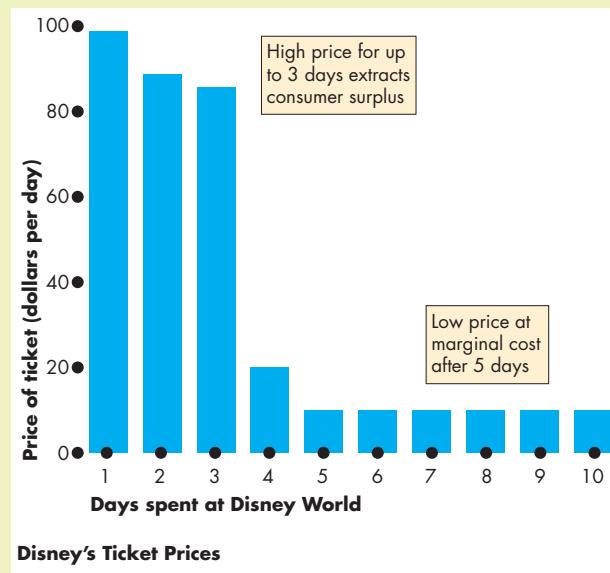
We next study some key monopoly policy issues.

### Economics in Action

#### Attempting Perfect Price Discrimination

If you want to spend a day at Disney World in Orlando, it will cost you \$99. You can spend a second consecutive day for an extra \$89. A third day will cost you \$86. But for a fourth day, you'll pay only \$20 and for more days all the way up to 10, you'll pay only \$10 a day.

The Disney Corporation hopes that it has read your willingness to pay correctly and not left you with too much consumer surplus.



### REVIEW QUIZ

- 1 What is price discrimination and how is it used to increase a monopoly's profit?
- 2 Explain how consumer surplus changes when a monopoly price discriminates.
- 3 Explain how consumer surplus, economic profit, and output change when a monopoly perfectly price discriminates.
- 4 What are some of the ways that real-world airlines price discriminate?

Work these questions in Study Plan 13.4 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**



## ECONOMICS IN THE NEWS

### Microsoft Monopoly

#### Microsoft Windows 8 to Go on Sale in October

Microsoft announced that its Windows 8 operating system will be released in October 2012, three years after Windows 7 went public. Windows 8 will be available in 109 languages across 231 markets worldwide.

Source: AFP, July 9, 2012

### SOME DATA

Microsoft Windows 8 Versions and U.S. Prices	
Version	Price
Full from Microsoft	249.99
Upgrade from Microsoft	199.99
Full from Amazon	162.99
OEM	148.95
Student from Microsoft	69.99

Microsoft sold 180 million Windows 8 licences at different prices in different national markets.

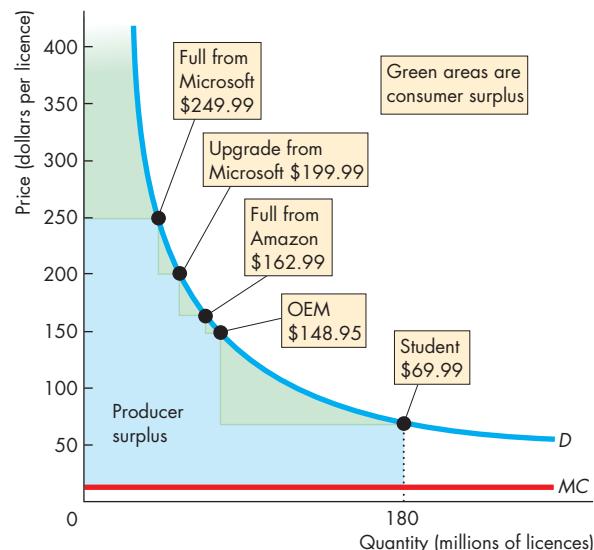
### THE QUESTIONS

- Is Microsoft a monopoly?
- Is Microsoft a natural monopoly or a legal monopoly?
- Does Microsoft price discriminate or do the different prices of Windows reflect cost differences?
- Sketch a demand curve for Windows, Microsoft's marginal cost curve, and the distribution of the total surplus between consumers and Microsoft.

### THE ANSWERS

- Microsoft controls 87 percent of the market for computer operating systems, and almost 100 percent of the non-Apple market, which makes it an effective monopoly.
- Microsoft is a natural monopoly. It has large fixed costs and almost zero marginal cost, so its long-run average cost curve (*LRAC*) slopes downward and economies of scale are achieved when the *LRAC* curve intersects the demand curve.
- Microsoft sells Windows for a number of different prices to different market segments and the marginal cost of a Windows licence is the same for all market segments, so Microsoft is a price-discriminating monopoly.

- The figure illustrates the demand curve, *D*, and marginal cost curve, *MC*, for Windows licences.
- Using the U.S. prices in the data table, the figure shows how Microsoft converts consumer surplus into producer surplus by price discriminating.
- Because Microsoft also price discriminates among its different national markets, it gains even more producer surplus than the figure illustrates.



Microsoft Grabs Consumer Surplus



Windows 8 has 109 foreign language versions, which expands Microsoft's scope for price discrimination.

## Monopoly Regulation

Natural monopoly presents a dilemma. With economies of scale, it produces at the lowest possible cost. But with market power, it has an incentive to raise the price above the competitive price and produce too little—to operate in the self-interest of the monopolist and not in the social interest.

**Regulation**—rules administered by a government agency to influence prices, quantities, entry, and other aspects of economic activity in a firm or industry—is a possible solution to this dilemma.

To implement regulation, the government establishes agencies to oversee and enforce the rules. For example, the Canadian Transportation Agency regulates transport under federal jurisdiction, including rail, air, marine transportation, and some inter-provincial commercial motor transport. The National Energy Board regulates international and interprovincial aspects of the oil, gas, and electric utility industries.

**Deregulation** is the process of removing regulation of prices, quantities, entry, and other aspects of economic activity in a firm or industry. During the past 30 years, deregulation has occurred in many Canadian markets, including domestic rail and air transportation, telephone service, natural gas, and grain transportation. In 2012, wheat handling and marketing were deregulated.

Regulation is a possible solution to the dilemma presented by natural monopoly but not a guaranteed solution. There are two theories about how regulation actually works: the *social interest theory* and the *capture theory*.

The **social interest theory** is that the political and regulatory process relentlessly seeks out inefficiency and introduces regulation that eliminates deadweight loss and allocates resources efficiently.

The **capture theory** is that regulation serves the self-interest of the producer, who captures the regulator and maximizes economic profit. Regulation that benefits the producer but creates a deadweight loss gets adopted because the producer's gain is large and visible while each individual consumer's loss is small and invisible. No individual consumer has an incentive to oppose the regulation, but the producer has a big incentive to lobby for it.

We're going to examine efficient regulation that serves the social interest and see why it is not a simple matter to design and implement such regulation.

## Efficient Regulation of a Natural Monopoly

A cable TV company is a *natural monopoly*—it can supply the entire market at a lower price than two or more competing firms can. Shaw Communications provides cable TV to households in Western Canada. The firm has invested heavily in satellite receiving dishes, cables, and control equipment and so has large fixed costs. These fixed costs are part of the firm's average total cost. Its average total cost decreases as the number of households served increases because the fixed cost is spread over a larger number of households.

Unregulated, Shaw produces the quantity that maximizes profit. Like all single-price monopolies, the profit-maximizing quantity is less than the efficient quantity, and underproduction results in a deadweight loss.

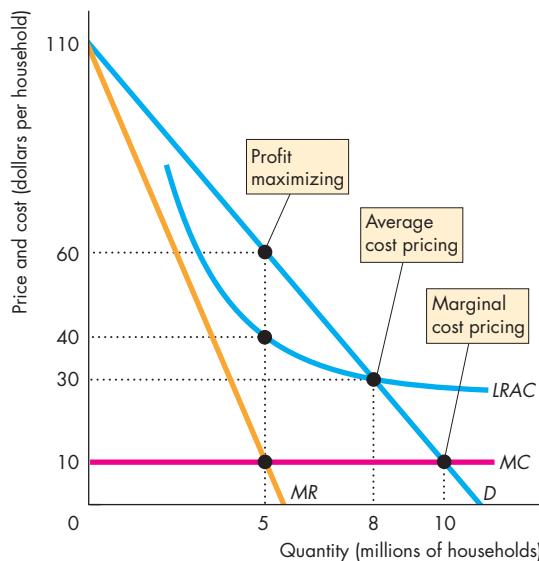
How can Shaw be regulated to produce the efficient quantity of cable TV service? The answer is by being regulated to set its price equal to marginal cost, known as the **marginal cost pricing rule**. The quantity demanded at a price equal to marginal cost is the efficient quantity—the quantity at which marginal benefit equals marginal cost.

Figure 13.11 illustrates the marginal cost pricing rule. The demand curve for cable TV is  $D$ . Shaw's marginal cost curve is  $MC$ . That marginal cost curve is (assumed to be) horizontal at \$10 per household per month—that is, the cost of providing each additional household with a month of cable programming is \$10. The efficient outcome occurs if the price is regulated at \$10 per household per month with 10 million households served.

But there is a problem: At the efficient output, average total cost exceeds marginal cost, so a firm that uses marginal cost pricing incurs an economic loss. A cable TV company that is required to use a marginal cost pricing rule will not stay in business for long. How can the firm cover its costs and, at the same time, obey a marginal cost pricing rule?

There are two possible ways of enabling the firm to cover its costs: price discrimination and a two-part price (called a *two-part tariff*).

For example, local telephone companies offer plans at a fixed monthly price that give access to the cellphone network and unlimited free calls. The price of a call (zero) equals the marginal cost of a call. Similarly, a cable TV operator can charge a one-time connection fee that covers its fixed cost and then charge a monthly fee equal to marginal cost.

**FIGURE 13.11** Regulating a Natural Monopoly

A natural monopoly cable TV supplier faces the demand curve  $D$ . The firm's marginal cost is constant at \$10 per household per month, as shown by the curve labelled  $MC$ . The long-run average cost curve is  $LRAC$ .

Unregulated, as a profit-maximizer, the firm serves 5 million households at a price of \$60 a month. An efficient marginal cost pricing rule sets the price at \$10 a month. The monopoly serves 10 million households and incurs an economic loss. A second-best average cost pricing rule sets the price at \$30 a month. The monopoly serves 8 million households and earns zero economic profit.

[MyEconLab Animation](#)

### Second-Best Regulation of a Natural Monopoly

A natural monopoly cannot always be regulated to achieve an efficient outcome. There are two possible ways of enabling a regulated monopoly to avoid an economic loss:

- Average cost pricing
- Government subsidy

**Average Cost Pricing** The **average cost pricing rule** sets price equal to average total cost. With this rule the firm produces the quantity at which the average

total cost curve cuts the demand curve. This rule results in the firm making zero economic profit—breaking even. But because for a natural monopoly average total cost exceeds marginal cost, the quantity produced is less than the efficient quantity and a deadweight loss arises.

Figure 13.11 illustrates the average cost pricing rule. The price is \$30 a month and 8 million households get cable TV.

**Government Subsidy** A government subsidy is a direct payment to the firm equal to its economic loss. To pay a subsidy, the government must raise the revenue by taxing some other activity. You saw in Chapter 6 that taxes themselves generate deadweight loss.

**And the Second-Best Is ...** Which is the better option, average cost pricing or marginal cost pricing with a government subsidy? The answer depends on the relative magnitudes of the two deadweight losses. Average cost pricing generates a deadweight loss in the market served by the natural monopoly. A subsidy generates deadweight losses in the markets for the items that are taxed to pay for the subsidy. The smaller deadweight loss is the second-best solution to regulating a natural monopoly. Making this calculation in practice is too difficult, so average cost pricing is generally preferred to a subsidy.

Implementing average cost pricing presents the regulator with a challenge because it is not possible to be sure what a firm's costs are. So regulators use one of two practical rules:

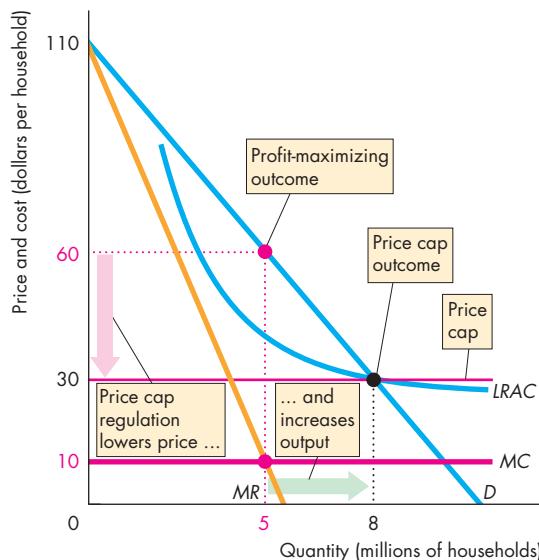
- Rate of return regulation
- Price cap regulation

**Rate of Return Regulation** Under **rate of return regulation**, a firm must justify its price by showing that its return on capital doesn't exceed a specified target rate. This type of regulation can end up serving the self-interest of the firm rather than the social interest. The firm's managers have an incentive to inflate costs by spending on items such as private jets, free hockey tickets (disguised as public relations expenses), and lavish entertainment. Managers also have an incentive to use more capital than the efficient amount. The rate of return on capital is regulated but not the total return on capital, and the greater the amount of capital, the greater is the total return.

**Price Cap Regulation** For the reason that we've just examined, rate of return regulation is increasingly being replaced by price cap regulation. A **price cap regulation** is a price ceiling—a rule that specifies the highest price the firm is permitted to set. This type of regulation gives a firm an incentive to operate efficiently and keep costs under control. Price cap regulation has become common for the electricity and telecommunications industries and is replacing rate of return regulation.

To see how a price cap works, let's suppose that the cable TV operator is subject to this type of regulation. Figure 13.12 shows that without regulation, the firm maximizes profit by serving 5 million households and charging a price of \$60 a month. If a price cap is set at \$30 a month, the firm is permitted to sell

**FIGURE 13.12** Price Cap Regulation



A natural monopoly cable TV supplier faces the demand curve  $D$ . The firm's marginal cost is constant at \$10 per household per month, as shown by the curve labelled  $MC$ . The long-run average cost curve is  $LRAC$ .

Unregulated, the firm serves 5 million households at a price of \$60 a month. A price cap sets the maximum price at \$30 a month. The firm has an incentive to minimize cost and serve the quantity of households that demand service at the price cap. The price cap regulation lowers the price and increases the quantity.

**MyEconLab Animation**

any quantity it chooses at that price or at a lower price. At 5 million households, the firm now incurs an economic loss. It can decrease the loss by increasing output to 8 million households. To increase output above 8 million households, the firm would have to lower the price and again it would incur a loss. So the profit-maximizing quantity is 8 million households—the same as with average cost pricing.

Notice that a price cap lowers the price and increases output. This outcome is in sharp contrast to the effect of a price ceiling in a competitive market that you studied in Chapter 6 (pp. 128–130). The reason is that in a monopoly, the unregulated equilibrium output is *less* than the competitive equilibrium output, and the price cap regulation replicates the conditions of a competitive market.

In Fig. 13.12, the price cap delivers average cost pricing. In practice, the regulator might set the cap too high. For this reason, price cap regulation is often combined with *earnings sharing regulation*—a regulation that requires firms to make refunds to customers when profits rise above a target level.

## REVIEW QUIZ

- What is the pricing rule that achieves an efficient outcome for a regulated monopoly? What is the problem with this rule?
- What is the average cost pricing rule? Why is it not an efficient way of regulating monopoly?
- What is a price cap? Why might it be a more effective way of regulating monopoly than rate of return regulation?
- Compare the consumer surplus, producer surplus, and deadweight loss that arise from average cost pricing with those that arise from profit-maximization pricing and marginal cost pricing.

Work these questions in Study Plan 13.5 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

You've now completed your study of monopoly. *Economics in the News* on pp. 316–317 looks at Google's dominant position in the market for Internet search advertising.

In the next chapter, we study markets that lie between the extremes of perfect competition and monopoly and that blend elements of the two.



# Is Google Misusing Monopoly Power?

## Google and E.U. Agree to Settle Search Row

*The Financial Times*

February 5, 2014

Google ended its three-year tangle with antitrust regulators on Wednesday, as it reached a deal with Brussels which critics claimed would cement its dominance of some of the most valuable commercial activity on the web.

Following the U.S. Federal Trade Commission closing a similar case last year, regulators on both sides of the Atlantic have now largely cleared Google's practice of overriding its own algorithmically chosen results to put paid-for links at the top of its pages.

The European Commission went further than U.S. regulators by extracting a concession that will require the Internet group to give rival Internet services a showing alongside its own preferred results, provided they bid against each other for the space.

Rivals immediately panned the approach as "worse than nothing" as it gave Brussels' blessing to Google sucking traffic from other Internet sites for some of the most valuable searches on the web, such as users looking for digital cameras or hotels. ...

Joaquín Almunia, the E.U. competition chief, said

... "Google should not be prevented from trying to provide users with what they're looking for."

... "What Google should do is also give rivals a prominent space... in a visual format which will attract users." ...

Although it still faces an investigation in Canada, the deal effectively brings the curtain down on Google's first showdown with the world's leading antitrust regulators. Unlike Microsoft, which became embroiled in a 10-year battle with Brussels, it chose to settle rather than risk large fines or tying up senior management attention in a fight. ...

...

Written by Alex Barker and Richard Waters. Copyright © 2014. Used under licence from *The Financial Times*. All rights reserved.

### ESSENCE OF THE STORY

- Google reached a settlement with the European Union antitrust regulators.
- It settled a similar case with the U.S. Federal Trade Commission in 2013 but still faces an investigation in Canada.
- The European regulators require Google to display rival Internet services alongside its preferred results, provided they bid against each other for the space.
- Competitors say the regulations are too weak and enable Google to capture traffic from other Internet sites for some of the most valuable searches.

**MyEconLab More Economics in the News**

## ECONOMIC ANALYSIS

- Google gets its revenue by selling advertisements associated with search keywords.
- Google sells keywords based on a combination of willingness-to-pay and the number of clicks an advertisement receives, with bids starting at 5 cents per click.
- Google has steadily improved its search engine and refined and simplified its interface with both searchers and advertisers to make searches more powerful and advertising more effective.
- Figure 1 shows Google's extraordinary success in terms of its revenue, cost, and profit.
- Google could have provided a basic search engine with none of the features of today's Google.
- If Google had followed this strategy, people seeking information would have used other search engines and advertisers would have been willing to pay lower prices for Google ads.
- Google would have faced the market described in Fig. 2 and earned a small economic profit.
- Instead, Google improved its search engine and the effectiveness of advertising. The demand for Google ads increased.
- By selling keywords to the highest bidder, Google is able to achieve perfect price discrimination.

- Figure 3 shows the consequences of Google's successful strategy. With perfect price discrimination, Google's producer surplus is maximized. Google produces the efficient quantity of search and advertising by accepting ads at prices that exceed or equal marginal cost.
- Google does not appear to be acting against the social interest: There is no antitrust case to answer.

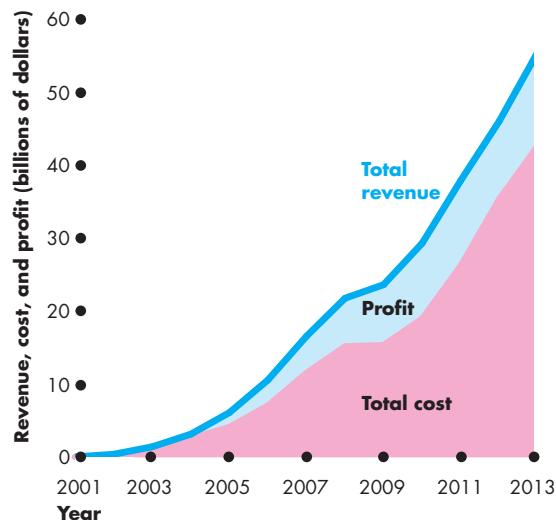


Figure 1 Google's Revenue, Cost, and Profit

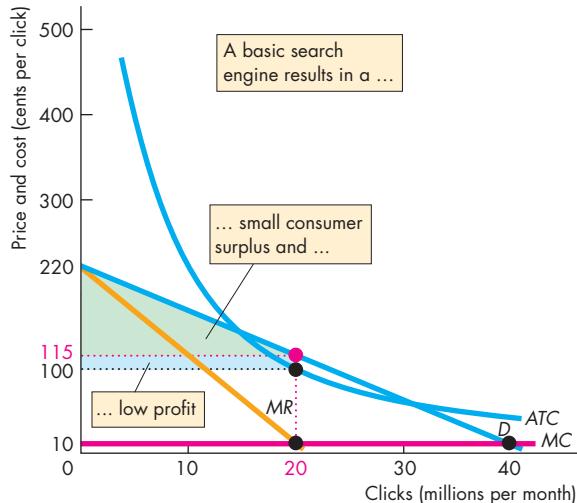


Figure 2 Basic Search Engine

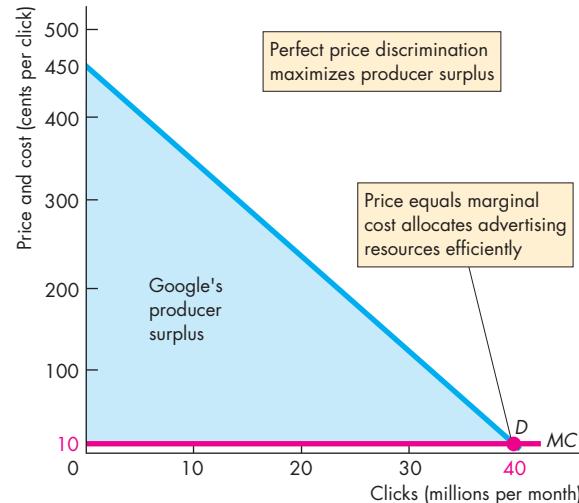


Figure 3 Google with AdWords and Other Features

## SUMMARY

### Key Points

#### Monopoly and How It Arises (pp. 298–299)

- A monopoly is a market with a single supplier of a good or service that has no close substitutes and in which barriers to entry prevent competition.
- Barriers to entry may be legal (public franchise, licence, patent, or copyright), ownership (one firm controls a resource), or natural (created by economies of scale).
- A monopoly might be able to price discriminate when there is no resale possibility.
- Where resale is possible, a firm charges one price.

Working Problem 1 will give you a better understanding of monopoly and how it arises.

#### A Single-Price Monopoly's Output and Price Decision (pp. 300–303)

- A monopoly's demand curve is the market demand curve and a single-price monopoly's marginal revenue is less than price.
- A monopoly maximizes profit by producing the output at which marginal revenue equals marginal cost and by charging the maximum price that consumers are willing to pay for that output.

Working Problems 2 to 4 will give you a better understanding of a single-price monopoly's output and price decision.

#### Single-Price Monopoly and Competition Compared (pp. 304–307)

- A single-price monopoly charges a higher price and produces a smaller quantity than a perfectly competitive market.
- A single-price monopoly restricts output and creates a deadweight loss.

### Key Terms

Average cost pricing rule, 314  
 Barrier to entry, 298  
 Capture theory, 313  
 Deregulation, 313  
 Economic rent, 306  
 Legal monopoly, 298

Marginal cost pricing rule, 313  
 Monopoly, 298  
 Natural monopoly, 298  
 Perfect price discrimination, 310  
 Price cap regulation, 315  
 Price discrimination, 299

### MyEconLab Key Terms Quiz

Rate of return regulation, 314  
 Regulation, 313  
 Rent seeking, 306  
 Single-price monopoly, 299  
 Social interest theory, 313

- The total loss that arises from monopoly equals the deadweight loss plus the cost of the resources devoted to rent seeking.

Working Problem 5 will give you a better understanding of the comparison of single-price monopoly and perfect competition.

#### Price Discrimination (pp. 307–312)

- Price discrimination converts consumer surplus into economic profit.
- Perfect price discrimination extracts the entire consumer surplus; each unit is sold for the maximum price that each consumer is willing to pay; the quantity produced is the efficient quantity.
- Rent seeking with perfect price discrimination might eliminate the entire consumer surplus and producer surplus.

Working Problem 6 will give you a better understanding of price discrimination.

#### Monopoly Regulation (pp. 313–315)

- Monopoly regulation might serve the social interest or the interest of the monopoly (the monopoly captures the regulator).
- Price equal to marginal cost achieves efficiency but results in economic loss.
- Price equal to average cost enables the firm to cover its cost but is inefficient.
- Rate of return regulation creates incentives for inefficient production and inflated cost.
- Price cap regulation with earnings sharing regulation can achieve a more efficient outcome than rate of return regulation.

Working Problems 7 to 9 will give you a better understanding of monopoly regulation.



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 13 Study Plan.

Tanya's Tattoos is a local monopoly. Columns 1 and 2 of the table set out the market demand schedule and columns 2 and 3 set out the total cost schedule.

Price (dollars per tattoo)	Quantity (tattoos per hour)	Total cost (dollars per hour)
60	0	30
50	1	50
40	2	70
30	3	90
20	4	110

### Questions

- If Tanya's Tattoos is a single-price monopoly, what is Tanya's profit-maximizing quantity? What price does Tanya charge? What are its economic profit and producer surplus?
- If Tanya's Tattoos can perfectly price discriminate, what is its profit-maximizing quantity? What are its economic profit and producer surplus?

### Solutions

- The profit-maximizing quantity is that at which marginal cost equals marginal revenue. Marginal cost—the increase in total cost when output increases by one unit—is \$20 at all output levels. Marginal revenue—the change in total revenue when output increases by one unit—is calculated in the table at the top of the next column.

Marginal revenue equals marginal cost of \$20 at 2 tattoos per hour (midway between \$30 and

Price (dollars per tattoo)	Quantity (tattoos per hour)	Total revenue (dollars per hour)	Marginal revenue (dollars per tattoo)
60	0	0	..... 50
50	1	50	..... 30
40	2	80	..... 10
30	3	90	..... -10
20	4	80	

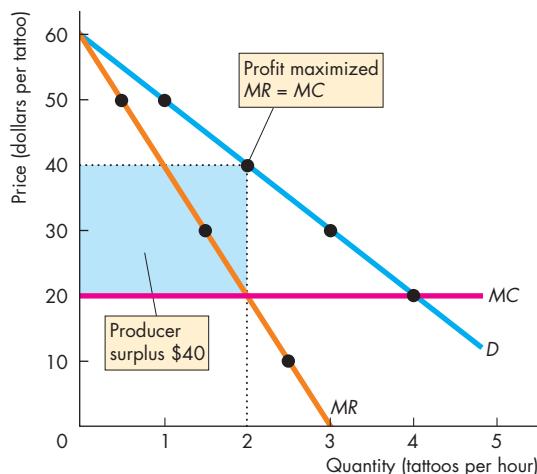
\$10). So this quantity maximizes profit. The highest price of a tattoo at which 2 tattoos per hour can be sold is \$40, so total revenue is \$80. Total cost is \$70, so economic profit is \$10.  $TFC (TC \text{ at zero output}) = \$30$ , so  $TVC = \$40$  and producer surplus =  $TR - TVC = \$40$ .

**Key Point:** Profit is maximized when marginal cost equals marginal revenue.

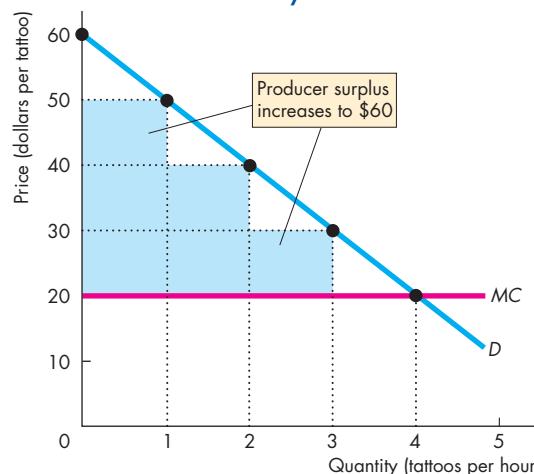
- If Tanya can perfectly price discriminate, she produces 4 tattoos per hour and sells one for \$50, one for \$40, one for \$30, and one for \$20. Total revenue is \$140 per hour. Total cost is \$110 per hour, so economic profit is \$30 per hour. Producer surplus =  $TR - TVC$ , which is  $\$140 - \$80 = \$60$  per hour.

**Key Point:** With perfect price discrimination, a firm charges the highest price that each buyer is willing to pay and increases production to the quantity at which the lowest price equals marginal cost.

### Key Figure



(a) Single-price monopoly



(b) Price-discriminating monopoly

**MyEconLab** Interactive Animation

## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work this problems 1 to 9 in Chapter 13 Study Plan and get instant feedback.

### Monopoly and How It Arises (Study Plan 13.1)

- Canada Post has a monopoly on residential mail delivery. Pfizer Inc. makes Lipitor, a prescription drug that lowers cholesterol. Rogers Communications is the sole provider of cable television service in some parts of Ontario.

Are any of these firms protected by a barrier to entry? Do any of these firms produce a good or service that has a substitute? Might any of them be able to profit from price discrimination? Explain your answers.

### A Single-Price Monopoly's Output and Price Decision (Study Plan 13.2)

Use the following table to work Problems 2 to 4. Minnie's Mineral Springs is a single-price monopoly. Columns 1 and 2 of the table set out the market demand schedule for Minnie's water, and columns 2 and 3 set out Minnie's total cost schedule.

Price (dollars per bottle)	Quantity (bottles per hour)	Total cost (dollars per hour)
10	0	1
8	1	3
6	2	7
4	3	13
2	4	21
0	5	31

- Calculate Minnie's marginal revenue schedule and draw a graph of the market demand curve and Minnie's marginal revenue curve. Explain why Minnie's marginal revenue is less than the price.
- At what price is Minnie's total revenue maximized and over what price range is the demand for water elastic? Why will Minnie not produce a quantity at which the market demand is inelastic?
- Calculate Minnie's profit-maximizing output and price and economic profit.

### Single-Price Monopoly and Competition Compared (Study Plan 13.3)

- Use the data in Problem 2 to work this problem.
  - Use a graph to illustrate the producer surplus generated from Minnie's Mineral Springs' water production and consumption.

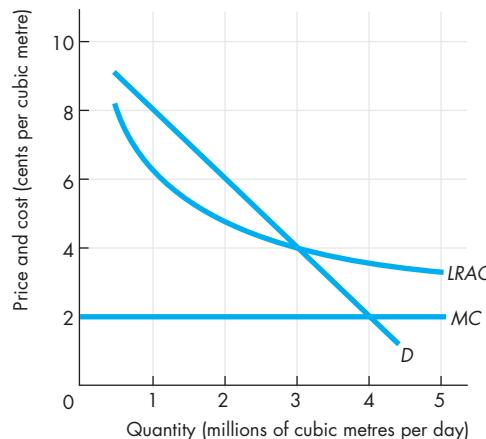
- Is Minnie's an efficient producer of water? Explain your answer.
- Suppose that new wells were discovered nearby to Minnie's and Minnie's faced competition from new producers. Explain what would happen to Minnie's output, price, and profit.

### Price Discrimination (Study Plan 13.4)

- La Bella Pizza can produce a pizza for a marginal cost of \$2. Its price of a pizza is \$15.
  - Could La Bella Pizza make a larger economic profit by offering a second pizza for \$5? Use a graph to illustrate your answer.
  - How might La Bella Pizza make even more economic profit? Would it then be more efficient than when it charged \$15 for each pizza?

### Monopoly Regulation (Study Plan 13.5)

Use the following figure to work Problems 7 to 9. The figure shows Calypso, a natural gas distributor. Calypso is a natural monopoly that cannot price discriminate.



What quantity will Calypso produce, what price will it charge, and what will be the total surplus and dead-weight loss if Calypso is:

- An unregulated profit-maximizing firm?
- Regulated to make zero economic profit?
- Regulated to be efficient?

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### Monopoly and How It Arises

Use the following list, which gives some information about seven firms, to answer Problems 10 and 11.

- Coca-Cola cuts its price below that of Pepsi in an attempt to increase its market share.
  - A single firm, protected by a barrier to entry, produces a personal service that has no close substitutes.
  - A barrier to entry exists, but the good has some close substitutes.
  - A firm offers discounts to students and seniors.
  - A firm can sell any quantity it chooses at the going price.
  - The government issues Nike an exclusive licence to produce golf balls.
  - A firm experiences economies of scale even when it produces the quantity that meets the entire market demand.
10. In which of the seven cases might monopoly arise?  
 11. Which of the seven cases are natural monopolies and which are legal monopolies? Which can price discriminate, which cannot, and why?

### A Single-Price Monopoly's Output and Price Decision

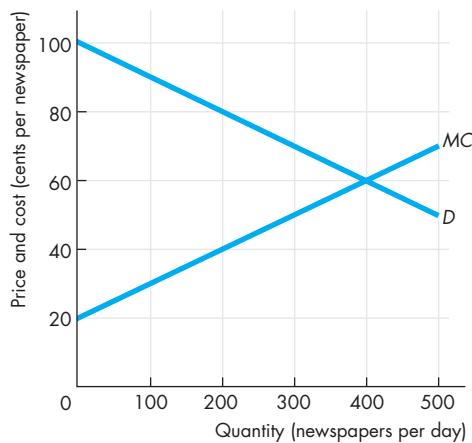
Use the following information to work Problems 12 to 16.

Hot Air Balloon Rides is a single-price monopoly. Columns 1 and 2 of the table set out the market demand schedule, and columns 2 and 3 set out the total cost schedule:

Price (dollars per ride)	Quantity (rides per month)	Total cost (dollars per month)
220	0	80
200	1	160
180	2	260
160	3	380
140	4	520
120	5	680

12. Construct Hot Air's total revenue and marginal revenue schedules.  
 13. Draw a graph of the market demand curve and Hot Air's marginal revenue curve.  
 14. Find Hot Air's profit-maximizing output and price and calculate the firm's economic profit.

15. If the government imposes a tax on Hot Air's profit, how do its output and price change?  
 16. If instead of taxing Hot Air's profit, the government imposes a sales tax on balloon rides of \$30 a ride, what are the new profit-maximizing quantity, price, and economic profit?  
 17. The figure illustrates the situation facing the publisher of the only newspaper containing local news in an isolated community.



- a. On the graph, mark the profit-maximizing quantity and price and the publisher's total revenue per day.  
 b. At the price charged, is the demand for this newspaper elastic or inelastic? Why?

### Single-Price Monopoly and Competition Compared

18. Show on the graph in Problem 17 the consumer surplus from newspapers and the deadweight loss created by the monopoly. Explain why this market might encourage rent seeking.  
 19. If the newspaper market in Problem 17 were perfectly competitive, what would be the quantity, price, consumer surplus, and producer surplus? Mark each on the graph.  
 20. **What the Apple-Samsung Verdict Means for Your Smartphone**  
 A California jury found Samsung guilty of violating the majority of the patents in question, including software features like double-tap zooming and scrolling. It recommended that Apple be awarded more than \$1 billion in damages. This verdict

could significantly affect both smartphone users and producers.

Source: CNN Money, August 26, 2012

- If Apple became a monopoly in the smartphone market, who would benefit and who would lose?
- Compared to a smartphone monopoly, who would benefit and who would lose if the smartphone market became perfectly competitive?
- Explain which market would be efficient: a perfectly competitive one or a monopoly.

### Price Discrimination

#### 21. AT&T Moves Away from Unlimited-Data Pricing

AT&T said it will eliminate its \$30 unlimited data plan as the crush of data use from the iPhone has hurt call quality. AT&T is introducing new plans costing \$15 a month for 200 megabytes of data traffic or \$25 a month for 2 gigabytes. AT&T says those who exceed 2 gigabytes of usage will pay \$10 a month for each additional gigabyte. AT&T hopes that these plans will attract more customers.

Source: *The Wall Street Journal*, June 2, 2010

- Explain why AT&T's new plans might be price discrimination.
- Draw a graph to illustrate the original plan and the new plans.

### Monopoly Regulation

#### 22. iSurrender

In 2008, getting your hands on the new iPhone meant signing a two-year AT&T contract. Some markets, because of the costs of being a player, tend toward either a single firm or a small number of firms. Everyone hoped the wireless market would be different. A telephone monopoly has been the norm for most of American telecommunication history, except for what may turn out to have been a brief experimental period from 1984 through 2012 or so. It may be that telephone monopolies in America are a national tradition.

Source: *Slate*, June 10, 2008

- How did AT&T, the exclusive provider of wireless service for the iPhone in 2008, influence the wireless telecommunication market?

- Explain why the wireless market might "tend toward either a single firm or a small number of firms." Why might this justify allowing a regulated monopoly to exist in this market?

### Economics in the News

- After you have studied *Economics in the News* on pp. 316–317, answer the following questions.
  - Why did the European regulators say that Google was misusing its monopoly power? Do you agree? Explain why or why not.
  - Explain why it would be inefficient to regulate Google to make it charge the same price per keyword click to all advertisers.
  - Explain why selling keywords to the highest bidder can lead to an efficient allocation of advertising resources.

#### 24. F.C.C. Planning Rules to Open Cable Market

The Federal Communications Commission (F.C.C.) is setting new regulations to open the cable television market to independent programmers and rival video services. The new rules will make it easier for small independent programmers to lease access to cable channels, and the size of the nation's largest cable companies will be capped at 30 percent of the market.

Source: *The New York Times*, November 10, 2007

- What barriers to entry exist in the cable television market?
- Are high cable prices evidence of monopoly power?
- Draw a graph to illustrate the effects of the F.C.C.'s new regulations on the price, quantity, total surplus, and deadweight loss.

#### 25. Antitrust Inquiry Launched into Intel

Intel, the world's largest chipmaker, holds 80 percent of the microprocessor market. Advanced Micro Devices complains that Intel stifles competition, but Intel says that the 42.4 percent fall in prices between 2000 and 2007 shows that this industry is fiercely competitive.

Source: *The Washington Post*, June 7, 2008

- Is Intel a monopoly in the chip market?
- Evaluate the argument made by Intel that the fall in prices "shows that this industry is fiercely competitive."



# 14

## MONOPOLISTIC COMPETITION

After studying this chapter,  
you will be able to:

- ◆ Define and identify monopolistic competition
- ◆ Explain how a firm in monopolistic competition determines its price and output in the short run and the long run
- ◆ Explain why advertising costs are high and why firms in monopolistic competition use brand names

At [tennis-warehouse.com](http://tennis-warehouse.com), you have a choice of racquets made by 19 producers. The top five have 265 different racquets to choose among. Tennis racquet producers compete, but each has a monopoly on its own special kind of racquet—the market is an example of monopolistic competition.

The model of monopolistic competition helps us to understand the competition that we see every day. And in *Economics in the News*, at the end of the chapter, we apply the model to the market for tennis racquets.



## What Is Monopolistic Competition?

You have studied perfect competition, in which a large number of firms produce at the lowest possible cost, make zero economic profit, and are efficient. You've also studied monopoly, in which a single firm restricts output, produces at a higher cost and price than in perfect competition, and is inefficient.

Most real-world markets are competitive but not perfectly competitive, because firms in these markets have some power to set their prices, as monopolies do. We call this type of market *monopolistic competition*.

**Monopolistic competition** is a market structure in which:

- A large number of firms compete.
- Each firm produces a differentiated product.
- Firms compete on product quality, price, and marketing.
- Firms are free to enter and exit the industry.

### Large Number of Firms

In monopolistic competition, as in perfect competition, the industry consists of a large number of firms. The presence of a large number of firms has three implications for the firms in the industry.

**Small Market Share** In monopolistic competition, each firm supplies a small part of the total industry output. Consequently, each firm has only limited power to influence the price of its product. Each firm's price can deviate from the average price of other firms by only a relatively small amount.

**Ignore Other Firms** A firm in monopolistic competition must be sensitive to the average market price of the product, but the firm does not pay attention to any one individual competitor. Because all the firms are relatively small, no one firm can dictate market conditions, and so no one firm's actions directly affect the actions of the other firms.

**Collusion Impossible** Firms in monopolistic competition would like to be able to conspire to fix a higher price—called *collusion*. But because the number of firms in monopolistic competition is large, coordination is difficult and collusion is not possible.

### Product Differentiation

A firm practises **product differentiation** if it makes a product that is slightly different from the products of competing firms. A differentiated product is one that is a close substitute but not a perfect substitute for the products of the other firms. Some people are willing to pay more for one variety of the product, so when its price rises, the quantity demanded of that variety decreases, but it does not (necessarily) decrease to zero. For example, Adidas, Asics, Brooks, Fila, New Balance, Nike, Puma, Reebok, and others all make differentiated running shoes. If the price of Adidas running shoes rises and the prices of the other shoes remain constant, Adidas sells fewer shoes and the other producers sell more. But Adidas shoes don't disappear unless the price rises by a large enough amount.

### Competing on Quality, Price, and Marketing

Product differentiation enables a firm to compete with other firms in three areas: product quality, price, and marketing.

**Quality** The quality of a product is the physical attributes that make it different from the products of other firms. Quality includes design, reliability, the service provided to the buyer, and the buyer's ease of access to the product. Quality lies on a spectrum that runs from high to low. Some firms—such as Dell Computer Corp.—offer high-quality products. They are well designed and reliable, and the customer receives quick and efficient service. Other firms offer a lower-quality product that is poorly designed, that might not work perfectly, and that is not supported by effective customer service.

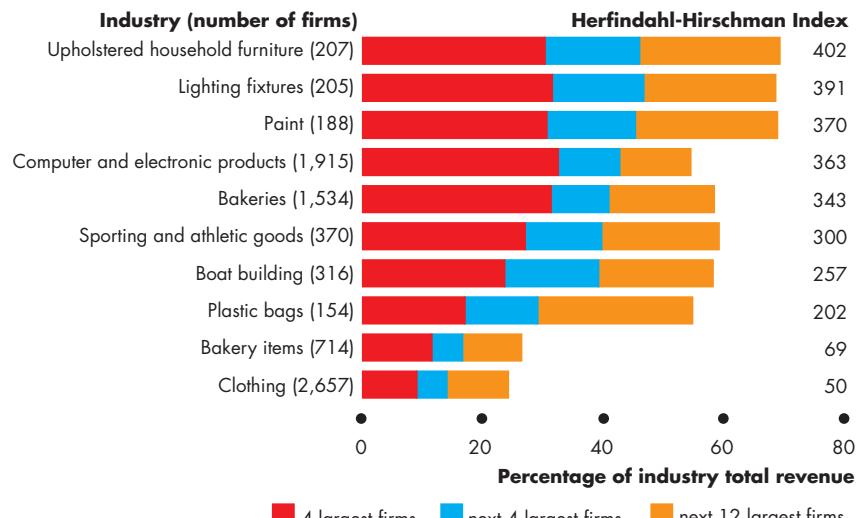
**Price** Because of product differentiation, a firm in monopolistic competition faces a downward-sloping demand curve. So, like a monopoly, the firm can set both its price and its output. But there is a tradeoff between the product's quality and price. A firm that makes a high-quality product can charge a higher price than a firm that makes a low-quality product.

**Marketing** Because of product differentiation, a firm in monopolistic competition must market its product. Marketing takes two main forms: advertising and packaging. A firm that produces a high-quality

## Economics in Action

### Monopolistic Competition Today

These ten industries operate in monopolistic competition. The number of firms in the industry is shown in parentheses after the name of the industry. The red bars show the percentage of industry sales by the 4 largest firms. The blue bars show the percentage of industry sales by the next 4 largest firms, and the orange bars show the percentage of industry sales by the next 12 largest firms. So the entire length of the combined red, blue, and orange bars shows the percentage of industry sales by the 20 largest firms. The Herfindahl-Hirschman Index is shown on the right.



#### Measures of Concentration

Source of data: Statistics Canada.

product wants to sell it for a suitably high price. To be able to do so, it must advertise and package its product in a way that convinces buyers that they are getting the higher quality for which they are paying a higher price. For example, pharmaceutical companies advertise and package their brand-name drugs to persuade buyers that these items are superior to the lower-priced generic alternatives. Similarly, a low-quality producer uses advertising and packaging to persuade buyers that although the quality is low, the low price more than compensates for this fact.

### Entry and Exit

Monopolistic competition has no barriers to prevent new firms from entering the industry in the long run. Consequently, a firm in monopolistic competition cannot make an economic profit in the long run. When existing firms make an economic profit, new firms enter the industry. This entry lowers prices and eventually eliminates economic profit. When firms incur economic losses, some firms leave the industry in the long run. This exit increases prices and eventually eliminates the economic loss.

In long-run equilibrium, firms neither enter nor leave the industry and the firms in the industry make zero economic profit.

### Examples of Monopolistic Competition

*Economics in Action* below shows 10 industries that are good examples of monopolistic competition. These industries have a large number of firms, which is shown in parentheses. In the market for upholstered household furniture, the 4 largest firms produce only 30 percent of the industry's total sales and the 20 largest firms produce 75 percent of total sales. The number on the right is the Herfindahl-Hirschman Index (see Chapter 10, p. 234).

### REVIEW QUIZ

- 1 What are the distinguishing characteristics of monopolistic competition?
- 2 How do firms in monopolistic competition compete?
- 3 Provide some examples of industries near your school that operate in monopolistic competition (excluding those in the figure below).

Work these questions in Study Plan 14.1 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

## Price and Output in Monopolistic Competition

Suppose you've been hired by Michael Budman and Don Green, the co-founders of Roots Canada Ltd., to manage the production and marketing of Roots jackets. Think about the decisions that you must make at Roots. First, you must decide on the design and quality of jackets and on your marketing program. Second, you must decide on the quantity of jackets to produce and the price at which to sell them.

We'll suppose that Roots has already made its decisions about design, quality, and marketing, and now we'll concentrate on its output and pricing decisions. We'll study quality and marketing decisions in the next section.

For a given quality of jackets and marketing activity, Roots faces given costs and market conditions. Given its costs and the demand for its jackets, how does Roots decide the quantity of jackets to produce and the price at which to sell them?

### The Firm's Short-Run Output and Price Decision

In the short run, a firm in monopolistic competition makes its output and price decision just like a monopoly firm does. Figure 14.1 illustrates this decision for Roots jackets.

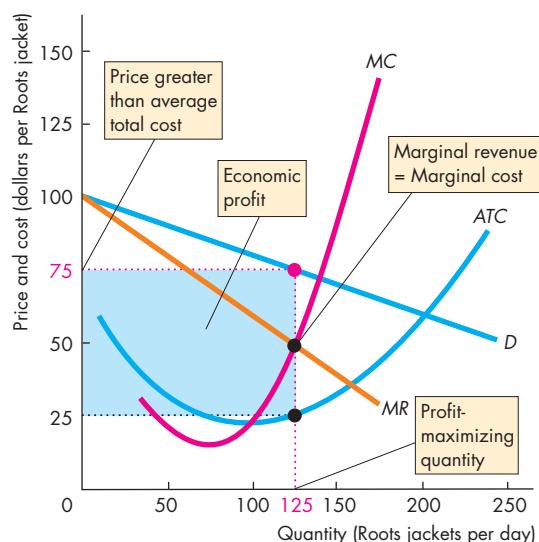
The demand curve for Roots jackets is  $D$ . This demand curve tells us the quantity of Roots jackets demanded at each price, given the prices of other jackets. It is not the demand curve for jackets in general.

The  $MR$  curve shows the marginal revenue curve associated with the demand curve for Roots jackets. It is derived in the same way as the marginal revenue curve of a single-price monopoly that you studied in Chapter 13.

The  $ATC$  curve and the  $MC$  curve show the average total cost and the marginal cost of producing Roots jackets.

Roots' goal is to maximize its economic profit. To do so, it produces the output at which marginal revenue equals marginal cost. In Fig. 14.1, this output is 125 jackets a day. Roots charges the price that buyers are willing to pay for this quantity, which is determined by the demand curve. This price is \$75 per jacket. When Roots produces 125 jackets a day, its average total cost is \$25 per jacket and it makes an economic profit of \$6,250 a day (\$50 per jacket

**FIGURE 14.1** Economic Profit in the Short Run



Roots maximizes profit by producing the quantity at which marginal revenue equals marginal cost, 125 jackets a day, and charging the price of \$75 a jacket. This price exceeds the average total cost of \$25 a jacket, so the firm makes an economic profit of \$50 a jacket. The blue rectangle illustrates economic profit, which equals \$6,250 a day (\$50 a jacket multiplied by 125 jackets a day).

**MyEconLab Animation and Draw Graph**

multiplied by 125 jackets a day). The blue rectangle shows Roots' economic profit.

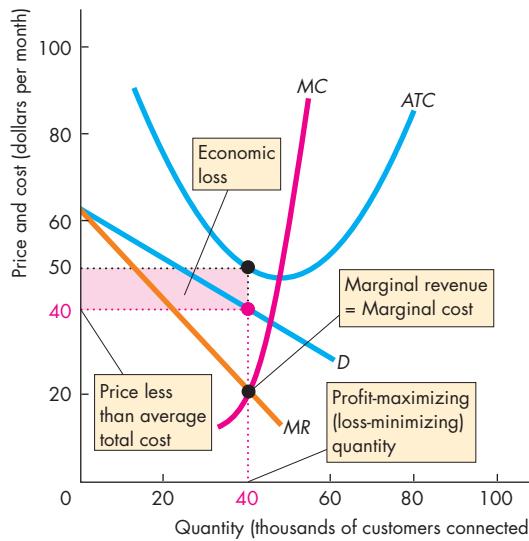
### Profit Maximizing Might Be Loss Minimizing

Figure 14.1 shows that Roots is making a large economic profit. But such an outcome is not inevitable. A firm might face a level of demand for its product that is too low for it to make an economic profit.

Excite@Home was such a firm. Offering high-speed Internet service over the same cable that provides television, Excite@Home hoped to capture a large share of the Internet portal market in competition with AOL, MSN, and a host of other providers.

Figure 14.2 illustrates the situation facing Excite@Home in 2001. The demand curve for its portal service is  $D$ , the marginal revenue curve is  $MR$ , the average total cost curve is  $ATC$ , and the marginal cost curve is  $MC$ . Excite@Home maximized profit—

**FIGURE 14.2** Economic Loss in the Short Run



Profit is maximized where marginal revenue equals marginal cost. The loss-minimizing quantity is 40,000 customers. The price of \$40 a month is less than the average total cost of \$50 a month, so the firm incurs an economic loss of \$10 a customer. The red rectangle illustrates economic loss, which equals \$400,000 a month (\$10 a customer multiplied by 40,000 customers).

#### MyEconLab Animation

equivalently, it minimized its loss—by producing the output at which marginal revenue equals marginal cost. In Fig. 14.2, this output is 40,000 customers. Excite@Home charged the price that buyers were willing to pay for this quantity, which was determined by the demand curve and which was \$40 a month. With 40,000 customers, Excite@Home's average total cost was \$50 per customer, so it incurred an economic loss of \$400,000 a month (\$10 a customer multiplied by 40,000 customers). The red rectangle shows Excite@Home's economic loss.

So far, the firm in monopolistic competition looks like a single-price monopoly. It produces the quantity at which marginal revenue equals marginal cost and then charges the price that buyers are willing to pay for that quantity, as determined by the demand curve. The key difference between monopoly and monopolistic competition lies in what happens next when firms either make an economic profit or incur an economic loss.

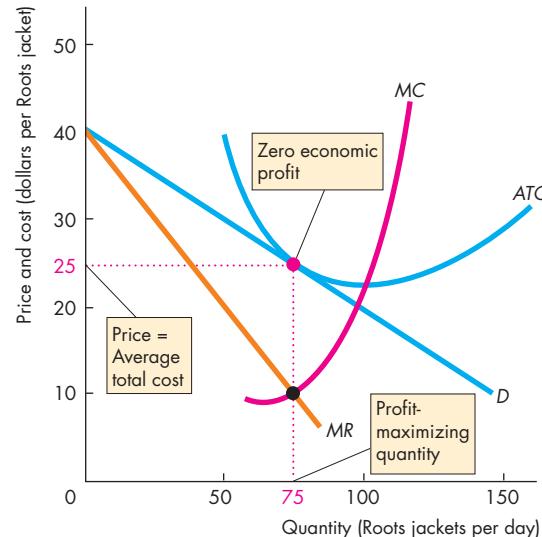
## Long Run: Zero Economic Profit

A firm like Excite@Home is not going to incur an economic loss for long. Eventually, it goes out of business. Also, there is no restriction on entry into monopolistic competition, so if firms in an industry are making economic profit, other firms have an incentive to enter that industry.

As the Gap and other firms start to make jackets similar to those made by Roots, the demand for Roots jackets decreases. The demand curve for Roots jackets and the marginal revenue curve shift leftward. As these curves shift leftward, the profit-maximizing quantity and price fall.

Figure 14.3 shows the long-run equilibrium. The demand curve for Roots jackets and the marginal revenue curve have shifted leftward. The firm produces 75 jackets a day and sells them for \$25 each. At this output level, average total cost is also \$25 per jacket.

**FIGURE 14.3** Output and Price in the Long Run



Economic profit encourages entry, which decreases the demand for each firm's product. When the demand curve touches the ATC curve at the quantity at which  $MR = MC$ , the market is in long-run equilibrium. The output that maximizes profit is 75 jackets a day, and the price is \$25 per jacket. Average total cost is also \$25 per jacket, so economic profit is zero.

#### MyEconLab Animation

So Roots is making zero economic profit on its jackets. When all the firms in the industry are making zero economic profit, there is no incentive for new firms to enter.

If demand is so low relative to costs that firms incur economic losses, exit will occur. As firms leave an industry, the demand for the products of the remaining firms increases and their demand curves shift rightward. The exit process ends when all the firms in the industry are making zero economic profit.

### Monopolistic Competition and Perfect Competition

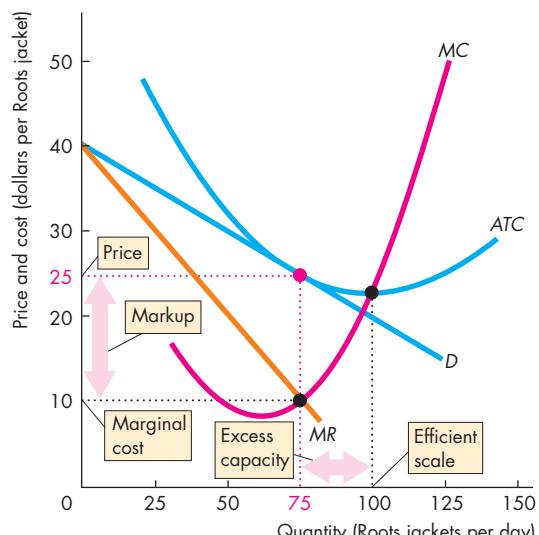
Figure 14.4 compares monopolistic competition and perfect competition and highlights two key differences between them:

- Excess capacity
- Markup

**Excess Capacity** A firm has **excess capacity** if it produces less than its **efficient scale**, which is the quantity at which average total cost is a minimum—the quantity at the bottom of the U-shaped *ATC* curve. In Fig. 14.4, the efficient scale is 100 jackets a day. Roots in part (a) produces 75 Roots jackets a day and has *excess capacity* of 25 jackets a day. But if all jackets are alike and are produced by firms in perfect competition, each firm in part (b) produces 100 jackets a day, which is the efficient scale. Average total cost is the lowest possible only in *perfect competition*.

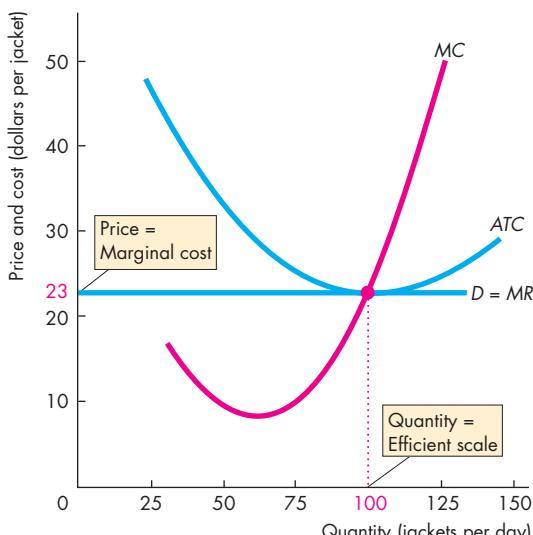
You can see the excess capacity in monopolistic competition all around you. Family restaurants (except for the truly outstanding ones) almost always have some empty tables. You can always get a pizza delivered in less than 30 minutes. It is rare that every pump at a gas station is in use with customers waiting in line. Many realtors are ready to help you find or sell a home. These industries are examples of monopolistic competition. The firms have excess capacity.

**FIGURE 14.4** Excess Capacity and Markup



(a) Monopolistic competition

The efficient scale is 100 jackets a day. In monopolistic competition in the long run, because the firm faces a downward-sloping demand curve for its product, the quantity produced is less than the efficient scale and the firm has excess capacity. Price exceeds marginal cost by the amount of the markup.



(b) Perfect competition

In contrast, because in perfect competition the demand for each firm's product is perfectly elastic, the quantity produced in the long run equals the efficient scale and price equals marginal cost. The firm produces at the least possible cost and there is no markup.

They could sell more by cutting their prices, but they would then incur economic losses.

**Markup** A firm's **markup** is the amount by which price exceeds marginal cost. Figure 14.4(a) shows Roots' markup. In perfect competition, marginal cost always equals price, so there is no markup. Figure 14.4(b) shows this case. In monopolistic competition, buyers pay a higher price than in perfect competition and also pay more than marginal cost.

### Is Monopolistic Competition Efficient?

Resources are used efficiently when marginal social benefit equals marginal social cost. Price equals marginal social benefit and the firm's marginal cost equals marginal social cost (assuming there are no external benefits or costs). So if the price of a Roots jacket exceeds the marginal cost of producing it, the quantity of Roots jackets produced is less than the efficient quantity. And you've just seen that in long-run equilibrium in monopolistic competition, price *does* exceed marginal cost. So is the quantity produced in monopolistic competition less than the efficient quantity?

**Making the Relevant Comparison** Two economists meet in the street, and one asks the other, "How is your husband?" The quick reply is "Compared to what?" This bit of economic wit illustrates a key point: Before we can conclude that something needs fixing, we must check out the available alternatives.

The markup that drives a gap between price and marginal cost in monopolistic competition arises from product differentiation. It is because Roots jackets are not quite the same as jackets from Banana Republic, CK, Diesel, DKNY, Earl Jackets, Gap, Levi's, Ralph Lauren, or any of the other dozens of producers of jackets that the demand for Roots jackets is not perfectly elastic. The only way in which the demand for jackets from Roots might be perfectly elastic is if there were only one kind of jacket and all firms made it. In this situation, Roots jackets are indistinguishable from all other jackets. They don't even have identifying labels.

If there were only one kind of jacket, the total benefit of jackets would almost certainly be less than it is with variety. People value variety—not only because it enables each person to select what he or she likes best but also because it provides an external benefit. Most of us enjoy seeing variety in the choices of

others. Contrast a scene from the China of the 1960s, when everyone wore a Mao tunic, with the China of today, where everyone wears the clothes of their own choosing. Or contrast a scene from the Germany of the 1930s, when almost everyone who could afford a car owned a first-generation Volkswagen Beetle, with the world of today with its enormous variety of styles and types of automobiles.

If people value variety, why don't we see infinite variety? The answer is that variety is costly. Each different variety of any product must be designed, and then customers must be informed about it. These initial costs of design and marketing—called setup costs—mean that some varieties that are too close to others already available are just not worth creating.

**The Bottom Line** Product variety is both valued and costly. The efficient degree of product variety is the one for which the marginal social benefit of product variety equals its marginal social cost. The loss that arises because the quantity produced is less than the efficient quantity is offset by the gain that arises from having a greater degree of product variety. So compared to the alternative—product uniformity—monopolistic competition might be efficient.

### REVIEW QUIZ

- 1 How does a firm in monopolistic competition decide how much to produce and at what price to offer its product for sale?
- 2 Why can a firm in monopolistic competition make an economic profit only in the short run?
- 3 Why do firms in monopolistic competition operate with excess capacity?
- 4 Why is there a price markup over marginal cost in monopolistic competition?
- 5 Is monopolistic competition efficient?

Work these questions in Study Plan 14.2 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

You've seen how the firm in monopolistic competition determines its output and price in both the short run and the long run when it produces a given product and undertakes a *given* marketing effort. But how does the firm choose its product quality and marketing effort? We'll now study these decisions.



## Product Development and Marketing

When Roots made its output and pricing decisions that we've just studied, it had already made its product quality and marketing decisions. We'll now look at these decisions and see how they influence the firm's output, price, and economic profit.

### Product Development

The prospect of new firms entering the industry keeps firms in monopolistic competition on their toes! To enjoy economic profits, they must continually seek ways of keeping one step ahead of imitators—other firms who imitate the success of profitable firms.

To maintain economic profit, a firm must either develop an entirely new product, or develop a significantly improved product that provides it with a competitive edge, even if only temporarily. A firm that introduces a new or improved and more differentiated product faces a demand that is less elastic and is able to increase its price and make an economic profit. Eventually, imitators will make close substitutes for the firm's new product and compete away the economic profit arising from an initial advantage. So to restore economic profit, the firm must develop another new or seriously improved product.

**Profit-Maximizing Product Development** The decision to develop a new or improved product is based on the same type of profit-maximizing calculation that you've already studied.

Product development is a costly activity, but it also brings in additional revenue. The firm must balance the cost and revenue at the margin.

The marginal dollar spent on developing a new or improved product is the marginal cost of product development. The marginal dollar that the new or improved product earns for the firm is the marginal revenue of product development. At a low level of product development, the marginal revenue from a better product exceeds the marginal cost. At a high level of product development, the marginal cost of a better product exceeds the marginal revenue.

When the marginal cost and marginal revenue of product development are equal, the firm is undertaking the profit-maximizing amount of product development.

**Efficiency and Product Development** Is the profit-maximizing amount of product development also the efficient amount? Efficiency is achieved if the marginal social benefit of a new and improved product equals its marginal social cost.

The marginal social benefit of an improved product is the increase in price that consumers are willing to pay for it. The marginal social cost is the amount that the firm must pay to make the improvement. Profit is maximized when marginal *revenue* equals marginal cost. But in monopolistic competition, marginal revenue is less than price, so product development is probably not pushed to its efficient level.

Monopolistic competition brings many product changes that cost little to implement and are purely cosmetic, such as improved packaging or a new scent in laundry powder. Even when there is a truly improved product, it is never as good as the consumer would like and for which the consumer is willing to pay a higher price. For example, "The Legend of Zelda: Skyward Sword" is regarded as an almost perfect and very cool game, but users complain that it isn't quite perfect. It is a game whose features generate a marginal revenue equal to the marginal cost of creating them.

### Advertising

A firm with a differentiated product needs to ensure that its customers know how its product is different from the competition. A firm also might attempt to create a consumer perception that its product is different, even when that difference is small. Firms use advertising and packaging to achieve this goal.

**Advertising Expenditures** Firms in monopolistic competition incur huge costs to ensure that buyers appreciate and value the differences between their own products and those of their competitors. So a large proportion of the price that we pay for a good covers the cost of selling it, and this proportion is increasing. Advertising in newspapers and magazines and on radio, television, and the Internet is the main selling cost. But it is not the only one. Selling costs include the cost of shopping malls that look like movie sets, glossy catalogues and brochures, and the salaries, airfares, and hotel bills of salespeople.

Advertising expenditures affect the profits of firms in two ways: They increase costs, and they change demand. Let's look at these effects.

## Economics in Action

### The Cost of Selling a Pair of Shoes

When you buy a pair of running shoes that cost you \$110, you're paying \$14.25 for the materials from which the shoes are made, \$4.25 for the services of the Malaysian worker who made the shoes, and \$8.25 for the production and transportation services of a manufacturing firm in Asia and a shipping company. These numbers total \$26.75. You pay \$5.25 to the Canadian government in import duty. So we've now accounted for a total of \$32. Where did the other \$78 go? It is the cost of advertising, retailing, and other sales and distribution services.

The selling costs associated with running shoes are not unusual. Almost everything that you buy includes a selling cost component that exceeds one-half of the total cost. Your clothing, food, electronic items, DVDs, magazines, and even your textbooks cost more to sell than they cost to manufacture.

Advertising costs are only a part, and often a small part, of total selling costs. For example, Nike spends about \$6.25 on advertising per pair of shoes sold.

For the North American economy as a whole, there are some 20,000 advertising agencies, which employ more than 200,000 people and have sales of \$45 billion. These numbers are only part of the total cost of advertising because firms have their own internal advertising departments, the costs of which we can only guess.

But the biggest part of selling costs is not the cost of advertising. It is the cost of retailing services. The retailer's selling costs (and economic profit) are often as much as 50 percent of the price you pay.

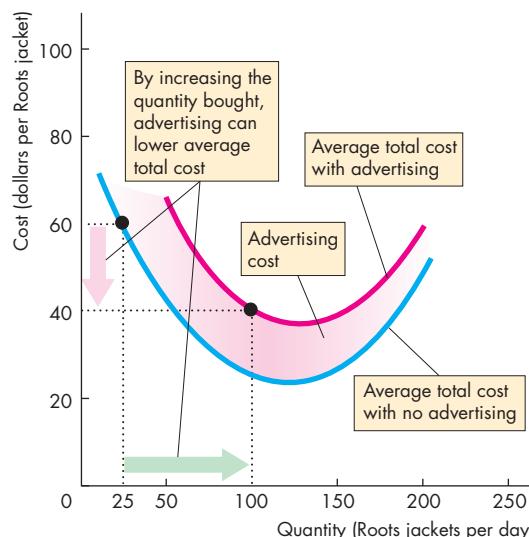


**Selling Costs and Total Cost** Selling costs are fixed costs and they increase the firm's total cost. So like the fixed cost of producing a good, advertising costs per unit decrease as the quantity produced increases.

Figure 14.5 shows how selling costs change a firm's average total cost. The blue curve shows the average total cost of production. The red curve shows the firm's average total cost of production plus advertising. The height of the red area between the two curves shows the average fixed cost of advertising. The *total* cost of advertising is fixed. But the *average* cost of advertising decreases as output increases.

Figure 14.5 shows that if advertising increases the quantity sold by a large enough amount, it can lower average total cost. For example, if the quantity sold increases from 25 jackets a day with no advertising to 100 jackets a day with advertising, average total cost falls from \$60 to \$40 a jacket. The reason is that although the *total* fixed cost has increased, the greater fixed cost is spread over a greater output, so average total cost decreases.

**FIGURE 14.5** Selling Costs and Total Cost



Selling costs such as the cost of advertising are fixed costs. When added to the average total cost of production, selling costs increase average total cost by a greater amount at small outputs than at large outputs. If advertising enables sales to increase from 25 jackets a day to 100 jackets a day, average total cost falls from \$60 to \$40 a jacket.

**MyEconLab Animation**

**Selling Costs and Demand** Advertising and other selling efforts change the demand for a firm's product. But how? Does demand increase or does it decrease? The most natural answer is that advertising increases demand. By informing people about the quality of its products or by persuading people to switch from the products of other firms, a firm might expect to increase the demand for its own products.

But all firms in monopolistic competition advertise, and all seek to persuade customers that they have the best deal. If advertising enables a firm to survive, the number of firms in the market might increase. And to the extent that the number of firms does increase, advertising *decreases* the demand faced by any one firm. It also makes the demand for any one firm's product more elastic. So advertising can end up not only lowering average total cost but also lowering the markup and the price.

Figure 14.6 illustrates this possible effect of advertising. In part (a), with no advertising, the demand for Roots jackets is not very elastic. Profit is

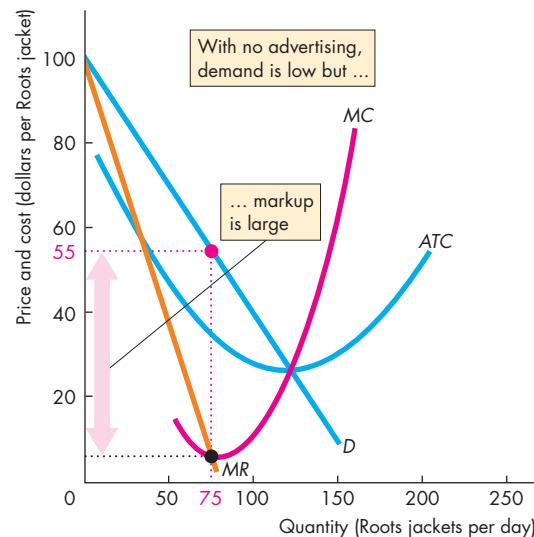
maximized at 75 jackets per day, and the markup is large. In part (b), advertising, which is a fixed cost, increases average total cost from  $ATC_0$  to  $ATC_1$  but leaves marginal cost unchanged at  $MC$ . Demand becomes much more elastic, the profit-maximizing quantity increases, and the markup shrinks.

### Using Advertising to Signal Quality

Some advertising, like the Roger Federer Rolex watch ad in glossy magazines or the huge number of dollars that Coke and Pepsi spend, seems hard to understand. There doesn't seem to be any concrete information about a watch in a tennis player's smile. And surely everyone knows about Coke and Pepsi. What is the gain from pouring millions of dollars into advertising these well-known colas?

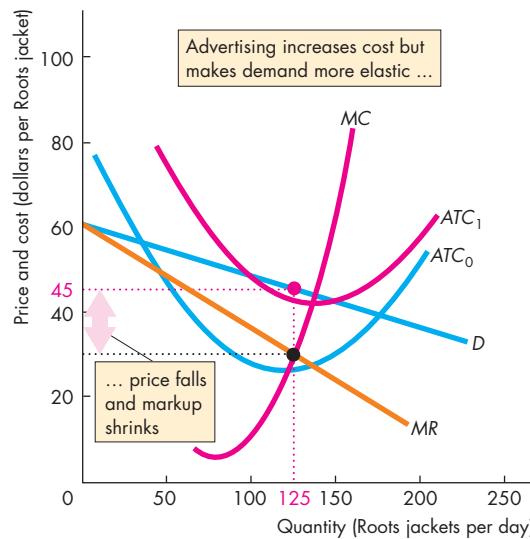
One answer is that advertising is a signal to the consumer of a high-quality product. A **signal** is an action taken by an informed person (or firm) to send a message to uninformed people. Think about two colas:

**FIGURE 14.6** Advertising and the Markup



(a) No firms advertise

If no firms advertise, demand for each firm's product is low and not very elastic. The profit-maximizing output is small, the markup is large, and the price is high.



(b) All firms advertise

Advertising increases average total cost and shifts the  $ATC$  curve upward from  $ATC_0$  to  $ATC_1$ . If all firms advertise, the demand for each firm's product becomes more elastic. Output increases, the price falls, and the markup shrinks.

Coke and Oke. Oke knows that its cola is not very good and that its taste varies a lot depending on which cheap batch of unsold cola it happens to buy each week. So Oke knows that while it could get a lot of people to try Oke by advertising, they would all quickly discover what a poor product it is and switch back to the cola they bought before. Coke, in contrast, knows that its product has a high-quality, consistent taste and that once consumers have tried it, there is a good chance they'll never drink anything else. On the basis of this reasoning, Oke doesn't advertise but Coke does. And Coke spends a lot of money to make a big splash.

Cola drinkers who see Coke's splashy ads know that the firm would not spend so much money advertising if its product were not truly good. So consumers reason that Coke is indeed a really good product. The flashy expensive ad has signalled that Coke is really good without saying anything about Coke.

Notice that if advertising is a signal, it doesn't need any specific product information. It just needs to be expensive and hard to miss. That's what a lot of advertising looks like. So the signalling theory of advertising predicts much of the advertising that we see.

## Brand Names

Many firms create and spend a lot of money promoting a brand name. Why? What benefit does a brand name bring to justify the sometimes high cost of establishing it?

The basic answer is that a brand name provides information to consumers about the quality of a product and is an incentive to the producer to achieve a high and consistent quality standard.

To see how a brand name helps the consumer, think about how you use brand names to get information about quality. You're on a road trip, and it is time to find a place to spend the night. You see roadside advertisements for Holiday Inn, Joe's Motel, and Annie's Driver's Stop. You know about Holiday Inn because you've stayed in it before. You've also seen their advertisements and know what to expect. You have no information at all about Joe's and Annie's. They might be better than the lodgings you do know about, but without that knowledge, you're not going to try them. You use the brand name as information and stay at Holiday Inn.

This same story explains why a brand name provides an incentive to achieve high and consistent quality. Because no one would know whether Joe's and Annie's were offering a high standard of service, they

have no incentive to do so. But equally, because everyone expects a given standard of service from Holiday Inn, a failure to meet a customer's expectation would almost surely lose that customer to a competitor. So Holiday Inn has a strong incentive to deliver what it promises in the advertising that creates its brand name.

## Efficiency of Advertising and Brand Names

To the extent that advertising and brand names provide consumers with information about the precise nature of product differences and product quality, they benefit the consumer and enable a better product choice to be made. But the opportunity cost of the additional information must be weighed against the gain to the consumer.

The final verdict on the efficiency of monopolistic competition is ambiguous. In some cases, the gains from extra product variety offset the selling costs and the extra cost arising from excess capacity. The tremendous varieties of books, magazines, clothing, food, and drinks are examples of such gains. It is less easy to see the gains from being able to buy a brand-name drug with the identical chemical composition to that of a generic alternative, but many people willingly pay more for the brand-name alternative.

## REVIEW QUIZ

- 1 How, other than by adjusting price, do firms in monopolistic competition compete?
- 2 Why might product innovation be efficient and why might it be inefficient?
- 3 Explain how selling costs influence a firm's cost curves and its average total cost.
- 4 Explain how advertising influences the demand for a firm's product.
- 5 Are advertising and brand names efficient?

Work these questions in Study Plan 14.3 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

◆ Monopolistic competition is one of the most common market structures that you encounter in your daily life. *Economics in the News* on pp. 334–335 applies the model of monopolistic competition to the market for tennis racquets and shows why you can expect continual innovation and the introduction of new racquets from Babolat, Wilson, Head, Prince, Dunlop, and other racquet producers.



# Product Differentiation in Tennis Racquets

## Big Serves, Big Data: The First Connected Tennis Racquet

*Popular Mechanics*

November 7, 2013

Tennis players know all about the feel of hitting the sweet spot in the strings. Now they can back up that feeling with facts. The first tennis racquet with an on/off switch is also the first racquet to track stroke data, including where the ball hits the string bed.

The Babolat Play Pure Drive Set will launch on Dec. 12. Babolat, a French racquet manufacturer founded in 1875, revealed the racquet to PopMech early, showing off the culmination of a 10-year project.

CEO Eric Babolat envisioned the connected racquet a decade ago, but it took time for sensor technology to shrink down and lighten up enough so that he wouldn't have to strap a backpack and wires to players. ...

Babolat teamed with French firm Movea, the company behind the Nintendo Wii remote, to build the digital guts. Inside the otherwise-hollow grip they placed an accelerometer and gyroscope along with a 6-hour battery, USB port, Bluetooth connectivity, and enough memory to hold 150 hours of play data. ...

The Babolat Play detects stroke type—forehand, backhand, smash, and first and second serves—measures spin and power, tracks rally length and play time, and maps out the location the ball strikes the string bed. The racquet saves all that data, which is available for download to an app via either Bluetooth to Android or Apple mobile devices, or USB to a computer. In two test sessions, the app distilled the information accurately.

...  
The app saves training and match sessions, shares information in a community setting, and compares data head-to-head with friends or top players—so you can see how well you stack up against a champion like [Rafael] Nadal. ...

“The oldest company in tennis is making tennis cool,” Eric Babolat says. All with an on/off switch.

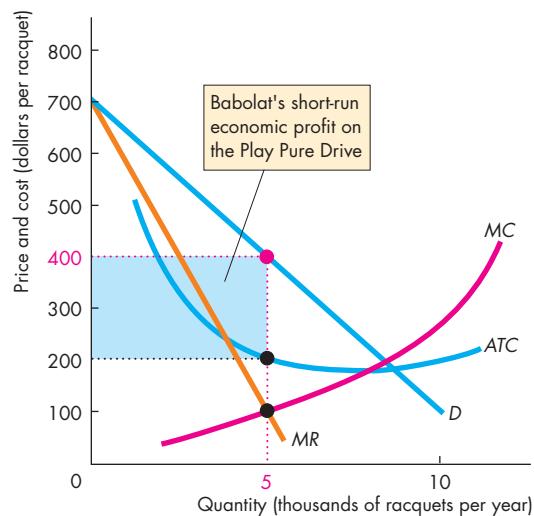
Written by Tim Newcomb. Copyright © 2013 by *Popular Mechanics*. Used by permission.

### ESSENCE OF THE STORY

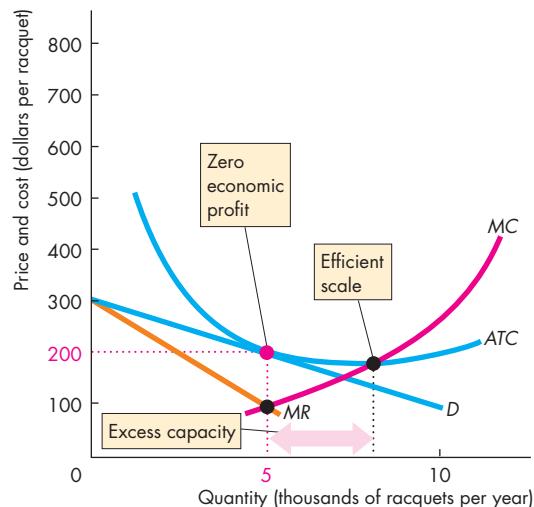
- Babolat, a French tennis racquet manufacturer, has created a tennis racquet that tracks and stores stroke data.
- Babolat started making tennis racquets in 1875.
- CEO Eric Babolat envisioned the racquet 10 years ago, but the technology needed was not then available.
- Babolat worked with the company behind the Nintendo Wii remote to create the new racquet.
- The oldest company in tennis is at the forefront of racquet technology.

## ECONOMIC ANALYSIS

- The market for tennis racquets is an example of monopolistic competition.
- Nineteen firms compete in a market with up to 1,000 differentiated racquets.
- Although the racquets are differentiated, most of them are close substitutes for each other.
- Close substitutes have highly elastic demand, so markups are low and economic profit is competed away.
- To make an economic profit, a firm must keep innovating.
- The market for tennis racquets has seen a sequence of innovation: metal frame (Wilson, 1967), oversize frame (Prince, 1976), and graphite frame (Prince, 1980).
- Today's innovation is Babolat's Play Pure Drive electronic racquet described in the news article.
- By creating a substantially differentiated product, Babolat was able to bring to the market a product more clearly differentiated from its competitors.
- The monopolistic competition model explains what is now happening at Babolat and what the future holds.
- Figure 1 shows the market for Babolat's electronic racquet. (The numbers are assumptions.)
- Because Babolat's smart racquet differs from other racquets and has features that users value, the demand curve,  $D$ , and marginal revenue curve,  $MR$ , provide a large short-run profit opportunity.
- The marginal cost curve is  $MC$  and the average total cost curve is  $ATC$ . Babolat maximizes its economic profit by producing the quantity at which marginal revenue equals marginal cost.
- This quantity of racquets can be sold for \$400 each.
- The blue rectangle shows Babolat's economic profit.
- Because Babolat makes an economic profit, entry will take place. Dunlop, Head, Prince, and Wilson will enter the smart racquet market.
- Figure 2 shows the consequences of entry for Babolat.
- The demand for the Babolat racquet decreases as the market is shared with the other racquets.
- Babolat's profit-maximizing price for the electronic racquet falls, and in the long run economic profit is eliminated.



**Figure 1 Economic Profit in the Short Run**



**Figure 2 Zero Economic Profit in the Long Run**

- With zero economic profit, Babolat (along with the other producers) has an incentive to develop an even better differentiated racquet and start the cycle described here again, making an economic profit with a new racquet in the short run.



## SUMMARY

### Key Points

#### What Is Monopolistic Competition? (pp. 324–325)

- Monopolistic competition occurs when a large number of firms compete with each other on product quality, price, and marketing.

Working Problems 1 and 2 will give you a better understanding of what monopolistic competition is.

#### Price and Output in Monopolistic Competition

(pp. 326–329)

- Each firm in monopolistic competition faces a downward-sloping demand curve and produces the profit-maximizing quantity.
- Entry and exit result in zero economic profit and excess capacity in long-run equilibrium.

Working Problems 3 to 8 will give you a better understanding of price and output in monopolistic competition.

#### Product Development and Marketing (pp. 330–333)

- Firms in monopolistic competition innovate and develop new products.
- Advertising expenditures increase total cost, but average total cost might fall if the quantity sold increases by enough.
- Advertising expenditures might increase demand, but demand might decrease if competition increases.
- Whether monopolistic competition is inefficient depends on the value we place on product variety.

Working Problem 9 will give you a better understanding of product development and marketing.

### Key Terms

Efficient scale, 328

Excess capacity, 328

Markup, 329

Monopolistic competition, 324

### MyEconLab Key Terms Quiz

Product differentiation, 324

Signal, 332



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 14 Study Plan.

The table provides information about Prue's Personal Trainer Service, a firm that is in monopolistic competition with similar firms that offer slightly differentiated services.

Demand schedule		Production costs	
Price (dollars per session)	Quantity (sessions per hour)	MC (dollars per session)	ATC (dollars per session)
45	0	..	..
40	1	12	33
35	2	5	19
30	3	7	15
25	4	27	18

### Questions

- Calculate Prue's profit-maximizing quantity and price.
- What is Prue's markup and does she have excess capacity?
- Is Prue in a long-run equilibrium?

### Solutions

- The profit-maximizing quantity is that at which marginal cost equals marginal revenue. The table above provides the marginal cost data. For example, the marginal cost of the 4th session per hour is \$27. The table below shows the calculation of marginal revenue. Multiply quantity by price to find total revenue (third column) and then calculate the change in total revenue when the quantity increases by 1 session (fourth column).

Demand schedule		Total revenue (dollars per hour)	Marginal revenue (dollars per session)
Price (dollars per session)	Quantity (sessions per hour)	.....	.....
45	0	0	..... 40
40	1	40	..... 30
35	2	70	..... 20
30	3	90	..... 10
25	4	100	

When the number of sessions increases from 2 to 3 an hour, marginal revenue (\$20) exceeds marginal cost (\$7), so profit increases. But when the number of sessions increases from 3 to 4 an hour, marginal cost (\$27) exceeds marginal revenue (\$10), so profit decreases. So 3 sessions an hour maximizes Prue's profit. The highest price at which 3 sessions an hour can be sold is \$30 a session, which is the profit-maximizing price.

**Key Point:** To maximize profit, increase production if  $MR > MC$  and decrease production if  $MR < MC$ .

- To find Prue's markup, we compare price to marginal cost. Use the fact that  $MC = ATC$  at minimum  $ATC$  and notice that minimum  $ATC$  is \$15 a session at 3 sessions an hour. The price is \$30 a session, so the markup is 100 percent. Prue is producing at minimum  $ATC$ , which is the efficient scale, so she has no excess capacity.

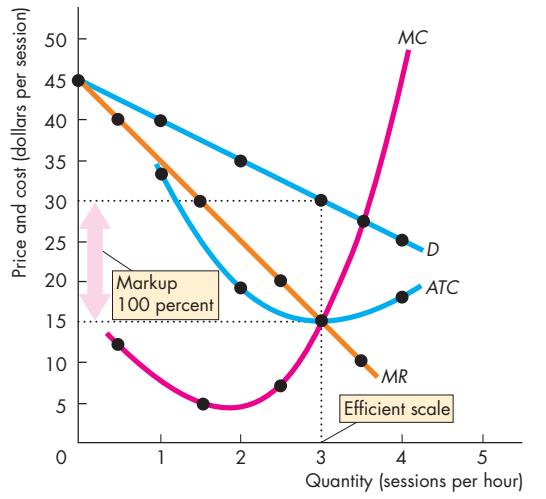
**Key Point:** Markup is the amount by which price exceeds marginal cost; and excess capacity is the gap between output and the efficient scale.

- In the long run, entry decreases demand and drives economic profit to zero. Prue is making a profit of \$45 an hour (price of \$30 a session minus  $ATC$  of \$15 a session, multiplied by 3 sessions an hour). So Prue is not in a long-run equilibrium.

**Key Point:** Entry decreases the demand for the firm's good or service and economic profit falls to zero.

The key figure illustrates Prue's short-run equilibrium situation.

### Key Figure



**MyEconLab Interactive Animation**

## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 9 in Chapter 14 Study Plan and get instant feedback.

### What Is Monopolistic Competition? (Study Plan 14.1)

- Which of the following items are sold by firms in monopolistic competition? Explain your selections.
  - Cable television service
  - Wheat
  - Athletic shoes
  - Soft drinks
  - Toothbrushes
  - Ready-mix concrete
- The four-firm concentration ratio for audio equipment makers is 30, and for electric lamp makers it is 89. The HHI for audio equipment makers is 415, and for electric lamp makers it is 2,850. Which of these markets is an example of monopolistic competition?

### Price and Output in Monopolistic Competition (Study Plan 14.2)

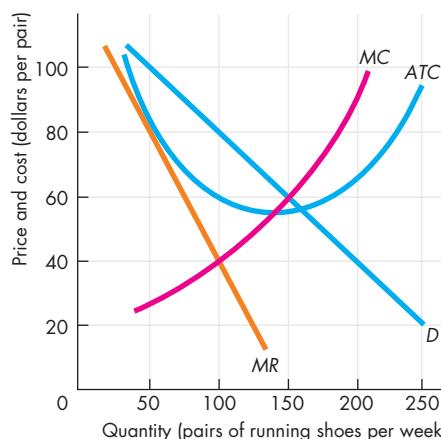
Use the following information to work Problems 3 and 4.

Sara is a dot.com entrepreneur who has established a Web site at which people can design and buy sweatshirts. Sara pays \$1,000 a week for her Web server and Internet connection. The sweatshirts that her customers design are made to order by another firm, and Sara pays this firm \$20 a sweatshirt. Sara has no other costs. The table sets out the demand schedule for Sara's sweatshirts.

Price (dollars per sweatshirt)	Quantity demanded (sweatshirts per week)
0	100
20	80
40	60
60	40
80	20
100	0

- Calculate Sara's profit-maximizing output, price, and economic profit.
- a. Do you expect other firms to enter the Web sweatshirt business and compete with Sara?  
b. What happens to the demand for Sara's sweatshirts in the long run? What happens to Sara's economic profit in the long run?

Use the following figure, which shows the situation facing Flight Inc., a producer of running shoes, to work Problems 5 to 8.



- What quantity does Flight produce, what price does it charge, and what is its economic profit?
- In the long run, how does Flight change its price and the quantity it produces? What happens to the market output of running shoes?
- Does Flight have excess capacity in the long run? If it has excess capacity in the long run, why doesn't it decrease its capacity?
- Is the market for running shoes efficient or inefficient in the long run? Explain your answer.

### Product Development and Marketing

(Study Plan 14.3)

- Suppose that Roots' marginal cost of a jacket is a constant \$100 and the total fixed cost at one of its stores is \$2,000 a day. This store sells 20 jackets a day, which is its profit-maximizing number of jackets. Then the stores nearby start to advertise their jackets. The Roots store now spends \$2,000 a day advertising its jackets, and its profit-maximizing number of jackets sold jumps to 50 a day.
  - What is this store's average total cost of a jacket sold (i) before the advertising begins and (ii) after the advertising begins?
  - Can you say what happens to the price of a Roots jacket, Roots' markup, and Roots' economic profit? Why or why not?



## ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### What Is Monopolistic Competition?

10. Which of the following items are sold by firms in monopolistic competition? Explain your selection.
  - Orange juice
  - Canned soup
  - PCs
  - Chewing gum
  - Breakfast cereals
  - Corn
  
11. The HHI for automobiles is 2,350, for sporting goods it is 161, for batteries it is 2,883, and for jewellery it is 81. Which of these markets is an example of monopolistic competition?

### Price and Output in Monopolistic Competition

Use the following data to work Problems 12 and 13.

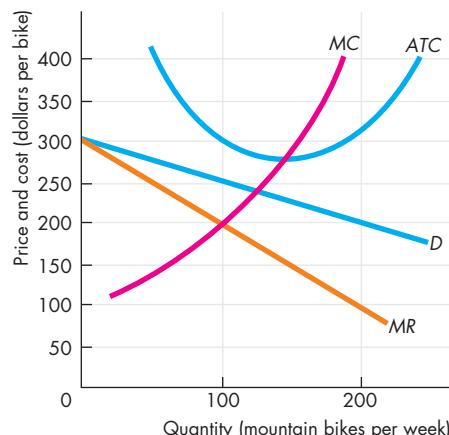
Lorie teaches singing. Her fixed costs are \$1,000 a month, and it costs her \$50 of labour to give one class. The table shows the demand schedule for Lorie's singing lessons.

Price (dollars per lesson)	Quantity demanded (lessons per month)
0	250
50	200
100	150
150	100
200	50
250	0

12. Calculate Lorie's profit-maximizing output, price, and economic profit.
13. a. Do you expect other firms to enter the singing lesson business and compete with Lorie?  
b. What happens to the demand for Lorie's lessons in the long run? What happens to Lorie's economic profit in the long run?

Use the figure in the next column, which shows the situation facing Mike's Bikes, a producer of mountain bikes, to work Problems 14 to 18. The demand and costs of other mountain bike producers are similar to those of Mike's Bikes.

14. What quantity does the firm produce and what is its price? Calculate the firm's economic profit or economic loss.



15. What will happen to the number of firms producing mountain bikes in the long run?
16. a. How will the price of a mountain bike and the number of bikes produced by Mike's Bikes change in the long run?  
b. How will the quantity of mountain bikes produced by all firms change in the long run?
17. Is there any way for Mike's Bikes to avoid having excess capacity in the long run?
18. Is the market for mountain bikes efficient or inefficient in the long run? Explain your answer.

Use the following news clip to work Problems 19 and 20.

### Groceries for the Gourmet Palate

No food, it seems, is safe from being repackaged to look like an upscale product. Samuel Adams' \$120 Utopias, in a ridiculous copper-covered 24-oz. bottle meant to resemble an old-fashioned brew kettle, is barely beer. It's not carbonated like a Bud, but aged in oak barrels like scotch. It has a vintage year, like a Bordeaux, is light, complex, and free of any alcohol sting, despite having six times as much alcohol content as a regular can of brew.

Source: *Time*, April 14, 2008

19. a. Explain how Samuel Adams has differentiated its Utopias to compete with other beer brands in terms of quality, price, and marketing.  
b. Predict whether Samuel Adams produces at, above, or below the efficient scale in the short run.

20. a. Predict whether the \$120 price tag on the Utopias is at, above, or below marginal cost: (i) in the short run and (ii) in the long run.  
 b. Do you think that Samuel Adams' Utopias makes the market for beer inefficient?

Use the following news clip to work Problems 21 and 22.

### Swinging for Female Golfers

One of the hottest areas of innovation is in clubs for women, who now make up nearly a quarter of the 24 million golfers in the United States. Callaway and Nike, two of the leading golf-equipment manufacturers, recently released new clubs designed for women.

Source: *Time*, April 21, 2008

21. a. How are Callaway and Nike attempting to maintain economic profit?  
 b. Draw a graph to illustrate the cost curves and revenue curves of Callaway or Nike in the market for golf clubs for women.  
 c. Show on your graph in part (b) the short-run economic profit.  
 22. a. Explain why the economic profit that Callaway and Nike make on golf clubs for women is likely to be temporary.  
 b. Draw a graph to illustrate the cost curves and revenue curves of Callaway or Nike in the market for golf clubs for women in the long run. Mark the firm's excess capacity.

### Product Development and Marketing

Use the following data to work Problems 23 to 25. Bianca bakes delicious cookies. Her total fixed cost is \$40 a day, and her average variable cost is \$1 a bag. Few people know about Bianca's Cookies, and she is maximizing her profit by selling 10 bags a day for \$5 a bag. Bianca thinks that if she spends \$50 a day on advertising, she can increase her market share and sell 25 bags a day for \$5 a bag.

23. If Bianca's advertising works as she expects, can she increase her economic profit by advertising?  
 24. If Bianca advertises, will her average total cost increase or decrease at the quantity produced?  
 25. If Bianca advertises, will she continue to sell her cookies for \$5 a bag or will she change her price?

Use the following news clip to work Problems 26 and 27.

### A Thirst for More Champagne

Champagne exports have tripled in the past 20 years. That poses a problem for northern France, where the

bubbly hails from—not enough grapes. So French authorities have unveiled a plan to extend the official Champagne grape-growing zone to cover 40 new villages. This revision has provoked debate. The change will take several years to become effective. In the meantime the vineyard owners whose land values will jump markedly if the changes are finalized certainly have reason to raise a glass.

Source: *Fortune*, May 12, 2008

26. a. Why is France so strict about designating the vineyards that can use the Champagne label?  
 b. Explain who most likely opposes this plan.  
 27. Assuming that vineyards in these 40 villages are producing the same quality of grapes with or without this plan, why will their land values "jump markedly" if this plan is approved?  
 28. **Under Armour's Big Step Up**

Under Armour, the red-hot athletic-apparel brand, has joined Nike, Adidas, and New Balance as a major player in the market for athletic footwear. Under Armour plans to revive the long-dead cross-training category. But will young athletes really spend \$100 for a cross-training shoe to lift weights in?

Source: *Time*, May 26, 2008

What factors influence Under Armour's ability to make an economic profit in the cross-training shoe market?

### Economics in the News

29. After you have studied *Economics in the News* on pp. 334–335, answer the following questions.
- Why do you think Babolat worked with the firm that helped Nintendo develop the Wii remote?
  - How would Babolat's cost curves ( $MC$  and  $ATC$ ) have been different if they had not worked with the Wii developer?
  - How do you think the launch of Babolat's new-technology racquet has influenced the demand for other firm's racquets?
  - Draw a graph to illustrate your answer to part (c). Explain your answer.
  - Explain the effects of the introduction of the new-technology racquet on Prince and other firms in the market for tennis racquets. In particular, explain what will happen to the markup and excess capacity in the market for smart racquets.



# 15

## OLIGOPOLY

After studying this chapter,  
you will be able to:

- ◆ Define and identify oligopoly
- ◆ Use game theory to explain how price and output are determined in oligopoly
- ◆ Use game theory to explain other strategic decisions
- ◆ Describe the anti-combine laws that regulate oligopoly

**Chances are that your cellphone service provider is** Rogers, Bell, or Telus. Nine out of ten Canadians have plans with these firms. Similarly, the chip in your computer was made by either Intel or AMD; the battery in your TV remote by Duracell or Energizer; and the airplane that takes you on a long-distance trip by Boeing or the European firm Airbus.

How does a market work when only two or a handful of firms compete? To answer this question, we use the model of oligopoly.

At the end of the chapter, in *Economics in the News*, we'll look at the market for cellphone service and see how Rogers, Bell, and Telus battle to maximize profit.

## What Is Oligopoly?

Oligopoly, like monopolistic competition, lies between perfect competition and monopoly. The firms in oligopoly might produce an identical product and compete only on price, or they might produce a differentiated product and compete on price, product quality, and marketing. **Oligopoly** is a market structure in which:

- Natural or legal barriers prevent the entry of new firms.
- A small number of firms compete.

### Barriers to Entry

Natural or legal barriers to entry can create oligopoly. You saw in Chapter 13 how economies of scale and demand form a natural barrier to entry that can create a *natural monopoly*. These same factors can create a *natural oligopoly*.

Figure 15.1 illustrates two natural oligopolies. The demand curve,  $D$  (in both parts of the figure), shows the demand for taxi rides in a town. If the average

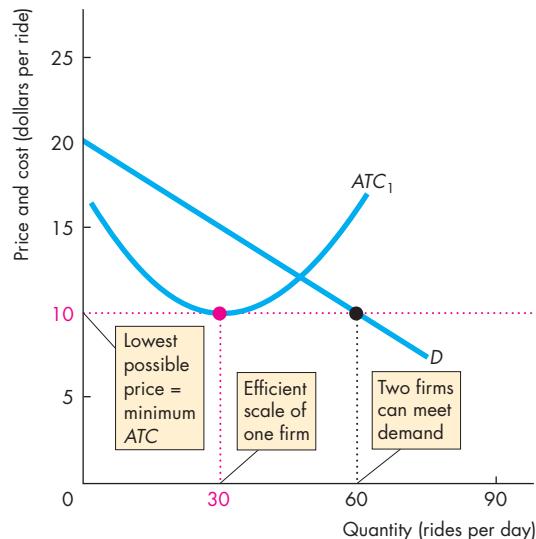
total cost curve of a taxi company is  $ATC_1$  in part (a), the market is a natural **duopoly**—an oligopoly market with two firms. You can probably see some examples of duopoly where you live. Some cities have only two taxi companies, two car rental firms, two copy centres, or two college bookstores.

The lowest price at which the firm would remain in business is \$10 a ride. At that price, the quantity of rides demanded is 60 a day, the quantity that can be provided by just two firms. There is no room in this market for three firms. But if there were only one firm, it would make an economic profit and a second firm would enter to take some of the business and economic profit.

If the average total cost curve of a taxi company is  $ATC_2$  in part (b), the efficient scale of one firm is 20 rides a day. This market is large enough for three firms.

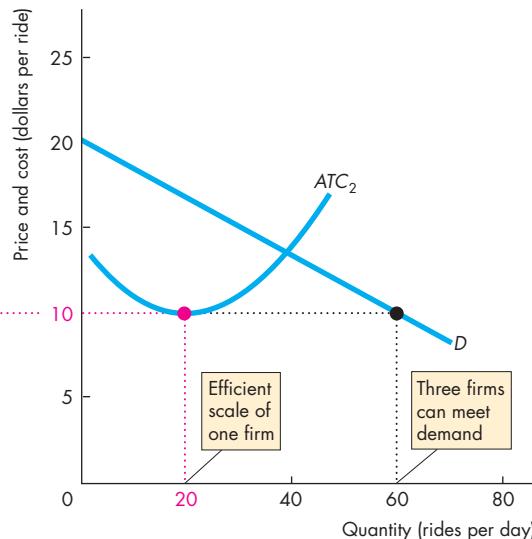
A legal oligopoly arises when a legal barrier to entry protects the small number of firms in a market. A city might license two taxi firms or two bus companies, for example, even though the combination of demand and economies of scale leaves room for more than two firms.

**FIGURE 15.1** Natural Oligopoly



(a) Natural duopoly

The minimum average total cost of producing a ride is \$10, so \$10 a ride is the lowest possible price that a firm can charge. When a firm produces the efficient scale of 30 rides a day, two firms can satisfy the market demand. This market is a natural oligopoly with two firms—a natural duopoly.



(b) Natural oligopoly with three firms

When the efficient scale of one firm is 20 rides per day, three firms can satisfy the market demand at the lowest possible price. This natural oligopoly has three firms.

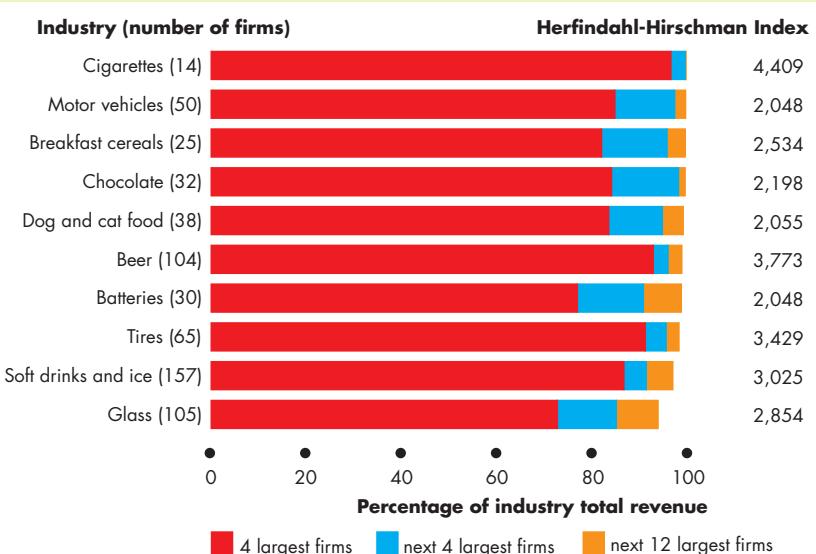
## Economics in Action

### Oligopoly Today

These markets are oligopolies. Although in some of them, the number of firms (in parentheses) is large, the share of the market held by the four largest firms (the red bars) is close to 100 percent.

The most concentrated markets—cigarettes, motor vehicles, breakfast cereals, chocolates, pet food, and batteries—are dominated by one or two firms.

If you want to buy a battery for your TV remote or toothbrush, you'll find it hard to avoid buying a Duracell or an Energizer.



#### Measures of Concentration

Source of data: Adapted from Statistics Canada, Manufacturing, Construction, and Energy Division.

### Small Number of Firms

Because barriers to entry exist, oligopoly consists of a small number of firms, each of which has a large share of the market. Such firms are interdependent, and they face a temptation to cooperate to increase their joint economic profit.

**Interdependence** With a small number of firms in a market, each firm's actions influence the profits of all the other firms. When Penny Stafford opened her coffee shop in Lethbridge, Alberta, a nearby Starbucks coffee shop took a hit. Within days, Starbucks began to attract Penny's customers with enticing offers and lower prices. Starbucks survived, but Penny eventually went out of business. Penny Stafford and Starbucks were interdependent.

**Temptation to Cooperate** When a small number of firms share a market, they can increase their profits by forming a cartel and acting like a monopoly. A **cartel** is a group of firms acting together—colluding—to limit output, raise the price, and increase economic profit. Cartels are illegal, but they do operate in some markets. But for reasons that you'll discover in this chapter, cartels tend to break down.

### Examples of Oligopoly

*Economics in Action* above shows some examples of oligopoly. The dividing line between oligopoly and monopolistic competition is hard to pin down. As a practical matter, we identify oligopoly by looking at concentration ratios, the Herfindahl-Hirschman Index, and information about the geographical scope of the market and barriers to entry. The HHI that divides oligopoly from monopolistic competition is generally taken to be 2,500. An HHI below 2,500 is usually an example of monopolistic competition, and a market in which the HHI exceeds 2,500 is usually an example of oligopoly.

### REVIEW QUIZ

- 1 What are the two distinguishing characteristics of oligopoly?
- 2 Why are firms in oligopoly interdependent?
- 3 Why do firms in oligopoly face a temptation to collude?
- 4 Can you think of some examples of oligopolies that you buy from?

Work these questions in Study Plan 15.1 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

## Oligopoly Games

Economists think about oligopoly as a game between two or a few players, and to study oligopoly markets they use game theory. **Game theory** is a set of tools for studying *strategic behaviour*—behaviour that takes into account the expected behaviour of others and the recognition of mutual interdependence. Game theory was invented by John von Neumann in 1937 and extended by von Neumann and Oskar Morgenstern in 1944 (p. 367). Today, it is one of the major research fields in economics.

Game theory seeks to understand oligopoly as well as other forms of economic, political, social, and even biological rivalries by using a method of analysis specifically designed to understand games of all types, including the familiar games of everyday life (see Talking with Thomas Hubbard on p. 368). To lay the foundation for studying oligopoly games, we first think about the features that all games share.

### What Is a Game?

What is a game? At first thought, the question seems silly. After all, there are many different games. There are ball games and parlour games, games of chance and games of skill. But what is it about all these different activities that makes them games? What do all these games have in common? All games share four common features:

- Rules
- Strategies
- Payoffs
- Outcome

We're going to look at these features of games by playing a game called "the prisoners' dilemma." The prisoners' dilemma game displays the essential features of many games, including oligopoly games, and it gives a good illustration of how game theory works and generates predictions.

### The Prisoners' Dilemma

Art and Bob have been caught red-handed stealing a car. Facing airtight cases, they will receive a sentence of two years each for their crime. During his interviews with the two prisoners, the Crown attorney begins to suspect that he has stumbled on the two people who were responsible for a multimillion-dollar bank robbery some months earlier. But this is just a

suspicion. He has no evidence on which he can convict them of the greater crime unless he can get them to confess. But how can he extract a confession? The answer is by making the prisoners play a game. The Crown attorney makes the prisoners play the following game.

**Rules** Each prisoner (player) is placed in a separate room and cannot communicate with the other prisoner. Each is told that he is suspected of having carried out the bank robbery and that:

If both of them confess to the larger crime, each will receive a sentence of 3 years for both crimes.

If he alone confesses and his accomplice does not, he will receive only a 1-year sentence while his accomplice will receive a 10-year sentence.

**Strategies** In game theory, **strategies** are all the possible actions of each player. Art and Bob each have two possible actions:

1. Confess to the bank robbery.
2. Deny having committed the bank robbery.

Because there are two players, each with two strategies, there are four possible outcomes:

1. Both confess.
2. Both deny.
3. Art confesses and Bob denies.
4. Bob confesses and Art denies.

**Payoffs** Each prisoner can work out his *payoff* in each of these situations, and we can tabulate the four possible payoffs for each of the prisoners in what is called a payoff matrix for the game. A **payoff matrix** is a table that shows the payoffs for every possible action by each player for every possible action by each other player.

Table 15.1 shows a payoff matrix for Art and Bob. The squares show the payoffs for each prisoner—the red triangle in each square shows Art's and the blue triangle shows Bob's. If both prisoners confess (top left), each gets a prison term of 3 years. If Bob confesses but Art denies (top right), Art gets a 10-year sentence and Bob gets a 1-year sentence. If Art confesses and Bob denies (bottom left), Art gets a 1-year sentence and Bob gets a 10-year sentence. Finally, if both of them deny (bottom right), neither can be convicted of the bank robbery charge but both are sentenced for the car theft—a 2-year sentence.

**Outcome** The choices of both players determine the outcome of the game. To predict that outcome, we use an equilibrium idea proposed by John Nash of Princeton University (who received the Nobel Prize for Economic Science in 1994 and was the subject of the 2001 movie *A Beautiful Mind*). In **Nash equilibrium**, player *A* takes the best possible action given the action of player *B* and player *B* takes the best possible action given the action of player *A*.

In the case of the prisoners' dilemma, the Nash equilibrium occurs when Art makes his best choice given Bob's choice and when Bob makes his best choice given Art's choice.

To find the Nash equilibrium, we compare all the possible outcomes associated with each choice and eliminate those that are dominated—that are not as good as some other choice. Let's find the Nash equilibrium for the prisoners' dilemma game.

**Finding the Nash Equilibrium** Look at the situation from Art's point of view. If Bob confesses (top row), Art's best action is to confess because in that case, he is sentenced to 3 years rather than 10 years. If Bob denies (bottom row), Art's best action is still to confess because in that case, he receives 1 year rather than 2 years. So Art's best action is to confess.

Now look at the situation from Bob's point of view. If Art confesses (left column), Bob's best action is to confess because in that case, he is sentenced to 3 years rather than 10 years. If Art denies (right column), Bob's best action is still to confess because in that case, he receives 1 year rather than 2 years. So Bob's best action is to confess.

Because each player's best action is to confess, each does confess, each goes to jail for 3 years, and the Crown attorney has solved the bank robbery. This is the Nash equilibrium of the game.

The Nash equilibrium for the prisoners' dilemma is called a **dominant-strategy equilibrium**, which is an equilibrium in which the best strategy of each player is to cheat (confess) *regardless of the strategy of the other player*.

**The Dilemma** The dilemma arises as each prisoner contemplates the consequences of his decision and puts himself in the place of his accomplice. Each knows that it would be best if both denied. But each also knows that if he denies it is in the best interest of the other to confess. So each considers whether to deny and rely on his accomplice to deny or to confess

**TABLE 15.1** Prisoners' Dilemma Payoff Matrix

		Art's strategies	
		Confess	Deny
Bob's strategies	Confess	3 years 3 years	10 years 1 year
	Deny	1 year 10 years	2 years 2 years

Each square shows the payoffs for the two players, Art and Bob, for each possible pair of actions. In each square, the red triangle shows Art's payoff and the blue triangle shows Bob's. For example, if both confess, the payoffs are in the top left square. The equilibrium of the game is for both players to confess and each gets a 3-year sentence.

#### MyEconLab Animation

hoping that his accomplice denies but expecting him to confess. The dilemma leads to the equilibrium of the game.

**A Bad Outcome** For the prisoners, the equilibrium of the game, with each confessing, is not the best outcome. If neither of them confesses, each gets only 2 years for the lesser crime. Isn't there some way in which this better outcome can be achieved? It seems that there is not, because the players cannot communicate with each other. Each player can put himself in the other player's place, and so each player can figure out that there is a best strategy for each of them. The prisoners are indeed in a dilemma. Each knows that he can serve 2 years *only* if he can trust the other to deny. But each prisoner also knows that it is *not* in the best interest of the other to deny. So each prisoner knows that he must confess, thereby delivering a bad outcome for both.

The firms in an oligopoly are in a similar situation to Art and Bob in the prisoners' dilemma game. Let's see how we can use this game to understand oligopoly.

## An Oligopoly Price-Fixing Game

We can use game theory and a game like the prisoners' dilemma to understand price fixing, price wars, and other aspects of the behaviour of firms in oligopoly. We'll begin with a price-fixing game.

To understand price fixing, we're going to study the special case of duopoly—an oligopoly with two firms. Duopoly is easier to study than oligopoly with three or more firms, and it captures the essence of all oligopoly situations. Somehow, the two firms must share the market. And how they share it depends on the actions of each. We're going to describe the costs of the two firms and the market demand for the item they produce. We're then going to see how game theory helps us to predict the prices charged and the quantities produced by the two firms in a duopoly.

**Cost and Demand Conditions** Two firms, Trick and Gear, produce switchgears. They have identical costs. Figure 15.2(a) shows their average total cost curve ( $ATC$ ) and marginal cost curve ( $MC$ ). Figure 15.2(b) shows the market demand curve for switchgears ( $D$ ). The two firms produce identical switchgears, so one firm's switchgear is a perfect substitute for the other's, and the market price of each firm's product is identical. The quantity demanded depends on that price—the higher the price, the smaller is the quantity demanded.

This industry is a natural duopoly. Two firms can produce this good at a lower cost than either one firm or three firms can. For each firm, average total cost is at its minimum when production is 3,000 units a week. When price equals minimum average total cost, the total quantity demanded is 6,000 units a week, and two firms can just produce that quantity.

**Collusion** We'll suppose that Trick and Gear enter into a collusive agreement. A **collusive agreement** is an agreement between two (or more) producers to form a cartel to restrict output, raise the price, and increase profits. Such an agreement is illegal in Canada and is undertaken in secret. The firms in a cartel can pursue two strategies:

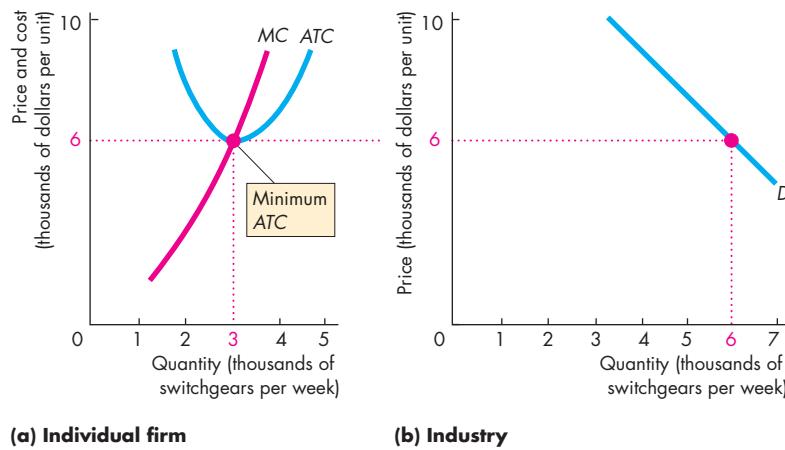
- Comply
- Cheat

A firm that complies carries out the agreement. A firm that cheats breaks the agreement to its own benefit and to the cost of the other firm.

Because each firm has two strategies, there are four possible combinations of actions for the firms:

1. Both firms comply.
2. Both firms cheat.
3. Trick complies and Gear cheats.
4. Gear complies and Trick cheats.

**FIGURE 15.2** Costs and Demand



The average total cost curve for each firm is  $ATC$ , and the marginal cost curve is  $MC$  (part a). Minimum average total cost is \$6,000 a unit, and it occurs at a production of 3,000 units a week.

Part (b) shows the market demand curve. At a price of \$6,000, the quantity demanded is 6,000 units per week. The two firms can produce this output at the lowest possible average cost. If the market had one firm, it would be profitable for another to enter. If the market had three firms, one would exit. There is room for only two firms in this industry. It is a natural duopoly.

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**Colluding to Maximize Profits** Let's work out the payoffs to the two firms if they collude to make the maximum profit for the cartel by acting like a monopoly. The calculations that the two firms perform are the same calculations that a monopoly performs. (You can refresh your memory of these calculations by looking at Chapter 13, pp. 302–303.) The only thing that the firms in duopoly must do beyond what a monopoly does is to agree on how much of the total output each of them will produce.

Figure 15.3 shows the price and quantity that maximize industry profit for the duopoly. Part (a) shows the situation for each firm, and part (b) shows the situation for the industry as a whole. The curve labelled  $MR$  is the industry marginal revenue curve. This marginal revenue curve is like that of a single-price monopoly (Chapter 13, p. 300). The curve labelled  $MC_I$  is the industry marginal cost curve if each firm produces the same quantity of output. This curve is constructed by adding together the outputs of the two firms at each level of marginal cost. Because the two firms are the same size, at each level of marginal cost, the industry output is twice the output of one firm. The curve  $MC_I$  in part (b) is twice as far to the right as the curve  $MC$  in part (a).

To maximize industry profit, the firms in the duopoly agree to restrict output to the rate that makes the industry marginal cost and marginal revenue equal. That output rate, as shown in part (b), is 4,000 units a week. The demand curve shows that the

highest price for which the 4,000 switchgears can be sold is \$9,000 each. Trick and Gear agree to charge this price.

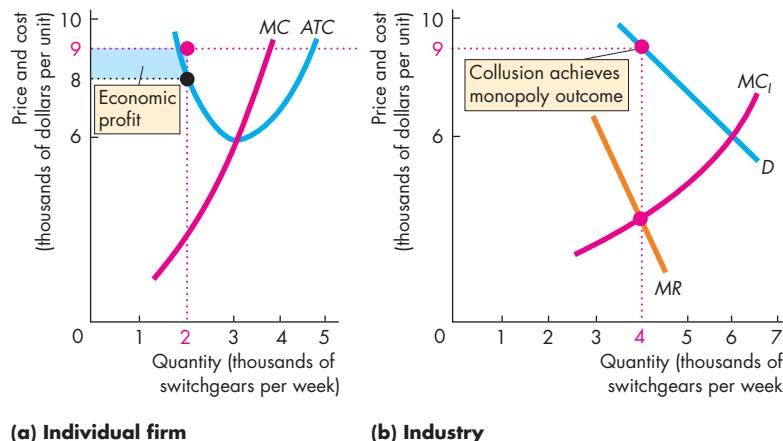
To hold the price at \$9,000 a unit, production must be 4,000 units a week. So Trick and Gear must agree on output rates for each of them that total 4,000 units a week. Let's suppose that they agree to split the market equally so that each firm produces 2,000 switchgears a week. Because the firms are identical, this division is the most likely.

The average total cost ( $ATC$ ) of producing 2,000 switchgears a week is \$8,000, so the profit per unit is \$1,000 and economic profit is \$2 million (2,000 units  $\times$  \$1,000 per unit). The economic profit of each firm is represented by the blue rectangle in Fig. 15.3(a).

We have just described one possible outcome for a duopoly game: The two firms collude to produce the monopoly profit-maximizing output and divide that output equally between themselves. From the industry point of view, this solution is identical to a monopoly. A duopoly that operates in this way is indistinguishable from a monopoly. The economic profit that is made by a monopoly is the maximum total profit that can be made by the duopoly when the firms collude.

But with price greater than marginal cost, either firm might think of trying to increase profit by cheating on the agreement and producing more than the agreed amount. Let's see what happens if one of the firms does cheat in this way.

**FIGURE 15.3** Colluding to Make Monopoly Profits



The industry marginal cost curve,  $MC_I$  in part (b), is the horizontal sum of the two firms' marginal cost curves,  $MC$  in part (a). The industry marginal revenue curve is  $MR$ . To maximize profit, the firms produce 4,000 units a week (the quantity at which marginal revenue equals marginal cost). They sell that output for \$9,000 a unit. Each firm produces 2,000 units a week. Average total cost is \$8,000 a unit, so each firm makes an economic profit of \$2 million (blue rectangle)—2,000 units multiplied by \$1,000 profit a unit.

**One Firm Cheats on a Collusive Agreement** To set the stage for cheating on their agreement, Trick convinces Gear that demand has decreased and that it cannot sell 2,000 units a week. Trick tells Gear that it plans to cut its price so that it can sell the agreed 2,000 units each week. Because the two firms produce an identical product, Gear matches Trick's price cut but still produces only 2,000 units a week.

In fact, there has been no decrease in demand. Trick plans to increase output, which it knows will lower the price, and Trick wants to ensure that Gear's output remains at the agreed level.

Figure 15.4 illustrates the consequences of Trick's cheating. Part (a) shows Gear (the complier); part (b) shows Trick (the cheat); and part (c) shows the industry as a whole. Suppose that Trick increases output to 3,000 units a week. If Gear sticks to the agreement to produce only 2,000 units a week, total output is now 5,000 a week, and given demand in part (c), the price falls to \$7,500 a unit.

Gear continues to produce 2,000 units a week at a cost of \$8,000 a unit and incurs a loss of \$500 a unit, or \$1 million a week. This economic loss is shown by the red rectangle in part (a). Trick produces 3,000 units a week at a cost of \$6,000 a unit. With a price

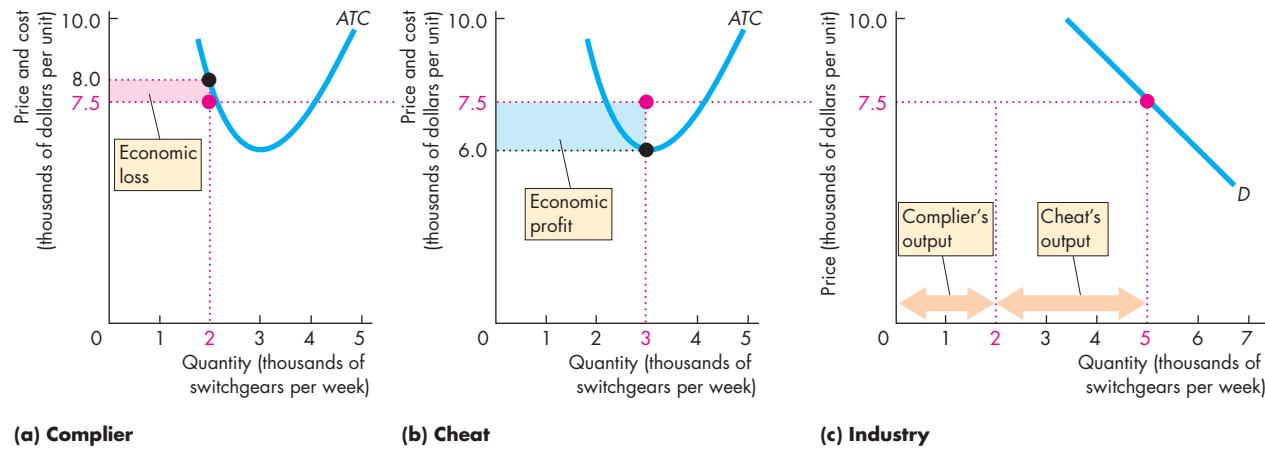
of \$7,500, Trick makes a profit of \$1,500 a unit and therefore an economic profit of \$4.5 million. This economic profit is the blue rectangle in part (b).

We've now described a second possible outcome for the duopoly game: One of the firms cheats on the collusive agreement. In this case, the industry output is larger than the monopoly output and the industry price is lower than the monopoly price. The total economic profit made by the industry is also smaller than the monopoly's economic profit. Trick (the cheat) makes an economic profit of \$4.5 million, and Gear (the complier) incurs an economic loss of \$1 million. The industry makes an economic profit of \$3.5 million. This industry profit is \$0.5 million less than the economic profit that a monopoly would make, but it is distributed unevenly. Trick makes a bigger economic profit than it would under the collusive agreement, while Gear incurs an economic loss.

A similar outcome would arise if Gear cheated and Trick complied with the agreement. The industry profit and price would be the same, but in this case, Gear (the cheat) would make an economic profit of \$4.5 million and Trick (the complier) would incur an economic loss of \$1 million.

Let's next see what happens if both firms cheat.

**FIGURE 15.4** One Firm Cheats



One firm, shown in part (a), complies with the agreement and produces 2,000 units. The other firm, shown in part (b), cheats on the agreement and increases its output to 3,000 units a week. Given the market demand curve, shown in part (c), and with a total production of 5,000 units a week,

the price falls to \$7,500 a unit. At this price, the complier in part (a) incurs an economic loss of \$1 million (\$500 per unit  $\times$  2,000 units), shown by the red rectangle. In part (b), the cheat makes an economic profit of \$4.5 million (\$1,500 per unit  $\times$  3,000 units), shown by the blue rectangle.

**Both Firms Cheat** Suppose that both firms cheat and that each firm behaves like the cheating firm that we have just analyzed. Each tells the other that it is unable to sell its output at the going price and that it plans to cut its price. But because both firms cheat, each will propose a successively lower price. As long as price exceeds marginal cost, each firm has an incentive to increase its production—to cheat. Only when price equals marginal cost is there no further incentive to cheat. This situation arises when the price has reached \$6,000. At this price, marginal cost equals price. Also, price equals minimum average total cost. At a price less than \$6,000, each firm incurs an economic loss. At a price of \$6,000, each firm covers all its costs and makes zero economic profit. Also, at a price of \$6,000, each firm wants to produce 3,000 units a week, so the industry output is 6,000 units a week. Given the demand conditions, 6,000 units can be sold at a price of \$6,000 each.

Figure 15.5 illustrates the situation just described. Each firm, in part (a), produces 3,000 units a week, and its average total cost is a minimum (\$6,000 per unit). The market as a whole, in part (b), operates at the point at which the market demand curve ( $D$ ) intersects the industry marginal cost curve ( $MC_I$ ). Each firm has lowered its price and increased its output to try to gain an advantage over the other firm. Each has pushed this process as far as it can without incurring an economic loss.

We have now described a third possible outcome of this duopoly game: Both firms cheat. If both firms

cheat on the collusive agreement, the output of each firm is 3,000 units a week and the price is \$6,000 a unit. Each firm makes zero economic profit.

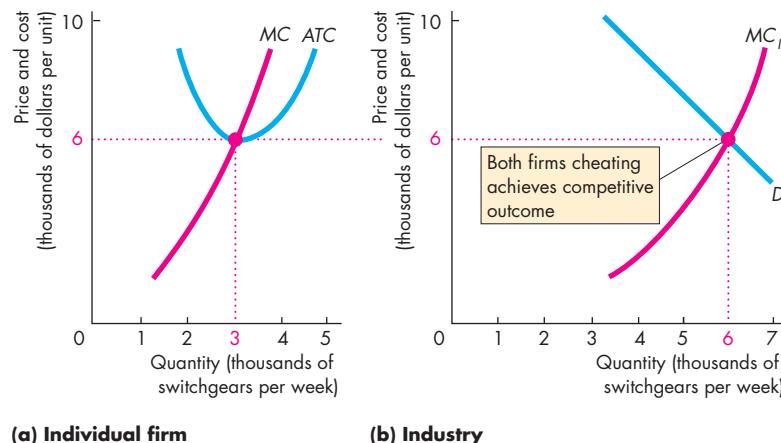
**The Payoff Matrix** Now that we have described the strategies and payoffs in the duopoly game, we can summarize the strategies and the payoffs in the form of the game's payoff matrix. Then we can find the Nash equilibrium.

Table 15.2 sets out the payoff matrix for this game. It is constructed in the same way as the payoff matrix for the prisoners' dilemma in Table 15.1. The squares show the payoffs for the two firms—Gear and Trick. In this case, the payoffs are profits. (For the prisoners' dilemma, the payoffs were losses.)

The table shows that if both firms cheat (top left), they achieve the perfectly competitive outcome—each firm makes zero economic profit. If both firms comply (bottom right), the industry makes the monopoly profit and each firm makes an economic profit of \$2 million. The top right and bottom left squares show the payoff if one firm cheats while the other complies. The firm that cheats makes an economic profit of \$4.5 million, and the one that complies incurs a loss of \$1 million.

**Nash Equilibrium in the Duopolists' Dilemma** The duopolists have a dilemma like the prisoners' dilemma. Do they comply or cheat? To answer this question, we must find the Nash equilibrium.

**FIGURE 15.5 Both Firms Cheat**



If both firms cheat by increasing production, the collusive agreement collapses. The limit to the collapse is the competitive equilibrium. Neither firm will cut its price below \$6,000 (minimum average total cost) because to do so will result in losses. In part (a), each firm produces 3,000 units a week at an average total cost of \$6,000. In part (b), with a total production of 6,000 units, the price falls to \$6,000. Each firm now makes zero economic profit. This output and price are the ones that would prevail in a competitive industry.

**TABLE 15.2** Duopoly Payoff Matrix

		Gear's strategies	
		Cheat	Comply
Trick's strategies	Cheat	\$0	-\$1.0m
	Comply	+\$4.5m	+\$2m

Each square shows the payoffs from a pair of actions. For example, if both firms comply with the collusive agreement, the payoffs are recorded in the bottom right square. The red triangle shows Gear's payoff, and the blue triangle shows Trick's. In Nash equilibrium, both firms cheat.

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Look at things from Gear's point of view. Gear reasons as follows: Suppose that Trick cheats. If I comply, I will incur an economic loss of \$1 million. If I also cheat, I will make zero economic profit. Zero is better than *minus* \$1 million, so I'm better off if I cheat. Now suppose Trick complies. If I cheat, I will make an economic profit of \$4.5 million, and if I comply, I will make an economic profit of \$2 million. A \$4.5 million profit is better than a \$2 million profit, so I'm better off if I cheat. So regardless of whether Trick cheats or complies, Gear's best strategy is to cheat.

Trick comes to the same conclusion as Gear because the two firms face an identical situation. So both firms cheat. The Nash equilibrium of the duopoly game is that both firms cheat. And although the industry has only two firms, they charge the same price and produce the same quantity as those in a competitive industry. Also, as in perfect competition, each firm makes zero economic profit.

*Economics in Action* (opposite) and *Economics in the News* (p. 353) look at some other prisoners' dilemma games. But not all games are prisoners' dilemmas, as you'll now see.

## Economics in Action

### A Game in the Market for Tissues

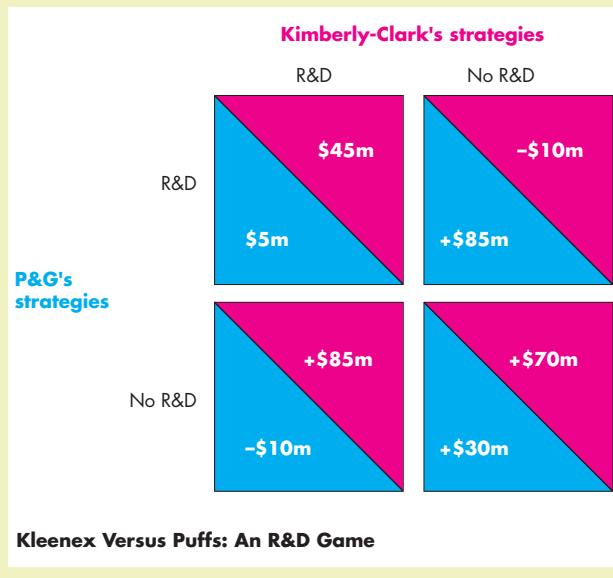
Anti-Viral Kleenex and Puffs Plus Lotion didn't get developed because Kimberly-Clark (Kleenex) and P&G (Puffs) were thinking about helping you cope with a miserable cold. These new-style tissues and other innovations in the quality of facial tissues are the product of a costly research and development (R&D) game.

The table below illustrates the game (with hypothetical numbers). Each firm can spend either \$25 million or nothing on R&D. If neither firm spends, Kimberly-Clark makes an economic profit of \$70 million and P&G of \$30 million (bottom right). If each firm spends on R&D, Kimberly-Clark's economic profit is \$45 million and P&G's is \$5 million (top left). The other parts of the matrix show the economic profits for each when one spends on R&D and the other doesn't.

Confronted with these payoffs, Kimberly-Clark sees that it gets a bigger profit if it spends on R&D regardless of what P&G does. P&G reaches the same conclusion: It, too, gets a bigger profit by spending on R&D regardless of what Kimberly-Clark does.

Because R&D is the best strategy for both players, it is the Nash equilibrium—a *dominant-strategy Nash equilibrium*.

The outcome of this game is that both firms conduct R&D. They make less profit than they would if they could collude to achieve the cooperative outcome of no R&D. But you get a better Kleenex or Puffs tissue.



## A Game of Chicken

The Nash equilibrium for the prisoners' dilemma is unique: Both players cheat (confess). Not all games have a unique equilibrium, and one that doesn't is a game called "chicken."

**An Example of the Game of Chicken** A graphic, if disturbing, version of "chicken" has two cars racing toward each other. The first driver to swerve and avoid a crash is the "chicken." The payoffs are a big loss for both if no one "chickens out;" zero for both if both "chicken out;" and zero for the chicken and a gain for the one who stays the course. If player 1 swerves, player 2's best strategy is to stay the course; and if player 1 stays the course, player 2's best strategy is to swerve.

**An Economic Example of Chicken** An economic game of chicken can arise when research and development (R&D) creates a new technology that cannot be kept secret or patented, so both firms benefit from the R&D of either firm. The chicken in this case is the firm that does the R&D.

Suppose, for example, that either Apple or Nokia spends \$9 million developing a new touch-screen technology that both would end up being able to use regardless of which of them developed it.

Table 15.3 illustrates a payoff matrix for the game that Apple and Nokia play. Each firm has two strategies: Do the R&D ("chicken out") or do not do the R&D. Each entry shows the additional profit (the profit from the new technology minus the cost of the research), given the strategies adopted.

If neither firm does the R&D, each makes zero additional profit. If both firms conduct the R&D, each firm makes an additional \$5 million. If one of the firms does the R&D ("chickens out"), the chicken makes \$1 million and the other firm makes \$10 million. Confronted with these payoffs the two firms calculate their best strategies. Nokia is better off doing R&D if Apple does no R&D. Apple is better off doing R&D if Nokia does no R&D. There are two Nash equilibrium outcomes: Only one of them does the R&D, but we can't predict which one.

You can see that an outcome with no firm doing R&D isn't a Nash equilibrium because one firm would be better off doing it. Also both firms doing R&D isn't a Nash equilibrium because one firm would be better off *not* doing it. To decide *which* firm does the R&D, the firms might toss a coin, called a mixed strategy.

**TABLE 15.3** An R&D Game of Chicken

		Apple's strategies	
		R&D	No R&D
Nokia's strategies	R&D	\$5m	\$10m
	No R&D	\$1m	\$0
No R&D	R&D	\$10m	\$0
	No R&D	\$0	\$0

If neither firm does the R&D, their payoffs are in the bottom right square. When one firm "chickens out" and does the R&D while the other does no R&D, their payoffs are in the top right and bottom left squares. When both "chicken out" and do the R&D, the payoffs are in the top left square. The red triangle shows Apple's payoff, and the blue triangle shows Nokia's. The equilibrium for this R&D game of chicken is for only one firm to undertake the R&D. We cannot tell which firm will do the R&D and which will not.

## REVIEW QUIZ

- 1 What are the common features of all games?
- 2 Describe the prisoners' dilemma game and explain why the Nash equilibrium delivers a bad outcome for both players.
- 3 Why does a collusive agreement to restrict output and raise the price create a game like the prisoners' dilemma?
- 4 What creates an incentive for firms in a collusive agreement to cheat and increase output?
- 5 What is the equilibrium strategy for each firm in a duopolists' dilemma and why do the firms not succeed in colluding to raise the price and profits?
- 6 Describe the payoffs for an R&D game of chicken and contrast them with the payoffs in a prisoners' dilemma game.

Work these questions in Study Plan 15.2 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

## Repeated Games and Sequential Games

The games that we've studied are played just once. In contrast, many real-world games are played repeatedly. This feature of games turns out to enable real-world duopolists to cooperate, collude, and make a monopoly profit.

Another feature of the games that we've studied is that the players move simultaneously. But in many real-world situations, one player moves first and then the other moves—the play is sequential rather than simultaneous. This feature of real-world games creates a large number of possible outcomes.

We're now going to examine these two aspects of strategic decision making.

### A Repeated Duopoly Game

If two firms play a game repeatedly, one firm has the opportunity to penalize the other for previous “bad” behaviour. If Gear cheats this week, perhaps Trick will cheat next week. Before Gear cheats this week, won't it consider the possibility that Trick will cheat next week? What is the equilibrium of this game?

Actually, there is more than one possibility. One is the Nash equilibrium that we have just analyzed. Both players cheat, and each makes zero economic profit forever. In such a situation, it will never pay for one of the players to start complying unilaterally because to do so would result in a loss for that player and a profit for the other. But a **cooperative equilibrium** in which the players make and share the monopoly profit is possible.

A cooperative equilibrium might occur if cheating is punished. There are two extremes of punishment. The smallest penalty is called “tit for tat.” A *tit-for-tat strategy* is one in which a player cooperates in the current period if the other player cooperated in the previous period, but cheats in the current period if the other player cheated in the previous period. The most severe form of punishment is called a trigger strategy. A *trigger strategy* is one in which a player cooperates if the other player cooperates but plays the Nash equilibrium strategy forever thereafter if the other player cheats.

In the duopoly game between Gear and Trick, a tit-for-tat strategy keeps both players cooperating and making monopoly profits. Let's see why with an example.

Table 15.4 shows the economic profit that Trick and Gear will make over a number of periods under two alternative sequences of events: colluding and cheating with a tit-for-tat response by the other firm.

If both firms stick to the collusive agreement in period 1, each makes an economic profit of \$2 million. Suppose that Trick contemplates cheating in period 1. The cheating produces a quick \$4.5 million economic profit and inflicts a \$1 million economic loss on Gear. But a cheat in period 1 produces a response from Gear in period 2. If Trick wants to get back into a profit-making situation, it must return to the agreement in period 2 even though it knows that Gear will punish it for cheating in period 1. So in period 2, Gear punishes Trick and Trick cooperates. Gear now makes an economic profit of \$4.5 million, and Trick incurs an economic loss of \$1 million. Adding up the profits over two periods of play, Trick would have made more profit by cooperating—\$4 million compared with \$3.5 million.

What is true for Trick is also true for Gear. Because each firm makes a larger profit by sticking with the collusive agreement, both firms do so and the monopoly price, quantity, and profit prevail.

In reality, whether a cartel works like a one-play game or a repeated game depends primarily on the

**TABLE 15.4** Cheating with Punishment

Period of play	Collude		Cheat with tit-for-tat	
	Trick's profit (millions of dollars)	Gear's profit (millions of dollars)	Trick's profit (millions of dollars)	Gear's profit (millions of dollars)
1	2	2	4.5	-1.0
2	2	2	-1.0	4.5
3	2	2	2.0	2.0
4	•	•	•	•

If duopolists repeatedly collude, each makes a profit of \$2 million per period of play. If one player cheats in period 1, the other player plays a tit-for-tat strategy and cheats in period 2. The profit from cheating can be made for only one period and must be paid for in the next period by incurring a loss. Over two periods of play, the best that a duopolist can achieve by cheating is a profit of \$3.5 million, compared to an economic profit of \$4 million by colluding.



## ECONOMICS IN THE NEWS

### Airbus Versus Boeing

#### Boeing Strikes Back in Single-Aisle Market

Airbus and Boeing are in fierce competition in the narrow-body passenger jet market. Airbus got moving first with its A320neo for which it has 1,400 orders. Boeing responded with the 737 Max for which it had 549 orders in mid-2012 and an aim for 1,000 orders by the end of 2012.

Boeing rejected suggestions that it was in a price war with Airbus over the A320neo and 737 Max but confirmed it would woo some airline customers of its European rival.

Source: *Financial Times*, July 9, 2012

#### SOME DATA

Aircraft	List price
Airbus Neo	\$96.7 million
Boeing Max	\$96.0 million

#### ASSUMPTIONS

- Assume that the performance and operating costs of the A320neo and the Max are identical.
- At list prices, Airbus and Boeing can get another 200 orders each and make \$2 billion each in economic profit.
- At discounted prices, Airbus and Boeing can get another 225 orders each and make \$1 billion each in economic profit.
- If one of them holds the list price and the other discounts, the discounter can get 450 new orders and makes \$3 billion and the other will get no new orders.

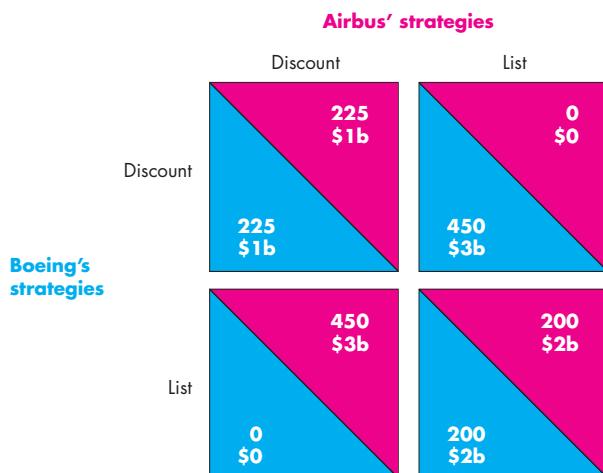
#### THE QUESTIONS

- In what type of market are Airbus and Boeing competing?
- How did moving first benefit Airbus?
- Given the assumptions above, will the airplane producers discount their prices or stick to the list prices? To answer this question, set out the payoff matrix for the game that Airbus and Boeing are playing and find the Nash equilibrium.
- If the game could be played repeatedly, how might the strategies and equilibrium change?

#### THE ANSWERS

- Airbus and Boeing are a duopoly.
- By moving first, Airbus had a temporary monopoly and was able to grab a large market share.

- The table illustrates the payoff matrix for the game between Airbus and Boeing.
- The outcome is a dominant-strategy Nash equilibrium. Both firms discount their prices and get 225 new orders each. If one firm held the list price, the other would discount and take the 450 new orders.
- If the game could be played repeatedly, the discounter could be punished and a cooperative equilibrium would arise in which neither discounts.



Duopoly Game: Market for Airplanes



Are the A320neo and Max in a price war?

number of players and the ease of detecting and punishing cheating. The larger the number of players, the harder it is to maintain a cartel.

**Games and Price Wars** A repeated duopoly game can help us understand real-world behaviour and, in particular, price wars. Some price wars can be interpreted as the implementation of a tit-for-tat strategy. But the game is a bit more complicated than the one we've looked at because the players are uncertain about the demand for the product.

Playing a tit-for-tat strategy, firms have an incentive to stick to the monopoly price. But fluctuations in demand lead to fluctuations in the monopoly price, and sometimes, when the price changes, it might seem to one of the firms that the price has fallen because the other has cheated. In this case, a price war will break out. The price war will end only when each firm is satisfied that the other is ready to cooperate again. There will be cycles of price wars and the restoration of collusive agreements. Fluctuations in the world price of oil might be interpreted in this way.

Some price wars arise from the entry of a small number of firms into an industry that had previously been a monopoly. Although the industry has a small number of firms, the firms are in a prisoners' dilemma and they cannot impose effective penalties for price cutting. The behaviour of prices and outputs in the computer chip industry during 1995 and 1996 can be explained in this way. Until 1995, the market for Pentium chips for IBM-compatible computers was dominated by one firm, Intel Corporation, which was able to make maximum economic profit by producing the quantity of chips at which marginal cost equalled marginal revenue. The price of Intel's chips was set to ensure that the quantity demanded equalled the quantity produced. Then in 1995 and 1996, with the entry of a small number of new firms, the industry became an oligopoly. If the firms had maintained Intel's price and shared the market, together they could have made economic profits equal to Intel's profit. But the firms were in a prisoners' dilemma, so prices fell toward the competitive level.

Let's now study a sequential game. There are many such games, and the one we'll examine is among the simplest. It has an interesting implication and it will give you the flavour of this type of game. The sequential game that we'll study is an entry game in a contestable market.

## A Sequential Entry Game in a Contestable Market

If two firms play a sequential game, one firm makes a decision at the first stage of the game and the other makes a decision at the second stage.

We're going to study a sequential game in a **contestable market**—a market in which firms can enter and leave so easily that firms in the market face competition from *potential entrants*. Examples of contestable markets are routes served by airlines and by barge companies that operate on the major waterways. These markets are contestable because firms could enter if an opportunity for economic profit arose and could exit with no penalty if the opportunity for economic profit disappeared.

If the Herfindahl-Hirschman Index (p. 234) is used to determine the degree of competition, a contestable market appears to be uncompetitive. But a contestable market can behave as if it were perfectly competitive. To see why, let's look at an entry game for a contestable air route.

**A Contestable Air Route** Agile Air is the only firm operating on a particular route. Demand and cost conditions are such that there is room for only one airline to operate. Wanabe Inc. is another airline that could offer services on the route.

We describe the structure of a sequential game by using a *game tree* like that in Fig. 15.6. At the first stage, Agile Air must set a price. Once the price is set and advertised, Agile can't change it. That is, once set, Agile's price is fixed and Agile can't react to Wanabe's entry decision. Agile can set its price at either the monopoly level or the competitive level.

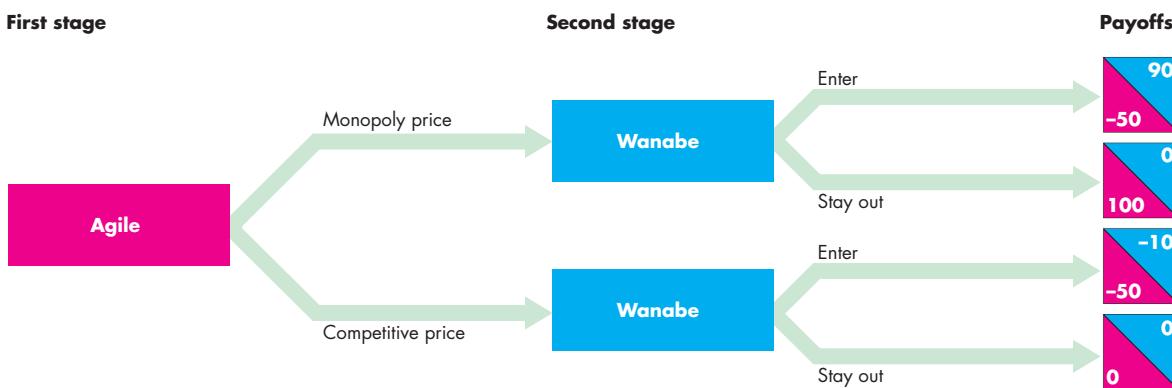
At the second stage, Wanabe must decide whether to enter or to stay out. Customers have no loyalty (there are no frequent-flyer programs) and they buy from the lowest-price firm. So if Wanabe enters, it sets a price just below Agile's and takes all the business.

Figure 15.6 shows the payoffs from the various decisions (Agile's in the red triangles and Wanabe's in the blue triangles).

To decide on its price, Agile's CEO reasons as follows: Suppose that Agile sets the monopoly price. If Wanabe enters, it earns 90 (think of all payoff numbers as thousands of dollars). If Wanabe stays out, it earns nothing. So Wanabe will enter. In this case Agile will lose 50.

Now suppose that Agile sets the competitive price. If Wanabe stays out, it earns nothing, and if it enters,

**FIGURE 15.6** Agile Versus Wanabe: A Sequential Entry Game in a Contestable Market



If Agile sets the monopoly price, Wanabe makes 90 (thousand dollars) by entering and earns nothing by staying out. So if Agile sets the monopoly price, Wanabe enters.

If Agile sets the competitive price, Wanabe earns nothing if it stays out and incurs a loss if it enters. So if Agile sets the competitive price, Wanabe stays out.

#### MyEconLab Animation

it loses 10, so Wanabe will stay out. In this case, Agile will make zero economic profit.

Agile's best strategy is to set its price at the competitive level and make zero economic profit. The option of earning 100 by setting the monopoly price with Wanabe staying out is not available to Agile. If Agile sets the monopoly price, Wanabe enters, undercuts Agile, and takes all the business.

In this example, Agile sets its price at the competitive level and makes zero economic profit. A less costly strategy, called **limit pricing**, sets the price at the highest level that inflicts a loss on the entrant. Any loss is big enough to deter entry, so it is not always necessary to set the price as low as the competitive price. In the example of Agile and Wanabe, at the competitive price Wanabe incurs a loss of 10 if it enters. A smaller loss would still keep Wanabe out.

This game is interesting because it points to the possibility of a monopoly behaving like a competitive industry and serving the social interest without regulation. But the result is not general and depends on one crucial feature of the setup of the game: At the second stage, Agile is locked in to the price set at the first stage.

If Agile could change its price in the second stage, it would want to set the monopoly price if Wanabe stayed out—100 with the monopoly price beats zero with the competitive price. But Wanabe can figure out what Agile would do, so the price set at the first stage

has no effect on Wanabe. Agile sets the monopoly price and Wanabe might either stay out or enter.

We've looked at two of the many possible repeated and sequential games, and you've seen how these types of games can provide insights into the complex forces that determine prices and profits.

#### REVIEW QUIZ

- 1 If a prisoners' dilemma game is played repeatedly, what punishment strategies might the players employ and how does playing the game repeatedly change the equilibrium?
- 2 If a market is contestable, how does the equilibrium differ from that of a monopoly?

Work these questions in Study Plan 15.3 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

So far, we've studied oligopoly with unregulated market power. Firms like Trick and Gear are free to collude to maximize their profit with no concern for the consumer or the law.

But when firms collude to achieve the monopoly outcome, they also have the same effects on efficiency and the social interest as monopoly. Profit is made at the expense of consumer surplus and a deadweight loss arises. Your next task is to see how Canada's anti-combine law limits market power.

 **Anti-Combine Law**

**Anti-combine law** is the law that regulates oligopolies and prevents them from becoming monopolies or behaving like monopolies. Anti-combine law can work in the social interest to maximize total surplus or in the self-interest of producers to maximize producer surpluses. We'll describe Canada's anti-combine law and examine some recent cases.

### Canada's Anti-Combine Law

Canada's anti-combine law dates from 1889. At that time, monopoly was a major political issue and people were concerned about the absence of competition in industries as diverse as sugar and groceries, biscuits and confectionery, coal, binder twine, agricultural implements, stoves, coffins, eggs, and fire insurance.

Canada's anti-combine law today is defined in the Competition Act of 1986, which is described in Table 15.5. The Act established a Competition Bureau and a Competition Tribunal. The Competition Act

distinguishes between criminal and noncriminal practices.

Criminal offences include conspiring to fix prices, bid-rigging, and false advertising. It is also a criminal offence for a manufacturer to set the price at which a retailer must sell its products—called resale price maintenance. The courts handle alleged criminal offences, and the standard level of proof beyond a reasonable doubt must be established.

Noncriminal offences are mergers, abuse of a dominant market position, refusal to deal, and other actions designed to limit competition such as exclusive dealing. The Director of the Competition Bureau sends alleged violations of a noncriminal nature to the Competition Tribunal for examination.

### Some Major Anti-Combine Cases

To see how the Competition Act has been working, we'll look at a few cases. The first case we'll examine is important because it confirms the Competition Tribunal's power to enforce its orders.

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**TABLE 15.5** Canada's Anti-Combine Law: The Competition Act, 1986

#### Abuse of Dominant Position

79 (1) Where on application by the Director, the Tribunal finds that:

- (a) one or more persons substantially or completely control, throughout Canada or any area thereof, a class or species of business,
- (b) that person or those persons have engaged in or are engaging in a practice of anti-competitive acts, and
- (c) the practice has had, is having or is likely to have the effect of preventing or lessening competition substantially in a market,

the Tribunal may make an order prohibiting all or any of those persons from engaging in that practice.

#### Mergers

92 (1) Where on application by the Director, the Tribunal finds that a merger or proposed merger prevents or lessens, or is likely to prevent or lessen, competition substantially ... the Tribunal may... [,]

in the case of a completed merger, order any party to the merger or any other person

- (i) to dissolve the merger ...
- (ii) to dispose of assets and shares ...

[or]

in the case of a proposed merger, make an order directed against any party to the proposed merger or any other person

- (i) ordering the person ... not to proceed with the merger

**Chrysler** In 1986, Chrysler stopped supplying autoparts to Richard Brunet, a Montreal auto dealer. Chrysler also discouraged other dealers from supplying Brunet. The Competition Tribunal claimed that Chrysler wanted Brunet's business for itself and ordered Chrysler to resume doing business with Brunet. Chrysler did not resume sending supplies and the Tribunal cited Chrysler for contempt. Appeals against this ruling eventually reached the Supreme Court of Canada, which confirmed the Tribunal's power over contempt for its ruling. The Tribunal subsequently dropped its contempt charge.

The second case we'll look at concerns aspartame, the sweetener in many soft drinks.

**NutraSweet** NutraSweet, the maker of aspartame, tried to gain a monopoly in aspartame. It did so by licensing the use of its "swirl" only on products for which it had an exclusive deal. On October 4, 1990, the Competition Tribunal ruled that this action was an abuse of dominant position and unduly limited competition. The Competition Tribunal told NutraSweet that it may not enforce existing contracts, enter into new contracts in which it is the exclusive supplier, or give inducements to encourage the display of its "swirl." As a result of this case, competition increased and the price of aspartame fell in Canada.

The third case we'll examine concerns a publication that is now struggling to stay alive: the Yellow Pages.

**Bell Canada Enterprises** Two subsidiaries of Bell Canada Enterprises have a 90 percent share of the market for the publication of telephone directories in their territories. These companies tie the sale of advertising services to the sale of advertising space in the Yellow Pages. If you want to advertise in the Yellow Pages, you must buy the advertising services of one of these two companies. As a result, other advertising agencies cannot effectively compete for business in Yellow Pages advertising.

The Director of the Competition Bureau applied for an order prohibiting the tied-sale practice of these two companies.

**Other Recent Cases** The Competition Bureau has investigated several high-profile cases in the past few years. These include two proposed mergers between big Canadian banks, a movie theatre merger when Cineplex Galaxy acquired Famous Players, a retail gasoline price-fixing cartel in Quebec, and the ownership transfer and relocation policies of the NHL when Jim Balsillie tried to buy the Nashville Predators.

We look at each of these cases in the following *Economics in Action* boxes.

## Economics in Action

### Mergers Blocked

In January 1998, the Royal Bank of Canada and the Bank of Montreal announced that they wanted to merge and create a new bank. Soon after, in April 1998, CIBC and TD Bank announced their desire to combine.

After some months of deliberation, in December 1998, the Finance Minister, Paul Martin, told the banks that they could not proceed with their proposed mergers.

**Why the Merger Was Blocked** The Finance Minister said that the bank mergers were not in the public interest because they would result in:

- Too much concentration of economic power in the hands of too few financial institutions

- Reduced competition in the financial services markets
- Reduced Government of Canada flexibility to address future concerns

A Competition Bureau report agreed.

**Competition Bureau's View** The Competition Bureau investigated the impact of the proposed bank mergers on competition in the banking industry. The Bureau concluded that the mergers would substantially lessen competition and would result in bank branches being closed. Canadians would end up paying higher prices for reduced banking services.

Bank mergers in Canada are now so politically sensitive that any future attempts to merge will require the sanction of the federal government.

## Economics in Action

### Cineplex Galaxy Acquires Famous Players

In 2004, Cineplex Galaxy bought Famous Players. But before the deal could be confirmed, the Competition Bureau needed to vet and approve it.

**The Firms** The firms in the deal were:

1. Cineplex Galaxy operated 86 theatres with 775 screens under the Cineplex Odeon and Galaxy brands in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Quebec.
2. Famous Players operated 77 theatres and 768 screens in the same six provinces as Cineplex Galaxy. The firm operated a number of brands other than its own name, including Coliseum, Colossus, Paramount, and SilverCity.

By number of theatres and screens, Cineplex Galaxy was larger but Famous Players had larger box-office receipts.

**The Markets** There isn't just one Canadian market for movie theatres. Each urban area is a separate market.

**Barriers to Entry** The Competition Bureau identified three barriers to entry into the movie-theatre industry:

1. Access to high box-office movies
2. Access to suitable locations
3. Sunk costs and risks

**Access to Movies** The distribution policies of the major movie studios and distributors make entry risky. A new entrant cannot be sure before entering that the studios and distributors will provide it with movies capable of generating box-office revenue. So entry is highly risky.

**Access to Locations** During the late 1990s, a major building program created a large number of new stadium theatres, all of which occupied the best sites. As a consequence, it is difficult today to acquire a suitable site or location for a new movie theatre in many urban markets.

**Sunk Costs and Risks** Most new movie theatres are stadium-seating complexes that are single-purpose



buildings. They are costly to build but have no resale value so the cost of building them is a sunk cost, which makes entry very risky.

### Concentration and Competition after the Merger

With Cineplex Galaxy and Famous Players operating as a single firm, many urban markets would become highly concentrated.

The Competition Bureau identified 17 local markets. In seven of them, the new merged firm would have had 100 percent market share and in five others, they would be near monopolies.

A few areas would have competition: in Montreal from Cinémas Guzzo; and in Montreal, Ottawa, and Toronto from AMC, a large U.S. operator. Outside of these major cities, the merged firm would have faced either no competition or very limited competition from small local firms.

**The Competition Bureau's Decision** The Competition Bureau examined the competitive impact of the merger in each of the cities where Famous Players and Cineplex Galaxy competed and determined that the merger would likely reduce competition substantially in 17 of these areas. The Bureau was concerned about both price and nonprice competition on such factors as theatre quality and film choice.

To resolve these concerns, in 17 cities the Bureau required the new firm to sell 35 of its theatres.

The general rule the Bureau employed was to reduce the new firm's market share in each city to a level similar to the pre-merger market share of the larger of Cineplex or Famous Players.

*Source:* The Competition Bureau, *Acquisitions of Famous Players by Cineplex Galaxy*.

## Economics in Action

### Price Fixing

In June 2008, during a period of rapidly rising oil and gasoline prices, the Competition Bureau laid criminal charges against a number of individuals and companies in Victoriaville, Thetford Mines, Magog, and Sherbrooke (all in Quebec) for fixing the price of gasoline at the pump.



Price-fixing cartels are hard to detect. Evidence of identical prices does not prove the operation of a price-fixing agreement. Firms in perfect competition charge identical prices. Canadian law requires the Competition Bureau to provide evidence that proves, beyond a reasonable doubt, that the competitors have an agreement to fix prices.

In the Quebec gas prices case, the Competition Bureau used wiretaps and searches and took advantage of an immunity program that encourages people who are themselves breaking the law to provide evidence to investigators.

After extensive investigations, evidence emerged that gas retailers had made agreements by telephone on the prices they would charge. The evidence suggested that the overwhelming majority of gasoline retailers in these markets participated in the cartel.

The Court imposed fines totalling more than \$2 million against the companies that pleaded guilty.

The Competition Bureau's investigation into potential price-fixing in the retail gasoline market continues in other markets in Canada.

*Source: Adapted from the Competition Bureau, *Competition Bureau Uncovers Gasoline Cartel in Quebec*.*

## Economics in Action

### Abuse of Dominant Position

In May 2007, Jim Balsillie did a tentative deal to buy the NHL team called Nashville Predators with the intention, it was believed, of relocating the team to Hamilton, Ontario.

Locating the Predators in Hamilton would take some of the market from the Toronto Maple Leafs, who would demand compensation. The Buffalo Sabres might also be damaged and demand compensation, although NHL rules do permit relocation outside a radius of 80 kilometres of an existing team.

NHL policy requires that before a relocation can be accepted, a new owner must make a good faith effort to keep the team in its city. Balsillie, it was claimed, had made no such attempt, and the NHL prevented him from completing the deal.

Following intense discussion in the media, the Competition Bureau investigated whether the NHL's transfer of ownership and relocation policies were anticompetitive or merely designed to protect the interests of the league.

After a major and highly detailed investigation, the Competition Bureau concluded that the NHL's policies were not anticompetitive and did not constitute an abuse of a dominant position. Rather, their aim was to maintain healthy rivalries among teams, to attract the largest possible audiences, and to encourage the investment in sports facilities by local governments.

*Source: The Competition Bureau, *NHL Ownership Transfer and Relocation Policies*.*

## REVIEW QUIZ

- 1 What is the Act of Parliament that provides our anti-combine law?
- 2 What actions violate the anti-combine law?
- 3 Under what circumstances is a merger unlikely to be approved?

Work these questions in Study Plan 15.4 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

◆ Oligopoly is a market structure that you often encounter in your daily life. *Economics in the News* on pp. 360–361 looks at a game played in the market for cellphone service.



# Oligopoly Games in Cellphone Service

## Wireless Carriers Hike Prices across Canada

CBC News

March 17, 2014

Canada's three biggest wireless companies hiked prices for new phone plans by \$5 this weekend.

Rogers, Telus, and Bell Mobility now all charge \$80 per month for new smartphone plans with a new contract, \$5 more than what many of those same plans cost when they were introduced last year. The prices for other smartphone plans with more data cost upwards of \$145.

The price hikes affect every province except Manitoba and Saskatchewan.

The \$80 a month plan includes 500 MB of data, unlimited nationwide calling, unlimited messaging, voicemail and call display.

Last summer, in response to the incoming wireless code of conduct, the three wireless carriers simplified their pricing models for new plans. Instead of choosing different plans based on minutes, data and messaging, customers instead pay a baseline fee depending on the type of phone they have, and then add a basket of data which can be shared by members of the same household.

Initially, those base prices were \$55 per month for higher-priced smartphones such as a Samsung Galaxy S4 or iPhone 5s, \$45 per month for other, cheaper smartphones, and \$35 per month for already unlocked smartphones. The prices for all three of these base prices has been increased.

Manitoba and Saskatchewan, however, have more competitive pricing. Due to strong regional competitors in SaskTel and MTS, Bell and Rogers plans start at \$65 per month with five GB of data. An equivalent plan elsewhere in the country costs \$55 more per month. ...

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### ESSENCE OF THE STORY

- Rogers, Telus, and Bell Mobility, Canada's three biggest wireless companies, increased the price of their smartphone plans by \$5 to \$80 per month.
- The \$80 plan includes 500 MB of data, unlimited nationwide calling, unlimited messaging, voicemail, and call display.
- The prices for plans with more data cost upwards of \$145 per month.
- The price hikes affect every province except Manitoba and Saskatchewan, where the big three face competition from SaskTel and MTS.

**MyEconLab More Economics in the News**

## ECONOMIC ANALYSIS

- The Canadian market in cellphone service is dominated by three firms: Rogers, Telus, and Bell.
- Figure 1 shows the shares in this market. You can see that Rogers has 35 percent of the market, Telus and Bell have 29 percent each, and another four smaller firms share the remaining 7 percent.
- In March 2014, the three big firms raised their prices together.
- They were able to take this step because they play a repeated game.
- If they played a one-shot game, they would be stuck in the prisoners' dilemma, shown in Table 1.
- Being a prisoners' dilemma like that on p. 345, the game has a dominant-strategy Nash equilibrium.
- If Rogers raised its price and the others didn't, Rogers would lose market share and its profit would fall; and if the others raised their prices and Rogers didn't, Rogers would take market share and the others would have lower profit.
- The Nash equilibrium is not to raise the price.
- But if the game is repeated with a tit-for-tat punishment strategy like that on p. 352, the firms can break free from the prisoners' dilemma.
- Table 2 summarizes what each player can anticipate if it doesn't cooperate with the others in raising the price.
- In the repeated game, Rogers knows that it will be punished for not going along with a price rise so its gain

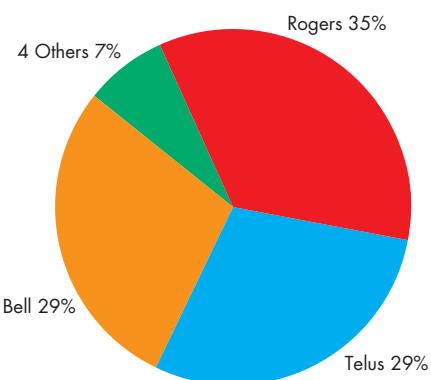


Figure 1 Market Shares in Cellphone Service

from holding the current price is temporary and it will incur a loss in the second period as punishment.

- That is, to restore cooperation with the price hike, Rogers will have to be the only firm with a higher price in the second period.
- The situation is symmetric for Rogers' competitors.
- So after two plays of the game, neither Rogers nor its competitors will have benefitted from a price hike.
- The best strategy for all players is to raise the price together.

		Rogers' strategies	
		Raise price	No change
Telus and Bell's strategies	Raise price	-\$1b	\$2b
	No change	-\$2b	\$0
	Raise price	-\$2b	\$0
	No change	\$0	\$0

Table 1 Rogers and Others Prisoners' Dilemma

TABLE 2 Cheating with Punishment

Period of play	Collude		Cheat with tit-for-tat	
	Rogers' profit (billions of dollars)	Others' profit (billions of dollars)	Rogers' profit (billions of dollars)	Others' profit (billions of dollars)
1	1	1	2	-2
2	1	1	-2	2
3	1	1	1	1
4	•	•	•	•



## SUMMARY

### Key Points

#### What Is Oligopoly? (pp. 342–343)

- Oligopoly is a market in which a small number of firms compete.

Working Problems 1 to 3 will give you a better understanding of what oligopoly is.

#### Oligopoly Games (pp. 344–351)

- Oligopoly is studied by using game theory, which is a method of analyzing strategic behaviour.
- In a prisoners' dilemma game, two prisoners acting in their own self-interest harm their joint interest.
- An oligopoly (duopoly) price-fixing game is a prisoners' dilemma in which the firms might collude or cheat.
- In Nash equilibrium, both firms cheat and output and price are the same as in perfect competition.
- Firms' decisions about advertising and R&D can be studied by using game theory.

Working Problems 4 to 6 will give you a better understanding of oligopoly games.

#### Repeated Games and Sequential Games (pp. 352–355)

- In a repeated game, a punishment strategy can produce a cooperative equilibrium in which price and output are the same as in a monopoly.
- In a sequential contestable market game, a small number of firms can behave like firms in perfect competition.

Working Problem 7 will give you a better understanding of repeated and sequential games.

#### Anti-Combine Law (pp. 356–359)

- Anti-combine law provides an alternative way for the government to control monopoly and monopolistic practices.
- The Competition Act of 1986 sets out Canada's anti-combine law and established a Competition Bureau and a Competition Tribunal.
- Criminal activity is handled by the courts; violations of a noncriminal nature are examined by the Competition Tribunal.

Working Problem 8 will give you a better understanding of anti-combine law.

### Key Terms

- Anti-combine law, 356
- Cartel, 343
- Collusive agreement, 346
- Contestable market, 354
- Cooperative equilibrium, 352

- Dominant-strategy equilibrium, 345
- Duopoly, 342
- Game theory, 344
- Limit pricing, 355
- Nash equilibrium, 345

### MyEconLab Key Terms Quiz

- Oligopoly, 342
- Payoff matrix, 344
- Strategies, 344



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 15 Study Plan.

Black and White are the two and only producers of piano keys. The firms are identical. They have the same technologies and costs, and they produce the same quantities of piano keys. Their keys are identical too, so they sell for the same price regardless of whether Black or White produces them.

The firms are busy and operating at capacity output. But profit margins are thin and they are making zero economic profit.

Despite it being illegal, the two firms decide to collude: to restrict output and raise the price. The deal is that each of them cuts output to 50 percent of the current level and raises the price.

With the deal in place, the firms can earn the maximum monopoly profit and share it equally.

But each firm wants a bigger share of the market and to get back to the original output level. They each know, though, that if only one of them increases output, profit will increase for the one with larger output and the other will incur an economic loss. They also know that if both of them increase production, they will be back in the situation before the deal.

### Questions

1. Describe the game played by Black and White.
2. Make up some profit numbers for Black and White that are consistent with the above account of their situation. Construct a payoff matrix for the game they are playing, and find the equilibrium of the game.

### Solutions

1. The game played by Black and White is a duopoly prisoners' dilemma cartel game.

Each player has two strategies: 1) keep the cartel agreement and 2) break the cartel agreement.

The payoffs are symmetric.

If both keep the agreement, they each earn 50 percent of the maximum attainable monopoly profit.

If both break the agreement, they each earn zero economic profit.

If one of them breaks the agreement, the breaker earns a profit that is larger than 50 percent of the monopoly profit and the other incurs a loss.

The game is a prisoners' dilemma because each knows that the joint best outcome requires keeping the agreement and that the other has an incentive to break it.

**Key Point:** A duopoly price-fixing game is a prisoners' dilemma in which the firms might keep or break an agreement to collude—might comply or cheat.

2. The table below shows a payoff matrix with profit (and loss) numbers that are consistent with the story about Black and White.

If both break the agreement (top left), they earn zero economic profit (\$0 in the table).

If both keep the agreement (bottom right), they earn a monopoly profit and share it equally (\$10m each in the table).

If one keeps the agreement and the other breaks it (top right and bottom left), the keeper incurs a loss (-\$5m in the table) and the breaker gets a profit larger than half the monopoly profit (\$14m in the table).

The Nash equilibrium is for both firms to break the agreement and make zero economic profit.

For each firm, breaking the agreement is the best strategy regardless of the strategy of the other player.

If the other firm keeps the agreement, then the firm that breaks it increases its profit by \$4m.

But if the other firm also breaks the agreement, then breaking the agreement avoids economic loss.

**Key Point:** The Nash equilibrium of a prisoners' dilemma is not the best joint outcome.

### Key Table

		Black's strategies	
		Break agreement	Keep agreement
White's strategies	Break agreement	\$0	-\$5m
	Keep agreement	\$14m	\$10m

**MyEconLab** Interactive Animation

## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 8 in Chapter 15 Study Plan and get instant feedback.

### What Is Oligopoly? (Study Plan 15.1)

1. Intel and Advanced Micro Devices make most of the chips that power a PC. What makes the market for PC chips a duopoly? Sketch the market demand and cost curves that describe the situation in the market and that prevent firms from entering.

### 2. Sparks Fly for Energizer

Energizer is gaining market share against competitor Duracell and its profit is rising despite the sharp rise in the price of zinc, a key battery ingredient.

Source: [www.businessweek.com](http://www.businessweek.com), August 2007

In what type of market are batteries sold? Explain your answer.

### 3. Oil City

In the 1990s, Reliance spent \$6 billion to build a world-class oil refinery at Jamnagar, India. Now Reliance's expansion will make it the world's biggest producer of gasoline—1.2 million gallons per day, or about 5% of global capacity. Reliance plans to sell the gasoline in the United States and Europe where it's too expensive and politically difficult to build new refineries. The bulked-up Jamnagar will be able to move the market, and Singapore traders expect a drop in fuel prices as soon as it's going at full steam.

Source: *Fortune*, April 28, 2008

- a. Explain why the news clip implies that the gasoline market is not perfectly competitive.
- b. What barriers to entry might limit competition and allow Reliance to influence the price?

### Oligopoly Games (Study Plan 15.2)

4. Consider a game with two players who cannot communicate, and in which each player is asked a question. The players can answer honestly or lie. If both answer honestly, each receives \$100. If one player answers honestly and the other lies, the liar receives \$500 and the honest player gets nothing. If both lie, then each receives \$50.
  - a. Describe the strategies and the payoffs.
  - b. Construct the payoff matrix.
  - c. What is the equilibrium of this game?
  - d. Compare this game to the prisoners' dilemma. Are the games similar or different? Explain.

5. Soapy Inc. and Sudties Inc., the only soap-powder producers, collude and agree to share the market equally. If neither firm cheats, each makes \$1 million. If one firm cheats, it makes \$1.5 million, while the complier incurs a loss of \$0.5 million. If both cheat, they break even. Neither firm can monitor the other's actions.
  - a. What are the strategies in this game? Construct the payoff matrix for this game.
  - b. If the game is played only once what is the equilibrium? Is it a dominant-strategy equilibrium? Explain.

### 6. The World's Largest Airline

United Airlines and Continental Airlines announced a \$3 billion merger to create the world's biggest airline. The new airline will be able to better compete with low-cost domestic and foreign airlines. Travellers could face higher fares although the merged airline has no such plans. But one rationale for any merger is to cut capacity.

Source: *The New York Times*, June 7, 2010

- a. Explain how this airline merger might
  - (i) increase air travel prices or (ii) lower air travel production costs.
- b. Explain how cost savings arising from a cut in capacity might be passed on to travellers or boost producers' profits. Which might happen from this airline merger and why?

### Repeated Games and Sequential Games

(Study Plan 15.3)

7. If Soapy Inc. and Sudties Inc. play the game in Problem 5 repeatedly, on each round of play:
  - a. What strategies might each firm adopt?
  - b. Can the firms adopt a strategy that gives the game a cooperative equilibrium?
  - c. Would one firm still be tempted to cheat in a cooperative equilibrium? Explain your answer.

### Anti-Combine Law (Study Plan 15.4)

8. Apple conspired with five publishers to undercut Amazon's 90 percent share of the e-book market, which caused e-book prices to rise to \$12.99 or \$14.99 from the \$9.99 that Amazon charged.

Source: *Financial Post*, July 10, 2013

Explain why this conspiracy to raise prices violates the anti-combine law.

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### What Is Oligopoly?

#### 9. An Energy Drink with a Monster of a Stock

The \$5.7 billion energy-drink category, in which Monster holds the No. 2 position behind the industry leader Red Bull, has slowed down as copycat brands jostle for shelf space. Over the past five years its market share in dollar terms has gone from 91 percent to well under 50 percent, and much of that loss has been Monster's gain.

Source: *Fortune*, December 25, 2006

- Describe the structure of the energy-drink market. How has that structure changed over the past few years?
- If Monster and Red Bull formed a cartel, how would the price charged for energy drinks and the profits made change?

### Oligopoly Games

Use the following data to work Problems 10 and 11. Bud and Wise are the only two producers of aniseed beer, a New Age product designed to displace root beer. Bud and Wise are trying to figure out how much of this new beer to produce. They know:

- If they both produce 10,000 litres a day, they will make the maximum attainable joint economic profit of \$200,000 a day, or \$100,000 a day each.
  - If either firm produces 20,000 litres a day while the other produces 10,000 litres a day, the one that produces 20,000 litres will make an economic profit of \$150,000 and the other will incur an economic loss of \$50,000.
  - If both produce 20,000 litres a day, each firm will make zero economic profit.
- Construct a payoff matrix for the game that Bud and Wise must play.
  - Find the Nash equilibrium of the game that Bud and Wise play.

#### 12. Asian Rice Exporters to Discuss Cartel

The Asian rice-exporting nations planned to discuss a proposal that they form a cartel. Ahead of the meeting, the countries said that the purpose of the rice cartel would be to contribute to ensuring food stability, not just in an individual country but also to address food shortages in the region

and the world. The cartel will not hoard rice and raise prices when there are shortages.

The Philippines says that it is a bad idea. It will create an oligopoly, and the cartel could price the grain out of reach for millions of people.

Source: CNN, May 6, 2008

- Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, explain how they would influence the global market for rice and the world price of rice.
  - Assuming the rice-exporting nations become a profit-maximizing colluding oligopoly, draw a graph to illustrate their influence on the global market for rice.
  - Even in the absence of international anti-trust laws, why might it be difficult for this cartel to successfully collude? Use the ideas of game theory to explain.
  - Suppose that Mozilla and Microsoft each develop their own versions of an amazing new Web browser that allows advertisers to target consumers with great precision. Also, the new browser is easier and more fun to use than existing browsers. Each firm is trying to decide whether to sell the browser or to give it away. What are the likely benefits from each action? Which action is likely to occur?
  - Why do Coca-Cola and PepsiCo spend huge amounts on advertising? Do they benefit? Does the consumer benefit? Explain your answer by constructing a game to illustrate the choices Coca-Cola and PepsiCo make.
- Use the following news clip to work Problems 15 and 16.
- PS4 vs. Xbox One Battle Means Gamers Win, Sony Says**
- Microsoft's latest move in the PlayStation 4 versus Xbox One battle was to lower the price of Xbox One to \$399—the same price as the PS4.
- Source: *Gamspot*, July 1, 2014
- Thinking about the competition between Sony and Microsoft in the market for game consoles as a game, describe the firms' strategies concerning design, marketing, and price.
  - What, based on the information provided, turned out to be the equilibrium of the game?
  - Can you think of reasons why the two consoles are different?

### Repeated Games and Sequential Games

17. If Bud and Wise in Problem 10 play the game repeatedly, what is the equilibrium of the game?
18. Agile Airlines' profit on a route on which it has a monopoly is \$10 million a year. Wanabe Airlines is considering entering the market and operating on this route. Agile warns Wanabe to stay out and threatens to cut the price so that if Wanabe enters it will make no profit. Wanabe determines that the payoff matrix for the game in which it is engaged with Agile is shown in the table.

		Agile's strategies	
		High price	Low price
Wanabe's strategies	Enter	7 5	1 0
	Don't enter	10 0	5 0

Does Wanabe believe Agile's assertion? Does Wanabe enter or not? Explain.

19. **Oil Trading Probe May Uncover Manipulation**  
 Amid soaring oil prices the Commodity Futures Trading Commission (CFTC) is looking into manipulation of the oil market—withholding oil in an attempt to drive prices higher. The CFTC has found such evidence in the past and it's likely it will find evidence again. But it is unlikely that a single player acting alone would be able to run the price up from \$90 to \$135.

Source: CNN, May 30, 2008

What type of market does the news clip imply best describes the oil market?

### Anti-Combine Law

Use the following news clip to work Problems 20 and 21.

#### Gadgets for Sale ... or Not

How come the prices of some gadgets, like the iPod, are the same no matter where you shop? No, the answer isn't that Apple illegally manages prices. In reality, Apple uses an accepted retail strategy called minimum advertised price to discourage resellers from discounting. The minimum advertised price (MAP) is the absolute lowest price of a product that resellers can advertise. Marketing subsidies offered by a manufacturer to its resellers usually keep the price at or above

the MAP. Stable prices are important to the company that is both a manufacturer and a retailer. If Apple resellers advertised the iPod below cost, they could squeeze the Apple Stores out of their own markets. The downside to the price stability is that by limiting how low sellers can go, MAP keeps prices artificially high (or at least higher than they might otherwise be with unfettered price competition).

Source: *Slate*, December 22, 2006

20. a. Describe the practice of resale price maintenance that violates the anti-combine law.  
 b. Describe the MAP strategy used by Apple and explain how it differs from a resale price maintenance agreement that would violate the anti-combine law.  
 21. Why might the MAP strategy be against the social interest and benefit only the producer?

### Economics in the News

22. After you have studied *Economics in the News* on pp. 360–361, answer the following questions.
- What are the strategies of Rogers, Telus, and Bell in the market for cellphone service?
  - Why did they not raise their prices in Manitoba and Saskatchewan? How is the game different in those provinces?
  - Why is a tit-for-tat punishment strategy needed to get the firms out of a prisoners' dilemma?
  - How would you expect the entry of a fourth big player, such as U.S. Verizon, to change the game and its outcome?
23. **Boeing and Airbus Predict Asian Sales Surge**

Airlines in the Asia-Pacific region are emerging as the biggest customers for aircraft-makers Boeing and Airbus. The two firms predict that over the next 20 years, more than 8,000 planes worth up to \$1.2 trillion will be sold there.

Source: BBC News, February 3, 2010

- In what type of market are big airplanes sold?
- Thinking of competition between Boeing and Airbus as a game, what are the strategies and the payoffs?
- Set out a hypothetical payoff matrix for the game you've described in part (b). What is the equilibrium of the game?
- Do you think the market for big airplanes is efficient? Explain and illustrate your answer.

# Managing Change and Limiting Market Power

Our economy is constantly changing. Every year, new goods appear and old ones disappear. New firms are born, and old ones die. This process of change is initiated and managed by firms operating in markets.

When a new product appears, just one or two firms sell it: Apple and IBM were the only producers of personal computers; Microsoft was (and almost still is) the only producer of the PC operating system; Intel was the only producer of the PC chip. These firms had enormous power to determine the quantity to produce and the price of their products.

In many markets, entry eventually brings competition. Even with just two rivals, the industry changes its face in a dramatic way. *Strategic interdependence* is capable of leading to an outcome like perfect competition.

With the continued arrival of new firms in an industry, the market becomes competitive. But in most markets, the competition isn't perfect: it becomes *monopolistic competition* with each firm selling its own differentiated product.

Often, an industry that is competitive becomes less so as the bigger and more successful firms in the industry begin to swallow up the smaller firms, either by driving them out of business or by acquiring their assets. Through this process, an industry might return to oligopoly or even monopoly. You can see such a movement in the auto and banking industries today.

By studying firms and markets, we gain a deeper understanding of the forces that allocate resources and begin to see the invisible hand at work.

**John von Neumann** was one of the great minds of the twentieth century. Born in Budapest, Hungary, in 1903, Johnny, as he was known, showed early mathematical brilliance. He was 25 when he published the article that changed the social sciences and began a flood of research on **game theory**—a flood that has not subsided. In that article, von Neumann proved that in a zero-sum game (such as sharing a pie), there exists a best strategy for each player.

Von Neumann did more than invent game theory: He also invented and built the first practical computer, and he worked on the Manhattan Project, which developed the atomic bomb during World War II.

Von Neumann believed that the social sciences would progress only if they used their own mathematical tools, not those of the physical sciences.

## PART FOUR

### UNDERSTANDING FIRMS AND MARKETS

*"Real life consists of bluffing, of little tactics of deception, of asking yourself what is the other man going to think I mean to do."*

**JOHN VON NEUMANN,**  
told to Jacob Bronowski (in a London taxi) and reported in *The Ascent of Man*.





TALKING WITH

**Thomas Hubbard\***

*Professor Hubbard, you have made important contributions to our understanding of outsourcing: whether a firm will make it or buy it. Can you summarize what economists know about this issue?*

If there is one thing that Coase (Ronald Coase, see p. 411) taught us about the boundaries of the firm, it is that when thinking about whether to do something internally or to outsource it, a very useful starting point is to make the decision on a transaction-by-transaction basis.

The way I like to think about it is to boil it down to the theory of markets and incentives. Markets provide strong incentives but not necessarily good incentives. So when you outsource something, you rely on a market mechanism rather than on something within a firm that is less than a market mechanism. By outsourcing, you expose people to a strong market incentive. Now that can be good, and it is good most of the time. Strong market incentives get people to do things that the market rewards. Market rewards are generally quite valuable, but in some circumstances what

**Markets provide strong incentives but not necessarily good incentives.**

THOMAS HUBBARD is the John L. and Helen Kellogg Distinguished Professor of Management and Strategy at the Kellogg School of Management, Northwestern University and a research fellow at the National Bureau of Economic Research.

Professor Hubbard is an empirical economist. His work is driven by data. The central problems that unify much of his work are the limits to information and the fact that information is costly to obtain. Professor Hubbard studies the ways in which information problems influence the organization of firms; the extent to which firms make or buy what they sell; and the structure and performance of markets.

His work appears in the leading journals such as the *American Economic Review*, the *Quarterly Journal of Economics*, and the *Rand Journal of Economics*. He is a co-editor of the *Journal of Industrial Economics*.

Michael Parkin and Robin Bade talked with Thomas Hubbard about his research and what we learn from it about the choices that firms make and their implications for market structure and performance.

the market rewards isn't what the buyer would want to reward. So there's a tradeoff. Strong incentives are sometimes good and sometimes bad. Therefore, keeping things inside the firm provides a weaker incentive. Sometimes that is good.

*Can you provide an example?*

Think about McDonald's. McDonald's is not one firm. It is many firms because a lot of the outlets are owned and managed by franchisees and some are owned and managed internally by McDonald's.

McDonald's thinks about whether to run one of its restaurants itself or to franchise it out. One thing that it has in mind is that if it franchises it out, then the franchisor is going to be exposed to very strong market incentives. Now under some circumstances this is great. The franchisee treats the business as if he owns it. So the good part about it is the franchisee works hard to try to develop his business.

But a flip side to the franchisee's treating the business as his own is that it can be harmful for the McDonald's brand.

\*Read the full interview with Thomas Hubbard in [MyEconLab](#).



## PART FIVE MARKET FAILURE AND GOVERNMENT

# 16

## EXTERNALITIES

After studying this chapter,  
you will be able to:

- ◆ Explain how externalities arise
- ◆ Explain why external costs bring market failure and overproduction and how property rights and public choices might achieve an efficient outcome
- ◆ Explain why external benefits bring market failure and underproduction and public choices might achieve an efficient outcome

How can we use less coal to generate electricity and reduce carbon emissions that bring climate change? How can we ensure that we spend enough on our schools, colleges, and universities to provide everyone with a quality education?

These are the questions we study in this chapter. They arise because some of our choices impose costs on or bring benefits to others that we don't think about when we make those choices.

In *Economics in the News* at the end of the chapter, we look at the success of British Columbia's way of cutting carbon emissions to fight climate change.

## Externalities In Our Lives

An **externality** is a cost of or a benefit from an action that falls on someone other than the person or firm choosing the action. We call an externality that imposes a cost a **negative externality**; and we call an externality that provides a benefit a **positive externality**.

We identify externalities as four types:

- Negative production externalities
- Positive production externalities
- Negative consumption externalities
- Positive consumption externalities

### Negative Production Externalities

Burning coal to generate electricity emits carbon dioxide that is warming the planet. Logging and the clearing of forests is destroying the habitat of wildlife and also adding carbon dioxide to the atmosphere. These activities are negative production externalities, the costs of which are borne by everyone, and even by future generations.

Noise is another negative production externality. When the Rogers Cup tennis tournament is being played in Toronto, players, spectators, and television viewers around the world share a cost that local residents experience every day: the noise of airplanes taking off from Pearson International Airport. Aircraft noise imposes a cost on millions of people who live under the flight paths to airports in every major city.

### Positive Production Externalities

To produce orange blossom honey, a honey producer locates beehives next to an orange orchard. The honeybees collect pollen and nectar from the orange blossoms to make the honey. At the same time, they transfer pollen between the blossoms, which helps to fertilize the blossoms. Two positive production externalities are present in this example. The honey producer gets a positive production externality from the owner of the orange orchard; and the orange grower gets a positive production externality from the honey producer.

### Negative Consumption Externalities

Negative consumption externalities are a source of irritation for most of us. Smoking tobacco in a confined space creates fumes that many people find unpleasant and that pose a health risk. So smoking in restaurants and on airplanes generates a negative

externality. To avoid this negative externality, many restaurants and all airlines ban smoking. But while a smoking ban avoids a negative consumption externality for most people, it imposes a negative external cost on smokers who would prefer to enjoy the consumption of tobacco while dining or taking a plane trip.

Noisy parties and outdoor rock concerts are other examples of negative consumption externalities. They are also examples of the fact that a simple ban on an activity is not a solution. Banning noisy parties avoids the external cost on sleep-seeking neighbours, but it results in the sleepers imposing an external cost on the fun-seeking partygoers.

Permitting dandelions to grow in lawns, not picking up leaves in the fall, allowing a dog to bark loudly or to foul a neighbour's lawn, and letting a cellphone ring in class are other examples of negative consumption externalities.

### Positive Consumption Externalities

When you get a flu vaccination, you lower your risk of being infected. If you avoid the flu, your neighbour, who didn't get vaccinated, has a better chance of remaining healthy. Flu vaccinations generate positive consumption externalities.

When the owner of a historic building restores it, everyone who sees the building gets pleasure from it. Similarly, when someone erects a spectacular home—such as those built by Frank Lloyd Wright during the 1920s and 1930s—or other exciting building—such as the CN Tower in Toronto or the Sydney Opera House in Australia—an external consumption benefit flows to everyone who has an opportunity to view it.

Education, which we examine in more detail in this chapter, is a major example of this type of externality.

### REVIEW QUIZ

- 1 What are the four types of externality?
- 2 Provide an example of each type of externality that is different from the ones described above.

Work these questions in Study Plan 16.1 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

We're now going to examine the market failure that arises from an externality and the ways in which it can be avoided. We begin by looking at the negative production externality, pollution.

## Economics in Action

### Opposing Trends: Success and Failure

The trends in the air quality of Canadian cities and in global greenhouse gas concentrations are starkly opposing. The concentrations of air pollutants in Canadian cities is decreasing, as it has done so for many years. In contrast, the concentration of greenhouse gases (mainly carbon dioxide) in the global atmosphere is increasing and posing an ever more urgent problem.

#### Air Pollution Trends

Figure 1 shows the trends in the concentrations of four main pollutants of the air of Canada's cities between 1997 and 2011. With the exception of ozone, the concentrations of these pollutants decreased.

Environment Canada regulations have cut emissions of nitrogen dioxide to 60 percent of its 1997 level, and of volatile organic compounds and sulphur dioxide to around 40 percent of their 1997 levels.

These reductions in air pollution are even more impressive seen against the trends in economic activity. Between 1997 and 2011, total production in Canada increased by 43 percent, vehicle kilometres travelled increased by 5 percent, and the population increased by 15 percent.

Canada's air also compares favourably with that of other countries. No Canadian city, even on a bad day, experiences a smoggy dawn like that of Los Angeles.

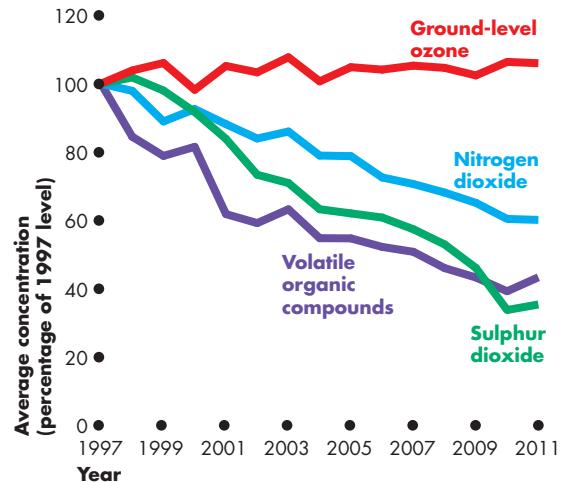
#### Global CO<sub>2</sub> and Temperature Trends

Figure 2 shows the global trends in carbon dioxide (CO<sub>2</sub>) concentration and temperature.

Both trends are starkly upward. CO<sub>2</sub> concentration has increased by almost 40 percent since 1850, and global temperature has been rising for more than 100 years.

Scientists agree that the scale on which we burn fossil fuels is the major source of the rising CO<sub>2</sub> trend. There is more uncertainty about the effect of the increase in CO<sub>2</sub> on global temperature, but the consensus is that the effect is significant.

Stopping the rising CO<sub>2</sub> trend requires joint action by the governments of every nation. But a binding agreement among nations to reduce greenhouse gas emissions, the *Kyoto Protocol*, excluded the major developing countries, and the United States refused to ratify it. You will see in this chapter why global warming is a much harder problem to solve than reducing local city air pollution.

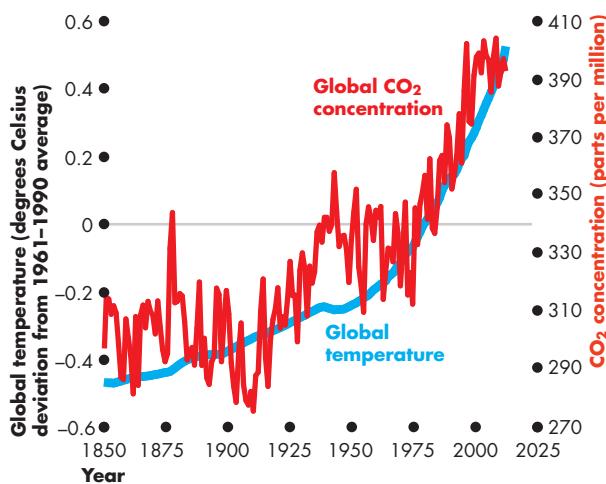


**Figure 1 Canadian Air Pollution Trends**

Source of data: Environment Canada.



Los Angeles still has a smoggy dawn on some days



**Figure 2 Global Warming Trends**

Sources of data: Temperature: Met Office Hadley Centre (combined land and oceans); CO<sub>2</sub>: Scripps Institution of Oceanography, Mauna Loa Observatory, Hawaii, data since 1960 and ice-core estimates before 1960.

## Negative Externality: Pollution

To see the effects and possible remedies for a negative production externality, we'll look at the example of production activities that pollute. We begin by distinguishing among three costs: private, external, and social.

### Private, External, and Social Cost

A **private cost** of production is a cost that is borne by the producer of a good or service. **Marginal cost** is the cost of producing an *additional unit* of a good or service. So **marginal private cost (MC)** is the cost of producing an additional unit of a good or service that is borne by its producer.

An **external cost** is a cost of producing a good or service that is *not* borne by the producer but borne by other people. A **marginal external cost** is the cost of producing an additional unit of a good or service that falls on people other than the producer.

**Marginal social cost (MSC)** is the marginal cost incurred by the producer and by everyone else on whom the cost falls—by society. It is the sum of marginal private cost and marginal external cost. That is,

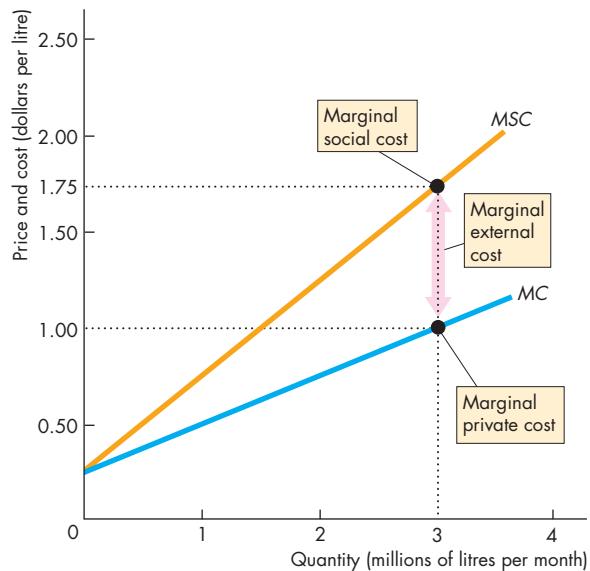
$$MSC = MC + \text{Marginal external cost}.$$

We express costs in dollars, but we must always remember that a cost is an opportunity cost—something real, such as clean air or a clean river, is given up to get something.

**Valuing an External Cost** Economists use market prices to put a dollar value on the external cost of pollution. For example, suppose that there are two similar rivers, one polluted and the other clean. Ten identical homes are built along the side of each river. The homes on the clean river rent for \$2,000 per month, and those on the polluted river rent for \$1,500 per month. If the pollution is the only detectable difference between the two rivers and the two locations, the rent difference of \$500 per month is the pollution cost per home. With 10 homes on the side of a polluted river, the external cost of pollution is \$5,000 per month.

**External Cost and Output** Figure 16.1 shows an example of the relationship between output and cost in a paint industry that pollutes rivers. The marginal cost curve, *MC*, describes the marginal private cost borne by the paint producers, which increases as the quantity of paint produced increases.

**FIGURE 16.1** An External Cost



The *MC* curve shows the marginal private cost borne by the factories that produce paint. The *MSC* curve shows the sum of marginal private cost and marginal external cost. When output is 3 million litres of paint per month, marginal private cost is \$1.00 per litre, marginal external cost is 75¢ per litre, and marginal social cost is \$1.75 per litre.

### MyEconLab Animation

If a firm pollutes a river, it imposes an external cost borne by other users of the river. Pollution and its marginal external cost increase with the amount of paint produced.

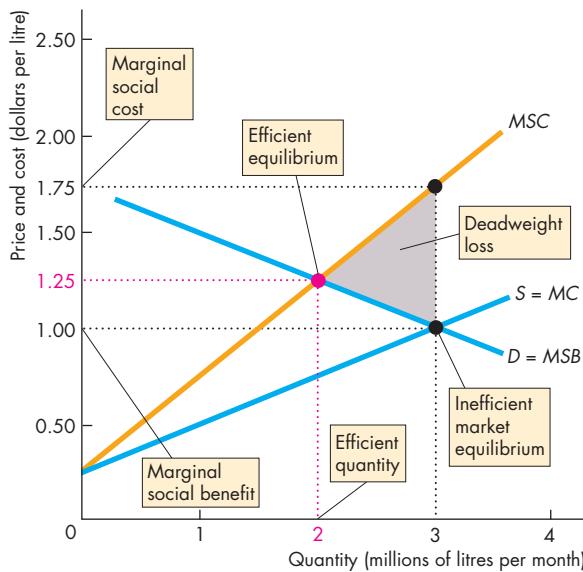
The marginal social cost curve, *MSC*, is found by adding marginal external cost to marginal private cost. So a point on the *MSC* curve shows the sum of the marginal private cost and marginal external cost at a given level of output.

For example, if 3 million litres of paint per month are produced, marginal private cost is \$1.00 per litre, marginal external cost is 75¢ per litre, and marginal social cost is \$1.75 per litre.

Let's now see how much paint gets produced and how much pollution gets created.

**Equilibrium and Amount of Pollution** Equilibrium in the market for paint determines the amount of pollution. Figure 16.2 has the same *MC* and *MSC* curves as Fig. 16.1 and also has a market demand and marginal social benefit curve, *D* = *MSB*. Equilibrium occurs at a price of \$1.00 per litre and 3 million litres

**FIGURE 16.2** Inefficiency with an External Cost



The factories' marginal private cost curve is the market supply curve,  $S = MC$ . The market demand curve is the marginal social benefit curve,  $D = MSB$ . The market equilibrium occurs at a price of \$1.00 per litre and 3 million litres per month. This outcome is inefficient because marginal social cost exceeds marginal social benefit. The efficient quantity of paint is 2 million litres per month. The grey triangle shows the deadweight loss created by the pollution.

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per month. This equilibrium is one with *inefficient overproduction* (Chapter 5, p. 114) because marginal social cost at \$1.75 per litre exceeds marginal social benefit at \$1.00 per litre.

The efficient equilibrium occurs where marginal social benefit *equals* marginal social cost at 2 million litres of paint per month. Too much paint is produced, too much pollution is created, and the area of the deadweight loss triangle measures the society's loss.

The deadweight loss arises because the paint factories only take their private cost into account when making their production decision. If some method can be found to get paint factories to create less pollution and eliminate the deadweight loss, everyone—the owners of paint factories and the residents of the riverside homes—can gain. So, what can be done to fix the inefficiency that arises from an external

cost? Three approaches are available and we will examine each of them. They are:

- Establish property rights
- Mandate clean technology
- Tax or price pollution

### Establish Property Rights

**Property rights** are legally established titles to the ownership, use, and disposal of factors of production and goods and services that are enforceable in the courts. Property rights are a foundation stone of the market economy. But they don't apply to all property. Establishing property rights can confront producers with the costs of their actions and provide the incentives that allocate resources efficiently.

To see how property rights work, suppose that the paint producers have property rights on a river and the homes alongside it—they *own* the river and the homes. The rental income that the paint producers are able to make on the homes depends on the amount of pollution they create. Using the earlier example, people are willing to pay a rent of \$2,000 a month to live alongside a pollution-free river but only \$1,500 a month to live with the pollution created by producing 3 million litres of paint per month.

The forgone rental income from homes alongside a polluted river is an opportunity cost of producing paint. The paint producers must now decide how to respond to this cost. There are two possible responses:

- Use an abatement technology
- Produce less and pollute less

**Use an Abatement Technology** An **abatement technology** is a production technology that reduces or prevents pollution. The catalytic converter in every car is an example of an abatement technology. Its widespread adoption (with lead-free gasoline) has dramatically reduced pollution from highway vehicles and helped to achieve an improvement in air quality.

Abatement technologies exist to eliminate or reduce pollution from electricity generation and many industrial processes, including the manufacture of paint.

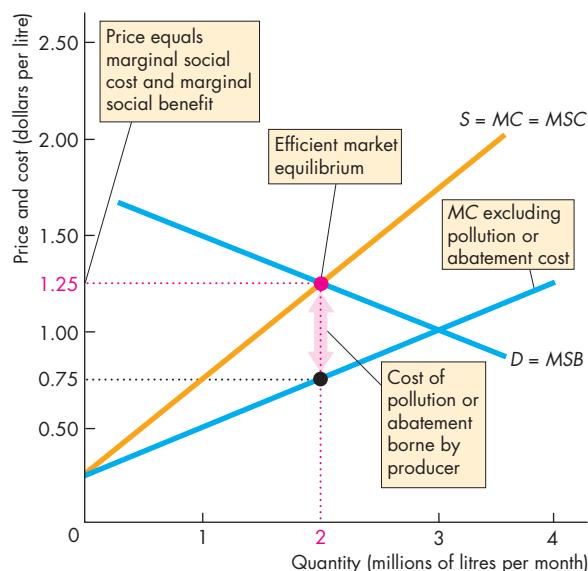
**Produce Less and Pollute Less** An alternative to incurring the cost of using an abatement technology is to use the polluting technology but cut production, reduce pollution, and get a higher income from renting homes by the river. The decision turns on cost: Firms will choose the least-cost alternative.

**Efficient Market Equilibrium** Figure 16.3 illustrates the efficient market outcome. With property rights in place, the paint producers face the pollution costs or the abatement costs, whichever is lower. The  $MSC$  curve includes the cost of producing paint plus *either* the cost of abatement *or* the cost of pollution (forgone rent), whichever is lower. This curve, labelled  $S = MC = MSC$ , is now the market supply curve.

Market equilibrium occurs at a price of \$1.25 per litre and 2 million litres of paint per month. This outcome is efficient.

If the forgone rent is less than the abatement cost, the factories will still create some pollution, but it will be the efficient quantity. If the abatement cost is lower than the forgone rent, the factories will stop polluting. But they will produce the efficient quantity because marginal cost includes the abatement cost.

**FIGURE 16.3** Property Rights Achieve an Efficient Outcome



With property rights, the marginal cost curve that excludes pollution and abatement costs shows only part of the producers' marginal cost. The marginal cost of producing paint now includes the cost of pollution—the external cost—or the cost of abatement. So the market supply curve is  $S = MC = MSC$ . Market equilibrium occurs at a price of \$1.25 per litre and 2 million litres of paint per month. Marginal social cost equals marginal social benefit, so the outcome is efficient.

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**The Coase Theorem** Does it matter whether the polluter or the victim of the pollution owns the resource that might be polluted? Until 1960, everyone thought that it did matter. But in 1960, Ronald Coase (see p. 411) had a remarkable insight that we now call the Coase theorem.

The **Coase theorem** is the proposition that if property rights exist and the transactions costs of enforcing them are low, then private transactions are efficient and it doesn't matter who has the property rights.

**Application of the Coase Theorem** Suppose that instead of the paint factories owning the homes, the residents own their homes and the river. Now the factories must pay a fee to the homeowners for the right to dump their waste. The greater the quantity of waste dumped into the river, the more the factories must pay. So again, the factories face the opportunity cost of the pollution they create. The quantity of paint produced and the amount of waste dumped are the same whoever owns the homes and the river. If the factories own them, they bear the cost of pollution because they receive a lower income from home rents. If the residents own the homes and the river, the factories bear the cost of pollution because they must pay a fee to the homeowners. In both cases, the factories bear the cost of their pollution and dump the efficient amount of waste into the river.

The Coase solution works only when transactions costs are low. **Transactions costs** are the opportunity costs of conducting a transaction. For example, when you buy a house, you pay an agent to help you find the best place and a lawyer to run checks that assure you that the seller owns the property and that after you've paid for it, the ownership has been properly transferred to you. These costs are transactions costs.

In the example of the homes alongside a river, the transactions costs that are incurred by a small number of paint factories and a few homeowners might be low enough to enable them to negotiate the deals that produce an efficient outcome. But in many situations, transactions costs are so high that it would be inefficient to incur them. In these situations, the Coase solution is not available.

### Mandate Clean Technology

When property rights are too difficult to define and enforce, public choices are made. Regulation is a government's most likely response.

Most countries regulate what may be dumped in rivers and lakes and emitted into the atmosphere. The environmental resources of Canada are heavily regulated.

**Canadian Environmental Regulation** Environment Canada, the government department charged with monitoring and protecting the environment, was created by the Department of the Environment Act of 1985.

Environment Canada monitors air pollution with its National Air Pollution Surveillance Program and has issued thousands of regulations that require chemical plants and power utilities to adopt best-practice pollution abatement technologies and limit their emissions of specified air pollutants. Other regulations have been issued that govern road vehicle emission limits, which must be met by vehicle manufacturers.

Although direct regulation can and has reduced emissions and improved air quality, economists are generally skeptical about this approach. Abatement is not always the least-cost solution. Also, government agencies are not well placed to find the cost-minimizing solution to a pollution problem. Individual firms seeking to minimize cost and maximize profit and responding to price signals are more likely to achieve an efficient outcome. We'll now examine these other approaches to pollution.

### Tax or Cap and Price Pollution

Governments use two main methods of confronting polluters with the costs of their decisions:

- Taxes
- Cap-and-trade

**Taxes** Governments can use taxes as an incentive for producers to cut back the pollution they create. Taxes used in this way are called **Pigovian taxes**, in honour of Arthur Cecil Pigou, the British economist who first worked out this method of dealing with external costs during the 1920s.

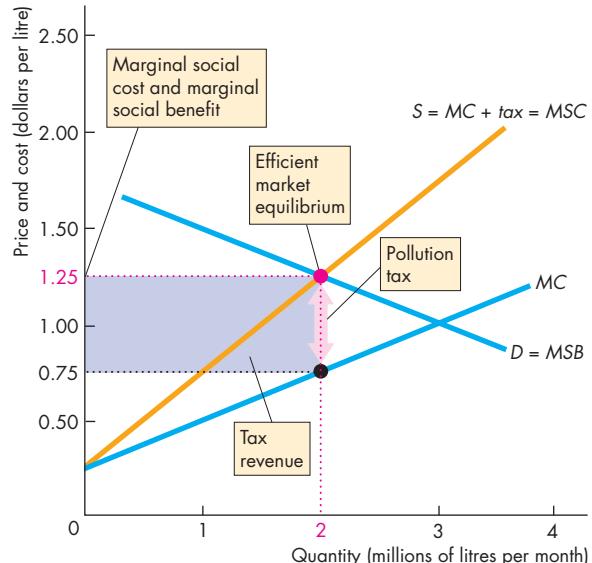
By setting the tax equal to the marginal external cost (or marginal abatement cost if it is lower), firms can be made to behave in the same way as they would if they bore the cost of the externality directly.

To see how government actions can change the outcome in a market with external costs, let's return to the example of paint factories and the river. Assume that the government has assessed the marginal external cost of pollution accurately and

imposes a tax on the factories that exactly equals this cost. The producers are now confronted with the social cost of their actions. The market equilibrium is one in which price equals marginal social cost—an efficient outcome.

Figure 16.4 illustrates the effects of a Pigovian tax on paint factory pollution. The curve  $D = MSB$  is the market demand and the marginal social benefit curve. The curve  $MC$  is the marginal cost curve. The tax equals the marginal external cost of the pollution. We add this tax to the marginal private cost to find the market supply curve, the curve labelled  $S = MC + \text{tax} = MSC$ . This curve is the market supply curve because it tells us the quantity supplied at each price, given the factories' marginal cost and the tax they must pay. This curve is also the marginal social cost curve because the pollution tax has been set equal to the marginal external cost.

**FIGURE 16.4** A Pollution Tax to Achieve an Efficient Outcome



When the government imposes a pollution tax equal to the marginal external cost of pollution, the market supply curve becomes the marginal private cost curve,  $MC$ , plus the tax—the curve  $S = MC + \text{tax}$ . Market equilibrium occurs at a price of \$1.25 per litre and a quantity of 2 million litres of paint per month. This equilibrium is efficient because marginal social cost equals marginal social benefit. The purple rectangle shows the government's tax revenue.

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## Economics in Action

### Taxing Carbon Emissions

British Columbia, Ireland, and the United Kingdom are making their carbon footprints smaller.

#### British Columbia's Carbon Tax

Introduced in 2008 at \$10 per tonne of carbon emitted, British Columbia's tax increased each year to its final rate of \$30 per tonne in 2012. The tax applies to all forms of carbon emission from coal, oil, and natural gas. The tax is revenue-neutral, which means that other taxes, personal and corporate income taxes, are cut by the amount raised by the carbon tax. Between 2008 and 2012, carbon emissions fell by 17 percent.

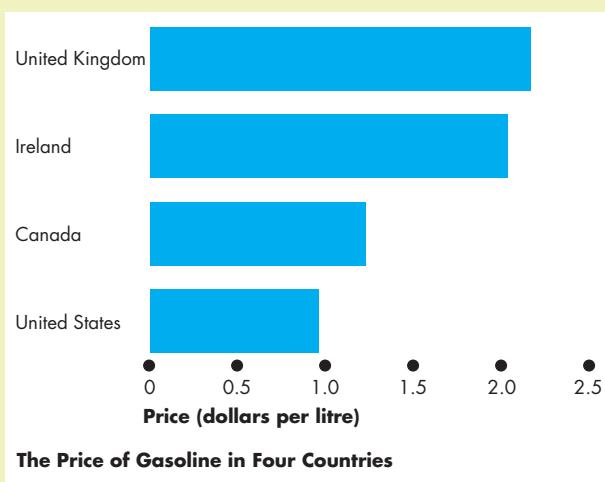
#### Ireland's Carbon Tax

Since 2010, Ireland has taxed kerosene, gas oil, liquid petroleum gas, fuel oil, natural gas, and solid fuels. The tax rate in 2013 was 10 euros (\$13) per tonne of CO<sub>2</sub> emitted and 20 euros (\$26) per tonne in 2014. Emissions have fallen since the tax was introduced, but recession as well as the carbon tax brought this fall.

#### U.K. Tax on Gasoline

The United Kingdom doesn't call its gasoline tax a carbon tax, but it has the same effect on drivers. The figure shows the U.K. price of gasoline compared with that in three other countries. The enormous differences arise almost entirely from tax differences.

An effect of these price differences is that cars in the United Kingdom get an average of 13.5 kilometres per litre while in Canada and the United States, the average is 8.13 kilometres per litre. A high gas tax cuts carbon emissions by inducing people to drive smaller cars and to drive less.



Demand and supply now determine the market equilibrium price at \$1.25 per litre and a quantity of 2 million litres of paint a month. At this quantity of paint production, the marginal social cost is \$1.25 and the marginal social benefit is \$1.25, so the market outcome is efficient. The factories incur a marginal private cost of 75¢ per litre and pay a pollution tax of 50¢ per litre. The government collects tax revenue of \$1 million per month.

**Cap-and-Trade** A cap is an upper limit. You've met the idea of a government imposing an upper limit before when you learned about production quotas (Chapter 6, p. 139), and import quotas (Chapter 7, p. 160). A cap is a quota—a pollution quota.

A government that uses this method must first estimate the efficient quantity of pollution and set the overall cap at that level.

Just like a production or import quota, a pollution quota or cap must somehow be allocated to individual firms (and possibly even households). In an efficient allocation of pollution quotas, each firm has the same marginal social cost. So to make an efficient allocation of the cap across firms, the government would need to know each firm's marginal production cost and marginal abatement cost.

A Pigovian tax achieves an efficient allocation of pollution across firms because each firm chooses how much to produce and pollute taking the tax into account, and produces the quantity at which marginal social cost equals price. Because all firms face the same market price, they also incur the same marginal social cost.

The government solves the allocation problem by making an initial distribution of the cap across firms and allowing them to trade in a market for pollution permits. Firms that have a low marginal abatement cost sell permits and make big cuts in pollution. Firms that have a high marginal abatement cost buy permits and make smaller cuts or perhaps even no cuts in pollution.

The market in permits determines the equilibrium price of pollution and each firm, confronted with that price, maximizes profit by setting its marginal pollution cost or marginal abatement cost, whichever is lower, equal to the market price of a permit.

By confronting polluters with a price of pollution, trade in pollution permits can achieve the same efficient outcome as a Pigovian tax.



## AT ISSUE

### Should We Be Doing More to Reduce Carbon Emissions?

Economists agree that tackling the global-warming problem requires changes in the incentives that people face. The cost of carbon-emitting activities must rise and the cost of clean-energy technologies must fall.

Disagreement centres on *how* to change incentives. Should more countries set targets for cutting carbon emissions at a faster rate? And should they introduce a carbon tax, emissions charges, or cap-and-trade to cut emissions? Should clean-energy research and development be subsidized?

#### Yes: *The Stern Review*

- Confronting emitters with a tax or price on carbon imposes low present costs for high future benefits.
- The cost of reducing greenhouse gas emissions to safe levels can be kept to 1 percent of global income each year.
- The future benefits are incomes at least 5 percent and possibly 20 percent higher than they will be with inaction every year forever.
- Climate change is a global problem that requires an international coordinated response.
- Unlike most taxes, which bring deadweight loss, a carbon tax eliminates (or reduces) deadweight loss.
- Strong, deliberate policy action is required to change the incentives that emitters face.
- Policy actions should include:
  1. Emissions limits and emissions trading
  2. Increased subsidies for energy research and development, including the development of low-cost clean technology for generating electricity
  3. Reduced deforestation and research into new drought and flood-resilient crop varieties



Economist Nicholas Stern, principal author of *The Stern Review on the Economics of Climate Change*.  
 Greenhouse gas emission is "the greatest market failure the world has ever seen."  
 To avoid the risk of catastrophic climate change, the upward CO<sub>2</sub> trend must be stopped.

#### No: *The Copenhagen Consensus*

- Confronting emitters with a tax or price on carbon imposes high present costs and low future benefits.
- Unless the entire world signs onto an emissions reduction program, free riders will increase their emissions and carbon leakage will occur.
- A global emissions reduction program and carbon tax would lower living standards in the rich countries and slow the growth rate of living standards in developing countries.
- Technology is already advancing and the cost of cleaner energy is falling.
- Fracking technology has vastly expanded the natural gas deposits that can be profitably exploited and replacing coal with gas halves the carbon emissions from electricity generation.
- Free-market price signals will allocate resources to the development of new technologies that stop and eventually reverse the upward trend in greenhouse gases.

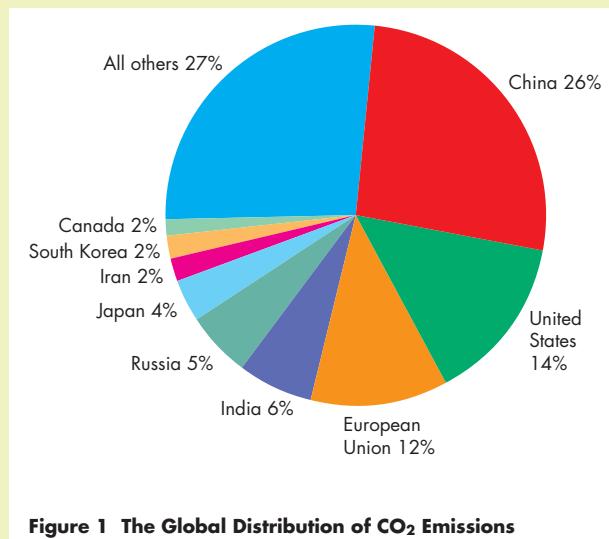


Bjørn Lomborg, President of the Copenhagen Consensus and author of *The Skeptical Environmentalist*.  
 "For little environmental benefit, we could end up sacrificing growth, jobs, and opportunities for the big majority, especially in the developing world."

## Economics in Action

### A Global Prisoners' Dilemma

China, the United States, and the European Union create 52 percent of global carbon emissions. Another six large countries create a further 21 percent (see Fig. 1).



**Figure 1 The Global Distribution of CO<sub>2</sub> Emissions**

Cutting global carbon emissions is a *prisoners' dilemma* (see pp. 344–345). The payoff matrix opposite illustrates the dilemma. The strategies for the United States and other countries are to keep increasing carbon emissions or to cut them.

### Coping with Global Externalities

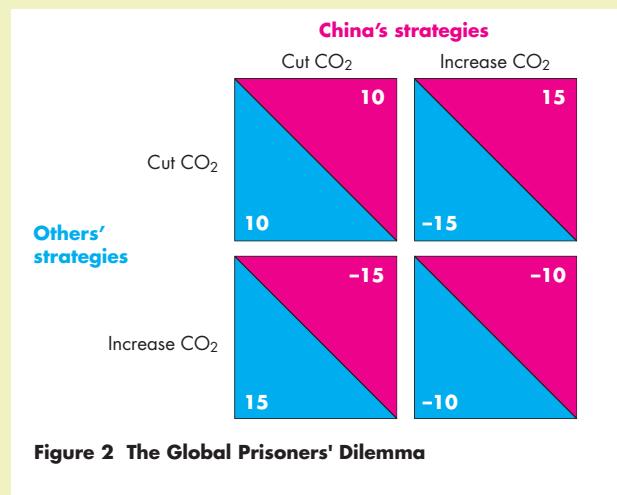
Canada has cut the emissions of local air pollutants and made its own air cleaner by adopting the measures you've just seen. But no country, even a big country such as the United States that accounts for 20 percent of the value of global output and 14 percent of carbon emissions, can solve the problem of global warming and climate change alone. Coping with this problem requires public choices at a *global* level, choices by all governments, which are much harder to make and coordinate.

A lower CO<sub>2</sub> concentration in the world's atmosphere is a global *public good*. And like all public goods, it brings a *free-rider problem* (see Chapter 17, p. 393). Without a mechanism to ensure participation in a global carbon-reduction program, countries are in a *prisoners' dilemma* (see *Economics in Action* above).

Cutting emissions requires using production technologies with higher private costs, but higher private costs make the nation's exporters less competitive in world markets. By letting others cut their emissions and continuing to use low-cost carbon-emitting technologies, a nation can gain a competitive advantage.

In the payoff matrix below, China is better off increasing emissions regardless of what others do; and the others are better off increasing their emissions regardless of what China does. The *Nash equilibrium* (see p. 345) is for all countries to keep increasing their emissions. But the world is better off if all cut.

The challenge is to find a cooperative outcome that avoids this prisoners' dilemma.



**Figure 2 The Global Prisoners' Dilemma**

### REVIEW QUIZ

- 1 What is the distinction between private cost and social cost?
- 2 How do external costs prevent a competitive market from allocating resources efficiently?
- 3 How can external costs be eliminated by assigning property rights?
- 4 How do taxes, pollution charges, and cap-and-trade work to reduce emissions?

Work these questions in Study Plan 16.2 and get instant feedback. Do a Key Terms Quiz.

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Your next task is to study another negative production externality, the tragedy of the commons and the arrangements that can achieve the efficient use of common resources.

## Positive Externality: Knowledge

Knowledge comes from education and research. To study the economics of knowledge, we distinguish between private benefits and social benefits.

### Private Benefits and Social Benefits

A **private benefit** is a benefit that the consumer of a good or service receives. **Marginal benefit** is the benefit from an additional unit of a good or service. So **marginal private benefit (MB)** is the benefit that the consumer of a good or service receives from an additional unit of it.

The **external benefit** from a good or service is the benefit that someone other than the consumer of the good or service receives. University graduates generate many external benefits. On average, they are better citizens, have lower crime rates, and are more tolerant of the views of others. They enable the success of high-quality newspapers and television channels, music, theatre, and other organized social activities that bring benefits to many other people.

A **marginal external benefit** is the benefit from an additional unit of a good or service that people *other than its consumer* enjoy. The benefit that your friends and neighbours get from your university education is its marginal external benefit.

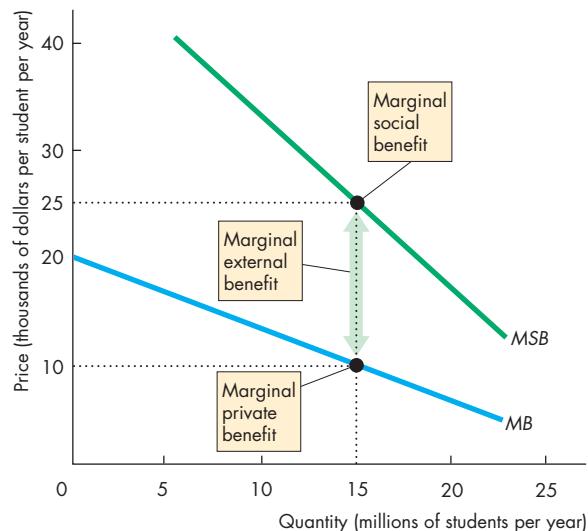
**Marginal social benefit (MSB)** is the marginal benefit enjoyed by society—by the consumer of a good or service (marginal private benefit) and by others (the marginal external benefit). That is,

$$MSB = MB + \text{Marginal external benefit.}$$

Figure 16.5 shows an example of the relationship between marginal private benefit, marginal external benefit, and marginal social benefit. The marginal benefit curve,  $MB$ , describes the marginal private benefit enjoyed by the people who receive a university education. Marginal private benefit decreases as the number of students enrolled increases.

In the example in Fig. 16.5, when 15 million students enroll in university, the marginal external benefit is \$15,000 per student per year. The marginal social benefit curve,  $MSB$ , is the sum of marginal private benefit and marginal external benefit at each number of students enrolled. For example, when 15 million students a year enroll, the marginal private benefit is \$10,000 per student and the marginal external benefit is \$15,000 per student, so the marginal social benefit is \$25,000 per student.

**FIGURE 16.5** An External Benefit



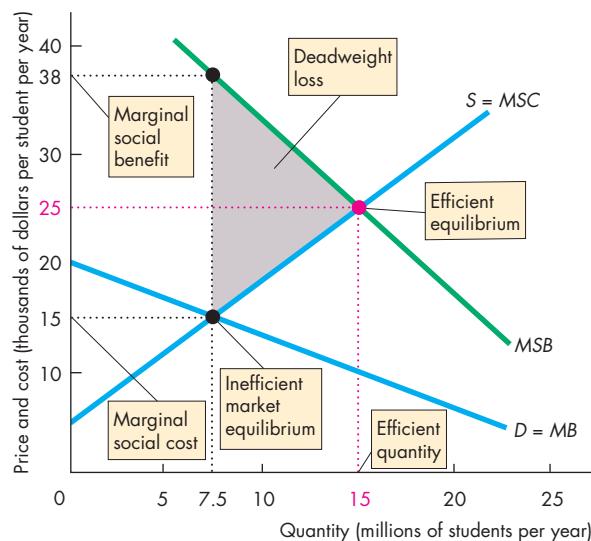
The  $MB$  curve shows the marginal private benefit enjoyed by the people who receive a university education. The  $MSB$  curve shows the sum of marginal private benefit and marginal external benefit. When 15 million students attend university, the marginal private benefit is \$10,000 per student, the marginal external benefit is \$15,000 per student, and the marginal social benefit is \$25,000 per student.

**MyEconLab Animation**

When people make schooling decisions, they ignore its external benefits and consider only their private benefits. So if education were provided by private schools that charged full-cost tuition, the market would produce too few graduates.

Figure 16.6 illustrates this private underprovision. The supply curve is the marginal social cost curve,  $S = MSC$ . The demand curve is the marginal private benefit curve,  $D = MB$ . Market equilibrium occurs at a tuition of \$15,000 per student per year with 7.5 million students per year. At this equilibrium, the marginal social benefit of \$38,000 per student exceeds the marginal social cost by \$23,000 per student. Too few students enroll in university. The efficient number is 15 million per year, where marginal social benefit equals marginal social cost. The grey triangle shows the deadweight loss created.

**FIGURE 16.6** Inefficiency with an External Benefit



The market demand curve is the marginal private benefit curve,  $D = MB$ . The supply curve is the marginal social cost curve,  $S = MSC$ . Market equilibrium at a tuition of \$15,000 a year and 7.5 million students is inefficient because marginal social benefit exceeds marginal social cost. The efficient quantity is 15 million students. A deadweight loss arises (grey triangle) because too few students enroll in university.

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Underproduction similar to that in Fig. 16.6 would occur in elementary school and high school if public education was left to an unregulated market. When children learn basic reading, writing, and number skills, they receive the private benefit of increased earning power. But even these basic skills bring the external benefit of developing better citizens.

External benefits also arise from the discovery of new knowledge. When Isaac Newton worked out the formulas for calculating the rate of response of one variable to another—calculus—everyone was free to use his method. When a spreadsheet program called VisiCalc was invented, Lotus Corporation and Microsoft were free to copy the basic idea and create 1-2-3 and Excel. When the first shopping mall was built and found to be a successful way of arranging

retailing, everyone was free to copy the idea, and malls sprouted like mushrooms.

Once someone has discovered a basic idea, others can copy it. Because they do have to work to copy an idea, they face an opportunity cost, but they do not usually have to pay a fee for the idea. When people make decisions, they ignore the external benefits and consider only the private benefits.

When people make decisions about the amount of education or research to undertake, they balance the marginal private cost against the marginal private benefit. They ignore the external benefit. As a result, if we left education and research to unregulated market forces, we would get too little of these activities.

To get closer to producing the efficient quantity of a good with an external benefit, we make public choices, through governments, to modify the market outcome.

### Government Actions in the Face of External Benefits

Four devices that governments can use to achieve a more efficient allocation of resources in the presence of external benefits are:

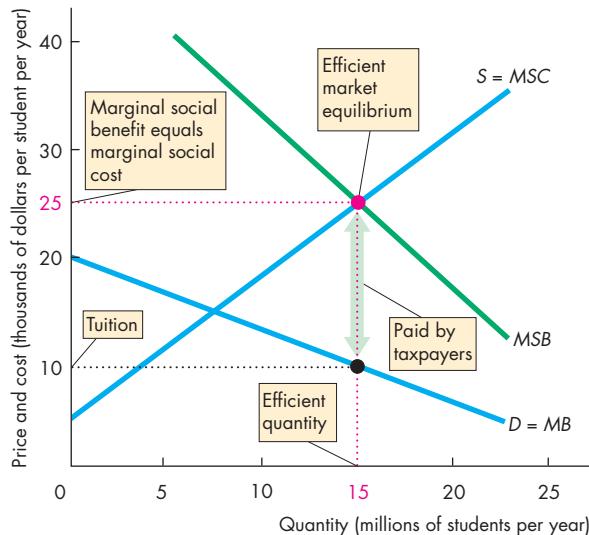
- Public production
- Private subsidies
- Vouchers
- Patents and copyrights

**Public Production** With **public production**, a good or service is produced by a public authority that receives its revenue from the government. The education services produced by public universities and colleges and public schools are examples of public production.

Figure 16.7 shows how public production might overcome underprovision. Public provision cannot lower the cost of production, so marginal social cost is the same as before. Marginal private benefit and marginal external benefit are also the same as before.

The efficient quantity occurs where marginal social benefit equals marginal social cost. In Fig. 16.7, this quantity is 15 million students. Tuition is set to ensure that the efficient number of students enrolls. That is, tuition is set equal to the marginal private benefit at the efficient quantity. In Fig. 16.7, tuition is \$10,000 a year. The rest of the cost of the public university is borne by the taxpayers and, in this example, is \$15,000 per student per year.

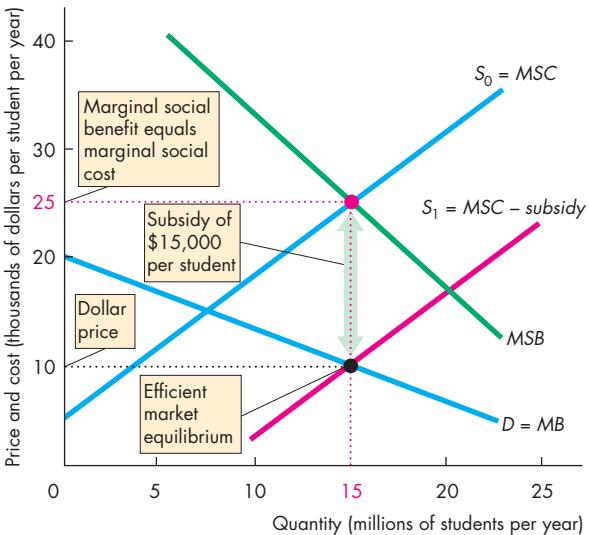
**FIGURE 16.7** Public Production to Achieve an Efficient Outcome



With public production, marginal social benefit equals marginal social cost with 15 million students enrolled per year, the efficient quantity. Tuition is set at \$10,000 per student per year equal to marginal private benefit. Taxpayers cover the other \$15,000 of cost per student per year.

[MyEconLab Animation and Draw Graph](#)

**FIGURE 16.8** Private Subsidy to Achieve an Efficient Outcome



With a subsidy of \$15,000 per student, the supply curve is  $S_1 = MSC - \text{subsidy}$ . The equilibrium price is \$10,000 per year, and the market equilibrium is efficient with 15 million students enrolled per year. Marginal social benefit equals marginal social cost.

[MyEconLab Animation](#)

**Private Subsidies** A *subsidy* is a payment by the government to private producers. By making the subsidy depend on the level of output, the government can induce private decision makers to consider external benefits when they make their choices.

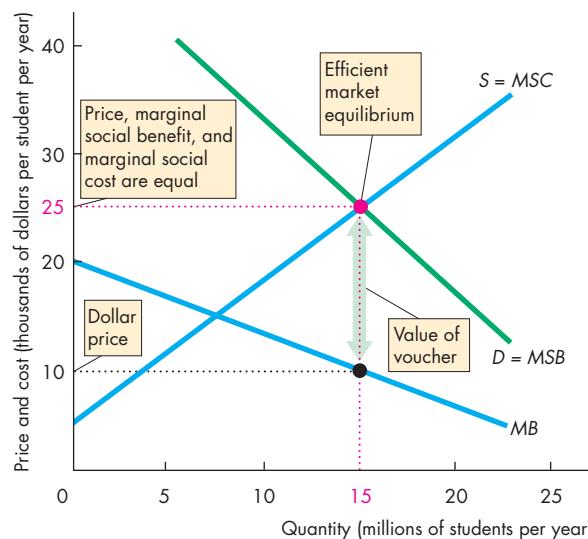
Figure 16.8 shows how a subsidy to private universities would work. In the absence of a subsidy, the market supply curve is  $S_0 = MSC$ . The demand curve is the marginal private benefit curve,  $D = MB$ . If the government provides a subsidy of \$15,000 per student per year, we must subtract the subsidy from the universities' marginal cost to find the new market supply curve. That curve is  $S_1 = MSC - \text{subsidy}$ . The market equilibrium is tuition of \$10,000 a year and 15 million students a year. The marginal social cost of educating 15 million students is \$25,000 and the marginal social benefit is \$25,000, so the subsidy has achieved an efficient outcome. The tuition plus the subsidy equals the universities' marginal cost.

**Vouchers** A *voucher* is a token that the government provides to households, which they can use to buy specified goods or services. Milton Friedman, recipient of the 1976 Nobel Prize for economic science, long advocated vouchers as a means of providing parents with greater choice and control over the education of their children. Some people advocate them for college and university so that students can both receive financial help and exercise choice.

A school voucher would allow parents to choose the school their children will attend and to use the voucher to pay part of the cost. The school cashes the vouchers to pay its bills. A voucher provided to a university student would work in a similar way. Because vouchers can be spent only on a specified item, they increase the willingness to pay for that item and so increase the demand for it.

Figure 16.9 shows how a voucher system would work. The government provides a voucher per

**FIGURE 16.9** Voucher to Achieve an Efficient Outcome



The efficient number of students is 15 million per year—the number at which marginal social benefit equals marginal social cost. With the demand and marginal private benefit curve,  $D = MSB$ , the tuition at which the efficient number will enroll is \$10,000 per year. If students pay this tuition price, the taxpayer must somehow pay the rest, which equals the marginal external benefit at the efficient quantity—\$15,000 per student per year.

[MyEconLab Animation](#)

student equal to the marginal external benefit. Parents (or students) use these vouchers to supplement the dollars they pay for education. The marginal social benefit curve becomes the demand for university education,  $D = MSB$ . The market equilibrium occurs at a price of \$25,000 per student per year, and 15 million students attend university. Each student pays \$10,000 tuition, and schools collect an additional \$15,000 per student from the voucher.

If the government estimates the value of the external benefit correctly and makes the value of the voucher equal the marginal external benefit, the outcome from the voucher scheme is efficient. Marginal social cost equals marginal social benefit, and the deadweight loss is eliminated.

Vouchers are similar to subsidies, but their advocates say that they are more efficient than subsidies because the consumer can monitor school performance more effectively than the government can.

## Economics in Action

### Education Efficiency and School Choices

Competition among suppliers is a source of efficiency. It keeps costs in check and it encourages innovation that benefits the consumer. Is there enough competition among Canada's schools?

Almost 93 percent of Canadians in grades K-12 attend a public school. The other 7 percent attend independent schools or (0.4 percent) get home schooling—see Fig. 1.

But the near monopoly of the public school sector doesn't lack competition within it. Anglophone, Francophone, and religious schools compete for public funding and students.

Alberta has the most competitive school system and is the only province to have established another alternative to public schools—charter schools. A *charter school* is funded like a regular public school but is free to make its own education policy.

This model of schooling, while rare in Canada, has become popular in the United States and has received high marks for the quality of education it achieves and the low cost at which it operates.

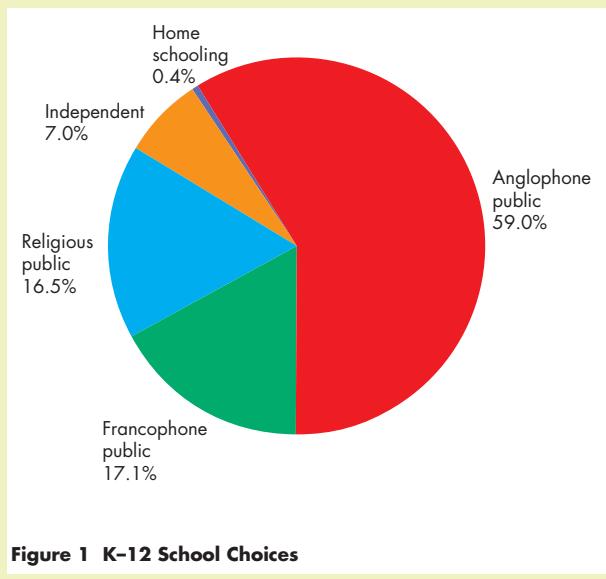
Today, around 4,000 charter schools in 40 U.S. states are teaching more than 1 million students. Are charter schools succeeding? Success has two dimensions: educational standards attained and cost per

**Patents and Copyrights** Knowledge might be an exception to the principle of diminishing marginal benefit. Additional knowledge (about the right things) makes people more productive. And there seems to be no tendency for the additional productivity from additional knowledge to diminish.

For example, in just 15 years, advances in knowledge about microprocessors have given us a sequence of processor chips that has made our personal computers increasingly powerful. Each advance in knowledge about how to design and manufacture a processor chip has brought ever larger increments in performance and productivity. Similarly, each advance in knowledge about how to design and build an airplane has brought apparently ever larger increments in performance: Orville and Wilbur Wright's 1903 Flyer was a one-seat plane that could hop a farmer's field. The Lockheed Constellation, designed in 1949, was an airplane that could fly 120 passengers from New York to London, but with two refuelling stops in Newfoundland and Ireland. Today, a Boeing 747 can carry 400 people nonstop from

student. Charter schools perform well on both dimensions. They achieve high standards and cost less. In the United States, charter school students achieve better test scores in math and reading than equivalent students who apply to but randomly don't get into a charter school.

Charter schools also achieve this higher standard at lower cost. For example, in New York, the cost per student in charter schools is 18 percent less than in regular public schools.



Singapore to New York (flights of 15,325 kilometres that take 20 hours). Similar examples can be found in agriculture, biogenetics, communications, engineering, entertainment, and medicine.

One reason why the stock of knowledge increases without diminishing returns is the sheer number of different techniques that can in principle be tried. Paul Romer, an economist at Stanford University, explains this fact: "Suppose that to make a finished good, 20 different parts have to be attached to a frame, one at a time. A worker could proceed in numerical order, attaching part one first, then part two. ... Or the worker could proceed in some other order, starting with part 10, then adding part seven ... With 20 parts, ... there are [more] different sequences ... than the total number of seconds that have elapsed since the big bang created the universe, so we can be confident that in all activities, only a very small fraction of the possible sequences have ever been tried."\*

\*Paul Romer, "Ideas and Things," in *The Future Surveyed*, supplement to *The Economist*, September 11, 1993.

Think about all the processes, all the products, and all the different bits and pieces that go into each, and you can see that we have only begun to scratch the surface of what is possible.

Because knowledge is productive and generates external benefits, it is necessary to use public policies to ensure that those who develop new ideas have incentives to encourage an efficient level of effort. The main way of providing the right incentives uses the central idea of the Coase theorem and assigns property rights—called **intellectual property rights**—to creators. The legal device for establishing intellectual property rights is the patent or copyright. A **patent** or **copyright** is a government-sanctioned exclusive right granted to the inventor of a good, service, or productive process to produce, use, and sell the invention for a given number of years. A patent enables the developer of a new idea to prevent others from benefiting freely from an invention for a limited number of years.

Although patents encourage invention and innovation, they do so at an economic cost. While a patent is in place, its holder has a monopoly. And monopoly is another source of inefficiency (which is explained in Chapter 13). But without a patent, the effort to develop new goods, services, or processes is diminished and the flow of new inventions is slowed. So the efficient outcome is a compromise that balances the benefits of more inventions against the cost of temporary monopoly in new inventions.

## REVIEW QUIZ

- 1 What is special about knowledge that creates external benefits?
- 2 How might governments use public provision, private subsidies, and vouchers to achieve an efficient amount of education?
- 3 How might governments use public provision, private subsidies, vouchers, and patents and copyrights to achieve an efficient amount of research and development?

Work these questions in Study Plan 16.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

◆ *Economics in the News* on pp. 384–385 looks at the effects of British Columbia's carbon tax on the efficient use of fuels that emit carbon dioxide.



# A Carbon Reduction Plan

## B.C.'s Carbon Tax Working to Reduce Emissions

Sustainable Prosperity

July 24, 2013

B.C.'s fuel consumption has dropped significantly since the carbon tax was brought in five years ago, according to a study released Wednesday, the same day premiers meet in Ontario to discuss a national energy strategy.

Topping the premiers' energy agenda in Niagara-on-the-Lake, Ont., is a discussion of how to lower carbon emissions, and the author of the report wants the premiers to note that B.C.'s plan is working.

The report, by an Ottawa-based think-tank called Sustainable Prosperity, found that from July 1, 2008, the date the carbon tax took effect, to July 1, 2012, B.C.'s fuel consumption fell by 17.4 percent, and nearly 19 percent per capita compared with the rest of Canada.

By contrast, over the same period, consumption rose 1.5 percent in the rest of the country.

Also during that time, the province's [production] gross domestic product kept pace with the rest of the country, the report found.

The author of the study, Stewart Elgie, a professor of law and economics at University of Ottawa, argues B.C. has successfully reduced fossil fuel consumption without damaging the economy.

"B.C.'s experience shows that it is possible to have both a healthier environment and a strong economy—by taxing pollution and lowering income taxes," said Elgie, in a statement.

Elgie admits that the changes in fossil fuel use may not all be due to the carbon tax, but he said a meaningful part of it is because of the levy.

Canada's premiers are meeting today through Friday to discuss a proposed Canadian energy strategy which includes a more integrated approach to climate change.

"I hope that B.C.'s success will inspire Canada's premiers to show leadership on a national approach to pricing carbon pollution," said Elgie.

Apart from B.C., Alberta and Quebec also have carbon taxes. . . .

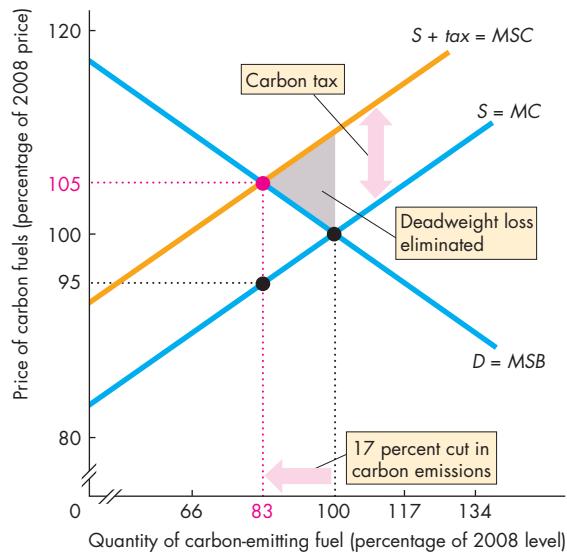
Report by Jonathan Fowle and Tiffany Crawford. Copyright © 2013 by Sustainable Prosperity. Used by permission.

### ESSENCE OF THE STORY

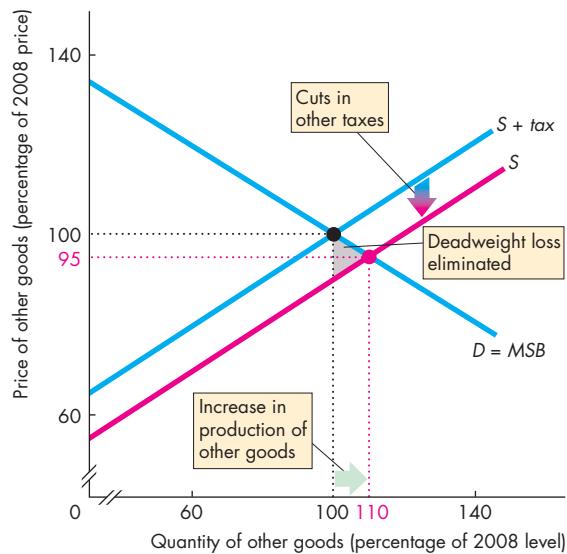
- British Columbia's carbon tax cut greenhouse gas emissions by 17.4 percent between July 1, 2008, and July 1, 2012.
- Ottawa-based think tank Sustainable Prosperity says British Columbia's carbon tax has not impaired economic growth.
- The B.C. government cut other taxes when it imposed the carbon tax.
- During the four years of falling greenhouse gas emissions in British Columbia, emissions in the rest of the country increased by 1.5 percent and the B.C. economy performed as well as the rest of Canada.

## ECONOMIC ANALYSIS

- The B.C. government has made two tax changes, both of which improve economic efficiency.
- The government imposed a carbon tax and cut other taxes, so that its total tax revenue is unchanged.
- A carbon tax is a tax on production activities that emit greenhouse gases and bring other forms of air pollution.
- These emissions bring external costs, overproduction, and deadweight loss.
- By imposing a carbon tax, the B.C. government can cut greenhouse gas emissions and decrease the deadweight loss that comes from them.
- Figure 1 shows how the B.C. carbon tax works. It shows the market for all carbon-emitting production activities (which are mainly electricity generation and road and air transportation).
- The curve  $D = MSB$  shows the demand for and marginal social benefit from these production activities. The curve  $S = MC$  is the private marginal cost and supply curve. With no carbon tax, equilibrium is at the intersection of the demand and supply curves (shown at a price and quantity equal to 100).
- The curve  $S + tax = MSC$  is the marginal social cost curve and the supply curve with a carbon tax equal to marginal external cost (a Pigovian tax). With the carbon tax, production activities that emit carbon decrease to 83 percent of their 2008 levels and the deadweight loss from overproduction is eliminated.
- Most other taxes are imposed on activities that do not bring external cost. These taxes bring underproduction and create a deadweight loss.
- By cutting or eliminating these other taxes, the B.C. government was able to expand production and achieve further efficiencies in the use of scarce resources.
- Figure 2 shows how the B.C. tax cuts work. It shows the market for all other production activities that are taxed.
- Again, the curve  $D = MSB$  shows the demand for and marginal social benefit from these production activities. The curve  $S + tax$  is the supply curve when the activities are taxed. Equilibrium is at the intersection of the demand curve and the  $S + tax$  curve (shown at a price and quantity equal to 100).
- To make the explanation as clear as possible, we'll suppose the B.C. government removes some taxes so that supply of other goods changes to the curve  $S$ . With the taxes gone, production increases and the deadweight loss from underproduction is eliminated.



**Figure 1 Carbon Tax Cuts Emissions**



**Figure 2 Cuts in Other Taxes Expand Production of Other Goods**

- The general lesson from the B.C. example is that taxing activities with external costs and removing taxes from activities without external costs achieves a more efficient outcome.



## SUMMARY

### Key Points

#### Externalities in Our Lives (pp. 370–371)

- An externality can arise from either a production activity or a consumption activity.
- A negative externality imposes an external cost. A positive externality provides an external benefit.

Working Problems 1 and 2 will give you a better understanding of the externalities in our lives.

#### Negative Externality: Pollution (pp. 372–378)

- A competitive market would produce too much of a good that has external production costs.
- External costs are costs of production that fall on people other than the producer of a good or service. Marginal social cost equals marginal private cost plus marginal external cost.
- Producers take account only of marginal private cost and produce more than the efficient quantity when there is a marginal external cost.
- Sometimes it is possible to overcome a negative externality by assigning a property right.
- When property rights cannot be assigned, governments might overcome externalities by using taxes or cap-and-trade.

Working Problems 3 to 7 will give you a better understanding of the external costs of pollution.

#### Positive Externality: Knowledge (pp. 379–383)

- External benefits are benefits that are received by people other than the consumer of a good or service. Marginal social benefit equals marginal private benefit plus marginal external benefit.
- External benefits from education arise because better-educated people tend to be better citizens, commit fewer crimes, and support social activities.
- External benefits from research arise because once someone has worked out a basic idea, others can copy it.
- Vouchers or subsidies to schools or the provision of public education below cost can achieve a more efficient provision of education.

Working Problems 8 to 10 will give you a better understanding of the external benefit from knowledge.

### Key Terms

- Abatement technology, 373
- Coase theorem, 374
- Copyright, 383
- Externality, 370
- Intellectual property rights, 383
- Marginal external benefit, 379
- Marginal external cost, 372

- Marginal private benefit, 379
- Marginal private cost, 372
- Marginal social benefit, 379
- Marginal social cost, 372
- Negative externality, 370
- Patent, 383
- Pigovian taxes, 375

### MyEconLab Key Terms Quiz

- Positive externality, 370
- Property rights, 373
- Public production, 380
- Transactions costs, 374
- Voucher, 381

## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 16 Study Plan.

The first two columns of the table show the demand schedule for fitness sessions with independent coaches; the second and third columns show the coaches' marginal cost. Fitness creates an external benefit and the marginal external benefit is \$10 per session. The market for fitness sessions is competitive.

Price (dollars per session)	Quantity (sessions per month)	Marginal cost (dollars per session)
10	800	30
15	600	25
20	400	20
25	200	15
30	0	10

### Questions

- What is the market-determined quantity of fitness sessions per month and what is the price of a session?
- Calculate the marginal social benefit from fitness at each quantity of sessions.
- What is the efficient number of fitness sessions per month?

### Solutions

- In the market for fitness sessions, the supply schedule is the same as the marginal cost schedule. The quantity of sessions is that at which marginal private benefit equals marginal cost. Marginal private benefit is the same as price, so the quantity of sessions per month is 400 and the price of a session is \$20.

**Key Point:** The market outcome is determined by marginal private benefit and marginal cost.

- Marginal social benefit ( $MSB$ ) equals the sum of marginal private benefit ( $MB$ ), which equals the market price, and the marginal external benefit of \$10 per session.

The table below shows the calculations.

Quantity (sessions per month)	MB (sessions per month)	MSB (dollars per session)
800	10	20
600	15	25
400	20	30
200	25	35
0	—	—

For example, the marginal social benefit from 600 sessions per month equals the marginal private benefit of \$15 per session plus the marginal external benefit of \$10 per session, which equals \$25 per session.

**Key Point:** The marginal social benefit from a service that creates a positive externality is the sum of the marginal private benefit and the marginal external benefit.

- To find the efficient number of fitness sessions, we need to determine the number of sessions per month at which the marginal social benefit ( $MSB$ ) equals marginal cost ( $MC$ ).

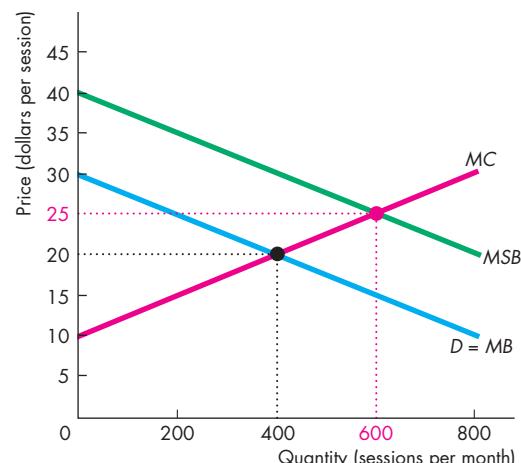
The table below combines the data from the other two tables.

Quantity (sessions per month)	MSB (sessions per month)	MC (dollars per session)
800	20	30
600	25	25
400	30	20
200	35	15
0	—	10

By inspecting the table above, you can see that  $MSB$  equals  $MC$  at 600 sessions per month, so that is the efficient quantity.

**Key Point:** The efficient quantity of a service that creates a positive externality is the quantity at which marginal social benefit from the service equals the marginal cost of producing the service.

### Key Figure



**MyEconLab** Interactive Animation

## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 10 in Chapter 16 Study Plan and get instant feedback.

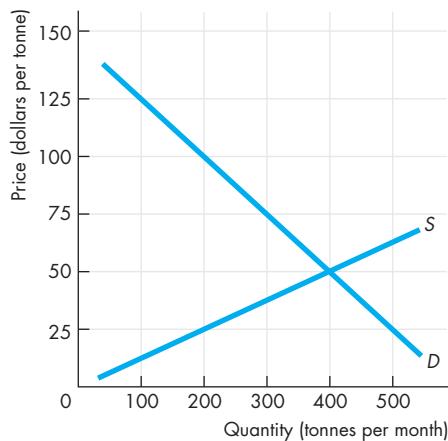
### Externalities in Our Lives (Study Plan 16.1)

1. Describe three consumption activities that create external costs.
2. Describe three production activities that create external benefits.

### Negative Externality: Pollution (Study Plan 16.2)

Use the following figure, which illustrates the market for tomatoes, to work Problems 3 to 5.

Suppose that the tomato grower uses a chemical to control insects and waste flows into the town's river. The marginal social cost of producing the tomatoes is double the marginal private cost.



3. If no one owns the river and the town takes no action to control the waste, what is the quantity of tomatoes and the deadweight loss created?
4. a. If the town owns the river and makes the tomato grower pay the cost of pollution, how many tomatoes are produced? What does the grower pay the town per tonne of tomatoes produced?  
b. If the tomato grower owns the river and rents it to the town, how many tomatoes are produced? How is the rent paid by the town to the grower (per tonne of tomatoes produced) influenced by tomato growing?  
c. Compare the quantities of tomatoes produced in parts (a) and (b) and explain the relationship between these quantities.
5. If no one owns the river and the city introduces a pollution tax, what is the tax per tonne of

tomatoes produced that achieves an efficient outcome?

6. Compare the outcomes when property rights exist and when the pollution tax achieves the efficient amount of waste.

### 7. Global Solutions for Local Gridlock

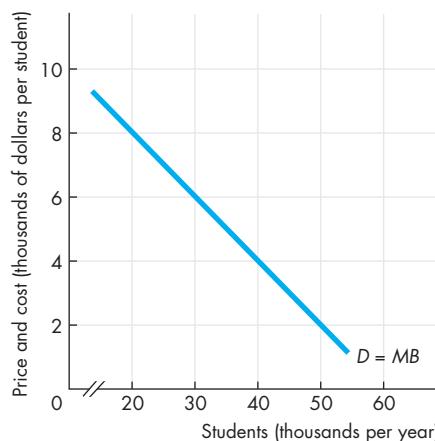
Gridlock costs Toronto \$6 billion a year, with average commutes of 80 minutes. By 2031, an additional 27 minutes will be added to the daily grind. Civic leaders are looking at road tolls, a regional gas tax, and parking levies.

Source: *Toronto Star*, June 24, 2011

Will road tolls, a regional gas tax, and parking levies make Toronto streets less congested and the Toronto road system more efficient? Explain.

### Positive Externality: Knowledge (Study Plan 16.3)

Use the following figure, which shows the demand for university education, to work Problems 8 to 10.



The marginal cost is a constant \$6,000 per student per year. The marginal external benefit from a university education is a constant \$4,000 per student per year.

8. What is the efficient number of students? If all universities are private, how many people enroll in university and what is the tuition?
9. If the government provides public universities, what tuition will achieve the efficient number of students? How much will taxpayers have to pay?
10. If the government offers students vouchers, what is the value of the voucher that will achieve the efficient number of students?



## ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

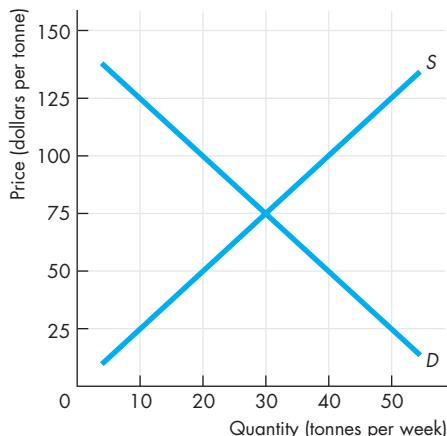
### Externalities in Our Lives

11. Which of the following activities creates an externality? If it does, is it a positive or negative production or consumption externality?
  - A sunset over the Pacific Ocean
  - An increase in the number of graduates
  - A person talks on a cellphone while driving
  - A bakery bakes bread
12. What externalities arise from smoking tobacco products and how do we deal with them?
13. What externalities arise from beautiful and ugly buildings and how do we deal with them?

### Negative Externality: Pollution

14. Betty and Anna work at the same office in Toronto and they have to attend a meeting in Montreal. They decide to drive to the out-of-town meeting together. Betty is a cigarette smoker and her marginal benefit from smoking a package of cigarettes a day is \$40. Cigarettes are \$6 a pack. Anna dislikes cigarette smoke, and her marginal benefit from a smoke-free environment is \$50 a day. What is the outcome if:
  - a. Betty drives her car with Anna as a passenger?
  - b. Anna drives her car with Betty as a passenger?

Use the following figure, which illustrates the market for a pesticide with no government intervention, to work Problems 15 to 18.



When factories produce pesticide, they also create waste, which they dump into a lake on the outskirts of the town. The marginal external cost of the waste is equal to the marginal private cost of producing the

pesticide (that is, the marginal social cost of producing the pesticide is double the marginal private cost).

15. What is the quantity of pesticide produced if no one owns the lake? What is the efficient quantity of pesticide?
16. If the town owns the lake, what is the quantity of pesticide produced and how much does the town charge the factories to dump waste?
17. If the pesticide factories own the lake, how much pesticide is produced?
18. If no one owns the lake and the government levies a pollution tax, what is the tax that achieves the efficient outcome?

Use the following table to work Problems 19 to 21.

The first two columns of the table show the demand schedule for electricity from a coal-burning utility; the second and third columns show the utility's cost of producing electricity. The marginal external cost of the pollution created equals the marginal cost.

Price (cents per kilowatt)	Quantity (kilowatts per day)	Marginal cost (cents per kilowatt)
4	500	10
8	400	8
12	300	6
16	200	4
20	100	2

19. With no government action to control pollution, what is the quantity of electricity produced, the price of electricity, and the marginal external cost of the pollution generated?
20. With no government action to control pollution, what is the marginal social cost of the electricity generated and the deadweight loss created?
21. If the government levies a pollution tax such that the utility produces the efficient quantity, what is the price of electricity, the tax levied, and the government's tax revenue per day?

### Positive Externality: Knowledge

Use the following news clip to work Problems 22 and 23.

#### Light Bulbs: Shining a Light on Bulb Recycling

We've received several questions about recycling light bulbs, ranging from regular incandescents to compact fluorescents (CFLs). First off, recycling incandescent bulbs is not on the priority list,

because they don't contain toxic materials and don't offer much in the way of recoverable resources. It is important to recycle the far more energy-efficient CFLs.

Home Depot Canada is aiming to recycle 1.5 million bulbs by 2011 and says all components from the bulbs will be reused in creating a host of new products, including glass bottles and jars, baseball bats, and products for the lighting industry. Lasting six to 10 times longer than the average incandescent bulb and using up to 75 percent less electricity, CFLs save on power consumption and cut your electricity bill. When properly recycled, CFLs are definitely your best bet for the environment—and your pocketbook.

Source: *Calgary Herald*, March 27, 2008

22. a. Relative to incandescents, what is the external benefit associated with CFLs?
- b. Draw a graph to illustrate and explain why the market for CFLs is inefficient.
23. Draw a graph to illustrate and explain how government actions might achieve an efficient outcome in the market for bulbs.

Use the following data to work Problems 24 to 27.

The table shows the demand for university education.

Price (dollars per student)	Quantity (students per year)
6,000	10,000
5,000	20,000
4,000	30,000
3,000	40,000
2,000	50,000

The marginal cost of educating a student is a constant \$4,000 a year and education creates an external benefit of a constant \$2,000 per student per year.

24. If all universities are private and the market for education is competitive, calculate the number of students, the tuition, and the deadweight loss.
25. If all universities are public, calculate the tuition that will achieve the efficient number of students. How much will taxpayers have to pay?
26. If the government decides to subsidize private universities, what subsidy will achieve the efficient number of students?

27. If all universities are private and the government offers vouchers to those who enroll, calculate the value of the voucher that will achieve the efficient number of students.

Use the following news clip to work Problems 28 to 30.

#### How Arts Funding Is Done Elsewhere

When Rick van der Ploeg became Holland's secretary of culture in 1998, he launched an arts-funding revolution that alarmed his quiet, multicultural country—but also became a potential model for smaller-population countries such as Canada. Bursaries for about \$100,000 a year were offered to foreign graduate students. Foreign filmmakers could also receive funding—as long as it met Dutch content requirements. More contentiously, artists would have to prove that there was a market for their creations if they wanted a subsidy. “My argument has always been to get the best people in the world. ... Whether they be Canadian, Japanese, and maybe the Dutch, bring them together, and the locals would then have to compete on a global scale.”

Source: *National Post*, September 26, 2008

28. What external benefits are associated with the arts?
29. Draw a graph to illustrate and explain why the market for arts creates a deadweight loss.
30. Draw a graph to illustrate and explain how bursaries for foreign graduate students might improve efficiency.

#### Economics in the News

31. After you have studied *Economics in the News* on pp. 384–385, answer the following questions.
  - a. Why would the market overproduce electricity and transportation?
  - b. How does a carbon tax change the supply of electricity and gasoline? Does it change the demand for electricity and gasoline too? Illustrate your answer with an appropriate graph.
  - c. At what level should a carbon tax be set to achieve an efficient use of resources?
  - d. How did British Columbia ensure that its carbon tax didn't damage its overall economy?



# 17

## PUBLIC GOODS AND COMMON RESOURCES

After studying this chapter, you will be able to:

- ◆ Distinguish among private goods, public goods, and common resources
- ◆ Explain how the free-rider problem arises and how the quantity of public goods is determined
- ◆ Explain the tragedy of the commons and its possible solutions

**The Gardiner Expressway, an 18-kilometre link**

between highways to the east and west of downtown Toronto, is undergoing major repairs. The Gardiner is a small part of the 17,000 kilometres of expressways in Canada built and maintained by governments. But why governments? Why not private firms? And are governments efficient in their provision of expressways and other goods and services?

These are the questions we study in this chapter. In *Economics in the News* at the end of the chapter, we return to the Gardiner Expressway and look at the problem of keeping it in a good state of repair.

## Classifying Goods and Resources

Goods, services, and resources differ in the extent to which people can be *excluded* from consuming them and the extent to which one person's consumption *rivals* the consumption of others.

### Excludable

A good is **excludable** if it is possible to prevent someone from enjoying its benefits. Brinks security services, Cooke Aquaculture's fish, and a U2 concert are examples. People must pay to consume them.

A good is **nonexcludable** if it is impossible (or extremely costly) to prevent anyone from benefiting from it. The services of the Calgary police, fish in the Atlantic Ocean, and a concert on network television are examples. When a police cruiser enforces the speed limit, everyone on the highway benefits; anyone with a boat can fish in the ocean; and anyone with a TV can watch a network broadcast.

### Rival

A good is **rival** if one person's use of it decreases the quantity available for someone else. A Brinks truck can't deliver cash to two banks at the same time. A fish can be consumed only once.

A good is **nonrival** if one person's use of it does not decrease the quantity available for someone else. The services of the police and a concert on network television are nonrival. One person's benefit doesn't lower the benefit of others.

### A Fourfold Classification

Figure 17.1 classifies goods, services, and resources into four types.

**Private Goods** A **private good** is both rival and excludable. A can of Coke and a fish on Cooke Aquaculture's farm are examples of private goods.

**Public Goods** A **public good** is both nonrival and nonexcludable. A public good can be consumed simultaneously by everyone, and no one can be excluded from enjoying its benefits. National defence is the best example of a public good. Another is weather forecasting.

**Common Resources** A **common resource** is rival and nonexcludable. A unit of a common resource can be

**FIGURE 17.1** Fourfold Classification of Goods

	Private goods	Common resources
Rival	Food and drink Car House	Fish in ocean Atmosphere National parks
Nonrival	Internet Cable television Bridge or tunnel	National defence The law Air traffic control
Excludable		Nonexcludable

A private good is rival and excludable: You must pay to get it and you alone enjoy it. A public good is nonrival and nonexcludable: You and everyone else enjoy it without paying for it. A common resource is rival but nonexcludable. And a natural monopoly good is nonrival but excludable.

**MyEconLab Animation**

used only once, but no one can be prevented from using what is available. Ocean fish are a common resource. They are rival because a fish taken by one person isn't available for anyone else, and they are nonexcludable because it is difficult to prevent people from catching them.

**Natural Monopoly Goods** A **natural monopoly good** is nonrival but excludable. Consumers can be excluded if they don't pay, but adding one more user doesn't rival other users, so marginal cost is zero. The fixed cost of producing such a good is usually high, so economies of scale exist over the entire range of output for which there is a demand (see p. 298). Examples of natural monopoly goods are the Internet, cable television, and an uncongested bridge or tunnel.

### REVIEW QUIZ

- 1 Distinguish among public goods, private goods, common resources, and natural monopoly goods.
- 2 Provide examples of goods (or services or resources) in each of the four categories that differ from the examples in this section.

Work these questions in Study Plan 17.1 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

## Public Goods

Why does the government provide our weather forecasting? Why don't we buy our weather forecasts from North Pole Weather, Inc., a private firm that competes for our dollars in the marketplace in the same way that McDonald's does? The answer is that weather forecasting is a public good—nonexcludable and nonrival—and it has a free-rider problem.

### The Free-Rider Problem

A *free rider* enjoys the benefits of a good or service without paying for it. Because a public good is provided for everyone to use and no one can be excluded from its benefits, no one has an incentive to pay his or her share of the cost. Everyone has an incentive to free ride. The **free-rider problem** is that the market would provide an inefficiently small quantity of a public good. Marginal social benefit from the public good would exceed its marginal social cost and a deadweight loss would arise.

Let's look at the marginal social benefit and marginal social cost of a public good.

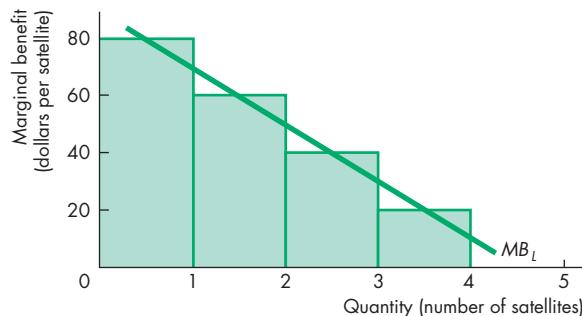
### Marginal Social Benefit from a Public Good

Lisa and Max (the only people in an imagined society) value weather forecasts. Figures 17.2(a) and 17.2(b) graph their marginal benefits from a weather satellite system as  $MB_L$  for Lisa and  $MB_M$  for Max. A person's marginal benefit from a public good, like that from a private good, diminishes as the quantity of the good increases—the marginal benefit curves slope downward.

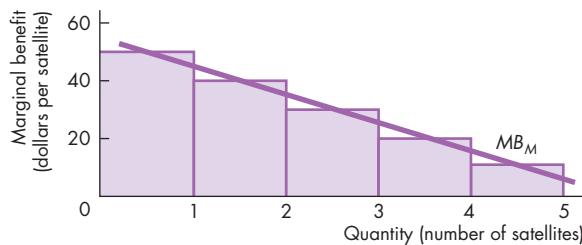
Figure 17.2(c) shows the marginal *social* benefit curve,  $MSB$ . Because everyone gets the same quantity of a public good, its marginal social benefit curve is the sum of the marginal benefits of all individuals at each quantity—it is the *vertical* sum of the individual  $MB$  curves. So the  $MSB$  curve in part (c) is the marginal social benefit curve for the economy made up of Lisa and Max. For each satellite, Lisa's marginal benefit is added to Max's marginal benefit to calculate the marginal social benefit from that satellite.

Contrast the  $MSB$  curve for a public good with that of a private good. To obtain the economy's  $MSB$  curve for a private good, we *sum the quantities demanded* by all individuals at each price—we sum the individual marginal benefit curves *horizontally* (see Chapter 5, p. 108).

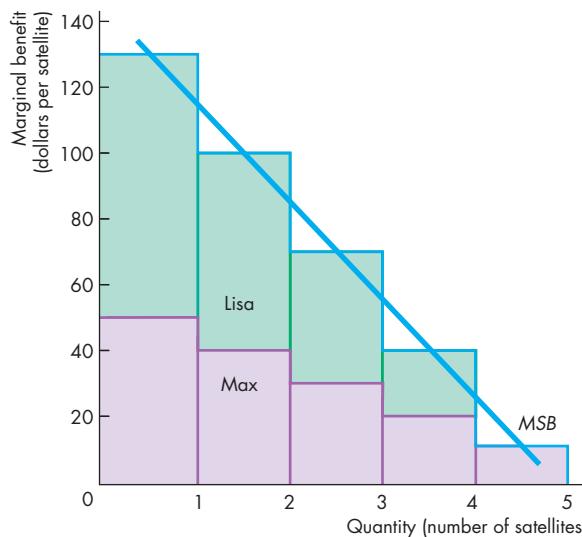
**FIGURE 17.2** Benefits of a Public Good



(a) Lisa's marginal benefit



(b) Max's marginal benefit



(c) Economy's marginal social benefit

The marginal social benefit at each quantity of the public good is the sum of the marginal benefits of all individuals. The marginal benefit curves are  $MB_L$  for Lisa and  $MB_M$  for Max. The economy's marginal social benefit curve is  $MSB$ .

**MyEconLab Animation**

## Marginal Social Cost of a Public Good

The marginal social cost of a public good is determined in exactly the same way as that of a private good—see p. 110. The principle of increasing marginal cost applies to the marginal cost of a public good and the marginal social cost curve of a public good slopes upward.

## Efficient Quantity of a Public Good

To determine the efficient quantity of a public good, we use the same principles that you learned in Chapter 5 and have used repeatedly: Find the quantity at which marginal social benefit equals marginal social cost.

Figure 17.3 shows the marginal social benefit curve,  $MSB$ , and the marginal social cost curve,  $MSC$ , for defence satellites. (Now think of society as consisting of Lisa and Max and 30 million others.)

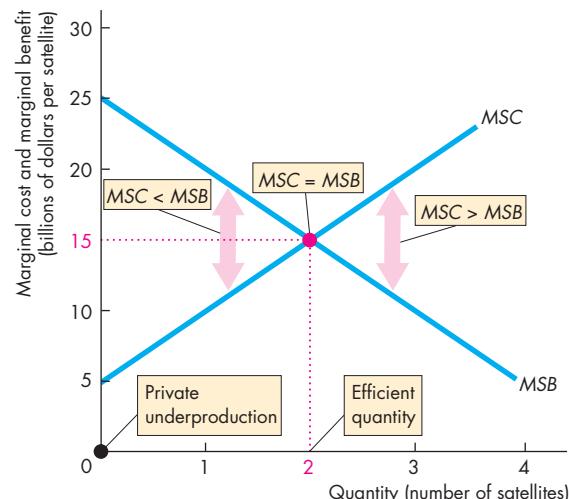
If marginal social benefit exceeds marginal social cost, as it does when fewer than 2 satellites are provided, resources can be used more efficiently by increasing the quantity. The extra benefit exceeds the extra cost. If marginal social cost exceeds marginal social benefit, as it does when more than 2 satellites are provided, resources can be used more efficiently by decreasing the quantity. The saving in cost exceeds the loss of benefit.

If marginal social benefit equals marginal social cost, as it does when exactly 2 satellites are provided, resources cannot be used more efficiently. To provide more than 2 satellites would cost more than the additional coverage is worth, and to provide fewer satellites lowers the benefit by more than its cost saving. Resources are allocated efficiently.

## Inefficient Private Provision

Could a private firm—North Pole Weather, Inc.—deliver the efficient quantity of satellites? Most likely it couldn't because no one would have an incentive to buy his or her share of the satellite system. Everyone would reason as follows: “The number of satellites provided by North Pole Weather, Inc., is not affected by my decision to pay my share or not. But my own private consumption will be greater if I free ride and do not pay my share of the cost of the satellite system. If I don't pay, I enjoy the same level of security and I can buy more private goods. I will spend my money on private goods and free ride on the public good.” Such reasoning is the free-rider problem. If everyone reasons the same way, North Pole Weather,

**FIGURE 17.3** The Efficient Quantity of a Public Good



With fewer than 2 satellites, marginal social benefit,  $MSB$ , exceeds marginal social cost,  $MSC$ . With more than 2 satellites,  $MSC$  exceeds  $MSB$ . Only with 2 satellites is  $MSC$  equal to  $MSB$  and the number of satellites is efficient.

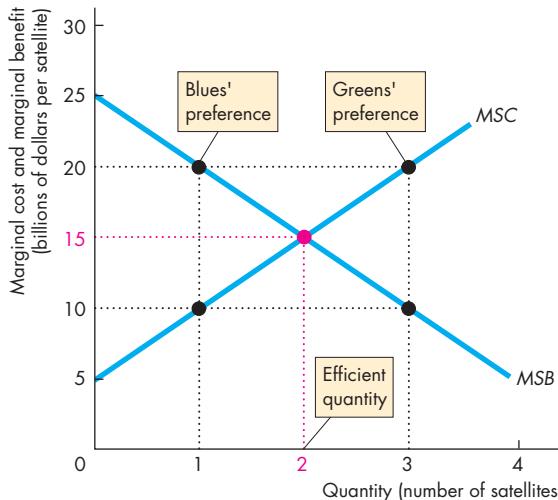
**MyEconLab Animation**

Inc. has no revenue and so provides no satellites. Because the efficient level is 2 satellites, private provision is inefficient.

## Efficient Public Provision

The political process might be efficient or inefficient. We look first at an efficient outcome. There are two political parties: Greens and Blues. They agree on all issues except for the number of satellites. The Greens want 3 satellites, and the Blues want 1 satellite. But both parties want to get elected, so they run a voter survey and discover the marginal social benefit curve of Fig. 17.4. They also consult with satellite producers to establish the marginal cost schedule. The parties then do a “what-if” analysis. If the Greens propose 3 satellites and the Blues propose 1 satellite, the voters will be equally unhappy with both parties. Compared to the efficient quantity, the Blues want an underprovision of 1 satellite and the Greens want an overprovision of 1 satellite. The deadweight losses are equal. So the election would be too close to call.

Contemplating this outcome, the Greens realize that they are too hawkish to get elected. They figure

**FIGURE 17.4** An Efficient Political Outcome

The Blues would like to provide 1 satellite and the Greens would like to provide 3 satellites. The political outcome is 2 satellites because unless each party proposes 2 satellites, the other party will beat it in an election.

**MyEconLab Animation**

that if they scale back to 2 satellites, they will win the election if the Blues propose 1 satellite. The Blues reason in a similar way and figure that if they increase the number of satellites to 2, they can win the election if the Greens propose 3 satellites.

So they both propose 2 satellites. The voters are indifferent between the parties, and each party receives 50 percent of the vote.

Regardless of which party wins the election, 2 satellites are provided and this quantity is efficient. Competition in the political marketplace results in the efficient provision of a public good.

**The Principle of Minimum Differentiation** The tendency for competitors to make themselves similar to appeal to the maximum number of clients or voters is called the **principle of minimum differentiation**. This principle describes the behaviour of political parties. It also explains why fast-food restaurants cluster in the same block and even why new auto models have similar features. If McDonald's opens a new restaurant, it is likely that Wendy's will open near to McDonald's rather than a kilometre down the road.

If Chrysler designs a new van with a sliding door on the driver's side, most likely Ford will too.

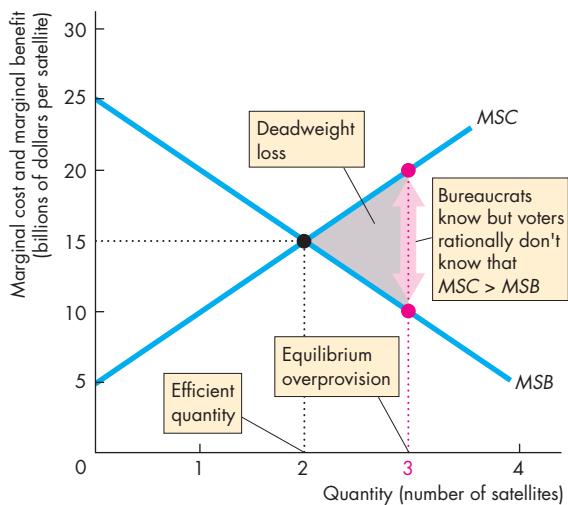
For the political process to deliver the efficient outcome that you've just seen, voters must be well informed, evaluate the alternatives, and vote in the election. Political parties must be well informed about voter preferences. As the next section shows, we can't expect to achieve this outcome.

### Inefficient Public Overprovision

If competition between two political parties is to deliver the efficient quantity of a public good, bureaucrats must cooperate and help to achieve this outcome. In the case of satellites, bureaucrats in the Department of Weather Forecasting (DWF) must cooperate and accept this outcome.

**Objective of Bureaucrats** Bureaucrats want to maximize their department's budget because a bigger budget brings greater status and more power. So the DWF's objective is to maximize the satellite budget.

Figure 17.5 shows the outcome if the DWF is successful in the pursuit of its goal. The DWF might try to persuade the politicians that 2 satellites cost more

**FIGURE 17.5** Bureaucratic Overprovision

Well-informed bureaucrats want to maximize their budget and rationally ignorant voters enable the bureaucrats to go some way toward achieving their goal. A public good might be inefficiently overprovided with a deadweight loss.

**MyEconLab Animation**

than the originally budgeted amount; or the DWF might press its position more strongly and argue for more than 2 satellites. In Fig. 17.5, the DWF persuades the politicians to provide 3 satellites.

Why don't the politicians block the DWF? Won't overproducing satellites cost future votes? It will if voters are well informed and know what is best for them. But voters might not be well informed, and well-informed interest groups might enable the DWF to achieve its objective and overcome the objections of the politicians.

**Rational Ignorance** A principle of the economic analysis of public choices is that it is rational for a voter to be ignorant about an issue unless that issue has a perceptible effect on the voter's economic welfare. **Rational ignorance** is the decision not to acquire information because the cost of doing so exceeds the expected benefit.

For example, each voter knows that he or she can make virtually no difference to the Government of Canada's weather forecasting. Each voter also knows that it would take an enormous amount of time and effort to become even moderately well informed about alternative weather technologies. So voters

remain relatively uninformed about the technicalities of weather issues. Although we are using weather forecasting as an example, the same reasoning applies to all aspects of government economic activity.

All voters are consumers of weather forecasts, but not all voters are producers of weather forecasts. Only a small number of voters are in this latter category. Voters who own or work for firms that produce components of satellites have a direct personal interest in weather satellites because it affects their incomes and careers. These voters have an incentive to become well informed about weather forecasting issues and to operate a political lobby aimed at furthering their own self-interests.

In collaboration with the bureaucrats who are responsible for the provision of a public good, informed voters who produce that public good exert a larger influence than do the relatively uninformed voters who only use the public good.

When the rationality of the uninformed voter and special interest groups are taken into account, the political equilibrium provides public goods in excess of the efficient quantity. So in the satellite example, 3 or more satellites might be installed rather than the efficient quantity of 2 satellites.

## Economics in Action

### Is a Lighthouse a Public Good?

Canada's first lighthouse was built at Louisbourg, Nova Scotia, in 1730.

For two centuries, economists used the lighthouse as an example of a public good. No one can be prevented from seeing its warning light—*nonexcludable*—and one person seeing its light doesn't prevent someone else from doing so too—*nonrival*.

Ronald Coase, who won the 1991 Nobel Prize for ideas he first developed when he was an undergraduate at the London School of Economics, discovered that before the nineteenth century, lighthouses in England were built and operated by private corporations that earned profits by charging tolls on ships docking at nearby ports. A ship that refused to pay the lighthouse toll was *excluded* from the port.

So the benefit arising from the services of a lighthouse is *excludable*. Because the services provided by a lighthouse are nonrival but excludable, a lighthouse is an example of a natural monopoly good and not a public good.



## Two Types of Political Equilibrium

We've seen that two types of political equilibrium are possible: efficient and inefficient. These two types of political equilibrium correspond to two theories of government:

- Social interest theory
- Public choice theory

**Social Interest Theory** Social interest theory predicts that governments make choices that achieve an efficient provision of public goods. This outcome occurs in a perfect political system in which voters are fully informed about the effects of policies and refuse to vote for outcomes that can be improved upon.

**Public Choice Theory** Public choice theory predicts that governments make choices that result in inefficient overprovision of public goods. This outcome occurs in political markets in which voters are rationally ignorant and base their votes only on issues that they know affect their own net benefit. Voters pay more attention to their self-interests as producers than their self-interests as consumers, and public officials also act in their own self-interest. The result is government failure that parallels market failure.

## Why Government Is Large and Growing

Now that we know how the quantity of public goods is determined, we can explain part of the reason for the growth of government. Government grows in part because the demand for some public goods increases at a faster rate than the demand for private goods. There are two possible reasons for this growth:

- Voter preferences
- Inefficient overprovision

**Voter Preferences** The growth of government can be explained by voter preferences in the following way. As voters' incomes increase (as they do in most years), the demand for many public goods increases more quickly than income. (Technically, the income elasticity of demand for many public goods is greater than 1—see Chapter 4, pp. 92–93.) These goods include public health, education, weather forecasting, highways, airports, and air traffic control systems. If politicians did not support increases in expenditures on these items, they would not get elected.

**Inefficient Overprovision** Inefficient overprovision might explain the size of government but not its growth rate. It (possibly) explains why government is larger than its efficient scale, but it does not explain why governments use an increasing proportion of total resources.

## Voters Strike Back

If government grows too large relative to the value that voters place on public goods, there might be a voter backlash against government programs and a large bureaucracy. Electoral success during the 1990s at the provincial and federal levels required politicians of all parties to embrace smaller, leaner, and more efficient government. But promising to trim the bureaucracy and eliminate waste turns out to be much easier than delivering more efficient government, so overspending persists.

Another way in which voters—and politicians—can try to counter the tendency of bureaucrats to expand their budgets is to privatize the production of public goods. Government provision of a public good does not automatically imply that a government-operated bureau must produce the good. Garbage collection (a public good) is often done by a private firm, and in the United Kingdom and United States, even prisons are provided by private firms.

## REVIEW QUIZ

- 1 What is the free-rider problem? Why do free riders make the private provision of a public good inefficient?
- 2 Under what conditions will competition among politicians for votes result in an efficient provision of a public good?
- 3 How do rationally ignorant voters and budget-maximizing bureaucrats prevent the political marketplace from delivering the efficient quantity of a public good?

Work these questions in Study Plan 17.2 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

You've seen how public goods create a free-rider problem that would result in the underprovision of such goods. We're now going to learn about common resources and see why they result in the opposite problem—the overuse of such resources.

## Common Resources

Overgrazing the pastures around a village in Middle Ages England and overfishing the cod stocks of the North Atlantic Ocean during the recent past are tragedies of the commons. The **tragedy of the commons** is the overuse of a common resource that arises when its users have no incentive to conserve it and use it sustainably.

To study the tragedy of the commons and its possible remedies, we'll focus on the recent and current tragedy—overfishing and depleting the stock of Atlantic cod. We begin by thinking about the sustainable use of a renewable resource.

### Sustainable Use of a Renewable Resource

A *renewable natural resource* is one that replenishes itself by the birth and growth of new members of the population. Fish, trees, and the fertile soil are all examples of this type of resource.

Focusing on fish, the sustainable catch is the quantity that can be caught year after year without depleting the stock. This quantity depends on the stock and in the interesting way illustrated in Fig. 17.6.

If the stock of fish is small, the quantity of new fish born is also small, so the sustainable catch is small.

### Economics in Action

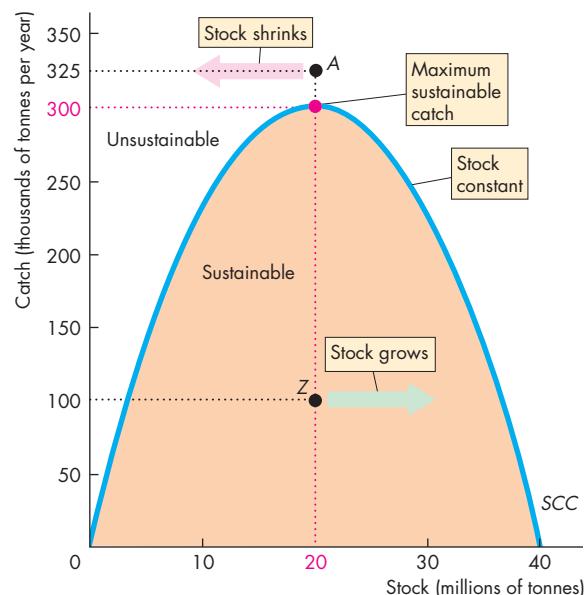
#### The Original Tragedy of the Commons

The term “tragedy of the commons” comes from fourteenth-century England, where areas of rough grassland surrounded villages. The commons were open to all and used for grazing cows and sheep owned by the villagers.

Because the commons were open to all, no one had an incentive to ensure that the land was not overgrazed. The result was a severe overgrazing situation and the number of cows and sheep that could feed on the commons kept falling as the overgrazing continued.

During the sixteenth century, the price of wool increased and England became a wool exporter to the world. Sheep farming became profitable, and sheep owners wanted to gain more effective control of the land

**FIGURE 17.6** Sustainable Catch



As the fish stock increases (on the x-axis), the sustainable catch (on the y-axis) increases to a maximum. As the stock increases further, the fish must compete for food and the sustainable catch falls. If the catch exceeds the sustainable catch, such as at point A, the fish stock diminishes. If the catch is less than the sustainable catch, such as at point Z, the fish stock increases.

[MyEconLab Animation](#)

they used. So the commons were gradually privatized and enclosed. Overgrazing ended, and land use became more efficient.



## Economics in Action

### One of Today's Tragedies of the Commons

Before 1970, Atlantic cod was abundant. It was fished for many centuries and was a major food source for the first European settlers in North America. During the sixteenth century, hundreds of European ships caught large quantities of cod in the northwest Atlantic off the coast of what is now New England and Newfoundland. By 1620, there were more than 1,000 fishing boats in the waters off Newfoundland, and in 1812 about 1,600 boats. During these years, cod were huge fish, typically weighing in at more than 110 kilograms and measuring 1 to 2 metres in length.

Most of the fishing during these years was done using lines and productivity was low. But low productivity limited the catch and enabled cod to be caught sustainably over hundreds of years.

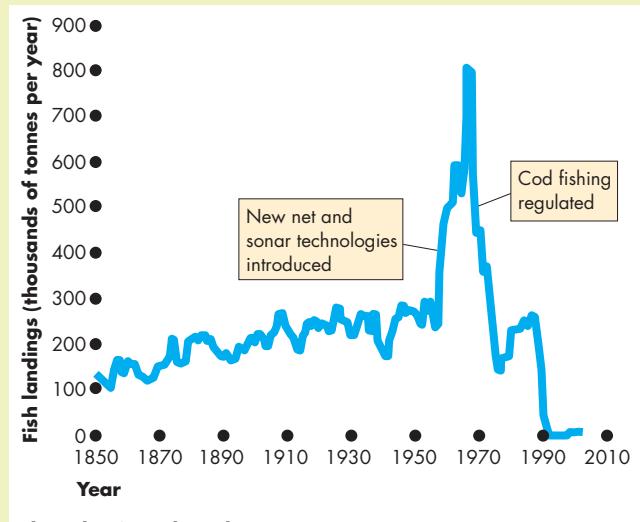
The situation changed dramatically during the 1960s with the introduction of high-efficiency nets (called trawls, seines, and gill nets), sonar technology to find fish concentrations, and large ships with efficient processing and storage facilities. These technological advances brought soaring cod harvests. In less than a decade, cod landings increased from less than 300,000 tonnes a year to 800,000 tonnes.

This volume of cod could not be taken without a serious collapse in the remaining stock, and by the 1980s it became vital to regulate cod fishing. But regulation was of limited success and stocks continued to fall.

In 1992, a total ban on cod fishing in the North Atlantic stabilized the population but at a very low level. Two decades of ban have enabled the species to repopulate, and it is now hoped that one day cod fishing will return but at a low and sustainable rate.

If the fish stock is large, many fish are born, but they must compete with each other for food so only a small number survive to reproduce and to grow large enough to catch.

Between a small and a large stock is a quantity of fish stock that maximizes the sustainable catch. In Fig. 17.6, this fish stock is 20 million tonnes and the sustainable catch is 300,000 tonnes a year. The maximum sustainable catch arises from a balancing of the birth of new fish from the stock and the availability of food to sustain the fish population.



**The Atlantic Cod Catch: 1850–2005**

*Source of data for graph:* Millennium Ecosystem Assessment.  
*Source of information in text:* Codfishes—Atlantic cod and its fishery, science.jrank.org.

If the quantity of fish caught is less than the sustainable catch, the fish stock grows; if the quantity caught exceeds the sustainable catch, the fish stock shrinks; and if the quantity caught equals the sustainable catch, the fish stock remains constant and is available for future generations of fishers in the same quantity that is available today.

If the fish stock exceeds the level that maximizes the sustainable catch, overfishing isn't a problem. But if the fish stock is less than the level that maximizes the sustainable catch, overfishing depletes the stock.

## The Overuse of a Common Resource

Why might a fish stock be overused? Why might overfishing occur? The answer is that fishers face only their own private cost and don't face the cost they impose on others—external cost. The *social cost* of fishing combines the *private cost* and *external cost*. Let's examine the costs of catching fish to see how the presence of external cost brings overfishing.

**Marginal Private Cost** You can think of the *marginal private cost* of catching fish as the additional cost incurred by keeping a boat and crew at sea for long enough to increase the catch by one tonne. Keeping a fishing boat at sea for an additional amount of time eventually runs into *diminishing marginal returns* (see p. 254). As the crew gets tired and the storage facilities get overfull, the catch per hour decreases. The cost of keeping the boat at sea for an additional hour is constant, so the marginal cost of catching fish increases as the quantity caught increases.

You've just seen that the *principle of increasing marginal cost* applies to catching fish just as it applies to other production activities: Marginal private cost increases as the quantity of fish caught increases.

The marginal private cost of catching fish determines an individual fisher's supply of fish. A profit-maximizing fisher is willing to supply the quantity at which the market price of fish covers the marginal private cost. And the market supply is the sum of the quantities supplied by each individual fisher.

**Marginal External Cost** The marginal external cost of catching fish is the cost per additional tonne that one fisher's production imposes on all other fishers. This additional cost arises because one fisher's catch decreases the remaining stock, which in turn decreases the renewal rate of the stock and makes it harder for others to find and catch fish.

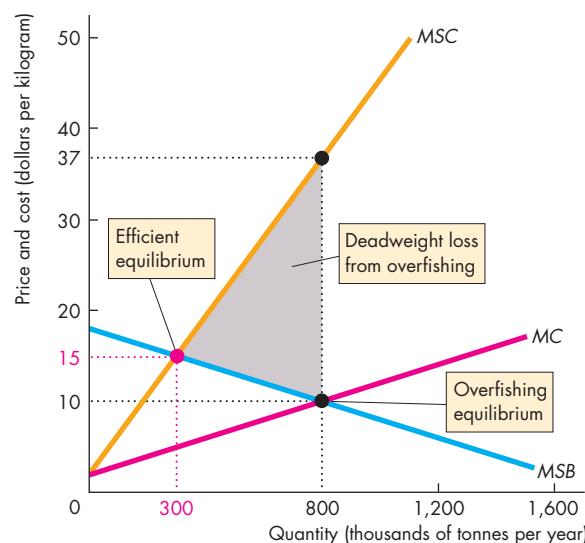
Marginal external cost also increases as the quantity of fish caught increases. If the quantity of fish caught is so large that it drives the species to near extinction, the marginal external cost becomes infinitely large.

**Marginal Social Cost** The *marginal social cost* of catching fish is the marginal private cost plus the marginal external cost. Because both of its components increase as the quantity caught increases, marginal social cost also increases with the quantity of fish caught.

**Marginal Social Benefit and Demand** The marginal social benefit from fish is the price that consumers are willing to pay for an additional kilogram of fish. Marginal social benefit decreases as the quantity of fish consumed increases, so the demand curve, which is also the marginal social benefit curve, slopes downward.

**Overfishing Equilibrium** Figure 17.7 illustrates overfishing and how it arises. The market demand curve for fish is the marginal social benefit curve, *MSB*. The market supply curve is the marginal *private cost* curve, *MC*. Market equilibrium occurs at the intersection point of these two curves. The equilibrium quantity is 800,000 tonnes per year and the equilibrium price is \$10 per kilogram.

**FIGURE 17.7** Why Overfishing Occurs



The supply curve is the marginal private cost curve, *MC*. The demand curve is the marginal social benefit curve, *MSB*. Market equilibrium occurs at a quantity of 800,000 tonnes and a price of \$10 per kilogram.

The marginal social cost curve is *MSC* and at the market equilibrium there is overfishing—marginal social cost exceeds marginal social benefit.

The quantity at which *MSC* equals *MSB* is the efficient quantity, 300,000 tonnes per year. The grey triangle shows the deadweight loss from overfishing.

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At this market equilibrium, overfishing is running down the fish stock. Figure 17.7 illustrates why overfishing occurs. At the market equilibrium quantity, marginal social benefit (and willingness to pay) is \$10 per kilogram, but the marginal social cost exceeds this amount. The marginal external cost is the cost of running down the fish stock.

**Efficient Equilibrium** What is the efficient use of a common resource? It is the use of the resource that makes the marginal social benefit from the resource equal to the marginal social cost of using it.

In Fig. 17.7, the efficient quantity of fish is 300,000 tonnes per year—the quantity that makes marginal social cost (on the *MSC* curve) equal to marginal social benefit (on the *MSB* curve). At this quantity, the marginal catch of each individual fisher costs society what people are willing to pay for it.

**Deadweight Loss from Overfishing** Deadweight loss measures the cost of overfishing. The grey triangle in Fig. 17.7 illustrates this loss. It is the marginal social cost minus the marginal social benefit from all the fish caught in excess of the efficient quantity.

### Achieving an Efficient Outcome

Defining the conditions under which a common resource is used efficiently is easier than delivering those conditions. To use a common resource efficiently, it is necessary to design an incentive mechanism that confronts the users of the resource with the marginal *social* consequences of their actions. The same principles apply to common resources as those that you met earlier in Chapter 16 when you studied the external cost of pollution.

The three main methods that might be used to achieve the efficient use of a common resource are:

- Property rights
- Production quotas
- Individual transferable quotas (ITQs)

**Property Rights** A common resource that no one owns and that anyone is free to use contrasts with *private property*, which is a resource that *someone* owns and has an incentive to use in the way that maximizes its value. One way of overcoming the tragedy of the commons is to convert a common resource to private property. By assigning private property rights to what was previously a common resource, its owner faces

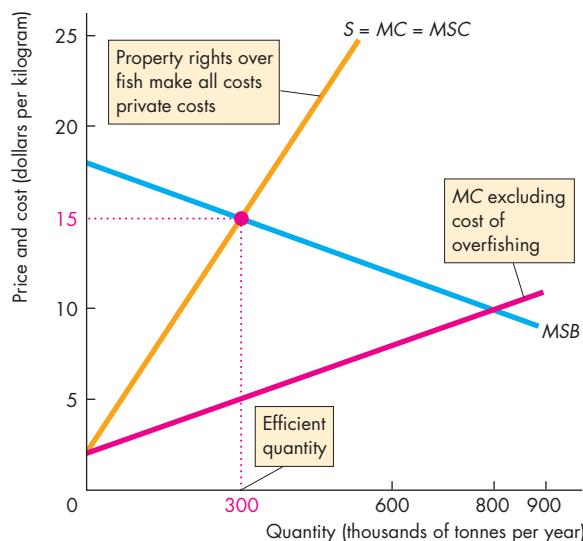
the same conditions as society faces. It doesn't matter who owns the resource.

The users of the resource will be confronted with the full cost of using it because they either own it or pay a fee to the owner for permission to use it.

When private property rights over a resource are established and enforced, the *MSC* curve becomes the marginal *private* cost curve, and the use of the resource is efficient.

Figure 17.8 illustrates an efficient outcome with property rights. The supply curve  $S = MC = MSC$  and the demand curve, the marginal social benefit curve, determine the equilibrium price and quantity. The price equals both marginal social benefit and marginal social cost and the quantity is efficient.

**FIGURE 17.8** Property Rights Achieve an Efficient Outcome



With private property rights, fishers pay the owner of the fish stock for permission to fish and face the full social cost of their actions. The marginal cost curve includes the external cost, so the supply curve is the marginal private cost curve and the marginal social cost curve,  $S = MC = MSC$ .

Market equilibrium occurs at \$15 per kilogram and, at that price, the quantity is 300,000 tonnes per year. At this quantity, marginal social cost equals marginal social benefit, and the quantity of fish caught is efficient.

The property rights convert the fish stock from a common resource to a private resource and it is used efficiently.

The private property solution to the tragedy of the commons is available in some cases. It was the solution to the original tragedy of the commons in England's Middle Ages. It is also a solution that has been used to prevent overuse of the airwaves that carry cellphone services. The right to use this space (called the frequency spectrum) has been auctioned by governments to the highest bidders. The owner of each part of the spectrum is the only one permitted to use it (or to license someone else to use it).

But assigning private property rights is not always feasible. It would be difficult, for example, to assign private property rights to the oceans. It would not be impossible, but the cost of enforcing private property rights over thousands of hectares of ocean would be high. It would be even more difficult to assign and protect private property rights to the atmosphere.

In some cases, there is an emotional objection to assigning private property rights. Critics of it have a moral objection to someone owning a resource that they regard as public. In the absence of property rights, some form of government intervention is used, one of which is a production quota.

**Production Quota** A *production quota* is an upper limit to the quantity of a good that may be produced in a specified period. The quota is allocated to individual producers, so each producer has its own quota.

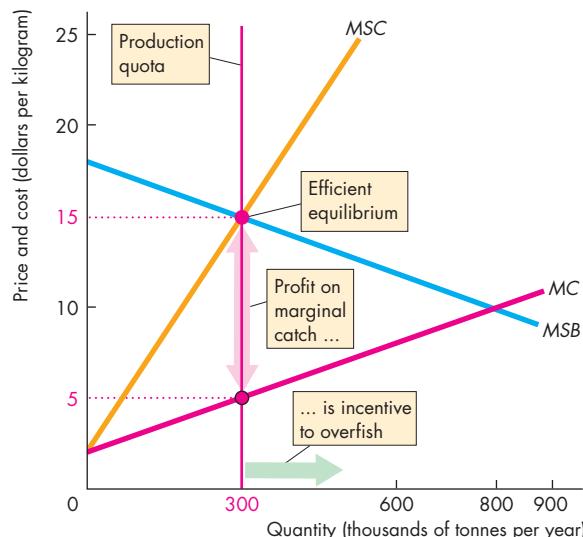
You studied the effects of a production quota in Chapter 6 (pp. 139–140) and learned that a quota can drive a wedge between marginal social benefit and marginal social cost and create deadweight loss. In that earlier example, the market was efficient without a quota. But in the case of common resources, the market overuses the resource and produces an inefficient quantity. A production quota in this market brings a move towards a more efficient outcome.

Figure 17.9 shows a quota that achieves an efficient outcome. The quota limits the catch (production) to 300,000 tonnes, the efficient quantity at which marginal social benefit, *MSB*, equals marginal social cost, *MSC*. If everyone sticks to their own quota, the outcome is efficient. But implementing a production quota has two problems.

First, it is in every fisher's self-interest to catch more fish than the quantity permitted under the quota. The reason is that price exceeds marginal private cost, so by catching more fish, a fisher gets a higher income. If enough fishers break the quota, overfishing and the tragedy of the commons remain.

Second, marginal cost is not, in general, the same for all producers—as we're assuming here. Efficiency

**FIGURE 17.9** A Production Quota to Use a Common Resource Efficiently



A quota of 300,000 tonnes that limits production to this quantity raises the price to \$15 per kilogram and lowers marginal cost to \$5 per kilogram. A fisher who cheats and produces more than the allotted quota increases his profit by \$10 per kilogram. If all (or most) fishers cheat, production exceeds the quota and there is a return to overfishing.

#### MyEconLab Animation

requires that the quota be allocated to the producers with the lowest marginal cost. But bureaucrats who allocate quotas do not have information about the marginal cost of individual producers. Even if they tried to get this information, producers would have an incentive to lie about their costs so as to get a bigger quota.

So where producers are difficult, or very costly, to monitor or where marginal cost varies across producers, a production quota cannot achieve an efficient outcome.

**Individual Transferable Quotas** Where producers are difficult to monitor or where marginal cost varies across producers, a more sophisticated quota system can be effective. It is an **individual transferable quota (ITQ)**, which is a production limit that is assigned to an individual who is then free to transfer (sell) the quota to someone else. A market in ITQs emerges and ITQs are traded at their market price.

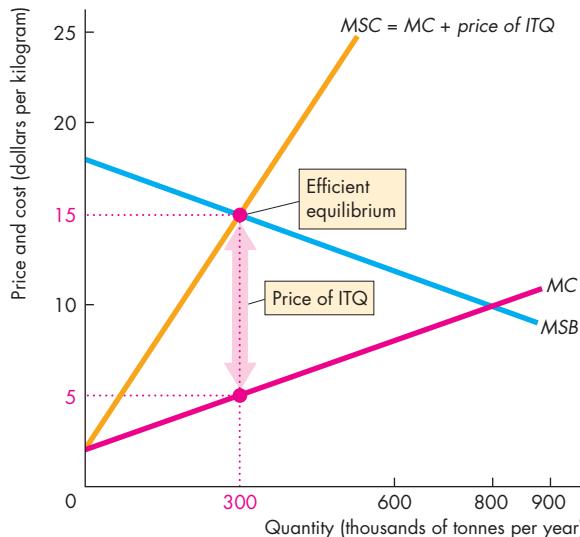
The market price of an ITQ is the highest price that someone is willing to pay for one. That price

is marginal social benefit minus marginal cost. The price of an ITQ will rise to this level because fishers who don't have a quota would be willing to pay this amount to get one.

A fisher with an ITQ could sell it for the market price, so by not selling the ITQ the fisher incurs an opportunity cost. The marginal cost of fishing, which now includes the opportunity cost of the ITQ, equals the marginal social benefit from the efficient quantity.

Figure 17.10 illustrates how ITQs work. Each fisher receives an allocation of ITQs and the total catch permitted by the ITQs is 300,000 tonnes per year. Fishers trade ITQs: Those with low marginal cost buy ITQs from those with high marginal cost and the market price of an ITQ settles at \$10 per kilogram of fish. The marginal private cost of fishing now becomes the original marginal private cost,  $MC$ , plus the price of the ITQ. The marginal private cost curve shifts upward from  $MC$  to  $MC + \text{price of ITQ}$  and each fisher is confronted with the marginal *social* cost of fishing. No one has an incentive to exceed the quota because to do so would send marginal cost above price and result in a loss on the marginal catch. The outcome is efficient.

**FIGURE 17.10** ITQs to Use a Common Resource Efficiently



ITQs are issued on a scale that keeps output at the efficient level. The market price of an ITQ equals the marginal social benefit minus marginal cost. Because each user of the common resource faces the opportunity cost of using the resource, self-interest achieves the social interest.

[MyEconLab Animation](#)

## Economics in Action

### ITQs Work

Iceland introduced the first ITQs in 1984 to conserve its stocks of lobster. In 1986, New Zealand and a bit later Australia introduced ITQs to conserve fish stocks in the South Pacific and Southern Oceans. The evidence from these countries suggests that ITQs work well.

ITQs help maintain fish stocks, but they also reduce the size of the fishing industry. This consequence of ITQs puts them against the self-interest of fishers. In all countries, the fishing industry opposes restrictions on its activities, but in Australia and New Zealand, the opposition is not strong enough to block ITQs.

In the United States the opposition has been harder to overcome, and in 1996 Congress passed the Sustainable Fishing Act that put a moratorium on ITQs. This moratorium was lifted in 2004, and since then ITQs have been applied to 28 fisheries from the Gulf of Alaska to the Gulf of Mexico. Economists have studied the effects of ITQs extensively and agree that they work. ITQs offer an effective tool for achieving an efficient use of the stock of ocean fish.

Opposition to ITQs has prevented them from being adopted in Canada. One Parliamentary committee in Ottawa even went so far as to argue that evidence from Australia and New Zealand should not be used to justify ITQs in Canada.

### REVIEW QUIZ

- 1 What is the tragedy of the commons? Give two examples, including one from your province.
- 2 Describe the conditions under which a common resource is used efficiently.
- 3 Review three methods that might achieve the efficient use of a common resource and explain the obstacles to efficiency.

Work these questions in Study Plan 17.3 and get instant feedback. Do a Key Terms Quiz.

[MyEconLab](#)

◆ *Economics in the News* on pp. 404–405 looks at the problem of keeping highway infrastructure in a good state of repair.



# Maintaining the Transportation Infrastructure

## Commuters Face More Than Two Years of Gardiner Lane Shutdowns Because of Repairs

*Toronto Star*

April 28, 2014

Following spring maintenance work that closed the Gardiner Expressway this weekend, the city has launched a series of long-term repair projects that will shut down parts of the highway for more than two years.

Work began Monday on three major projects, including the replacement of a steel beam guardrail, ... which will continue until August.

Structural work on three bridges ... will last through February 2015 and work on the elevated highway between the CNE and Grand Magazine will continue through December 2016. ...

These major projects are part of a 25-year strategic development plan to help make commuting along the Gardiner smoother, said Frank Clarizio of the city's engineering and construction division.

"As part of a 25-year plan, we are making sure that there's ongoing maintenance and rehabilitation of the Gardiner so that it's safe and operable for the public," he told the *Toronto Star*.

Clarizio said these projects will increase commute times.

"It depends on the time of day with respect to the traffic impact," he said. "We are anticipating at least one lane in each direction being closed for the rehabilitation work. You would probably see the Gardiner only opened for two lanes in each direction for traffic." ...

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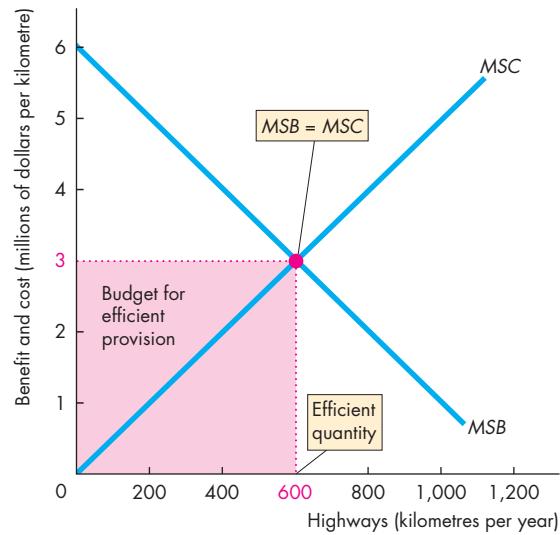
### ESSENCE OF THE STORY

- Toronto's Gardiner Expressway is undergoing a two-year repair program.
- The program is part of a 25-year plan of ongoing maintenance and rehabilitation to keep the Gardiner safe and operable.
- An increase in commute times is part of the cost of the program.

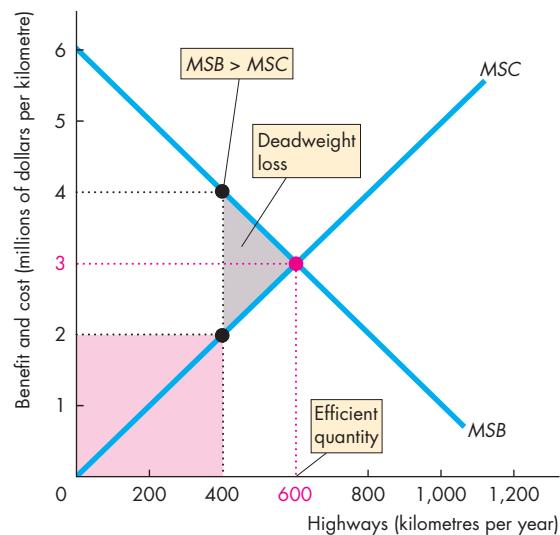
[MyEconLab](#) More Economics in the News

## ECONOMIC ANALYSIS

- Canada's road transportation infrastructure is constructed and maintained by all levels of government.
- Toronto's Gardiner Expressway was constructed and is maintained by the City of Toronto.
- To maintain any highway requires continuous repairs and eventually major refurbishment or replacement.
- The Gardiner Expressway was constructed 60 years ago and now requires a major overhaul.
- The City of Toronto has considered a variety of proposals that include tearing down the Gardiner and replacing it either with a surface or tunnel expressway.
- The City government decision is to undertake major and costly repairs as described in the news article.
- You can explain the problem of expressway maintenance by using the tools you've learned in this chapter.
- In Fig. 1, the  $x$ -axis measures the number of kilometres of expressway repaired per year and the  $y$ -axis measures the marginal benefit and cost of repairing a bridge.
- The  $MSC$  curve shows the marginal social cost of repairing a kilometre of expressway and the  $MSB$  curve shows the marginal social benefit.
- The efficient use of resources occurs when 600 kilometres per year are repaired at a cost of \$3 million per kilometre, with a total expenditure of \$1.8 billion per year.
- Restricted funds block this efficient outcome, illustrated in Fig. 2. The number of kilometres repaired is 400 per year at a cost of \$2 million per kilometre, with a total expenditure of \$0.8 billion per year. (The numbers are assumptions.)
- Because the number of kilometres repaired per year is less than the efficient quantity, there is a deadweight loss.
- If Fig. 2 is a correct description of the situation, a political party can propose an expressway repair and tax program that achieves an efficient outcome.
- The problem is that taxes are collected now and expressways are repaired later, so the political party must be able to credibly commit to doing the work after it has collected the funds.
- Credible commitment isn't possible, so budgets remain too small, expressways deteriorate, and deadweight loss arises.



**Figure 1 Efficient Provision of Highways**



**Figure 2 Inefficient Underprovision**

## SUMMARY

### Key Points

#### Classifying Goods and Resources (p. 392)

- A private good is a good or service that is rival and excludable.
- A public good is a good or service that is nonrival and nonexcludable.
- A common resource is a resource that is rival but nonexcludable.
- A natural monopoly good is a good or service that is nonrival and excludable.

Working Problems 1 and 2 will give you a better understanding of classifying goods and resources.

#### Public Goods (pp. 393–397)

- Because a public good is a good or service that is *nonrival* and *nonexcludable*, it creates a *free-rider problem*: No one has an incentive to pay their share of the cost of providing a public good.
- The efficient level of provision of a public good is that at which marginal social benefit equals marginal social cost.

- Competition between political parties can lead to the efficient scale of provision of a public good.
- Bureaucrats who maximize their budgets and voters who are rationally ignorant can lead to the inefficient overprovision of a public good—government failure.

Working Problems 3 to 6 will give you a better understanding of public goods.

#### Common Resources (pp. 398–403)

- Common resources create a problem that is called the *tragedy of the commons*—no one has a private incentive to conserve the resources and use them at an efficient rate.
- A common resource is used to the point at which the marginal social (private) benefit equals the marginal private cost.
- A common resource might be used efficiently by creating a private property right, setting a quota, or issuing individual transferable quotas.

Working Problems 7 to 9 will give you a better understanding of common resources.

### Key Terms

Common resource, 392	Natural monopoly good, 392	Private good, 392
Excludable, 392	Nonexcludable, 392	Public good, 392
Free-rider problem, 393	Nonrival, 392	Rational ignorance, 396
Individual transferable quota (ITQ), 402	Principle of minimum differentiation, 395	Rival, 392

### MyEconLab Key Terms Quiz

Tragedy of the commons, 398

## WORKED PROBLEM

### MyEconLab You can work this problem in Chapter 17 Study Plan.

The table sets out the marginal benefits that Ann, Sue, and Zack receive from spraying their shared swamp to control mosquitoes. The marginal social cost (*MSC*) is a constant \$12 per spray.

Number of sprays (per season)	Marginal benefit		
	Ann	Sue (dollars per spray)	Zack
0	5	10	15
1	4	8	12
2	3	6	9
3	2	4	6
4	1	2	3
5	0	0	0

#### Questions

- What is the marginal social benefit of mosquito control at each quantity of sprays?
- What is the efficient number of sprays per season?

#### Solutions

1. Mosquito control is a public good, so its marginal social benefit (*MSB*) is found by summing the marginal benefits of the three people at each quantity of sprays. The table below records the calculations.

At 2 sprays per season, for example, *MSB* is \$18 per spray, which is the sum of \$3 (Ann), \$6 (Sue), and \$9 (Zack).

The other rows of the table show the *MSB* for other quantities of sprays.

Figure 1 illustrates the *MSB* calculation.

Number of sprays (per season)	Marginal benefit			<i>MSB</i>
	Ann	Sue (dollars per spray)	Zack	
0	5	10	15	30
1	4	8	12	24
2	3	6	9	18
3	2	4	6	12
4	1	2	3	4
5	0	0	0	0

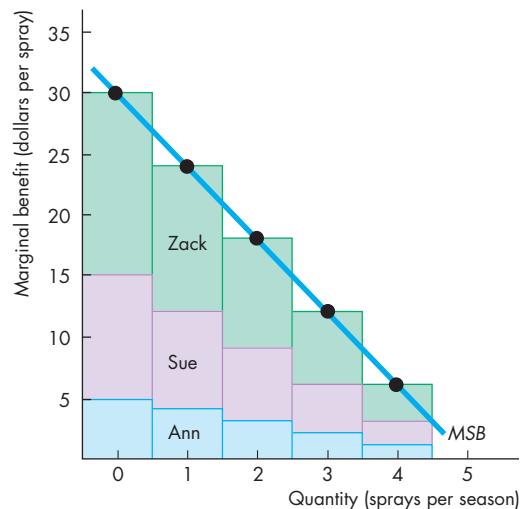
**Key Point:** The marginal social benefit curve of a public good is the *vertical sum* of the individual marginal benefit curves.

- To find the efficient number of sprays, we need to determine the number of sprays per season at which the *MSB* equals the *MSC* of \$12.

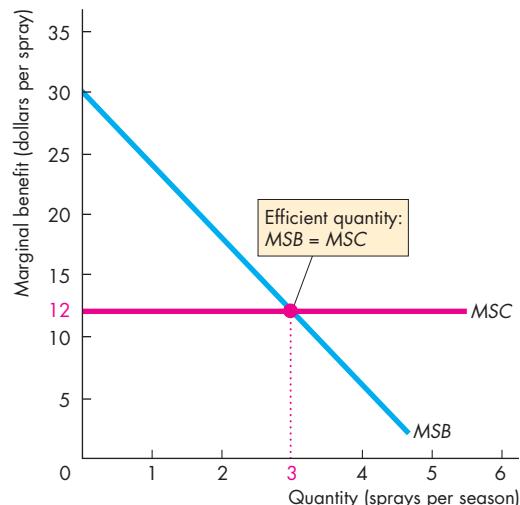
Inspecting the table below, *MSB* equals \$12 at 3 sprays per season, so that is the efficient quantity.

**Key Point:** The efficient quantity of a public good is that at which its marginal social benefit equals its marginal social cost.

#### Key Figures



**Figure 1 Marginal Social Benefit**



**Figure 2 Efficient Quantity**

## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 9 in Chapter 17 Study Plan and get instant feedback.

### Classifying Goods and Resources (Study Plan 17.1)

1. Classify each of the following items as excludable, nonexcludable, rival, or nonrival. Explain your answer.
  - A Big Mac
  - A bridge
  - A view of the sunset
  - A hurricane warning system
2. Classify each of the following items as a public good, a private good, a natural monopoly good, or a common resource. Explain your answer.
  - Highway police services
  - Internet service
  - A Tim Hortons coffee
  - Fish in the Atlantic ocean
  - Purolator courier service

### Public Goods (Study Plan 17.2)

3. For each of the following goods, explain why a free-rider problem arises or how it is avoided.
  - Canada Day fireworks display
  - TransCanada Highway in Manitoba
  - Wireless Internet access in a hotel
  - The public library in your city
4. The table sets out the benefits that Terri and Sue receive from on-campus police at night:

Police officers on duty (number per night)	Marginal benefit	
	Terri (dollars per police officer)	Sue
1	18	22
2	14	18
3	10	14
4	6	10
5	2	6

Suppose that Terri and Sue are the only students on campus at night. Draw a graph to show the marginal social benefit from the on-campus police at night.

Use the data on mosquito control in the table in the next column to work Problems 5 and 6.

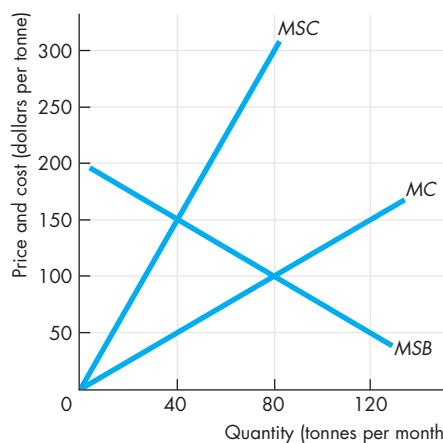
5. What quantity of spraying would a private firm provide? What is the efficient quantity of spraying? In a single-issue election on mosquito control, what quantity would the winner provide?

Quantity (hectares (sprayed per day)	Marginal social cost (thousands of dollars per day)	Marginal social benefit
1	2	10
2	4	8
3	6	6
4	8	4
5	10	2

6. If the government appoints a bureaucrat to run the program, would mosquito spraying most likely be underprovided, overprovided, or provided at the efficient quantity?

### Common Resources (Study Plan 17.3)

Use the following figure to work Problems 7 to 9. The figure shows the market for North Atlantic tuna.



7. a. What is the quantity of tuna that fishers catch and the price of tuna? Is the tuna stock being used efficiently? Explain why or why not.  
b. What would be the price of tuna if the stock of tuna is used efficiently?
8. a. With a quota of 40 tonnes a month for the tuna fishing industry, what is the equilibrium price of tuna and the quantity of tuna that fishers catch?  
b. Is the equilibrium an overfishing equilibrium?
9. If the government issues ITQs to individual fishers that limit the total catch to the efficient quantity, what is the market price of an ITQ?

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### Classifying Goods and Resources

10. Classify each of the following items as excludable, nonexcludable, rival, or nonrival and explain your classification.
  - Firefighting service
  - A Starbucks coffee
  - A view of Niagara Falls
  - Jasper National Park
  - A Google search
  
11. Classify each of the following items as a public good, a private good, a natural monopoly good, or a common resource and explain your classification.
  - A car licence
  - Tuna in the Pacific Ocean
  - Airline service within Canada
  - A cinema
  - A local storm-water system

### Public Goods

Use the following table to work Problems 12 and 13. The table sets out the marginal benefits that Sam and Nick receive from the town's street lighting:

Number of street lights	Marginal benefit	
	Sam (dollars per street light)	Nick
1	10	12
2	8	9
3	6	6
4	4	3
5	2	0

12. a. Is the town's street lighting a private good, a public good, or a common resource?  
 b. Suppose that Sam and Nick are the only residents of the town. Draw a graph to show the marginal social benefit from the town's street lighting.
  
13. What is the principle of diminishing marginal benefit? Does Sam's, Nick's, or the society's marginal benefit diminish faster?

Use the following news clip to work Problems 14 and 15.

### Should Childhood Vaccines Be Mandatory?

While Canadian vaccination rates are high, the outbreaks of measles in five provinces during 2014 show that not everyone is getting them. There is

no national policy making vaccinations mandatory, although Ontario, New Brunswick, and Manitoba require public school students to show their immunization records to attend school.

Source: CBC Radio, April 15, 2014

14. Explain why someone who doesn't get vaccinated against measles is a "free rider."
15. Explain why a measles vaccination is not a public good but why, nonetheless, an efficient outcome can be achieved by making it compulsory and paid for by government.

Use the following news clip to work Problems 16 and 17.

### A Bridge Too Far Gone

Gas taxes have paid for most of the American highway system. Now motorists pay about one-third as much in the gas taxes to drive a mile as they did in the 1960s. Raising gas taxes is politically tricky, but it wouldn't matter if private cash were flooding into infrastructure, or if new ways were being found to control demand. Neither is happening, and private companies building toll roads brings howls of outrage.

Source: *The Economist*, August 9, 2007

16. Why is it "politically tricky" to raise gas taxes to finance infrastructure?
17. What in this news clip points to a distinction between public *production* of a public good and public *provision*? Give examples of three public goods that are *produced* by private firms but *provided* by government and paid for with taxes.

### Common Resources

18. In Quebec, an Economic Plan

As the polar ice caps recede, Canada plans Asian shipping routes and sustainable developments for its northern lands. "We're building a parallel canal to the Panama Canal for Chinese and Indian ships, so they can accelerate the transport of goods," says Jean Charest, the premier of Québec. Charest announced Québec's Plan Nord: a plan to develop the north by opening mines, building infrastructure to mines, boosting tourism, and establishing sustainable logging.

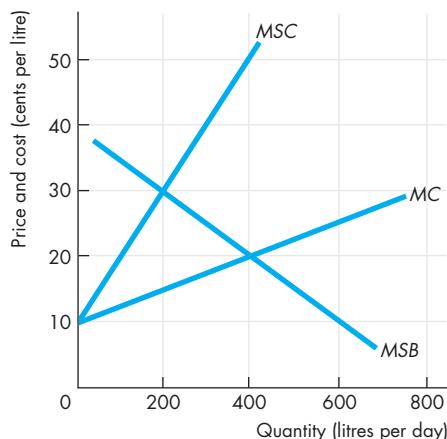
Source: *Fortune*, June 3, 2011

Which items in the news clip are common resources? Which items are public goods? Which activities are likely to increase climate change? Explain your answer.

19. If hikers were required to pay a fee to use the Overlander Trail in Jasper National Park,
- Would the use of this common resource be more efficient?
  - Would it be even more efficient if the most popular spots along the trail had the highest prices?
  - Why do you think we don't see more market solutions to the tragedy of the commons?

Use the following information to work Problems 20 to 22.

A spring runs under a village. Everyone can sink a well on her or his land and take water from the spring. The following figure shows the marginal social benefit from water and the marginal cost of taking it.



20. What is the quantity of water taken and what is the private cost of the water taken?
21. What is the efficient quantity of water taken and the marginal social cost at the efficient quantity?
22. If the village council sets a quota on the total amount of water such that the spring is used efficiently, what would be the quota and the market value of the water taken per day?

### 23. Polar Ice Cap Shrinks Further and Thins

With the warming of the planet, the polar ice cap is shrinking and the Arctic Sea is expanding. As the ice cap shrinks further, more and more underwater mineral resources will become accessible. Many countries are staking out territorial claims to parts of the polar region.

Source: *The Wall Street Journal*, April 7, 2009

Explain how ownership of these mineral resources will influence the amount of damage done to the Arctic Sea and its wildlife.

### Economics in the News

24. After you have studied *Economics in the News* on pp. 404–405, answer the following questions:
- What are some of the benefits of a well-maintained transportation infrastructure such as the Gardiner Expressway?
  - What are some of the costs of keeping transportation infrastructure such as the Gardiner Expressway well maintained?
  - What determines the efficient amount of expressway maintenance and what might lead to underprovision or overprovision of maintenance?
  - How would you expect Toronto's population growth to influence the marginal social benefit from the Gardiner Expressway?
  - Illustrate your answer to part (d) by drawing a version of Fig. 2 on p. 405 that shows the effect of an increase in the population.

### 25. Who's Hiding under the U.S. Umbrella?

Students of the Cold War learn that, to deter possible Soviet aggression, the United States placed a "strategic umbrella" over NATO Europe and Japan, with the United States providing most of their national security. Under President Ronald Reagan, the United States spent 6 percent of GDP on defence, whereas the Europeans spent only 2 to 3 percent and the Japanese spent only 1 percent, although all faced a common enemy. Thus the U.S. taxpayer paid a disproportionate share of the overall defence spending, whereas NATO Europe and Japan spent more on consumer goods or saved.

Source: *International Herald Tribune*, January 30, 2008

- Explain the free-rider problem described in this news clip.
- Does the free-rider problem in international defence mean that the world has too little defence against aggression?
- How do nations try to overcome the free-rider problem among nations?

# Making the Rules

## PART FIVE

### UNDERSTANDING MARKET FAILURE AND GOVERNMENT

Creating a system of responsible democratic government is a huge enterprise, and one that could easily go wrong. Creating a constitution that made despotic and tyrannical rule impossible was relatively easy. And we achieved such a constitution for Canada by using some sound economic ideas. We designed a sophisticated system of incentives—of carrots and sticks—to make the government responsive to public opinion and to limit the ability of individual self-interests to gain at the expense of the majority. But they were not able to create a constitution that effectively blocks the ability of special interest groups to capture the consumer and producer surpluses that result from specialization and exchange.

We have created a system of government to deal with four market failures: (1) monopoly, (2) externalities, (3) public goods, and (4) common resources.

Government might help cope with these market failures, but government does not eliminate the pursuit of self-interest. Voters, politicians, and bureaucrats pursue their self-interest, sometimes at the expense of the social interest, and instead of market failure, we get government failure.

Many economists have thought long and hard about the problems discussed in Part Five, but none has had as profound an effect on our ideas in this area as Ronald Coase.

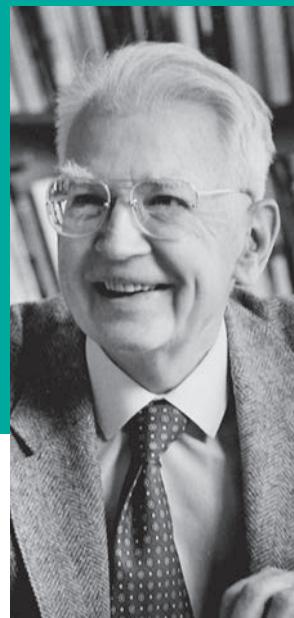
**Ronald Coase (1910–2013)**, was born in England and educated at the London School of Economics, where he was deeply influenced by his teacher, Arnold Plant, and by the issues of his youth: communist central planning versus free markets.

Professor Coase lived in the United States from 1951 until his death in 2013. He first visited America as a 20-year-old on a travelling scholarship during the depths of the Great Depression. It was on this visit, and before he had completed his Bachelor's degree, that he conceived the ideas that 60 years later were to earn him the 1991 Nobel Prize for Economic Science.

Ronald Coase discovered and clarified the significance of transactions costs and property rights for the functioning of the economy. He revolutionized the way we think about property rights and externalities and opened up the growing field of law and economics.

*"The question to be decided is: Is the value of fish lost greater or less than the value of the product which contamination of the stream makes possible?"*

**RONALD H. COASE**  
*The Problem of Social Cost*





TALKING WITH

## Caroline M. Hoxby\*



CAROLINE M. HOXBY is the Allie S. Freed Professor of Economics at Harvard University. Born in Cleveland, Ohio, she was an undergraduate at Harvard and a graduate student at Oxford and MIT.

Professor Hoxby is a leading student of the economics of education. She has written many articles on this topic and has published books entitled *The Economics of School Choice* and *College Choices* (both University of Chicago Press, 2003 and 2004, respectively). She is Program Director of the Economics of Education Program at the National Bureau of Economic Research, serves on several other national boards that study education issues, and has advised or provided testimony to several state legislatures and the United States Congress.

Michael Parkin and Robin Bade talked with Caroline Hoxby about her work and the progress that economists have made in understanding how the financing and the provision of education influence the quality of education and the equality of access to it.

### *Why did you decide to become an economist?*

I've wanted to be an economist from about the age of 13. That was when I took my first class in economics (an interesting story in itself) and discovered that all of the thoughts swimming around in my head belonged to a "science" and there was an entire body of people who understood this science—a lot better than I did, anyway. I can still recall reading *The Wealth of Nations* for the first time; it was a revelation.

### *What drew you to study the economics of education?*

We all care about education, perhaps because it is the key means by which opportunity is (or should be) extended to all in the United States. Also, nearly everyone now acknowledges that highly developed countries like the United States rely increasingly on education as the engine of economic growth. Thus, one reason I was drawn to education is its importance. However, what primarily drew me was that education issues were so clearly begging for economic analysis and that there was so little of it. I try hard to understand educational institutions and problems, but I insist on bringing economic logic to bear on educational issues.

### *What can economists say about the alternative methods of financing education? Is there a voucher solution that could work?*

There is definitely a voucher solution that could work because vouchers are inherently an extremely flexible policy....

Any well-designed voucher system will give schools an incentive to compete. However, when designing vouchers, we can also build in remedies for a variety of educational problems. Vouchers can be used to ensure that disabled children get the funding they need and the program choices they need.

Compared to current school finance programs, vouchers can do a better job of ensuring that low-income families have sufficient funds to invest in the child's education. Well-designed vouchers can encourage schools to make their student bodies socio-economically diverse.

Economists should say to policymakers: "Tell me your goals; I'll design you a voucher."

**Economists should say to policy makers: "Tell me your goals; I'll design you a voucher."**

\*Read the full interview with Caroline Hoxby in [MyEconLab](#).



## PART SIX FACTOR MARKETS AND INEQUALITY

# 18

## MARKETS FOR FACTORS OF PRODUCTION

After studying this chapter, you will be able to:

- ◆ Describe the anatomy of factor markets
- ◆ Explain how the value of marginal product determines the demand for a factor of production
- ◆ Explain how wage rates and employment are determined and how labour unions influence labour markets
- ◆ Explain how capital and land rental rates and natural resource prices are determined

A worker on Alberta's tar sands earns much more than a barista in a Calgary Starbucks. Why? What determines the wages that people earn?

Wages are important, but finding a job is important too. Why are so many good jobs in manufacturing disappearing; and what new jobs are being created to replace them?

In this chapter, we study labour markets as well as markets for the other factors of production—capital and natural resources. And in *Economics in the News* at the end of the chapter, we return to the labour markets of Alberta.

## The Anatomy of Factor Markets

The four factors of production are:

- Labour
- Capital
- Land (natural resources)
- Entrepreneurship

Let's take a brief look at the anatomy of the markets in which these factors of production are traded.

### Markets for Labour Services

*Labour services* are the physical and mental work effort that people supply to produce goods and services. A labour market is a collection of people and firms who trade labour services. The price of labour services is the wage rate.

Some labour services are traded day by day. These services are called *casual labour*. People who pick fruit and vegetables often just show up at a farm and take whatever work is available that day. But most labour services are traded on a job contract.

Most labour markets have many buyers and many sellers and are competitive. In these markets, supply and demand determine the wage rate and quantity of labour employed. Jobs expand when demand increases and jobs disappear when demand decreases.

In some labour markets, a labour union operates like a monopoly on the supply side of the labour market. In this type of labour market, a bargaining process between the union and the employer determines the wage rate.

We'll study both competitive labour markets and labour unions in this chapter.

### Markets for Capital Services

*Capital* consists of the tools, instruments, machines, buildings, and other constructions that have been produced in the past and that businesses now use to produce goods and services. These physical objects are themselves goods—capital goods. Capital goods are traded in goods markets, just as bottled water and toothpaste are. The price of a dump truck, a capital good, is determined by supply and demand in the market for dump trucks. This market is not a market for capital services.

A market for *capital services* is a *rental market*—a market in which the services of capital are hired.

An example of a market for capital services is the vehicle rental market in which Avis, Budget, Hertz,

U-Haul, and many other firms offer automobiles and trucks for hire. The price in a capital services market is a *rental rate*.

Most capital services are not traded in a market. Instead, a firm buys capital and uses it itself. The services of the capital that a firm owns and operates have an implicit price that arises from depreciation and interest costs (see Chapter 10, pp. 224–225). You can think of this price as the implicit rental rate of capital. Firms that buy capital and use it themselves are *implicitly* renting the capital to themselves.

### Markets for Land Services and Natural Resources

*Land* consists of all the gifts of nature—natural resources. The market for land as a factor of production is the market for the *services of land*—the use of land. The price of the services of land is a rental rate.

Most natural resources, such as farm land, can be used repeatedly. But a few natural resources are nonrenewable. **Nonrenewable natural resources** are resources that can be used only once. Examples are oil, natural gas, and coal. The prices of nonrenewable natural resources are determined in global *commodity markets* and are called *commodity prices*.

### Entrepreneurship

Entrepreneurial services are not traded in markets. Entrepreneurs receive the profit or bear the loss that results from their business decisions.

### REVIEW QUIZ

- 1 What are the factors of production and their prices?
- 2 What is the distinction between capital and the services of capital?
- 3 What is the distinction between the price of capital equipment and the rental rate of capital?

Work these questions in Study Plan 18.1 and get instant feedback. Do a Key Term Quiz.

**MyEconLab**

The rest of this chapter explores the influences on the demand and supply of factors of production. We begin by studying the demand for a factor of production.



## The Demand for a Factor of Production

The demand for a factor of production is a **derived demand**—it is derived from the demand for the goods and services that the labour produces. You've seen, in Chapters 10 through 15, how a firm determines its profit-maximizing output. The quantities of factors of production demanded are a consequence of the firm's output decision. A firm hires the quantities of factors of production that produce the firm's profit-maximizing output.

To decide the quantity of a factor of production to hire, a firm compares the cost of hiring an additional unit of the factor with its value to the firm. The cost of hiring an additional unit of a factor of production is the factor price. The value to the firm of hiring one more unit of a factor of production is called the factor's **value of marginal product**. We calculate the value of marginal product as the price of a unit of output multiplied by the marginal product of the factor of production.

To study the demand for a factor of production, we'll use labour as the example. But what you learn here about the demand for labour applies to the demand for all factors of production.

### Value of Marginal Product

Table 18.1 shows you how to calculate the value of marginal product of labour at Angelo's Bakery. The first two columns show Angelo's total product

schedule—the number of loaves per hour that each quantity of labour can produce. The third column shows the marginal product of labour—the change in total product that results from a one-unit increase in the quantity of labour employed. (See Chapter 11, pp. 249–252 for a refresher on product schedules.)

Angelo can sell bread at the going market price of \$2 a loaf. Given this information, we can calculate the value of marginal product (fourth column). It equals price multiplied by marginal product. For example, the marginal product of hiring the second worker is 6 loaves. Each loaf sold brings in \$2, so the value of marginal product of the second worker is \$12 (6 loaves at \$2 each).

### A Firm's Demand for Labour

The value of marginal product of labour tells us what an additional worker is worth to a firm. It tells us the revenue that the firm earns by hiring one more worker. The wage rate tells us what an additional worker costs a firm.

The value of marginal product of labour and the wage rate together determine the quantity of labour demanded by a firm. Because the value of marginal product decreases as the quantity of labour employed increases, there is a simple rule for maximizing profit: Hire the quantity of labour at which the value of marginal product equals the wage rate.

If the value of marginal product of labour exceeds the wage rate, a firm can increase its profit by hiring

**TABLE 18.1** Value of Marginal Product at Angelo's Bakery

Quantity of labour (L) (workers)	Total product (TP) (loaves per hour)	Marginal product (MP = $\Delta TP / \Delta L$ ) (loaves per worker)	Value of marginal product (VMP = MP × P) (dollars per worker)
A 0	0	..... 7	14
B 1	7	..... 6	<b>12</b>
C 2	13	..... 5	10
D 3	18	..... 4	8
E 4	22	..... 3	6
F 5	25		

The value of marginal product of labour equals the price of the product multiplied by the marginal product of labour. If Angelo's hires 2 workers, the marginal product of the second worker is 6 loaves (in the third column). The price of a loaf is \$2, so the value of marginal product of the second worker is \$2 a loaf multiplied by 6 loaves, which is \$12 (in the fourth column).

one more worker. If the wage rate exceeds the value of marginal product of labour, a firm can increase its profit by firing one worker. But if the wage rate equals the value of marginal product of labour, the firm cannot increase its profit by changing the number of workers it employs. The firm is making the maximum possible profit, so:

The quantity of labour demanded by a firm is the quantity at which the value of marginal product of labour equals the wage rate.

### A Firm's Demand for Labour Curve

A firm's demand for labour curve is derived from its value of marginal product curve. Figure 18.1 shows these two curves. Figure 18.1(a) shows the value of marginal product curve at Angelo's Bakery. The blue bars graph the numbers in Table 18.1. The curve labelled *VMP* is Angelo's value of marginal product curve.

If the wage rate falls and other things remain the same, a firm hires more workers. Figure 18.1(b) shows Angelo's demand for labour curve.

Suppose the wage rate is \$10 an hour. You can see in Fig. 18.1(a) that if Angelo hires 2 workers, the value of the marginal product of labour is \$12 an hour. At a wage rate of \$10 an hour, Angelo makes a profit of \$2 an hour on the second worker. If Angelo hires a third worker, the value of marginal product of that worker is \$10 an hour. So on this third worker, Angelo breaks even.

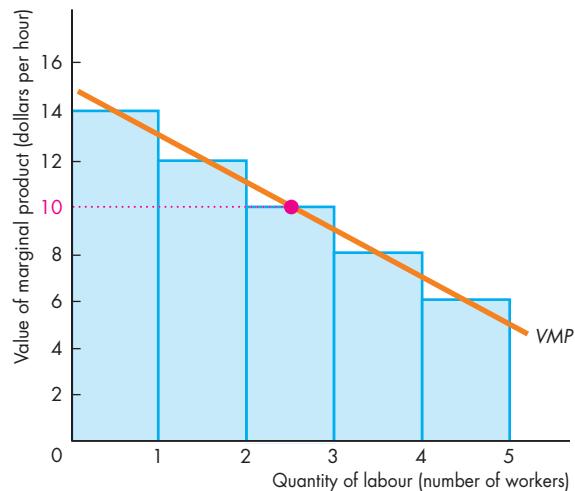
If Angelo hired 4 workers, his profit would fall. The fourth worker generates a value of marginal product of only \$8 an hour but costs \$10 an hour, so Angelo does not hire the fourth worker. When the wage rate is \$10 an hour, the quantity of labour demanded by Angelo is 3 workers.

Figure 18.1(b) shows Angelo's demand for labour curve, *D*. At \$10 an hour, the quantity of labour demanded by Angelo is 3 workers. If the wage rate increased to \$12 an hour, Angelo would decrease the quantity of labour demanded to 2 workers. If the wage rate decreased to \$8 an hour, Angelo would increase the quantity of labour demanded to 4 workers.

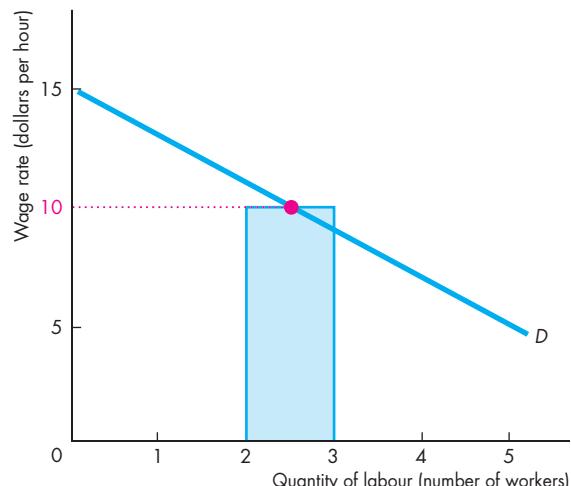
A change in the wage rate brings a change in the quantity of labour demanded and a movement along the demand for labour curve.

A change in any other influence on a firm's labour-hiring plans changes the demand for labour and shifts the demand for labour curve.

**FIGURE 18.1** The Demand for Labour at Angelo's Bakery



(a) Value of marginal product



(b) Demand for labour

Angelo's Bakery can sell any quantity of bread at \$2 a loaf. The blue bars in part (a) represent the firm's value of marginal product of labour (based on Table 18.1). The line labelled *VMP* is the firm's value of marginal product curve. Part (b) shows Angelo's demand for labour curve. Angelo hires the quantity of labour that makes the value of marginal product equal to the wage rate. The demand for labour curve slopes downward because the value of marginal product diminishes as the quantity of labour employed increases.

## Changes in a Firm's Demand for Labour

A firm's demand for labour depends on:

- The price of the firm's output
- The prices of other factors of production
- Technology

**The Price of the Firm's Output** The higher the price of a firm's output, the greater is the firm's demand for labour. The price of output affects the demand for labour through its influence on the value of marginal product of labour. A higher price for the firm's output increases the value of marginal product of labour. A change in the price of a firm's output leads to a shift in the firm's demand for labour curve. If the price of the firm's output increases, the demand for labour increases and the demand for labour curve shifts rightward.

For example, if the price of bread increased to \$3 a loaf, the value of marginal product of Angelo's fourth worker would increase from \$8 an hour to \$12 an hour. At a wage rate of \$10 an hour, Angelo would now hire 4 workers instead of 3.

**The Prices of Other Factors of Production** If the price of using capital decreases relative to the wage rate, a firm substitutes capital for labour and increases the quantity of capital it uses. Usually, the demand for labour will decrease when the price of using capital falls. For example, if the price of a bread-making machine falls, Angelo might decide to install one machine and lay off a worker. But the demand for labour could increase if the lower price of capital led to a sufficiently large increase in the scale of production. For example, with cheaper machines available, Angelo might install a machine and hire more labour to operate it. This type of factor substitution occurs in the long run when the firm can change the size of its plant.

**Technology** New technologies decrease the demand for some types of labour and increase the demand for other types. For example, if a new automated bread-making machine becomes available, Angelo might install one of these machines and fire most of his workforce—a decrease in the demand for bakery workers. But the firms that manufacture and service automated bread-making machines hire more labour, so there is an increase in the demand for this type of labour. An event similar to this one occurred during the 1990s when the introduction of electronic

telephone exchanges decreased the demand for telephone operators and increased the demand for computer programmers and electronics engineers.

Table 18.2 summarizes the influences on a firm's demand for labour.

**TABLE 18.2** A Firm's Demand for Labour

### The Law of Demand

(Movements along the demand curve for labour)

*The quantity of labour demanded by a firm*

*Decreases if:*

- The wage rate increases

*Increases if:*

- The wage rate decreases

### Changes in Demand

(Shifts in the demand curve for labour)

*A firm's demand for labour*

*Decreases if:*

- The price of the firm's output decreases
- The price of a substitute for labour falls
- The price of a complement of labour rises
- A new technology or new capital decreases the marginal product of labour

*Increases if:*

- The price of the firm's output increases
- The price of a substitute for labour rises
- The price of a complement of labour falls
- A new technology or new capital increases the marginal product of labour

## REVIEW QUIZ

- 1 What is the value of marginal product of labour?
- 2 What is the relationship between the value of marginal product of labour and the marginal product of labour?
- 3 How is the demand for labour derived from the value of marginal product of labour?
- 4 What are the influences on the demand for labour?

Work these questions in Study Plan 18.2 and get instant feedback. Do a Key Terms Quiz.

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## Labour Markets

Labour services are traded in many different labour markets. Examples are markets for bakery workers, van drivers, crane operators, computer support specialists, air traffic controllers, surgeons, and economists. Some of these markets, such as the market for bakery workers, are local. They operate in a given neighbourhood or town. Some labour markets, such as the market for air traffic controllers, are national. Firms and workers search across the nation for the right match of worker and job. And some labour markets are global, such as the market for superstar hockey, basketball, and soccer players.

We'll look at a local market for bakery workers as an example. First, we'll look at a *competitive* labour market. Then, we'll see how monopoly elements can influence a labour market.

### A Competitive Labour Market

A competitive labour market is one in which many firms demand labour and many households supply labour.

**Market Demand for Labour** Earlier in the chapter, you saw how an individual firm decides how much labour to hire. The market demand for labour is derived from the demand for labour by individual firms. We determine the market demand for labour by adding together the quantities of labour demanded by all the firms in the market at each wage rate. (The market demand for a good or service is derived in a similar way—see Chapter 5, pp. 108–109.)

Because each firm's demand for labour curve slopes downward, the market demand for labour curve also slopes downward.

**The Market Supply of Labour** The market supply of labour is derived from the supply of labour decisions made by individual households.

**Individual's Labour Supply Decision** People can allocate their time to two broad activities: labour supply and leisure. (Leisure is a catch-all term. It includes all activities other than supplying labour.) For most people, leisure is more fun than work, so to induce them to work they must be offered a wage.

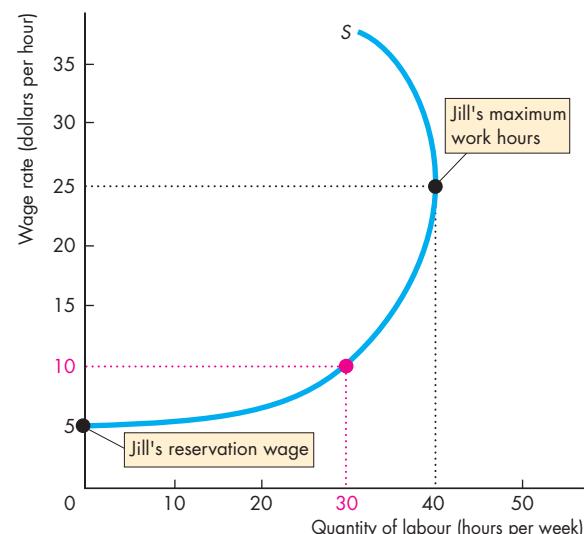
Think about the labour supply decision of Jill, one of the workers at Angelo's Bakery. Let's see how the wage rate influences the quantity of labour she is willing to supply.

**Reservation Wage Rate** Jill enjoys her leisure time, and she would be pleased if she didn't have to spend her time working at Angelo's Bakery. But Jill wants to earn an income, and as long as she can earn a wage rate of at least \$5 an hour, she's willing to work. This wage is called her *reservation wage*. At any wage rate above her reservation wage, Jill supplies some labour.

The wage rate at Angelo's is \$10 an hour, and at that wage rate, Jill chooses to work 30 hours a week. At a wage rate of \$10 an hour, Jill regards this use of her time as the best available. Figure 18.2 illustrates.

**Backward-Bending Labour Supply Curve** If Jill were offered a wage rate between \$5 and \$10 an hour, she would want to work fewer hours. If she were offered a wage rate above \$10 an hour, she would want to work more hours, but only up to a point. If Jill could

**FIGURE 18.2** Jill's Labour Supply Curve



Jill's labour supply curve is S. Jill supplies no labour at wage rates below her reservation wage of \$5 an hour. As the wage rate rises above \$5 an hour, the quantity of labour that Jill supplies increases to a maximum of 40 hours a week at a wage rate of \$25 an hour. As the wage rate rises above \$25 an hour, Jill supplies a decreasing quantity of labour: her labour supply curve bends backward. The income effect on the demand for leisure dominates the substitution effect.

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earn \$25 an hour, she would be willing to work 40 hours a week (and earn \$1,000 a week). But at a wage rate above \$25 an hour, with the goods and services that Jill can buy for \$1,000, her priority would be a bit more leisure time. So if the wage rate increased above \$25 an hour, Jill would cut back on her work hours and take more leisure. Jill's labour supply curve eventually bends backward.

Jill's labour supply decisions are influenced by a substitution effect and an income effect.

**Substitution Effect** At wage rates below \$25 an hour, the higher the wage rate Jill is offered, the greater is the quantity of labour that she supplies. Jill's wage rate is her *opportunity cost of leisure*. If she leaves work an hour early to catch a movie, the cost of that extra hour of leisure is the wage rate that Jill forgoes. The higher the wage rate, the less willing Jill is to forgo the income and take the extra leisure time. This tendency for a higher wage rate to induce Jill to work longer hours is a *substitution effect*.

**Income Effect** The higher Jill's wage rate, the higher is her income. A higher income, other things remaining the same, induces Jill to increase her demand for most goods and services. Leisure is one of those goods. Because an increase in income creates an increase in the demand for leisure, it also creates a decrease in the quantity of labour supplied.

**Market Supply Curve** The market supply curve shows the quantity of labour supplied by all households in a particular job market. It is found by adding together the quantities supplied by all households to the job market at each wage rate, so the greater the number of households (the greater is the working-age population), the greater is the market supply of labour.

Despite the fact that an individual's labour supply curve eventually bends backward, the market supply curve of labour slopes upward. The higher the wage rate for bakery workers, the greater is the quantity of bakery workers supplied in that labour market.

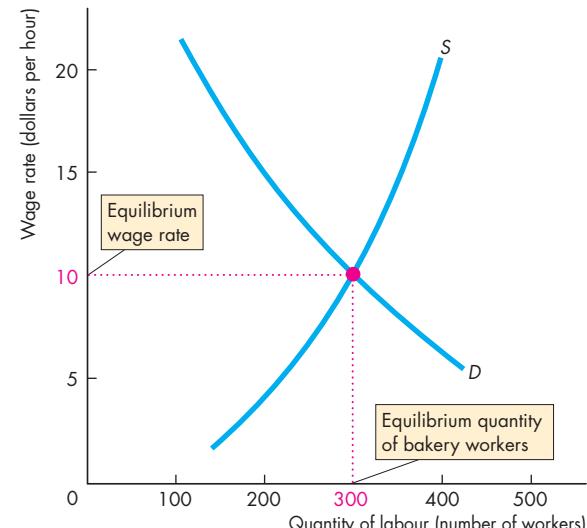
One reason why the market supply curve doesn't bend backward is that different households have different reservation wage rates and different wage rates at which their labour supply curves bend backward.

Also, along a supply curve in a particular job market, the wage rates available in other job markets remain the same. For example, along the supply curve of bakers, the wage rates of salespeople and all other types of labour are constant.

Let's now look at labour market equilibrium.

**Competitive Labour Market Equilibrium** Labour market equilibrium determines the wage rate and employment. In Fig. 18.3, the market demand curve for bakery workers is  $D$  and the market supply curve of bakery workers is  $S$ . The equilibrium wage rate is \$10 an hour, and the equilibrium quantity is 300 bakery workers. If the wage rate exceeded \$10 an hour, there would be a surplus of bakery workers. More people would be looking for jobs in bakeries than firms were willing to hire. In such a situation, the wage rate would fall as firms found it easy to hire people at a lower wage rate. If the wage rate were less than \$10 an hour, there would be a shortage of bakery workers. Firms would not be able to fill all the positions they had available. In this situation, the wage rate would rise as firms found it necessary to offer higher wages to attract labour. Only at a wage rate of \$10 an hour are there no forces operating to change the wage rate.

**FIGURE 18.3** The Market for Bakery Workers



A competitive labour market coordinates firms' and households' plans. The market is in equilibrium—the quantity of labour demanded equals the quantity supplied at a wage rate of \$10 an hour when 300 workers are employed. If the wage rate exceeds \$10 an hour, the quantity supplied exceeds the quantity demanded and the wage rate will fall. If the wage rate is below \$10 an hour, the quantity demanded exceeds the quantity supplied and the wage rate will rise.

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## Economics in Action

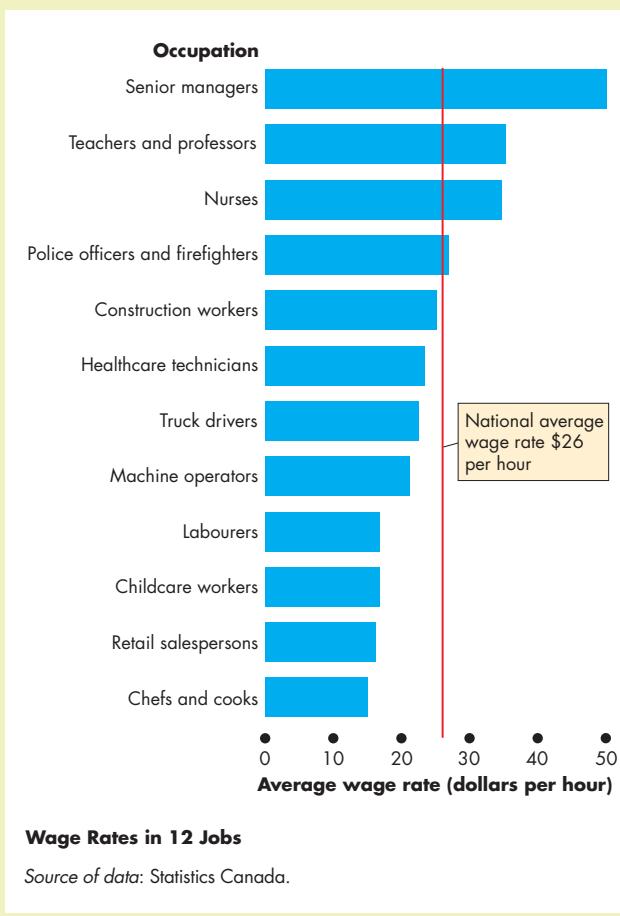
### Wage Rates in Canada

In 2013, the average hourly wage in Canada was \$26. The figure shows the average hourly wage rates for 12 jobs selected from the hundreds of jobs for which Statistics Canada reports wage rate data.

You can see that a senior manager, on average, earns more than 3 times as much per hour as a chef or cook and twice as much as a construction worker. Remember that these numbers are averages. Some senior managers earn much more and some earn less than the average.

Many more occupations earn a wage rate below the national average than above it. Most of the occupations that earn more than the national average require a university degree and postgraduate training.

Earning differences are explained by differences in the value of marginal product of the skills in the various occupations and in market power.



### Differences and Trends in Wage Rates

You can use what you've learned about labour markets to explain some of the differences in wage rates across occupations and the trends in wage rates.

Wage rates are unequal, and *Economics in Action* on this page shows a sample of the inequality in wages in 2013. The differences in wage rates across occupations—including university professors and basketball coaches—are driven by differences in demand and supply in labour markets. The highest wage rates are earned in occupations where the value of marginal product is highest and where few people have the ability and training to perform the job.

**Rising Wage Rates** Wage rates increase over time and trend upward. The reason is that the value of marginal product of labour also increases over time. Technological change and the new types of capital that it brings make workers more productive. With greater labour productivity, the demand for labour increases, which increases the wage rate. Even jobs in which physical productivity doesn't increase experience increases in the *value* of marginal product. Childcare is an example. A worker can't care for an increasing number of children, but an increasing number of parents who earn high wages are willing to hire childcare workers. The *value* of marginal product of these workers increases, so the demand for their services increases, and so does their wage rate.

**Increased Wage Inequality** In recent years wage inequality has increased. High wage rates have increased more rapidly than the low ones, and some low wage rates have stagnated or even fallen. The reasons are complex and not fully understood, but the best explanation is that there is an interaction between technology and education.

The new information technologies of the 1990s and 2000s made well-educated, skilled workers more productive, so it raised their wage rates. For example, the computer created the jobs and increased the wage rates of computer programmers and electronic engineers.

These same technologies destroyed some low-skilled jobs. For example, the ATM took the jobs and lowered the wage rate of bank tellers, and automatic telephones took the jobs of telephone operators.

Another reason for increased inequality is that globalization has brought increased competition for low-skilled workers and at the same time opened global markets for high-skilled workers.



## ECONOMICS IN THE NEWS

### Degree Major and Job Prospects

#### The Most Valuable Major

Which subject is most likely to land you a well-paying job right out of university? Katie Bardaro, an economist at PayScale, a compensation research firm, says biomedical engineering is your best bet. The median U.S. salary starts at \$53,800 and by mid-career reaches \$84,700 and keeps rising. The median salary for all biomedical engineers in 2012 was \$88,000.

Some other science and engineering jobs pay more but don't have as good an outlook for job growth. The U.S. Bureau of Labor Statistics projects the number of jobs for biomedical engineers to increase from today's 20,000 to 32,000 in 2020—an increase of more than 60 percent. In contrast, the working-age population will increase by only 8 percent by 2020.

Sources: The Bureau of Labor Statistics and *Forbes*, May 15, 2012

#### THE QUESTIONS

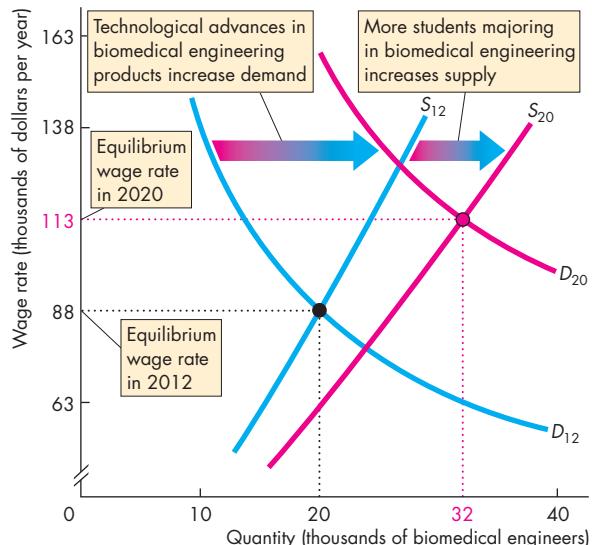
- Why is the number of jobs for biomedical engineering graduates increasing?
- What determines the demand for biomedical engineers and why might it be increasing?
- What determines the supply of biomedical engineers and why might it be increasing?
- What determines whether the wage rate of biomedical engineers will rise?
- Provide a graphical illustration of the market for biomedical engineers in 2012 and 2020.



Biomedical engineers design and build replacement parts for the human body.

#### THE ANSWERS

- The number of jobs for biomedical engineers is growing because *both* demand for and supply of biomedical engineers are increasing.
- The demand for biomedical engineers is *derived* from the demand for biomedical products. The demand for replacement parts for the human body is increasing because technological advances are creating new and improved products.
- The supply of biomedical engineers is determined by the working-age population and the number of people who decide to major in the subject. The supply of engineers is increasing because the working-age population is increasing and good job prospects are attracting a larger percentage of people to study biomedical engineering.
- The wage rate of biomedical engineers will rise if the demand for their services increases faster than supply.
- The figure illustrates the market for biomedical engineers in 2012 and in 2020.
- Demand is expected to increase from  $D_{12}$  to  $D_{20}$ .
- Supply is expected to increase from  $S_{12}$  to  $S_{20}$ .
- The increase in demand is much greater than the increase in supply.
- The equilibrium quantity (the number of jobs) increases from 20,000 in 2012 to 32,000 in 2020.
- Because demand increases by more than supply, the equilibrium wage rate rises. (The 2020 wage rate is an assumption.)



The Market for Biomedical Engineers in 2012 and 2020

## A Labour Market with a Union

A **labour union** is an organized group of workers that aims to increase the wage rate and influence other job conditions. Let's see what happens when a union enters a competitive labour market.

**Influences on Labour Supply** One way of raising the wage rate is to decrease the supply of labour. In some labour markets, a union can restrict supply by controlling entry into apprenticeship programs or by influencing job qualification standards. Markets for skilled workers, doctors, dentists, and lawyers are the easiest ones to control in this way.

If there is an abundant supply of nonunion labour, a union can't decrease supply. For example, in the market for farm labour in southern California, the flow of nonunion labour from Mexico makes it difficult for a union to control the supply.

On the demand side of the labour market, the union faces a tradeoff: The demand for labour curve slopes downward, so restricting supply to raise the wage rate costs jobs. For this reason, unions also try to influence the demand for union labour.

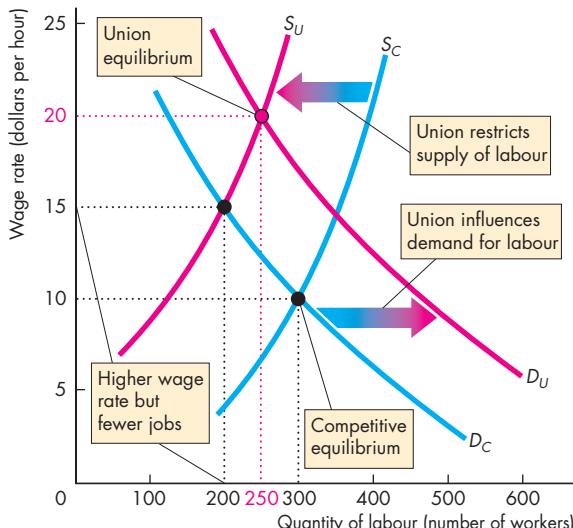
**Influences on Labour Demand** A union tries to increase the demand for the labour of its members in four main ways:

1. Increasing the value of marginal product of its members by organizing and sponsoring training schemes and apprenticeship programs, and by professional certification.
2. Lobbying for import restrictions and encouraging people to buy goods made by unionized workers.
3. Supporting minimum wage laws, which increase the cost of employing low-skilled labour and lead firms to substitute high-skilled union labour for low-skilled nonunion labour.
4. Lobbying for restrictive immigration laws to decrease the supply of foreign workers.

**Labour Market Equilibrium with a Union** Figure 18.4 illustrates what happens to the wage rate and employment when a union successfully enters a competitive labour market. With no union, the demand curve is  $D_C$ , the supply curve is  $S_C$ , the wage rate is \$10 an hour, and 300 workers have jobs.

Now a union enters this labour market. First, look at what happens if the union has sufficient control over the supply of labour to be able to restrict supply

**FIGURE 18.4** A Union Enters a Competitive Labour Market



In a competitive labour market, the demand curve is  $D_C$  and the supply curve is  $S_C$ . The wage rate is \$10 an hour and 300 workers are employed. If a union decreases the supply of labour and the supply of labour curve shifts to  $S_U$ , the wage rate rises to \$15 an hour and employment decreases to 200 workers. If the union can also increase the demand for labour and shift the demand for labour curve to  $D_U$ , the wage rate rises to \$20 an hour and 250 workers are employed.

### MyEconLab Animation and Draw Graph

below its competitive level—to  $S_U$ . If that is all the union is able to do, employment falls to 200 workers and the wage rate rises to \$15 an hour.

Suppose now that the union is also able to increase the demand for labour to  $D_U$ . The union can get an even bigger increase in the wage rate and with a smaller fall in employment. By maintaining the restricted labour supply at  $S_U$ , the union increases the wage rate to \$20 an hour and achieves an employment level of 250 workers.

Because a union restricts the supply of labour in the market in which it operates, the union's actions spill over into nonunion markets. Workers who can't get union jobs must look elsewhere for work. This action increases the supply of labour in nonunion markets and lowers the wage rate in those markets. This spillover effect further widens the gap between union and nonunion wages.

**Monopsony in the Labour Market** Not all labour markets in which unions operate are competitive. Rather, some are labour markets in which the employer possesses market power and the union enters to try to counteract that power.

A market in which there is a single buyer is called a **monopsony**. A monopsony labour market has one employer. Provincial governments are the major employer of healthcare professionals. In some communities, a mining company is the major employer. These firms have monopsony power.

A monopsony acts on the buying side of a market in a similar way to a monopoly on the selling side. The firm maximizes profit by hiring the quantity of labour that makes the marginal cost of labour equal to the value of marginal product of labour and by paying the lowest wage rate at which it can attract this quantity of labour.

Figure 18.5 illustrates a monopsony labour market. Like all firms, a monopsony faces a downward-sloping value of marginal product curve,  $VMP$ , which is its demand for labour curve,  $D$ —the curve labelled  $VMP = D$  in the figure.

What is special about monopsony is the marginal cost of labour. For a firm in a competitive labour market, the marginal cost of labour is the wage rate. For a monopsony, the marginal cost of labour exceeds the wage rate. The reason is that being the only buyer in the market, the firm faces an upward-sloping supply of labour curve—the curve  $S$  in the figure.

To attract one more worker, the monopsony must offer a higher wage rate. But it must pay this higher wage rate to all its workers, so the marginal cost of a worker is the wage rate plus the increased wage bill that arises from paying all the workers the higher wage rate.

The supply curve is now the average cost of labour curve and the relationship between the supply curve and the marginal cost of labour curve,  $MCL$ , is similar to that between a monopoly's demand curve and marginal revenue curve (see p. 300). The relationship between the supply curve and the  $MCL$  curve is also similar to that between a firm's average cost curve and marginal cost curve (see pp. 258–259).

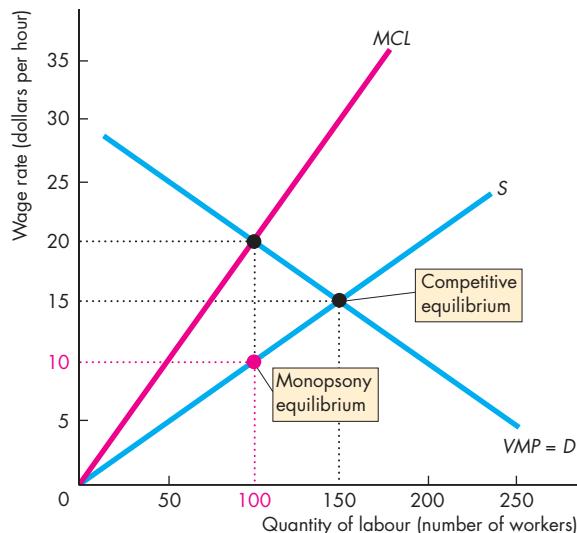
To find the profit-maximizing quantity of labour to hire, the monopsony sets the marginal cost of labour equal to the value of marginal product of labour. In Fig. 18.5, this outcome occurs when the firm employs 100 workers.

To hire 100 workers, the firm must pay \$10 an hour (on the supply of labour curve). Each worker is paid \$10 an hour, but the value of marginal product of labour is \$20 an hour, so the firm makes an economic profit of \$10 an hour on the marginal worker.

If the labour market in Fig. 18.5 were competitive, the equilibrium wage rate and employment would be determined by the demand and supply curves. The wage rate would be \$15 an hour and 150 workers would be employed. So compared with a competitive labour market, a monopsony pays a lower wage rate and employs fewer workers.

**A Union and a Monopsony** A union is like a monopoly. If the union (monopoly seller) faces a monopsony buyer, the situation is called **bilateral monopoly**. An example of bilateral monopoly is the National Hockey League (the owners) and the National Hockey League

**FIGURE 18.5** A Monopsony Labour Market



A monopsony is a market structure in which there is a single buyer. A monopsony in the labour market has a value of marginal product curve  $VMP = D$  and faces a labour supply curve  $S$ . The marginal cost of labour curve is  $MCL$ . Making the marginal cost of labour equal to the value of marginal product of labour maximizes profit. The monopsony hires 100 hours of labour and pays the lowest wage rate for which that quantity of labour will work—\$10 an hour.

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## AT ISSUE

### Monopoly Power for Evil or Good?

The standard view of economists is that monopoly is bad. It prevents resources from being used efficiently, and on any criterion of fairness or equity, monopoly is unfair. It fails to serve the social interest.

We normally think of a monopoly as a big firm that gouges its customers. But a surprising monopoly (and monopsony) has attracted attention—the National Collegiate Athletic Association (NCAA).

Does the NCAA do a good job at efficiently allocating the talents of college athletes and providing those athletes with a fair return for their efforts?

The standard economist's view is that the NCAA doesn't serve the social interest. But there is an opposing view.

Let's look at both sides of this argument.

#### The Standard View

Robert Barro expresses the standard economist view. While acknowledging that the NCAA has boosted the productivity of college sports programs, he says that the NCAA monopoly:

- Suppresses financial competition in college sports.
- Restricts scholarships and other payments to college athletes.
- Prevents college basketball players who come from poor families from accumulating wealth during a college career.
- Keeps poor students poor.

Despite doing these bad things, the NCAA manages to convince most people that the bad guys are the colleges that violate NCAA rules by attempting to pay their athletes competitive wages.



The contenders for best monopoly in America include the Post Office, Microsoft, and the NCAA. And the winner is ... the NCAA.

Robert Barro, "The Best Little Monopoly in America", *BusinessWeek*, December 9, 2002

#### An Opposing View

Richard B. McKenzie of the University of California, Irvine, and Dwight R. Lee of the University of Georgia, in their book, *In Defense of Monopoly: How Market Power Fosters Creative Production* (University of Michigan Press, 2008), say the NCAA:

- Helps its members to cooperate to everyone's benefit.
- Has enabled healthy growth of college athletics over the past 50 years.
- Has generated economic profits for member schools.
- Does not lower student athletes' wages.
- Has stimulated the demand for student athletes and increased their wages and employment opportunities.
- Permitting NCAA colleges to pay athletes competitive wages is misguided.



The Connecticut Huskies celebrate their victory at the 2014 NCAA National Championship.

Players' Association (the union of players). The NHL and the NHPLA negotiate a multi-year salary deal.

In bilateral monopoly, the outcome is determined by bargaining, which depends on the costs that each party can inflict on the other. The firm can shut down temporarily and lock out its workers, and the workers can shut down the firm by striking. Each party estimates the other's strength and what it will lose if it does not agree to the other's demands.

Usually, an agreement is reached without a strike or a lockout. The threat is usually enough to bring the bargaining parties to an agreement. When a strike or lockout does occur, it is because one party has misjudged the costs each party can inflict on the other. Such an event occurred in December 2012 when negotiations over a new collective bargaining agreement failed and owners locked out the players. Fifty-eight percent of the regular season was cancelled. Teams lost billions in revenue from tickets, media, sponsorships, and concessions, while players lost salaries.

In the example in Fig. 18.5, if the union and employer are equally strong, and each party knows the strength of the other, they will agree to split the gap between \$10 (the wage rate on the supply curve) and \$20 (the wage rate on the demand curve) and agree to a wage rate of \$15 an hour.

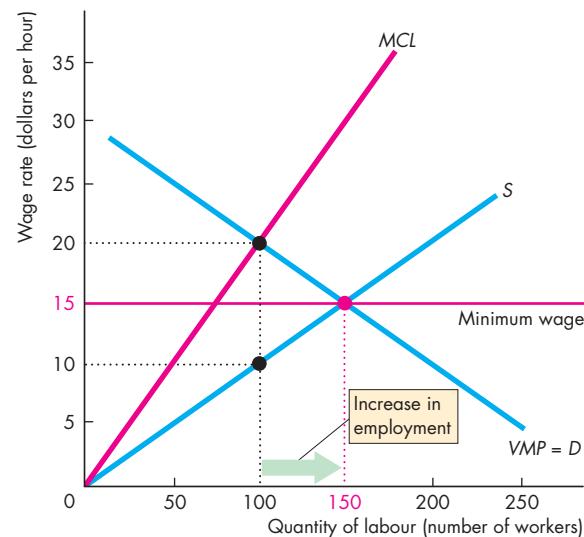
You've now seen that in a monopsony, a union can bargain for a higher wage rate without sacrificing jobs. A similar outcome can arise in a monopsony labour market when a minimum wage law is enforced. Let's look at the effect of a minimum wage.

**Monopsony and the Minimum Wage** In a competitive labour market, a minimum wage that exceeds the equilibrium wage decreases employment (see Chapter 6, pp. 131–132). In a monopsony labour market, a minimum wage can increase both the wage rate and employment. Let's see how.

Figure 18.6 shows a monopsony labour market without a union. The wage rate is \$10 an hour and 100 workers are employed.

A minimum wage law is passed that requires employers to pay at least \$15 an hour. The monopsony now faces a perfectly elastic supply of labour at \$15 an hour up to 150 workers (along the minimum wage line). To hire more than 150 workers, a wage rate above \$15 an hour must be paid (along the supply curve). Because the wage rate is \$15 an hour up to 150 workers, so is the marginal cost of labour \$15 an hour up to 150 workers. To maximize profit, the monopsony sets the marginal cost of labour equal to the value of marginal product of

**FIGURE 18.6** Minimum Wage Law in Monopsony



In a monopsony labour market, the wage rate is \$10 an hour and 100 workers are hired. If a minimum wage law increases the wage rate to \$15 an hour, the wage rate rises to this level and employment increases to 150 workers.

#### MyEconLab Animation and Draw Graph

labour (on the demand curve). That is, the monopsony hires 150 workers and pays \$15 an hour. The minimum wage law has succeeded in raising the wage rate and increasing the number of workers employed.

#### REVIEW QUIZ

- 1 What determines the amount of labour that households plan to supply?
- 2 How are the wage rate and employment determined in a competitive labour market?
- 3 How do labour unions influence wage rates?
- 4 What is a monopsony and why is a monopsony able to pay a lower wage rate than a firm in a competitive labour market?
- 5 How is the wage rate determined when a union faces a monopsony?
- 6 What is the effect of a minimum wage law in a monopsony labour market?

Work these questions in Study Plan 18.3 and get instant feedback. Do a Key Terms Quiz.

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## Capital and Natural Resource Markets

The markets for capital and land can be understood by using the same basic ideas that you've seen when studying a competitive labour market. But markets for nonrenewable natural resources are different. We'll now examine three groups of factor markets:

- Capital rental markets
- Land rental markets
- Nonrenewable natural resource markets

### Capital Rental Markets

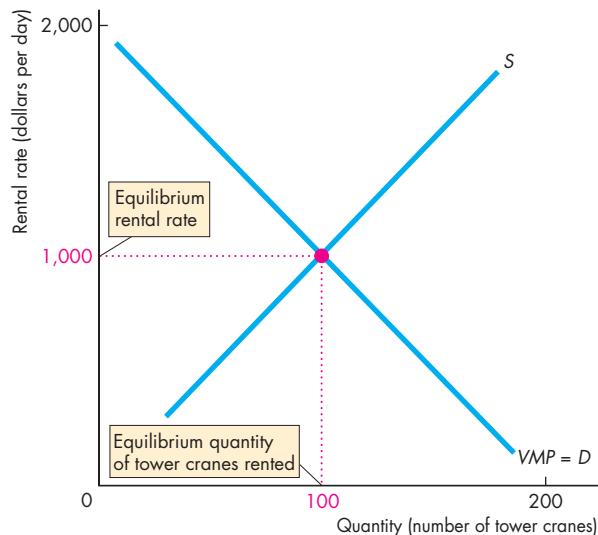
The demand for capital is derived from the *value of marginal product of capital*. Profit-maximizing firms hire the quantity of capital services that makes the value of marginal product of capital equal to the *rental rate of capital*. The *lower* the rental rate of capital, other things remaining the same, the *greater* is the quantity of capital demanded. The supply of capital responds in the opposite way to the rental rate. The *higher* the rental rate, other things remaining the same, the *greater* is the quantity of capital supplied. The equilibrium rental rate makes the quantity of capital demanded equal to the quantity supplied.

Figure 18.7 illustrates the rental market for tower cranes—capital used to construct high-rise buildings. The value of marginal product and the demand curve is  $VMP = D$ . The supply curve is  $S$ . The equilibrium rental rate is \$1,000 per day and 100 tower cranes are rented.

**Rent-Versus-Buy Decision** Some capital services are obtained in a rental market like the market for tower cranes. And as with tower cranes, many of the world's large airlines rent their airplanes. But not all capital services are obtained in a rental market. Instead, firms buy the capital equipment that they use. You saw in Chapter 10 (pp. 224–225) that the cost of the services of the capital that a firm owns and operates itself is an implicit rental rate that arises from depreciation and interest costs. Firms that buy capital *implicitly* rent the capital to themselves.

The decision to obtain capital services in a rental market rather than buy capital and rent it implicitly is made to minimize cost. The firm compares the cost of explicitly renting the capital and the cost of buying and implicitly renting it. This decision is the same as

**FIGURE 18.7** A Rental Market for Capital



The value of marginal product of tower cranes,  $VMP$ , determines the demand,  $D$ , for tower crane rentals. With the supply curve  $S$ , the equilibrium rental rate is \$1,000 a day and 100 cranes are rented.

[MyEconLab Animation](#)

the one that a household makes in deciding whether to rent or buy a home.

To make a rent-versus-buy decision, a firm must compare a cost incurred in the *present* with a stream of rental costs incurred over some *future* period. The Mathematical Note (pp. 432–433) explains how to make this comparison by calculating the *present value* of a future amount of money. If the *present value* of the future rental payments of an item of capital equipment exceeds the cost of buying the capital, the firm will buy the equipment. If the *present value* of the future rental payments of an item of capital equipment is less than the cost of buying the capital, the firm will rent (or lease) the equipment.

### Land Rental Markets

The demand for land is based on the same factors as the demand for labour and the demand for capital—the *value of marginal product of land*. Profit-maximizing firms rent the quantity of land at which the value of marginal product of land is equal to the *rental rate*.

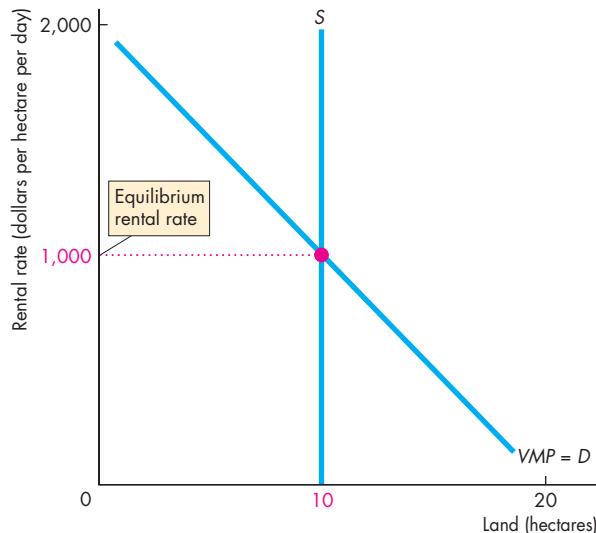
of land. The lower the rental rate, other things remaining the same, the greater is the quantity of land demanded.

But the supply of land is special: Its quantity is fixed, so the quantity supplied cannot be changed by people's decisions. The supply of each particular block of land is perfectly inelastic.

The equilibrium rental rate makes the quantity of land demanded equal to the quantity available. Figure 18.8 illustrates the market for a 1-hectare block of land on Yonge Street in Toronto. The quantity supplied is fixed and the supply curve is  $S$ . The value of marginal product and the demand curve is  $VMP = D$ . The equilibrium rental rate is \$1,000 a hectare per day.

The rental rate of land is high in Toronto because the willingness to pay for the services produced by that land is high, which in turn makes the  $VMP$  of land high. A Big Mac costs more at McDonald's on Yonge Street than at McDonald's on Mountain Road, Moncton, but not because the rental rate of land is higher in Toronto. The rental rate of land is higher in Toronto because of the greater willingness to pay for a Big Mac (and other goods and services) in Toronto.

**FIGURE 18.8** A Rental Market for Land



The value of marginal product of a 10-hectare block,  $VMP$ , determines the rental demand,  $D$ , for this land. With the supply curve  $S$ , the block rents for \$10,000 a day.

MyEconLab Animation

## Nonrenewable Natural Resource Markets

The nonrenewable natural resources are oil, gas, and coal. Burning one of these fuels converts it to energy and other by-products, and the used resource cannot be re-used. The natural resources that we use to make metals are also nonrenewable, but they can be used again, at some cost, by recycling them.

Oil, gas, and coal are traded in global commodity markets. The price of a given grade of crude oil is the same in New York, London, and Singapore. Traders, linked by telephone and the Internet, operate these markets around the clock every day of the year.

Demand and supply determine the prices and the quantities traded in these commodity markets. We'll look at the influences on demand and supply by considering the global market for crude oil.

**The Demand for Oil** The two key influences on the demand for oil are:

1. The *value of marginal product of oil*
2. The expected future price of oil

The value of marginal product of oil is the *fundamental* influence on demand. It works in exactly the same way for a nonrenewable resource as it does for any other factor of production. The greater the quantity of oil used, the smaller is the value of marginal product of oil. Diminishing value of marginal product makes the demand curve slope downward. The lower the price, the greater is the quantity demanded.

The higher the expected future price of oil, the greater is the present demand for oil. The expected future price is a *speculative* influence on demand. Oil in the ground and oil in storage tanks are inventories that can be held or sold. A trader might plan to buy oil to hold now and to sell it later for a profit. Instead of buying oil to hold and sell later, the trader could buy a bond and earn interest. The interest forgone is the opportunity cost of holding the oil. If the price of oil is expected to rise by a bigger percentage than the interest rate, a trader will hold oil and incur the opportunity cost. In this case, the return from holding oil exceeds the return from holding bonds.

**The Supply of Oil** The three key influences on the supply of oil are:

1. The known oil reserves
2. The scale of current oil production facilities
3. The expected future price of oil

*Known oil reserves* are the oil that has been discovered and can be extracted with today's technology. This quantity increases over time because advances in technology enable ever-less accessible sources to be discovered. The greater the size of known reserves, the greater is the supply of oil. But this influence on supply is small and indirect. It operates by changing the expected distant future price of oil. Even a major new discovery of oil would have a negligible effect on the current supply of oil.

The scale of current oil production facilities is the *fundamental* influence on the supply of oil. Producing oil is like any production activity: It is subject to increasing marginal cost. The increasing marginal cost of extracting oil means that the supply curve of oil slopes upward. The higher the price of oil, the greater is the quantity supplied. When new oil wells are sunk or when new faster pumps are installed, the supply of oil increases. When existing wells run dry, the supply of oil decreases. Over time, the factors that increase supply are more powerful than those that decrease supply, so changes in the scale of current oil production facilities increase the supply of oil.

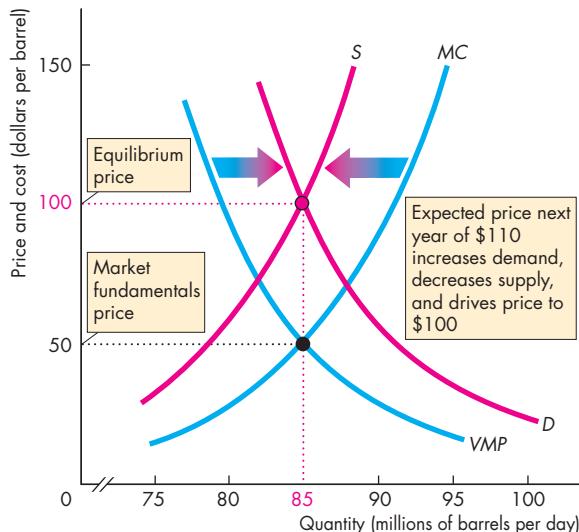
*Speculative* forces based on expectations about the future price also influence the supply of oil. The *higher* the expected future price of oil, the *smaller* is the present supply of oil. A trader with an oil inventory might plan to sell now or to hold and sell later. You've seen that interest forgone is the opportunity cost of holding the oil. If the price of oil is expected to rise by a bigger percentage than the interest rate, it is profitable to incur the opportunity cost of holding oil rather than selling it immediately.

**The Equilibrium Price of Oil** The demand for oil and the supply of oil determine the equilibrium price and quantity traded. Figure 18.9 illustrates the market equilibrium.

The value of marginal product of oil, *VMP*, is the *fundamental determinant of demand*, and the marginal cost of extraction, *MC*, is the *fundamental determinant of supply*. Together, they determine the *market fundamentals price*.

If expectations about the future price are also based on fundamentals, the equilibrium price is the market fundamentals price. But if expectations about the future price of oil depart from what the market fundamentals imply, *speculation* can drive a wedge between the equilibrium price and the market fundamentals price.

**FIGURE 18.9** A Nonrenewable Natural Resource Market



The value of marginal product of a natural resource, *VMP*, and the marginal cost of extraction, *MC*, determine the *market fundamentals* price. Demand, *D*, and supply, *S*, which determine the equilibrium price, are influenced by the expected future price. Speculation can bring a gap between the market fundamentals price and the equilibrium price.

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**The Hotelling Principle** Harold Hotelling, an economist at Columbia University, had an incredible idea: Traders expect the price of a nonrenewable natural resource to rise at a rate equal to the interest rate. We call this idea the **Hotelling Principle**. Let's see why it is correct.

You've seen that the interest rate is the opportunity cost of holding an oil inventory. If the price of oil is expected to rise at a rate that exceeds the interest rate, it is profitable to hold a bigger inventory. Demand increases, supply decreases, and the price rises. If the interest rate exceeds the rate at which the price of oil is expected to rise, it is not profitable to hold an oil inventory. Demand decreases, supply increases, and the price falls. But if the price of oil is expected to rise at a rate equal to the interest rate, holding an inventory of oil is just as good as holding bonds. Demand and supply don't change and the price does not change. Only when the price of oil is expected to rise at a rate equal to the interest rate is the price at its equilibrium.

## Economics in Action

### The World and Canadian Markets for Oil

The world produced 85 million barrels of oil per day in 2013 and the price was steady at around \$110 a barrel.

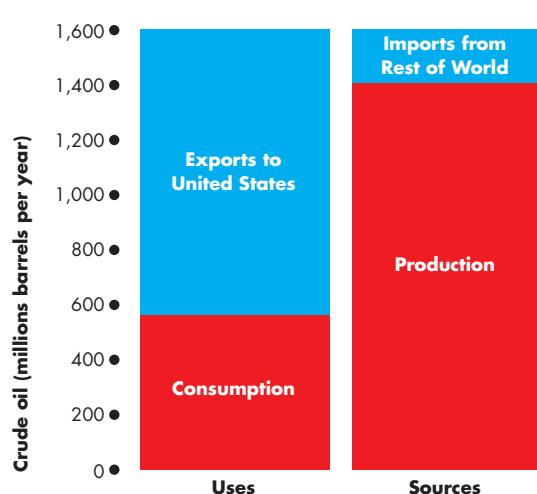
Canada produced 1.6 billion barrels in 2013, which is close to 4 percent of global production. This quantity is more than enough for Canada's use of crude oil. But we sell two-thirds of our production to the United States and we buy a small quantity of the oil that we use from Africa, Europe, the Middle East, Mexico, and Venezuela (see Fig. 1).

Transportation costs explain these movements of oil. It is easy and cheap to pipe oil from Alberta into the United States and Western Canada, and to transport oil in tankers from the rest of the world to Eastern Canada.

As a net exporter, Canada benefits from a high oil price and the Hotelling Principle tells us that we can expect that price to rise at a rate equal to the interest rate. That doesn't mean that the price will rise at this rate. As you can see in Fig. 2, the price of oil over the past 60 years has fluctuated a lot.

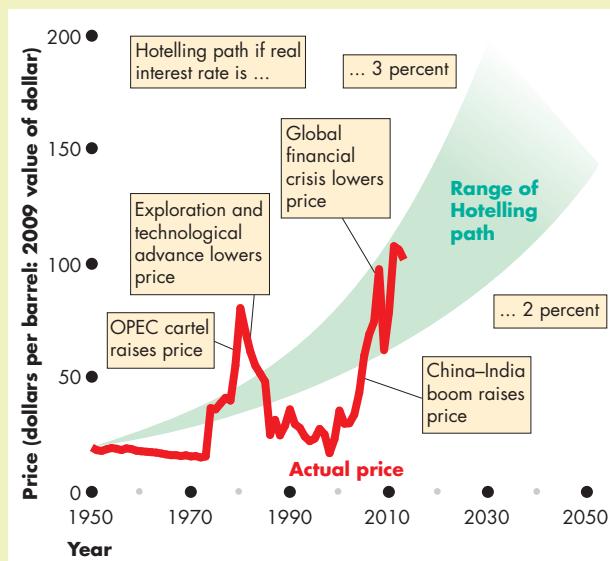
At some times, such as the 1970s and 2000s, the price of oil has soared. At other times, such as the 1980s and the recent years of global financial crisis, the price has plunged.

Changes in expectations about the future change demand and supply in the present and bring swings in the price. But despite its wild fluctuations, the price of



**Figure 1** Canada's Uses and Sources of Oil

Source of data: Statistics Canada, Table 126-0001.



**Figure 2** The Price of Oil and Its Hotelling Path

Source of data: U.S. Energy Information Administration.

oil keeps returning to the Hotelling path, and in 2011 the real price of oil was almost exactly on the path predicted by the Hotelling Principle.

## REVIEW QUIZ

- 1 What determines demand and supply in rental markets for capital and land?
- 2 What determines the demand for a nonrenewable natural resource?
- 3 What determines the supply of a nonrenewable natural resource?
- 4 What is the market fundamentals price and how might it differ from the equilibrium price?
- 5 Explain the Hotelling Principle.

Work these questions in Study Plan 18.4 and get instant feedback. Do a Key Terms Quiz.

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◆ *Economics in the News* on pp. 430–431 takes a look at the competitive Alberta labour market.

The next chapter looks more closely at the distribution of income and its trends. The chapter also looks at the efforts by governments to redistribute income and modify the market outcome.



# Resources and Labour Interact

## Alberta Labour Market May Be Too Hot

*Calgary Herald*

June 25, 2014

... From fast-food restaurants to oilsands mining projects, the seemingly unfettered access to a pool of employees under the temporary foreign workers program has been significantly constrained under new rules announced by Employment and Social Development Minister Jason Kenney. And it starts in the oil-patch.

As of July 31, a three-year-old pilot program in Alberta that allowed companies to hire qualified foreign workers in seven high-demand trades—including pipefitters, millwrights, heavyduty mechanics, welders, and carpenters—without going through Ottawa's standard vetting process will be ended.

"Employers will have to go back through the labour market screening process," Kenney told the *Herald*'s editorial board Monday as part of Ottawa's communications effort to win support for the controversial policy. "There is more rigour on the seven in demand trade occupations ... I don't think that's a big problem for them." ...

He noted the median wage in Alberta rose 31 percent since 2006 and inflation had increased 15 percent, while wages in the food service sector gained just 8 percent. The numbers were stark enough to prompt federal action to reduce the number of low-wage TFWs in Alberta from 14,000 to 8,400 by 2016. Kenney said the change will increase wages for low-wage earners.

He also lamented some businesses were "addicted" to the TFW program. He noted 1,200 businesses—again, mostly in Alberta—had TFWs accounting for more than 50 percent of their employees. Under Ottawa's new rules the maximum will be 10 percent.

... If all Canadians benefit from the oilsands, presumably the thinking is they should also be obliged to enjoy the opportunities.

However, Alberta already welcomes 50,000 new people a year—30,000 from abroad. ...

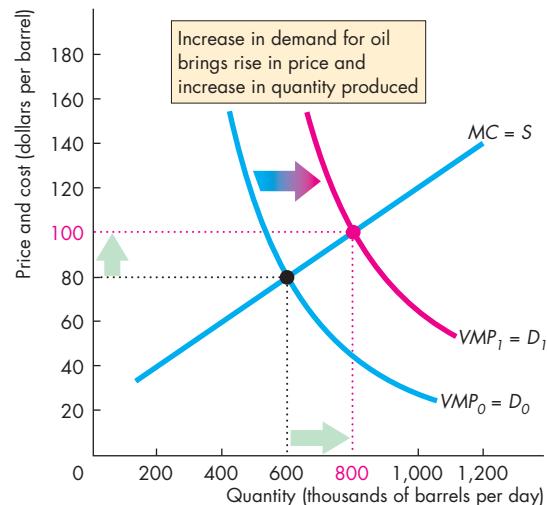
Written by Stephen Ewart. Material reprinted with the express permission of *Calgary Herald*, a division of Postmedia Network Inc.

### ESSENCE OF THE STORY

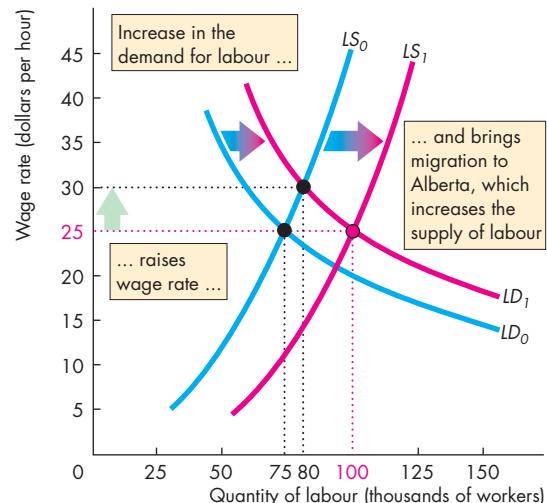
- Alberta has had free access to a pool of employees under the temporary foreign workers (TFW) program.
- This access will be less free after July 31, 2014, as Alberta employers will be required to use a more vigorous labour market screening process.
- The median wage in Alberta increased by 31 percent between 2006 and 2014, but prices increased by 15 percent, so the buying power of wages increased by only 16 percent.
- Wages in the food service sector increased by only 8 percent, so their buying power fell.
- Migration into Alberta runs at 50,000 people per year, 30,000 of whom are from other countries.

## ECONOMIC ANALYSIS

- Alberta's labour market and the global oil market interact to bring the conditions described in the news article.
- Demand and supply in the global oil market determine the price of oil.
- The price of oil fluctuates around the value determined by the value of marginal product (VMP) of oil and the marginal cost (MC) of extracting it.
- The sources of oil change in the long run as the price changes. Conventional crude oil reserves are used at a low price, and oil sands are used when the price rises to or exceeds the marginal cost of extracting oil from them.
- Figure 1 shows how an increase in the VMP and demand for oil bring a higher price and an increase in Alberta's production.
- With VMP and demand at  $VMP_0 = D_0$ , the price of oil is \$80 a barrel and conventional reserves of crude oil are used.
- With demand at  $VMP_1 = D_1$ , the price of oil rises to \$100 a barrel, and oil sands with their higher marginal cost of extraction are now used.
- As the price of oil keeps rising above \$100 a barrel, Alberta's oil sands projects expand and the quantity of oil produced steadily increases.
- The market for oil influences Alberta's labour market.
- With an expansion of the oil sands development, the demand for labour in Alberta increases. At first, to meet this increase in demand, the wage rate rises and the quantity of labour supplied increases.
- The higher wages and better jobs available in Alberta induce a migration from Eastern Canada westward and from the rest of the world (TFW program). This migration brings an increase in the supply of labour in Alberta, which lowers the wage rate but continues to increase the quantity of labour employed.
- Figure 2 illustrates these labour market developments. Initially, the demand for labour is  $LD_0$  and the supply of labour is  $LS_0$ .
- The higher price of oil increases the value of marginal product of oil workers, and the demand for labour increases. The demand curve shifts rightward to  $LD_1$ .
- The wage rate rises and the higher wage rate increases the quantity of labour supplied.



**Figure 1 Alberta Oil Market**



**Figure 2 Alberta Labour Market**

- The higher wage rate and better employment prospects in Alberta induce people to leave Eastern Canada and move west to Alberta.
- As people move, the supply of labour increases and the supply curve shifts rightward from  $LS_0$  to  $LS_1$ .
- The increase in supply increases employment further but lowers the wage rate. In this example, the wage rate returns to its original level.

## MATHEMATICAL NOTE

### Present Value and Discounting

#### Rent-Versus-Buy Decision

To decide whether to rent an item of capital equipment or to buy the capital and implicitly rent it, a firm must compare the present expenditure on the capital with the future rental cost of the capital.

#### Comparing Current and Future Dollars

To compare a present expenditure with a future expenditure, we convert the future expenditure to its “present value.”

The *present value* of a future amount of money is the amount that, if invested today, will grow to be as large as that future amount when the interest that it will earn is taken into account.

So the present value of a future amount of money is smaller than the future amount. The calculation that we use to convert a future amount of money to its present value is called *discounting*.

The easiest way to understand discounting and present value is to first consider its opposite: How a present value grows to a future amount of money because of *compound interest*.

#### Compound Interest

*Compound interest* is the interest on an initial investment plus the interest on the interest that the investment has previously earned. Because of compound interest, a present amount of money (a present value) grows into a larger future amount. The future amount is equal to the present amount (present value) plus the interest it will earn in the future. That is,

$$\text{Future amount} = \text{Present value} + \text{Interest income}.$$

The interest in the first year is equal to the present value multiplied by the interest rate,  $r$ , so

$$\text{Amount after 1 year} = \text{Present value} + (r \times \text{Present value})$$

or

$$\text{Amount after 1 year} = \text{Present value} \times (1 + r).$$

If you invest \$100 today and the interest rate is 10 percent a year ( $r = 0.1$ ), 1 year from today you will have \$110—the original \$100 plus \$10 interest.

Check that the above formula delivers that answer:

$$\$100 \times 1.1 = \$110.$$

If you leave this \$110 invested to earn 10 percent during a second year, at the end of that year you will have

$$\text{Amount after 2 years} = \text{Present value} \times (1 + r)^2.$$

With the numbers of the previous example, you invest \$100 today at an interest rate of 10 percent a year ( $r = 0.1$ ). After 1 year, you will have \$110—the original \$100 plus \$10 interest. And after 2 years, you will have \$121. In the second year, you earned \$10 on your initial \$100 plus \$1 on the \$10 interest that you earned in the first year.

Check that the above formula delivers that answer:

$$\$100 \times (1.1)^2 = \$100 \times 1.21 = \$121.$$

If you leave your \$100 invested for  $n$  years, it will grow to

$$\text{Amount after } n \text{ years} = \text{Present value} \times (1 + r)^n.$$

With an interest rate of 10 percent a year, your \$100 will grow to \$195 after 7 years ( $n = 7$ )—almost double the present value of \$100.

#### Discounting a Future Amount

We have just calculated future amounts 1 year, 2 years, and  $n$  years in the future, knowing the present value and the interest rate. To calculate the present value of these future amounts, we just work backward.

To find the present value of an amount 1 year in the future, we divide the future amount by  $(1 + r)$ .

That is,

$$\text{Present value} = \frac{\text{Amount of money}}{(1 + r)}$$

$$\text{Present value} = \frac{1 \text{ year in future}}{(1 + r)}$$

Let's check that we can use the present value formula by calculating the present value of \$110 1 year from now when the interest rate is 10 percent a year.

You'll be able to guess that the answer is \$100 because we just calculated that \$100 invested today at 10 percent a year becomes \$110 in 1 year. So the present value of \$110 to be received 1 year from today is \$100. But let's use the formula. Putting the numbers into the above formula, we have

$$\begin{aligned}\text{Present value} &= \frac{\$110}{(1 + 0.1)} \\ &= \frac{\$110}{1.1} = \$100.\end{aligned}$$

To calculate the present value of an amount of money 2 years in the future, we use the formula:

$$\text{Present value} = \frac{\text{Amount of money}}{(1 + r)^2}$$

Use this formula to calculate the present value of \$121 to be received 2 years from now at an interest rate of 10 percent a year. With these numbers, the formula gives

$$\begin{aligned}\text{Present value} &= \frac{\$121}{(1 + 0.1)^2} \\ &= \frac{\$121}{(1.1)^2} \\ &= \frac{\$121}{1.21} \\ &= \$100.\end{aligned}$$

We can calculate the present value of an amount of money  $n$  years in the future by using the general formula

$$\text{Present value} = \frac{\text{Amount of money}}{(1 + r)^n}$$

For example, if the interest rate is 10 percent a year, \$100 to be received 10 years from now has a present value of \$38.55. That is, if \$38.55 is invested today at 10 percent a year it will accumulate to \$100 in 10 years.

## Present Value of a Sequence of Future Amounts

You've seen how to calculate the present value of an amount of money to be received 1 year, 2 years, and  $n$  years in the future. Most practical applications of present value calculate the present value of a sequence of future amounts of money that are spread over several years. An airline's payment of rent for the lease of airplanes is an example.

To calculate the present value of a sequence of amounts over several years, we use the formula you have learned and apply it to each year. We then sum the present values for all the years to find the present value of the sequence of amounts.

For example, suppose that a firm expects to pay \$100 a year for each of the next 5 years and the interest rate is 10 percent a year ( $r = 0.1$ ). The present value ( $PV$ ) of these five payments of \$100 each is calculated by using the following formula:

$$PV = \frac{\$100}{1.1} + \frac{\$100}{1.1^2} + \frac{\$100}{1.1^3} + \frac{\$100}{1.1^4} + \frac{\$100}{1.1^5},$$

which equals

$$\begin{aligned}PV &= \$90.91 + \$82.64 + \$75.13 + \$68.30 \\ &\quad + \$62.09 = \$379.07.\end{aligned}$$

You can see that the firm pays \$500 over 5 years. But because the money is paid in the future, it is not worth \$500 today. Its present value is only \$379.07. And the farther in the future the money is paid, the smaller is its present value. The \$100 paid 1 year in the future is worth \$90.91 today, but the \$100 paid 5 years in the future is worth only \$62.09 today.

## The Decision

If this firm could lease a machine for 5 years at \$100 a year or buy the machine for \$500, it would jump at leasing. Only if the firm could buy the machine for less than \$379.07 would it want to buy.

Many personal and business decisions turn on calculations like the one you've just made. A decision to buy or rent an apartment, to buy or lease a car, and to pay off a student loan or let the loan run another year can all be made using the above calculation.

## SUMMARY

### Key Points

#### The Anatomy of Factor Markets (p. 414)

- The factor markets are the job markets for labour; the rental markets (often implicit rental markets) for capital and land; and the global commodity markets for nonrenewable natural resources.
- The services of entrepreneurs are not traded on a factor market.

Working Problem 1 will give you a better understanding of the anatomy of factor markets.

#### The Demand for a Factor of Production

(pp. 415–417)

- The value of marginal product determines the demand for a factor of production.
- The value of marginal product decreases as the quantity of the factor employed increases.
- The firm employs the quantity of each factor of production that makes the value of marginal product equal to the factor price.

Working Problems 2 to 6 will give you a better understanding of the demand for a factor of production.

#### Labour Markets (pp. 418–425)

- The value of marginal product of labour determines the demand for labour. A rise in the wage rate brings a decrease in the quantity demanded.
- The quantity of labour supplied depends on the wage rate. At low wage rates, a rise in the wage rate increases the quantity supplied. Beyond a high enough wage rate, a rise in the wage rate decreases the quantity supplied—the supply curve eventually bends backward.

### Key Terms

Bilateral monopoly, 423  
 Derived demand, 415  
 Hotelling Principle, 428  
 Labour union, 422

Monopsony, 423  
 Nonrenewable natural resources, 414  
 Value of marginal product, 415

- Demand and supply determine the wage rate in a competitive labour market.
- A labour union can raise the wage rate by restricting the supply or increasing the demand for labour.
- A monopsony can lower the wage rate below the competitive level.
- A union or a minimum wage in a monopsony labour market can raise the wage rate without a fall in employment.

Working Problems 7 to 9 will give you a better understanding of labour markets.

#### Capital and Natural Resource Markets (pp. 426–429)

- The value of marginal product of capital (and land) determines the demand for capital (and land).
- Firms make a rent-versus-buy decision by choosing the option that minimizes cost.
- The supply of land is inelastic and the demand for land determines the rental rate.
- The demand for a nonrenewable natural resource depends on the value of marginal product and on the expected future price.
- The supply of a nonrenewable natural resource depends on the known reserves, the cost of extraction, and the expected future price.
- The price of nonrenewable natural resources can differ from the market fundamentals price because of speculation based on expectations about the future price.
- The price of a nonrenewable natural resource is expected to rise at a rate equal to the interest rate.

Working Problem 10 will give you a better understanding of capital and natural resource markets.

#### MyEconLab Key Terms Quiz



## WORKED PROBLEM

### MyEconLab You can work this Problem in Chapter 18 Study Plan.

Tom hires workers to pack the tomatoes he grows. The market for tomatoes is perfectly competitive, and the price of tomatoes is \$2 a box. The labour market is competitive, and the market wage rate is \$16 an hour. The table shows the workers' total product schedule.

Number of workers	Quantity produced (boxes packed per hour)
1	14
2	26
3	36
4	44
5	50

#### Questions

- Calculate the marginal product of the third worker hired and that worker's value of marginal product.
- How many workers will Tom hire to maximize profit and what will the workers produce?
- If the market wage rate rises to \$20 an hour, how many workers will Tom hire?

#### Solutions

- Marginal product (*MP*) of the third worker equals the total product (*TP*) of 3 workers (36 boxes) minus the *TP* of 2 workers (26 boxes), so the *MP* of the third worker is 10 boxes of tomatoes.

The third worker's value of marginal product (*VMP*) equals the third worker's *MP* (10 boxes of tomatoes an hour) multiplied by the price of a box of tomatoes (\$2), so the *VMP* of the third worker equals \$20 an hour.

The figure shows the *VMP* of each worker.

**Key Point:** The value of marginal product of labour is the marginal product of labour multiplied by the market price of the good produced by the labour.

- Tom maximizes profit by hiring the number of workers at which *VMP* equals the market wage rate. The table in the next column shows the calculations.

The market wage rate is \$16 an hour, so Tom hires the number of workers at which the *VMP* equals \$16 an hour. You can see in the table that *VMP* equal \$16 an hour when Tom hires the fourth worker. So Tom maximizes profit when he

Number of workers	TP (boxes per hour)	MP (boxes per worker)	VMP (dollars per hour)
1	14	..... 12	24
2	26	..... 10	20
3	36	..... 8	16
4	44	..... 6	12
5	50		

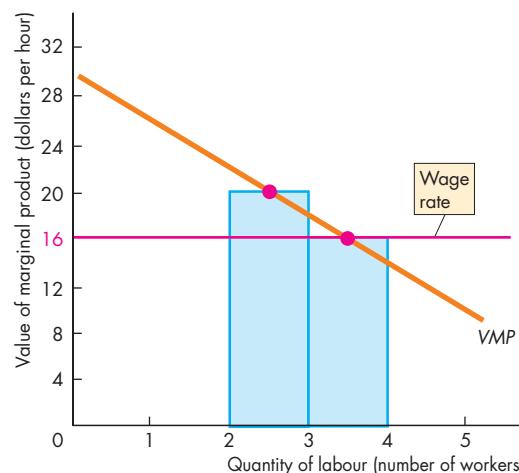
hires 4 workers who produce 44 boxes of tomatoes. Tom sells the tomatoes for \$88 and pays the wages of \$64, so his profit is \$24 an hour. The figure shows this equality.

**Key Point:** The firm maximizes profit by hiring the quantity of labour at which the value of marginal product of labour equals the market wage rate.

- If the market wage rate rises to \$20 an hour, the *VMP* of labour does not change and remains the same as in the table above. But now with a market wage rate of \$20 an hour, Tom hires fewer workers. *VMP* equals \$20 an hour when Tom hires the third worker. So Tom cuts the number of workers to 3.

**Key Point:** When the market wage rate rises, the firm maximizes profit by hiring fewer workers.

#### Key Figure



## ◆ STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 10 in Chapter 18 Study Plan and get instant feedback.

### The Anatomy of Factor Markets (Study Plan 18.1)

1. Tim is opening a new online store. He plans to hire two workers at \$10 an hour. Tim is also considering buying or leasing some new computers. The purchase price of a computer is \$900 and after three years it is worthless. The annual cost of leasing a computer is \$450.
  - a. In which factor markets does Tim operate?
  - b. What is the price of the capital equipment and the rental rate of capital?

### The Demand for a Factor of Production

(Study Plan 18.2)

Use the following data to work Problems 2 to 6. Wanda's is a fish store that hires students to pack the fish. Students can pack the following amounts of fish:

Number of students	Quantity of fish packed (kilograms per hour)
1	20
2	50
3	90
4	120
5	145
6	165
7	180
8	190

The fish market is competitive and the price of fish is 50¢ a kilogram. The market for packers is competitive and their market wage rate is \$7.50 an hour.

2. Calculate the value of marginal product of labour and draw the value of marginal product curve.
3. a. Find Wanda's demand for labour curve.  
b. How many students does Wanda's employ?

Use the following additional data to work Problems 4 and 5.

The market price of fish falls to 33.33¢ a kilogram, but the packers' wage rate remains at \$7.50 an hour.

4. How does the students' marginal product change? How does the value of marginal product of labour change?
5. How does Wanda's demand for labour change?

What happens to the number of students that Wanda's employs?

6. At Wanda's fish store, packers' wages increase to \$10 an hour, but the price of fish remains at 50¢ a kilogram.
  - a. What happens to the value of marginal product of labour?
  - b. What happens to Wanda's demand for labour curve?
  - c. How many students does Wanda's employ?

### Labour Markets (Study Plan 18.3)

Use the following news clip to work Problems 7 to 9.

#### In Modern Rarity, Workers Form Union at Small Chain

In New York's low-income neighbourhoods, labour unions have virtually no presence. But after a year-long struggle, 95 workers at a chain of 10 sneaker stores have formed a union. After months of negotiations, the two sides signed a three-year contract that sets the wage rate at \$7.25 an hour.

Source: *The New York Times*, February 5, 2006

7. Why are labour unions scarce in New York's low-income neighbourhoods?
8. Who wins from this union contract? Who loses?
9. How can this union try to change the demand for labour?

### Capital and Natural Resource Markets

(Study Plan 18.4)

#### 10. Land Prices Reflect High Commodity Prices

As their family grows, the Steens are finding it more difficult for the next generation to stay in ranching. "The problem is they don't create any more land," Steen said. As the prices for cattle, corn, and other commodities climb, so does the value of land in South Dakota.

Source: *Rapid City Journal*, January 30, 2012

- a. Why does the price of land in South Dakota keep rising? In your answer, include a discussion of the demand for and supply of land.
- b. Use a graph to show why the price of land in South Dakota increased over the past decade.
- c. Is the supply of land in South Dakota perfectly inelastic?

## ADDITIONAL PROBLEMS AND APPLICATIONS

**MyEconLab** You can work these problems in MyEconLab if assigned by your instructor.

### The Anatomy of Factor Markets

11. Venus is opening a tennis school. She plans to hire a marketing graduate to promote and manage the school at \$20 an hour. Venus is also considering buying or leasing a new tennis ball machine. The purchase price of the machine is \$1,000 and after three years it is worthless. The annual cost of leasing the machine is \$500.
- In which factor markets does Venus operate?
  - What is the price of the capital equipment and the rental rate of capital?

### The Demand for a Factor of Production

Use the following data to work Problems 12 to 15. Kaiser's Ice Cream Parlour hires workers to produce milk shakes. The market for milk shakes is perfectly competitive, and the price of a milk shake is \$4. The labour market is competitive, and the wage rate is \$40 a day. The table shows the workers' total product schedule.

Number of workers	Quantity produced (milk shakes per day)
1	7
2	21
3	33
4	43
5	51
6	55

- Calculate the marginal product of hiring the fourth worker and the fourth worker's value of marginal product.
- How many workers will Kaiser's hire to maximize its profit and how many milk shakes a day will Kaiser's produce?
- If the price of a milk shake rises to \$5, how many workers will Kaiser's hire?
- Kaiser's installs a new machine for making milk shakes that increases the productivity of workers by 50 percent. If the price of a milk shake remains at \$4 and the wage rises to \$48 a day, how many workers does Kaiser's hire?
- Detroit Oil Refinery Expansion Approved** Marathon Oil Saturday started work on a \$1.9 billion expansion of its gasoline refinery in Detroit. Marathon will employ 800 construction

workers and add 135 permanent jobs to the existing 480 workers at the refinery.

Source: *United Press International*, June 21, 2008

- Explain how rising gasoline prices influence the market for refinery labour.
- Draw a graph to illustrate the effects of rising gasoline prices on the market for refinery labour.

### Labour Markets

Use the following news clip to work Problems 17 and 18.

#### Miner Sacks 17,000 Workers Over Pay Dispute

Impala Platinum has sacked 17,000 South African miners at its Rustenburg mine because they took part in an illegal strike. The miners refused to have their union negotiate in the two-week pay dispute with the world's second-largest platinum producer. Mining provides a quarter of all jobs in Rustenburg.

Source: [abc.com.au](http://abc.com.au), February 3, 2012

- How would the wage rate and employment for the Rustenburg miners be determined in a competitive market?
- Explain how it is possible that the mine workers were being paid less than the wage that would be paid in a competitive labour market.
  - What would be the effect of a minimum wage law in the market for miners?

Use the following news clip to work Problems 19 to 22.

#### The New War over Wal-Mart

Today, Wal-Mart employs more people—1.7 million—than any other private employer in the world. With size comes power: Wal-Mart's prices are lower and United Food and Commercial Workers International Union argues that Wal-Mart's wages are also lower than its competitors. Last year, the workers at a Canadian outlet joined the union and Wal-Mart immediately closed the outlet. But does Wal-Mart behave any worse than its competitors? When it comes to payroll, Wal-Mart's median hourly wage tracks the national median wage for general retail jobs.

Source: *The Atlantic*, June 2006

- Assuming that Wal-Mart has market power in a labour market, explain how the firm could use that market power in setting wages.

- b. Draw a graph to illustrate how Wal-Mart might use labour market power to set wages.
20. a. Explain how a union of Wal-Mart's employees would attempt to counteract Wal-Mart's wage offers (a bilateral monopoly).
- b. Explain the response by the Canadian Wal-Mart to the unionization of employees.
21. Based upon evidence presented in this article, does Wal-Mart function as a monopsony in labour markets, or is the market for retail labour more competitive? Explain.
22. If the market for retail labour is competitive, explain the potential effect of a union on the wage rates. Draw a graph to illustrate your answer.

### Capital and Natural Resource Markets

23. New technology has allowed oil to be pumped from much deeper offshore oil fields than before. For example, 28 deep ocean rigs operate in the deep waters of the Gulf of Mexico.
- What effect do you think deep ocean sources have had on the world oil price?
  - Who will benefit from drilling for oil in the Gulf of Mexico? Explain your answer.
24. Water is a natural resource that is plentiful in Canada but not plentiful in Arizona.
- If Canadians start to export bulk water to Arizona, what do you predict will be the effect on the price of bulk water?
  - Will Canada eventually run out of water?
  - Do you think the Hotelling Principle applies to Canada's water? Explain why or why not.
25. **Gas Prices Create Land Rush**

There is a land rush going on across Pennsylvania, but buyers aren't interested in the land itself. Buyers are interested in what lies beneath the earth's surface—mineral rights to natural gas deposits. Record-high natural gas prices have pushed up drilling activity across the state, but drilling companies have discovered a new technology that will enable deep gas-bearing shale to be exploited. Development companies, drilling companies, and speculators have been trying to lease mineral rights from landowners. The new drilling techniques might recover about 10 percent of those reserves, and that would ring up at a value of \$1 trillion.

Source: *Erie Times-News*, June 15, 2008

- Explain why the demand for land in Pennsylvania has increased.

- If companies are responding to the higher prices for natural gas by drilling right now wherever they can, what does that imply about their assumptions about the future price of natural gas in relation to current interest rates?
- What could cause the price of natural gas to fall in the future?

### Economics in the News

26. After you have studied *Economics in the News* on pp. 430–431, answer the following questions.
- If foreign migration into Alberta is decreased by tightening the screening of foreign workers, how will the supply of labour, the demand for labour, and the wage rate change?
  - Draw a graph to illustrate the outcome you've described.
  - How would you expect inward migration from the rest of Canada to be influenced by tighter foreign worker regulation?
  - Draw a graph to illustrate the outcome you've described.
  - Why would the wages of food service workers have increased by less than the average wage rate? Hint: Oil workers migrate with family members.
  - Draw a graph to illustrate your explanation for the wages of food service workers.
  - Who gains and who loses from tighter foreign worker regulation? Illustrate your answer with a graph.

### Mathematical Note

27. Keshia is opening a new bookkeeping service. She is considering buying or leasing some new laptop computers. The purchase price of a laptop is \$1,500 and after three years it is worthless. The annual lease rate is \$550 per laptop. The value of marginal product of one laptop is \$700 a year. The value of marginal product of a second laptop is \$625 a year. The value of marginal product of a third laptop is \$575 a year. And the value of marginal product of a fourth laptop is \$500 a year.
- How many laptops will Keshia lease or buy?
  - If the interest rate is 4 percent a year, will Keshia lease or buy her laptops?
  - If the interest rate is 6 percent a year, will Keshia lease or buy her laptops?



# 19

## ECONOMIC INEQUALITY

After studying this chapter,  
you will be able to:

- ◆ Describe the distributions of income and wealth and the trends in economic inequality in Canada
- ◆ Describe the distribution of income and the trends in inequality in selected countries and the world
- ◆ Explain the sources of economic inequality and its trends
- ◆ Describe the scale of government income redistribution in Canada

**Every night in Vancouver, a city with mansions that are** home to some of the wealthiest Canadians, around 2,500 people sleep outside without shelter. In Toronto, where a luxury penthouse sells for \$30 million, more than 5,000 people seek a bed every night in a shelter for the homeless. Extreme poverty and extreme wealth exist side by side in every major Canadian city and in all parts of the world.

In this chapter, we study economic inequality—its extent, its sources, and the things governments do to make it less extreme. And in *Economics in the News* at the end of the chapter, we compare the inequality in Canada's most and least unequal provinces.

## Measuring Economic Inequality

Statistics Canada provides measures of economic inequality based on three definitions of income: market income, total income, and after-tax income. **Market income** equals the wages, interest, rent, and profit earned in factor markets before paying income taxes. **Total income** equals market income plus cash payments to households by governments. **After-tax income** equals total income minus tax payments by households to governments.

### The Distribution of Income

Figure 19.1 shows the distribution of annual after-tax income across the 14 million households in Canada in 2011. Note that the *x*-axis measures household after-tax income and the *y*-axis is percentage of households.

The most common household income, called the *mode* income, was received by the 6 percent of the households whose incomes fell between \$30,000 and \$34,999.

The middle level of household income in 2011, called the *median* income, was \$50,700. Fifty percent of households have an income that exceeds the median and fifty percent have an income below the median.

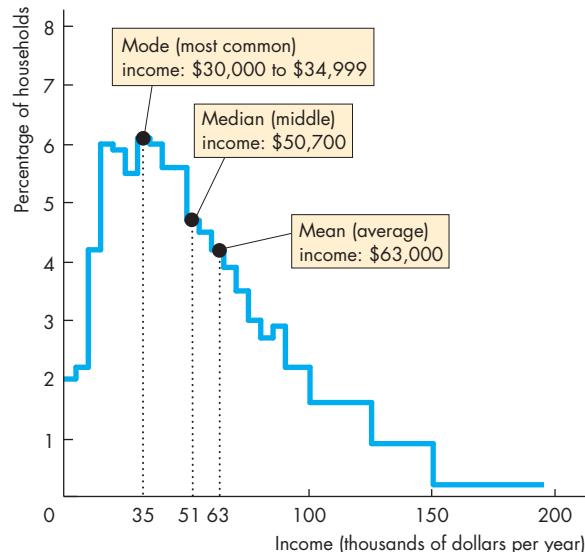
The *average* household money income in 2011, also called the *mean* income, was \$63,000. This number equals total household after-tax income divided by the 14 million households.

You can see in Fig. 19.1 that the mode income is less than the median income and that the median income is less than the mean income. This feature of the distribution of income tells us that there are more households with low incomes than with high incomes. It also tells us that some of the high incomes are very high.

The income distribution in Fig. 19.1 is called a *positively skewed* distribution, which means that it has a long tail of high values. This distribution shape contrasts with the bell distribution of people's heights. In a bell-shaped distribution, the mean, median, and mode are all equal.

Another way of looking at the distribution of income is to measure the percentage of total income received by each given percentage of households. Data are reported for five groups—called *quintiles*

**FIGURE 19.1** The Distribution of Income in Canada in 2011



The distribution of after-tax income is positively skewed. The mode (most common) income is less than the median (middle) income, which in turn is less than the mean (average) income. The distribution shown here ends at \$200,000 because data above that level are not available, but the distribution goes up to several million dollars a year.

Source of data: Statistics Canada, CANSIM Table 202-0601.

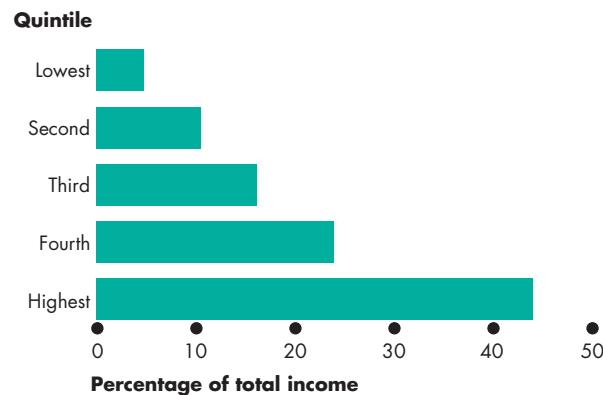
**MyEconLab Animation**

or fifth shares—each consisting of 20 percent of households.

Figure 19.2 shows the distribution based on these shares in 2011. The poorest 20 percent of households received 4.8 percent of total after-tax income; the second poorest 20 percent received 10.6 percent; the third 20 percent received 16.3 percent; the fourth 20 percent received 24.1 percent; and the highest 20 percent received 44.2 percent of total after-tax income.

The distribution of income in Fig. 19.1 and the quintile shares in Fig. 19.2 tell us that income is distributed unequally. But we need a way of comparing the distribution of income in different periods and using different measures. A clever graphical tool called the *Lorenz curve* enables us to make such comparisons.

**FIGURE 19.2** Quintile Shares in Canada in 2011



Households (quintile)	Income (percentage of total income)
Lowest	4.8
Second	10.6
Third	16.3
Fourth	24.1
Highest	44.2

In 2011, the poorest 20 percent of households received 4.8 percent of total income; the second poorest 20 percent received 10.6 percent; the middle 20 percent received 16.3 percent; the next highest 20 percent received 24.1 percent; and the highest 20 percent received 44.2 percent.

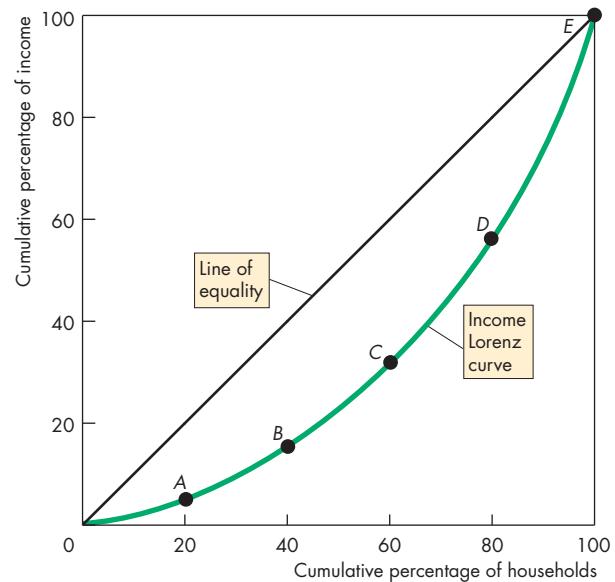
Source of data: See Fig. 19.1.

[MyEconLab Animation](#)

### The Income Lorenz Curve

The income **Lorenz curve** graphs the cumulative percentage of income against the cumulative percentage of households. Figure 19.3 shows the income Lorenz curve using the quintile shares from Fig. 19.2. The table shows the percentage of income of each quintile group. For example, row A tells us that the lowest quintile of households receives 4.8 percent of total income. The table also shows the *cumulative* percentages of households and income. For example, row B tells us that the lowest two quintiles (lowest 40 percent) of households receive 15.4 percent of total income (4.8 percent for the lowest quintile plus 10.6 percent for the next lowest).

**FIGURE 19.3** The Income Lorenz Curve in 2011



Quintile	Households		Income	
	Quintile	Cumulative percentage	Percentage	Cumulative percentage
A Lowest	20	4.8	4.8	4.8
B Second	40	10.6	10.6	15.4
C Third	60	16.3	16.3	31.7
D Fourth	80	24.1	24.1	55.8
E Highest	100	44.2	44.2	100.0

The cumulative percentage of income is graphed against the cumulative percentage of households. Points A through E on the Lorenz curve correspond to the rows of the table. If incomes were distributed equally, each 20 percent of households would receive 20 percent of total income and the Lorenz curve would fall along the line of equality. The Lorenz curve shows that income is unequally distributed.

Source of data: See Fig. 19.1.

[MyEconLab Animation and Draw Graph](#)

The Lorenz curve provides a direct visual clue about the degree of income inequality by comparing it with the line of equality. This line, identified in Fig. 19.3, shows what the Lorenz curve would be if everyone had the same level of income.

If income were distributed equally across all the households, each quintile would receive 20 percent of total income and the cumulative percentages of income received would equal the cumulative percentages of households, so the Lorenz curve would be the straight line labelled “Line of equality.”

The actual distribution of income shown by the curve labelled “Income Lorenz curve” can be compared with the line of equality. The closer the Lorenz curve is to the line of equality, the more equal is the distribution of income.

### The Distribution of Wealth

The distribution of wealth provides another way of measuring economic inequality. A household’s **wealth** is the value of the things that it owns.

Figure 19.4 shows the Lorenz curve for wealth in Canada in 1999. The median household wealth in 1999 was \$64,000. By looking closely at Fig. 19.4, you can see that wealth is extremely unequally distributed. The poorest 40 percent of households owns only 1.1 percent of total wealth (row  $A'$  in the table), and the wealthiest 10 percent of households owns 55.6 percent of total wealth (row  $G'$ ).

The Lorenz curve for wealth is much farther away from the line of equality than is the Lorenz curve for income: The distribution of wealth is much more unequal than the distribution of income.

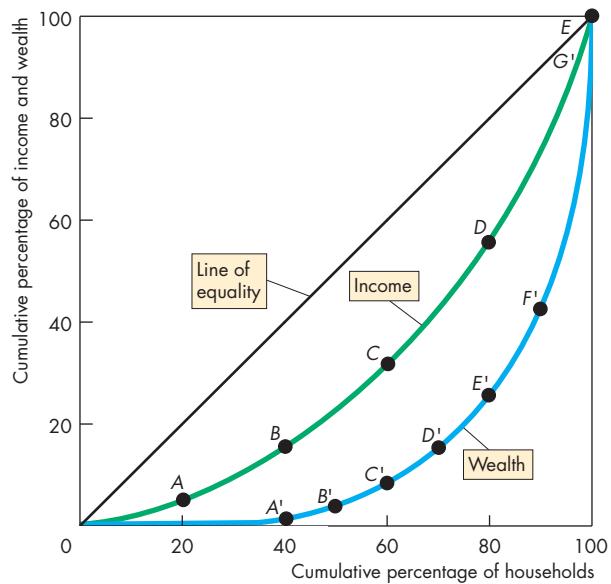
### Wealth or Income?

We’ve seen that wealth is much more unequally distributed than is income. Which distribution provides the better description of the degree of inequality? To answer this question, we need to think about the connection between wealth and income.

Wealth is a *stock* and income is the *flow* of earnings that results from the stock of wealth. Suppose that a person owns assets worth \$1 million—has a wealth of \$1 million. If the rate of return on assets is 5 percent a year, then this person receives an income of \$50,000 a year from those assets. We can describe this person’s economic condition by using either the wealth of \$1 million or the income of \$50,000. When the rate of return is 5 percent a year, \$1 million of wealth equals \$50,000 of income in perpetuity. Wealth and income are just different ways of looking at the same thing.

But in Fig. 19.4, the distribution of wealth is more unequal than the distribution of income. Why?

**FIGURE 19.4** Lorenz Curves for Income and Wealth



	Households		Wealth	
	Cumulative Percentage	Cumulative percentage	Cumulative Percentage	Cumulative percentage
$A'$	Lowest 40	40	1.1	1.1
$B'$	Next 10	50	2.8	3.9
$C'$	Next 10	60	4.7	8.6
$D'$	Next 10	70	7.4	16.0
$E'$	Next 10	80	11.0	27.0
$F'$	Next 10	90	17.4	44.4
$G'$	Highest 10	100	55.6	100.0

The cumulative percentage of wealth is graphed against the cumulative percentage of households. Points  $A'$  through  $G'$  on the Lorenz curve for wealth correspond to the rows of the table. By comparing the Lorenz curves for income and wealth, we can see that wealth is distributed much more unequally than is income.

Sources of data: Statistics Canada CANSIM Table 202-0604 and Catalogue 75-202-XIE.

**MyEconLab Animation**

It is because the wealth data do not include the value of *human capital*, while the income data measure income from all wealth, including human capital.

Think about Lee and Peter who have the same income and wealth. Lee's wealth is human capital and his entire income is from employment. Peter's wealth is investments in stocks and bonds and his entire income is from these investments.

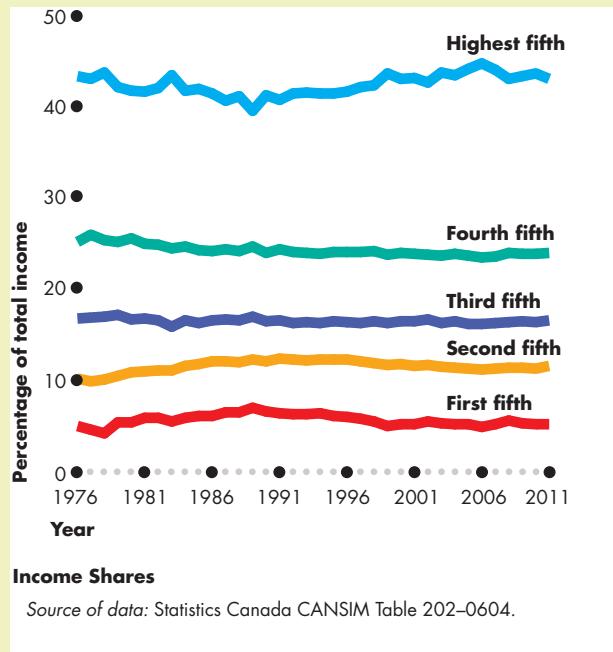
The national survey of wealth excludes human capital, so Peter looks more wealthy than Lee, although they have equal wealth. The bias in wealth measurement means that the income distribution is a more accurate measure of economic inequality than the wealth distribution.

## Economics in Action

### The Rich Get Richer

Figure 1 shows how the distribution of after-tax income changed between 1976 and 2011. The share of total income received by the highest 20 percent of households increased and the share received by the next highest 20 percent decreased. The shares of the other three quintiles didn't change much.

The quintile data in Fig. 1 mask the most interesting change in inequality, which is the changing share of the super rich. Figure 2 shows what has been happening to the income share of the top *one* percent.



### Annual or Lifetime Income and Wealth?

A typical household's income changes over its life cycle. Income starts out low, grows to a peak, and then falls after retirement. Like income, wealth starts out low, grows to a peak at the point of retirement, and falls after retirement.

Because of these life-cycle patterns, the distributions of annual income and wealth in a given year are much more unequal than the distributions of lifetime income and wealth.

Inequality in annual income and wealth data overstates lifetime inequality because households are at different stages in their life cycles.

Michael Veall of McMaster University compiled these Canadian data from tax returns as part of a global, multi-country study.

You can see that after decades of a falling income share—called the “Great Compression”—the income share received by the top one percent began a steady climb starting in 1979. By 2010 the top one percent were receiving 12 percent of total income.

No one knows for sure *why* the trend to greater inequality occurred, so it is not known whether the trend will persist or cycle back to a new “Great Compression.”

We'll explore a leading explanation for the rise in inequality later in this chapter (on p. 448).

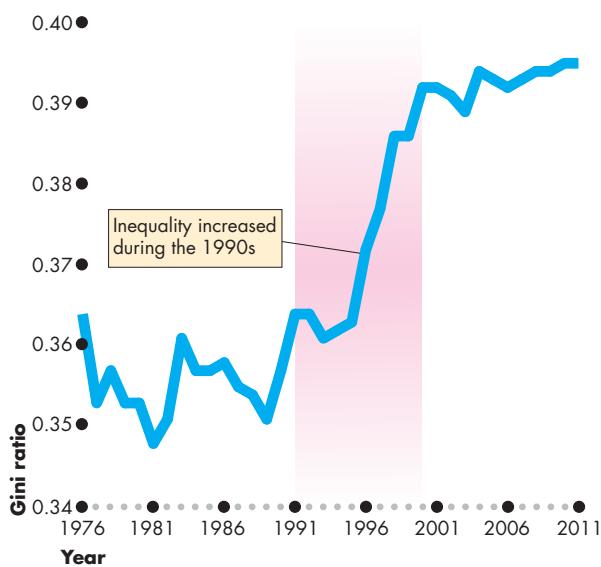


## Trends in Inequality

*Economics in Action* on the previous page looks at the trend in inequality as measured by changes in quintile shares. A more direct measure of inequality is called the **Gini ratio**, which equals the ratio of the area between the line of equality and the Lorenz curve to the entire area beneath the line of equality. The larger the Gini ratio, the greater is the degree of income inequality. If income is equally distributed, the Lorenz curve is the same as the line of equality, so the Gini ratio is zero. If one person has all the income and everyone else has none, the Gini ratio is 1.

Figure 19.5 shows the Canadian Gini ratio from 1976 to 2011. The first thing that stands out in this graph is the rising trend. But looking in more detail at the timing of the rise in the Gini ratio, you can see that the main increase occurred during the 1990s. From 1976 to 1990, the ratio fluctuated but had no rising trend. And after 2000, the rate of increase slowed to a crawl. The timing of the increase is a clue to its cause that we explore on p. 449.

**FIGURE 19.5** The Canadian Gini Ratio: 1976–2011



Measured by the Gini ratio, the distribution of income in Canada became more unequal from 1976 to 2011. The percentage of income earned by the richest households increased through these years. Some increase in inequality occurred during the 1980s, but most of the increase occurred during the 1990s. Since 2000, the Gini ratio has fluctuated but has not continued an upward trend.

Source of data: Statistics Canada, CANSIM Table 202-0705.

## Economics in Action

### School Pays

The lowest incomes are earned by people who scratch out a living doing seasonal work on farms. But the poorest Canadians are people who earn nothing and rely on handouts to survive. The incidence of poverty varies systematically depending on household characteristics, and six characteristics stand out:

- Education
- Labour force status
- Source of income
- Household type
- Age of householder
- Number of children

**Education** Education makes a huge difference to a household's income and to the risk of being poor. A person who has not completed high school has the highest risk of being poor. University graduates and those with a post-graduate or professional degree have the lowest risk of being poor.

**Labour Force Status** Households that are in the labour force, even if unemployed, tend to have higher incomes than those not in the labour force—either they've retired or they have become discouraged by a persistent failure to find a suitable job.

**Source of Income** A household that earns its income either by working or from its wealth is unlikely to be poor and a household that receives its income in the form of a transfer payment from the government is more likely to be poor.

**Household Type** Households with two parents present are unlikely to be poor. The poorest household is most likely to be one with a single female parent—almost 50 percent of whom are poor.

**Age of Householder** The youngest and the oldest households have lower incomes and a greater incidence of poverty than middle-aged households.

**Number of Children** On average, the more children in a household, the smaller is the income per person and the more likely the household is to be poor.

## Poverty

**Poverty** is a state in which a family's income is too low to be able to buy the quantities of food, shelter, and clothing that are deemed necessary.

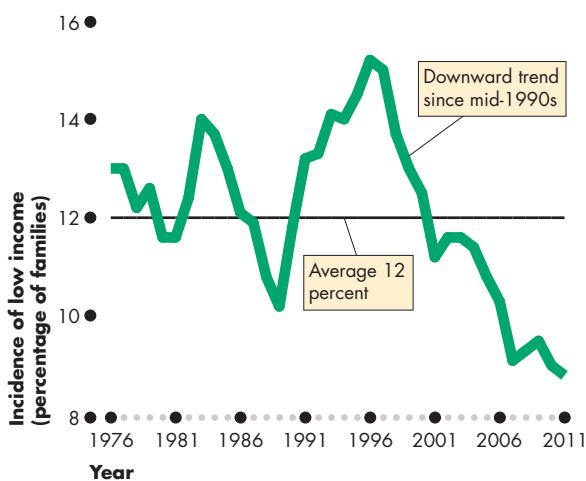
Poverty is both an absolute and a relative concept. Millions of people in Africa and Asia live, barely, in absolute poverty with incomes of less than \$400 a year.

In Canada, poverty is identified in relative terms using the concept of the **low-income cut-off**, defined as the income level below which a family normally spends 63.6 percent or more of its income on food, shelter, and clothing. (The low-income cut-off is determined separately for each family type.)

How much poverty (defined as the percentage of families with incomes below the low-income cut-off) is there in Canada, and is the problem getting worse or better? Figure 19.6 answers this question.

The incidence of poverty has fluctuated between a low of 14 percent in 1989 and a high of 20 percent in 1996 and 1997. But there has been no trend in poverty and on the average, 12 percent of Canadian families have incomes below the low-income cut-off.

**FIGURE 19.6** The Incidence of Low Income



The incidence of low income in Canada has fluctuated between 9 percent and 15 percent of families. On average, 12 percent of families have incomes below the low-income cut-off.

Source of data: Statistics Canada, CANSIM Table 202-0804.

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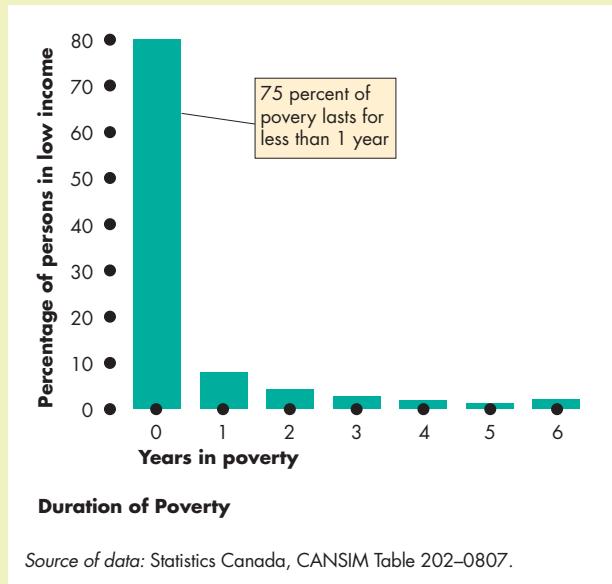
## Economics in Action

### How Long Does a Spell of Poverty Last?

Most poverty is temporary and short-lived. The figure shows the numbers: 75 percent of those in poverty remain in that state for less than 1 year and another 8 percent of those in poverty remain so for 1 year. Poverty rates for people who are in that state for 2 years or more are very low.

Given that the average poverty rate is 12 percent of families, around 2 percent of families experience poverty that persists for more than 2 years.

The duration of poverty, like its level, depends on household characteristics, and education is the key. The least well educated tend to be those who experience the most persistent poverty.



## REVIEW QUIZ

- 1 Which is distributed more unequally, income or wealth? Why? Which is the better measure?
- 2 How has the distribution of income changed in the past few decades?
- 3 What are the main characteristics of people who earn high incomes and who earn low incomes?
- 4 What is poverty and how does its incidence vary across families?
- 5 How long does a spell of poverty usually last?

Work these questions in Study Plan 19.1 and get instant feedback. Do a Key Terms Quiz.

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## Inequality in the World Economy

Which countries have the greatest economic inequality and which have the least and the greatest equality? Where does Canada rank? Is it one of the most equal or most unequal or somewhere in the middle? And how much inequality is there in the world as a whole when we consider the entire world as a single global economy?

We'll answer these questions by first looking at the income distribution in a selection of countries and then by examining features of the global distribution of income.

### Income Distributions in Selected Countries

By inspecting the income distribution data for every country, we can compare the degree of income inequality and identify the countries with the most inequality and those with the least inequality.

Figure 19.7 summarizes some extremes and shows where Canada lies in the range of degrees of income inequality.

Look first at the numbers in the table. They tell us that in Brazil and South Africa, the poorest 20 percent of households receive only 2 percent of total income while the highest 20 percent receive 65 percent of total income. An average person in the highest quintile receives 32.5 times the income of an average person in the lowest quintile.

Contrast these numbers with those for Finland and Sweden. In these countries, the poorest 20 percent receive 8 percent of total income and the highest 20 percent receive 35 percent. So an average person in the highest quintile receives 4.4 times the income of an average person in the lowest quintile.

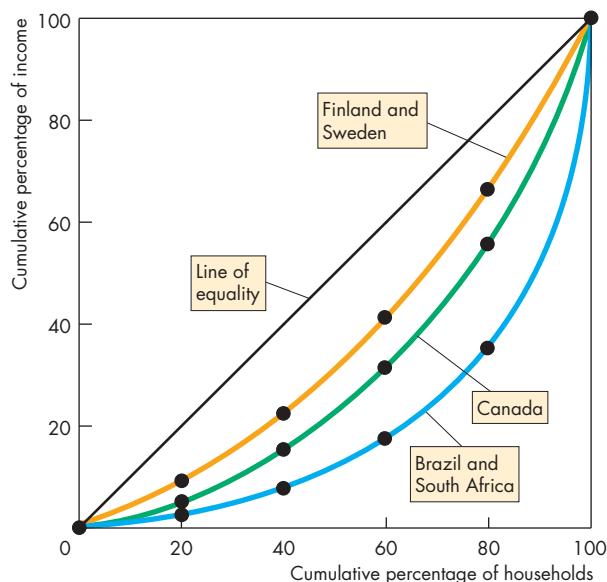
The numbers for Canada lie between these extremes, with an average person in the highest quintile receiving just under 9 times the income received by an average person in the lowest quintile.

Brazil and South Africa are extremes not matched in any other major country or region. Inequality is large in these countries because they have a relatively small but rich European population and a large and relatively poor indigenous population.

Finland and Sweden are extremes, but they are not unusual. Income distributions similar to these are found in many European countries in which governments pursue aggressive income redistribution policies.

We look next at the global income distribution.

**FIGURE 19.7** Lorenz Curves Compared



Households (quintile)	Percentage of total income <sup>1</sup>		
	Brazil and South Africa	Canada	Finland and Sweden
Lowest	2	5	8
Second	5	11	14
Third	10	16	20
Fourth	18	24	23
Highest	65	44	35

The table shows the percentages of total income received by each quintile. The figure shows the cumulative percentage of income graphed against the cumulative percentage of households. The data and the Lorenz curves show that income is distributed most unequally in Brazil and South Africa and least unequally in Finland and Sweden. The degree of income inequality in Canada lies between these extremes.

Sources of data: Brazil, South Africa, Finland, and Sweden, Klaus W. Deininger and Lyn Squire, Measuring Income Inequality Database, World Bank, go.worldbank.org/. Canada, see Fig. 19.1.

<sup>1</sup>The data are based on income after redistribution. See pp. 453–455 for an account of income redistribution in Canada.

## Global Inequality and Its Trends

The global distribution of income is much more unequal than the distribution within any one country. The reason is that many countries, especially in Africa and Asia, are in a pre-industrial stage of economic development and are poor, while industrial countries such as Canada, the United States, and those in Western Europe are rich. When we look at the distribution of income across the entire world population that goes from the low income of the poorest African to the high income of the richest North American, we observe a very large degree of inequality.

To put some raw numbers on this inequality, start with the poorest. Measured in the value of the Canadian dollar in 2005, a total of 3 billion people or 50 percent of the world population live on \$2.50 a day or less. Another 2 billion people or 30 percent of the world population live on more than \$2.50 but less than \$10 a day. So 5 billion people or 80 percent of the world population live on \$10 a day or less.

In contrast, in rich Canada, the average person has an income of \$164 per day and lowest income in the highest income quintile is \$240 a day.

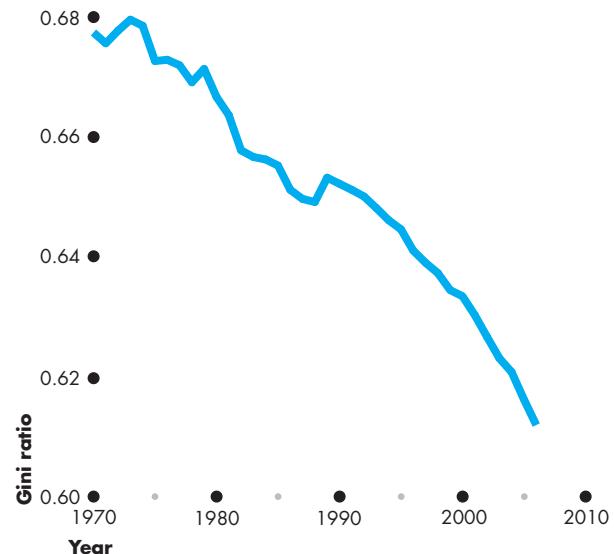
So the average Canadian earns 66 times the income of one of the world's 3 billion poorest people and more than 16.4 times the income of 80 percent of the people who live in developing economies. A Canadian with the lowest income in the highest income quintile earns 96 times that of the world's poorest people but only 9 times that of an average Canadian in the lowest quintile.

**World Gini Ratio** We can compare world inequality with Canadian inequality by comparing Gini ratios. You saw that the Canadian Gini ratio in 2011 was about 0.395. The world Gini ratio is about 0.64. Interpreting the Gini ratio in terms of the Lorenz curve, the world Lorenz curve lies much farther from the line of equality than the Canadian Lorenz curve.

**World Trend** You saw (in Fig. 19.5 on p. 444) that incomes have become more unequal in Canada—the Gini ratio has increased. The same trends are found in most economies. Increased income inequality is a big issue in two of the world's largest and poorer nations, China and India. In these two economies, urban middle classes are getting richer at a faster pace than the rural farmers.

Despite greater inequality within countries, the world is becoming *less* unequal. Figure 19.8 shows this trend towards less inequality as measured by

**FIGURE 19.8** The World Gini Ratio: 1970–2005



Measured by the Gini ratio, the distribution of income in the entire world became more equal between 1970 and 2005.

Source of data: Xavier Sala-i-Martin and Maxim Pinkovskiy, "Parametric estimations of the world distribution of income," 22 January 2010, <http://www.voxeu.org/article/parametric-estimations-world-distribution-income>.

**MyEconLab Animation**

the world Gini ratio. How can the world income distribution become less unequal while individual countries become more unequal? The answer is that average incomes in poorer countries are rising much faster than average incomes in rich countries. While the gap between rich and poor is widening *within* countries, it is narrowing *across* countries.

## REVIEW QUIZ

- 1 In which countries are incomes distributed most unequally and least unequally?
- 2 Which income distribution is more unequal and why: the income distribution in the Canada or in the entire world?
- 3 How can incomes become *more* unequally distributed within countries and *less* unequally distributed across countries?

Work these questions in Study Plan 19.2 and get instant feedback.

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## The Sources of Economic Inequality

We've described some key facts about economic inequality and its trends and our task now is to explain those facts. We began this task in Chapter 18 by learning about the forces that influence demand and supply in the markets for labour, capital, and land. We're now going to deepen our understanding of these forces.

Inequality arises from unequal labour market outcomes and from unequal ownership of capital. We'll begin by looking at labour markets and three features of them that contribute to differences in income:

- Human capital
- Discrimination
- Contests among superstars

### Human Capital

A clerk in a law firm earns less than one-tenth of the amount earned by the lawyer he assists. An operating room assistant earns less than one-tenth of the amount earned by the surgeon with whom she works. A bank teller earns less than one-tenth of the amount earned by the bank's CEO. Some of the differences in these earnings arise from differences in human capital.

To see the influence of human capital on labour incomes, consider the example of a law clerk and the lawyer he assists. (The same reasoning can be applied to an operating room assistant and surgeon, or a bank teller and bank CEO.)

**Demand, Supply, and Wage Rates** A lawyer performs many tasks that a law clerk cannot perform. Imagine an untrained law clerk cross-examining a witness in a complicated trial. The tasks that the lawyer performs are valued highly by her clients who willingly pay for her services. Using a term that you learned in Chapter 18, a lawyer has a *high value of marginal product*, and a higher value of marginal product than her law clerk. But you also learned in Chapter 18 that the value of marginal product of labour determines the demand for labour. So, because a lawyer has a high value of marginal product, there is also a high demand for her services.

To become a lawyer, a person must acquire human capital. But human capital is costly to acquire. This cost—an opportunity cost—includes expenditures on tuition and textbooks. It also includes forgone earnings during the years spent in

university and law school. It might also include low earnings doing on-the-job training in a law office during the summer.

Because the human capital needed to supply lawyer services is costly to acquire, a person's willingness to supply these services reflects this cost. The supply of lawyer services is smaller than the supply of law-clerk services.

The demand for and supply of each type of labour determine the wage rates that each type earns. Lawyers earn a higher wage rate than law clerks because the demand for lawyers is greater and the supply of lawyers is smaller. The gap between the wage rates reflects the higher value of marginal product of a lawyer (demand) and the cost of acquiring human capital (supply).

**Do Education and Training Pay?** You know that a lawyer earns much more than a law clerk, but does human capital add more to earning power generally and on average? The answer is that it does. Rates of return on high school and post-secondary education have been estimated to be in the range of 5 percent to 10 percent a year after allowing for inflation, which suggests that a university degree is a better investment than almost any other that a person can undertake.

Human capital differences help to explain much of the inequality that we observe. High-income households tend to be better educated, middle-aged, married couples. Human capital differences are correlated with these household characteristics. Education contributes directly to human capital. Age contributes indirectly to human capital because older workers have more experience than younger workers. Human capital differences can also explain a small part of the inequality associated with sex. A larger proportion of men than women have completed four years of university.

These differences in education levels between the sexes are becoming smaller, and today more women than men are enrolled in university, so this source of differences in average earnings is gradually being eliminated. But it remains a source of the difference in the average earnings of men and women.

Career interruptions can decrease human capital. A person (most often a woman) who interrupts a career to raise young children usually returns to the labour force with a lower earning capacity than a similar person who has kept working. Likewise, a person who has suffered a spell of unemployment

often finds a new job at a lower wage rate than that of a similar person who has not been unemployed.

### Trends in Inequality Explained by a Race Between Technology and Education

You've seen that high-income households have earned an increasing share of total income while lower-income households have earned a decreasing share: Why?

Harvard University economists Claudia Goldin and Lawrence Katz have amassed a heap of data that point towards an answer. They say there is a race between technological change and the education needed to work with the new technologies, and for now, technology is winning.

A related idea is that information technologies such as computers and laser scanners are *substitutes* for low-skilled labour: They perform tasks that previously low-skilled labour did. The introduction of these technologies has lowered the value of marginal product and the demand for low-skilled labour.

These same technologies require high-skilled labour to design, program, and run them. High-skilled labour and the information technologies are *complements*. So the introduction of these technologies has increased the value of marginal product and the demand for high-skilled labour.

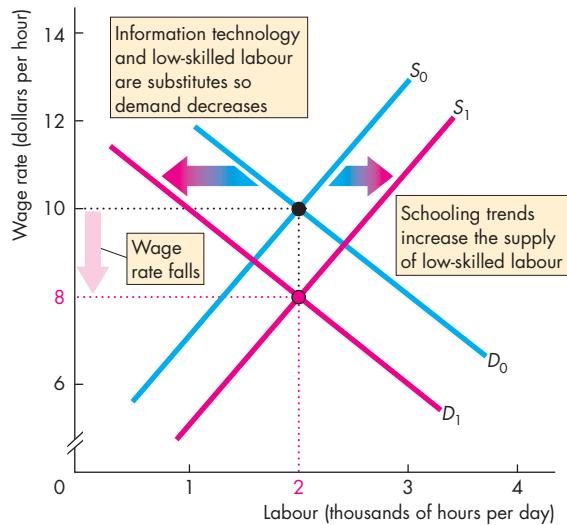
As changes in information technology have increased the growth rate of the demand for high-skilled labour, trends in schooling have lowered the growth rate of the supply of high-skilled labour. Since 1995, the trend growth rate of human capital through education has slowed. Before 1995, the percentage of the labour force with a university degree was growing at a rate of 4 percent a year. After 1995, that growth rate slowed to about 2 percent a year.

The combination of the two forces we've just described has lowered the earnings of low-skilled labour and increased the earnings of high-skilled labour.

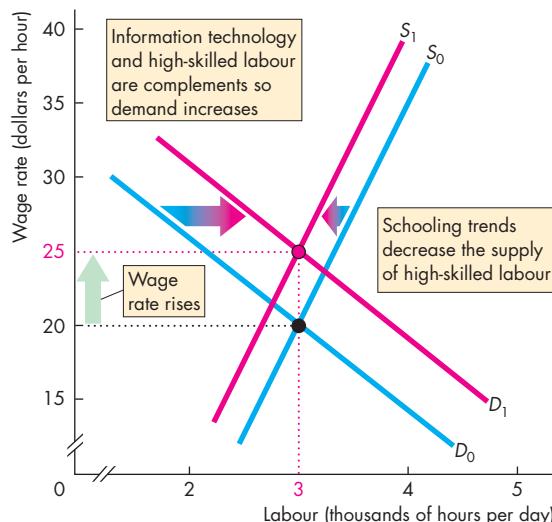
Figure 19.9 illustrates this outcome. In Fig. 19.9(a), the demand for low-skilled labour decreases from  $D_0$  to  $D_1$  and the supply of low-skilled labour increases from  $S_0$  to  $S_1$ . The wage rate falls from \$10 per hour to \$8 per hour. In Fig. 19.9(b), the demand for high-skilled labour increases from  $D_0$  to  $D_1$  and the supply of high-skilled labour decreases from  $S_0$  to  $S_1$ . The wage rate rises from \$20 per hour to \$25 per hour.

The wider wage gap increases the income share of the highest quintile and lowers the shares of the lower quintiles.

**FIGURE 19.9** Explaining the Trend in Income Distribution



(a) The market for low-skilled labour



(b) The market for high-skilled labour

In part (a), the demand for low-skilled labour decreases, the supply of low-skilled labour increases, and the wage rate of low-skilled labour falls.

In part (b), the demand for high-skilled labour increases, the supply of high-skilled labour decreases, and the wage rate of high-skilled labour rises. Inequality increases.

**MyEconLab Animation**

## Discrimination

Human capital differences can explain some of the economic inequality that we observe. Discrimination is another possible source of inequality.

Suppose that females and males have identical abilities as investment advisors. Figure 19.10 shows the supply curves of females,  $S_F$  in part (a), and of males,  $S_M$  in part (b). The value of marginal product of investment advisors, shown by the two curves labelled  $VMP$  in parts (a) and (b), is the same for both groups.

If everyone is free of sex-based prejudice, the market determines a wage rate of \$40,000 a year for investment advisors. But if the customers are prejudiced against women, this prejudice is reflected in the wage rate and employment.

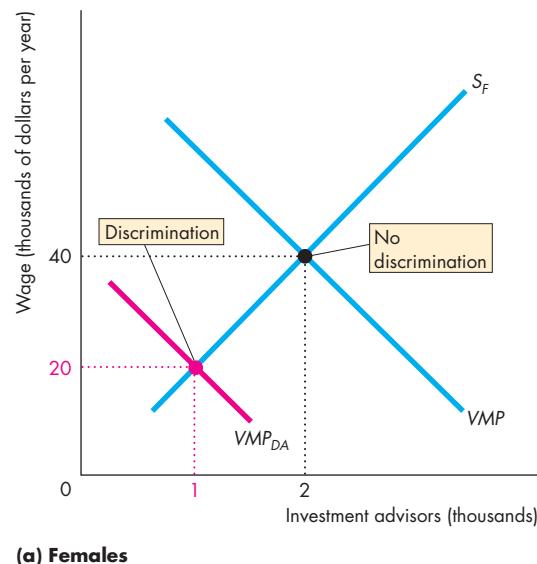
Suppose that the perceived value of marginal product of the females, when discriminated against, is  $VMP_{DA}$ . Suppose that the perceived value of marginal product for males, the group discriminated in favour of, is  $VMP_{DF}$ . With these  $VMP$  curves, females earn \$20,000 a year and only 1,000 females work as investment advisors; males earn \$60,000 a year and 3,000 of them work as investment advisors.

**Counteracting Forces** Economists disagree about whether prejudice actually causes wage differentials, and one line of reasoning implies that it does not. In the above example, customers who buy from men pay a higher service charge for investment advice than do the customers who buy from women. This price difference acts as an incentive to encourage people who are prejudiced to buy from the people against whom they are prejudiced. This force could be strong enough to eliminate the effects of discrimination altogether.

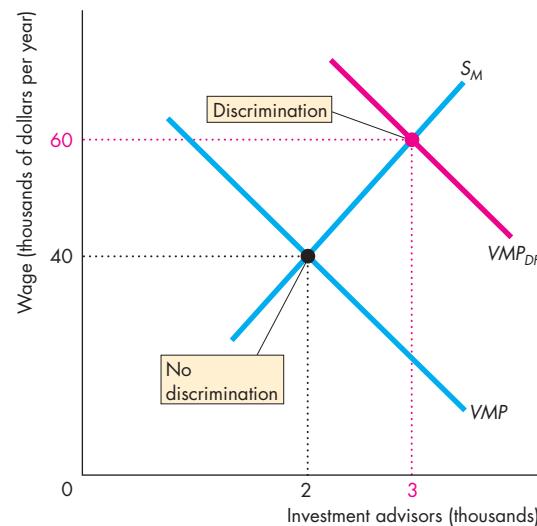
Suppose, as is true in manufacturing, that a firm's customers never meet its workers. If such a firm discriminates against women (or against visible minorities), it can't compete with firms that hire these groups because the firm that discriminates has higher costs than those of the nonprejudiced firms. Only firms that do not discriminate survive in a competitive industry.

Whether because of discrimination or from some other source, women on average do earn lower incomes than men. Another possible source of lower wage rates of women arises from differences in the relative degree of specialization of women and men.

**FIGURE 19.10** Discrimination



(a) Females



(b) Males

With no discrimination, the wage rate is \$40,000 a year and 2,000 of each group are hired. With discrimination against women, the value of marginal product curve in part (a) is  $VMP_{DA}$  and that in part (b) is  $VMP_{DF}$ . The wage rate for women falls to \$20,000 a year, and only 1,000 are employed. The wage rate for men rises to \$60,000 a year, and 3,000 are employed.

**MyEconLab Animation**

**Differences in the Degree of Specialization** Couples must choose how to allocate their time between working for a wage and doing jobs in the home, such as cooking, cleaning, shopping, organizing vacations, and, most important, bearing and raising children. Let's look at the choices of Bob and Sue.

Bob might specialize in earning an income and Sue in taking care of the home. Or Sue might specialize in earning an income and Bob in taking care of the home. Or both of them might earn an income and share home production jobs.

The allocation they choose depends on their preferences and on their earning potential. The choice of an increasing number of households is for each person to diversify between earning an income and doing some household chores. But in most households, Bob will specialize in earning an income and Sue will both earn an income and bear a larger share of the task of running the home. With this allocation, Bob will probably earn more than Sue. If Sue devotes time and effort to ensuring Bob's mental and physical well-being, the quality of Bob's market labour will be higher than it would be if he were diversified. If the roles were reversed, Sue would be able to supply market labour that earns more than Bob's.

To test whether the degree of specialization accounts for earnings differences between the sexes, economists have compared the incomes of never-married men and women. They have found that, on the average, with equal amounts of human capital, the wages of these two groups are the same.

### Contests Among Superstars

The differences in income that arise from differences in human capital are important and affect a large proportion of the population. But human capital differences can't account for some of the really large income differences.

The super rich—those in the top 1 percent of the income distribution—earn vastly more than can be explained by human capital differences. What makes a person super rich?

A clue to the answer is provided by thinking about the super rich in tennis and golf. What makes tennis players and golfers special is that their earnings depend on where they finish in a tournament. When Petra Kvitová won the Wimbledon Championship in 2014, she received £1,760,000, or \$3,257,000. The runner-up in this event, Eugenie Bouchard, received

£880,000. So Petra earned twice the amount earned by Eugenie. And Petra earned 65 times the amount received by the players who lost in the first round of the tournament.

It is true that Petra Kvitová has a lot of human capital. She practises hard and long and is a remarkable athlete. But anyone who is good enough to get into a tennis Grand Slam tournament is similarly well equipped with human capital and has spent a similar number of long hours in training and practice. It isn't human capital that explains the differences in earnings. It is the tournament and the prize differences that accounts for the large differences in earnings.

Three questions jump out: First, why do we reward superstar tennis players (and golfers) with prizes for winning a contest? Second, why are the prizes so different? And third, do the principles that apply on the tennis court (and golf course) apply more generally?

**Why Prizes for a Contest?** The answer to this question (which was noted in Chapter 5, p. 106) is that contests with prizes do a good job of allocating scarce resources efficiently when the efforts of the participants are hard to monitor and reward directly. There is only one winner, but many people work hard in an attempt to be that person. So a lot of diligent effort is induced by a contest.

**Why Are Prizes So Different?** The prizes need to be hugely different to induce enough effort. If the winner received 10 percent more than the runner-up, the gain from being the winner would be insufficient to encourage anyone to work hard enough. Someone would win, but no one would put in much effort. Tennis matches would be boring, golf scores would be high, and no one would be willing to pay to see these sports. Big differences are necessary to induce a big enough effort to generate the quality of performance that people are willing to pay to see.

**Does the Principle Apply More Generally?** Winner-takes-all isn't confined to tennis and golf. Movie stars; superstars in baseball, basketball, football, and hockey; and top corporate executives can all be viewed as participants in contests that decide the winners. The prize for the winner is an income around double that of the runner-up and many multiples of the incomes of those who drop out earlier in the tournament.

### Do Contests Among Superstars Explain the Trend?

Contests among superstars can explain large differences in incomes. But can contests explain the trend towards greater inequality with an increasing share of total income going to the super rich thereby boosting the income share of the highest quintile?

An idea first suggested by University of Chicago economist Sherwin Rosen suggests that a winner-takes-all contest can explain the trend. The key is that globalization has increased the market reach of the winner and increased the spread between the winner and the runners-up.

Global television audiences now watch all the world's major sporting events, and the total revenue generated by advertising spots during these events has increased. Competition among networks and cable and satellite television distributors has increased the fees that event organizers receive. And to attract the top star performers, prize money has increased and the winner gets the biggest share of the prize pot.

So the prizes in sports have become bigger and the share of income going to the “winner” has increased.

A similar story can be told about superstars and the super rich in business. As the cost of doing business on a global scale has fallen, more and more businesses have become global in their reach. Not only are large multinational corporations sourcing their inputs from far afield and selling in every country, they are also recruiting their top executives from a global talent pool. With a larger source of talent, and a larger total revenue, firms must make the “prize”—the reward for the top job—more attractive to compete for the best managers.

We've examined some sources of inequality in the labour market. Let's now look at the way inequality arises from unequal ownership of capital.

### Unequal Wealth

You've seen that wealth inequality—excluding human capital—is much greater than income inequality. This greater wealth inequality arises from two sources: life-cycle saving patterns and transfers of wealth from one generation to the next.

**Life-Cycle Saving Patterns** Over a family's life cycle, wealth starts out at zero or perhaps less than zero. A student who has financed education all the way through graduate school might have lots of human capital and an outstanding student loan of \$60,000. This person has negative wealth. Gradually loans get

paid off and a retirement fund is accumulated. At the point of retiring from full-time work, the family has maximum wealth. Then, during its retirement years, the family spends its wealth. This life-cycle pattern means that much of the wealth is owned by people in their sixties.

**Intergenerational Transfers** Some households inherit wealth from the previous generation. Some save more than enough on which to live during retirement and transfer wealth to the next generation. But these intergenerational transfers of wealth do not always increase wealth inequality. If a generation that has a high income saves a large part of that income and leaves wealth to a succeeding generation that has a lower income, this transfer decreases the degree of inequality. But one feature of intergenerational transfers of wealth leads to increased inequality: wealth concentration through marriage.

**Marriage and Wealth Concentration** People tend to marry within their own socioeconomic class—a phenomenon called *assortative mating*. In everyday language, “like attracts like.” Although there is a good deal of folklore that “opposites attract,” perhaps such Cinderella tales appeal to us because they are so rare in reality. Wealthy people seek wealthy partners.

Because of assortative mating, wealth becomes more concentrated in a small number of families and the distribution of wealth becomes more unequal.

### REVIEW QUIZ

- 1 What role does human capital play in accounting for income inequality?
- 2 What role might discrimination play in accounting for income inequality?
- 3 What role might contests among superstars play in accounting for income inequality?
- 4 How might technological change and globalization explain trends in the distribution of income?
- 5 Does inherited wealth make the distribution of income less equal or more equal?

Work these questions in Study Plan 19.3 and get instant feedback.

**MyEconLab**

Next, we're going to see how taxes and Canadian government programs redistribute income and decrease the degree of economic inequality.

## Income Redistribution

The three main ways in which governments in Canada redistribute income are:

- Income taxes
- Income maintenance programs
- Subsidized services

### Income Taxes

Income taxes may be progressive, regressive, or proportional. A **progressive income tax** is one that taxes income at an average rate that increases as income increases. A **regressive income tax** is one that taxes income at an average rate that decreases as income increases. A **proportional income tax** (also called a *flat-rate income tax*) is one that taxes income at a constant rate, regardless of the level of income.

The income tax rates that apply in Canada are composed of two parts: federal and provincial taxes. The highest income tax rates are in Quebec and the lowest are in Alberta. There is variety in the detailed tax arrangements in the individual provinces, but the tax system, at both the federal and provincial levels, is progressive.

The poorest Canadians pay no income tax. Even those who earn \$30,000 a year pay a very low rate of income tax. Those whose incomes are \$50,000 a year pay about 21 percent of their income in income taxes; those whose incomes are \$100,000 a year pay about 28 percent in income tax; and as incomes increase, the average tax rate increases to 45 percent or higher.

### Income Maintenance Programs

Three main types of programs redistribute income by making direct payments (in cash, services, or vouchers) to people in the lower part of the income distribution. They are:

- Social security
- Employment insurance
- Welfare

**Social Security** Four government programs—Old Age Security (OAS), Guaranteed Income Supplement (GIS), the Allowance, and the Allowance for the Survivor (AS)—ensure a minimum level of income for senior citizens. Cash

payments to retired or disabled workers or their surviving spouses are paid for by compulsory payroll taxes on both employers and employees. In 2014, the maximum OAS was \$558.71 a month, the maximum GIS for a single person was \$757.58, the maximum Allowance was \$1,061.05, and the maximum AS was \$1,187.05.

**Employment Insurance** To provide an income to unemployed workers, the federal government has established an unemployment compensation program. The Employment Insurance program is funded by employee and employer contributions, and after a qualifying period the worker is entitled to receive a benefit if he or she becomes unemployed. In 2014, the maximum unemployment benefit was 55 percent of gross weekly earnings over the previous 26 weeks, adjusted for the unemployment rate in his or her region of Canada to a maximum of \$514 per week.

**Welfare** Other welfare programs provide income maintenance for families and persons. They are:

1. Canada Social Transfer (CST), in support of post-secondary education, social assistance, and social services, including early childhood development, is administered by the provinces and provides basic assistance to cover the cost of food, clothing, personal and household items, and, in some provinces and territories, regularly recurring special needs.
2. Canada/Quebec Pension Plans, funded equally by employee and employer contributions, provide retirement benefits, survivor benefits, disability benefits, and death benefits.
3. Workers' Compensation, a provincial program funded by employers, is designed to provide financial assistance to, as well as medical care and rehabilitation of, workers injured at work.

### Subsidized Services

A great deal of redistribution takes place through the provision of subsidized services—services provided by the government at prices below the cost of production. The taxpayers who consume these goods and services receive a transfer in kind from the taxpayers who do not consume them. The two most important areas in which this form of redistribution takes place are education—both kindergarten through Grade 12 and college and university—and healthcare.

## Economics in Action

### Income Redistribution: Only the Richest Pay

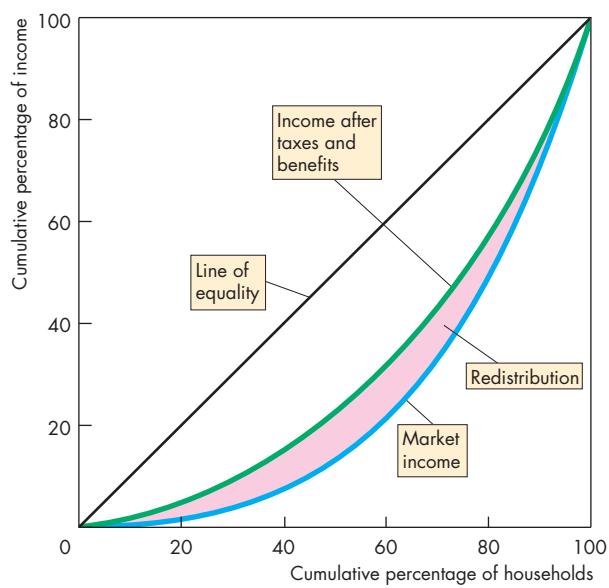
To determine the scale of income redistribution, we need to compare the distribution of *market income* with the distribution of *after-tax income*. The data available on benefits exclude the value of subsidized services (such as the value of university education and healthcare services), so the resulting distribution might underestimate the total amount of redistribution from the rich to the poor.

The figures show the scale of redistribution based on the calculations just described. In Fig. 1, the blue Lorenz curve describes the market distribution of income and the green Lorenz curve shows the distribution of income after all taxes and benefits. (The Lorenz curve based on total income—market income plus transfer payments from governments—lies between these two curves.)

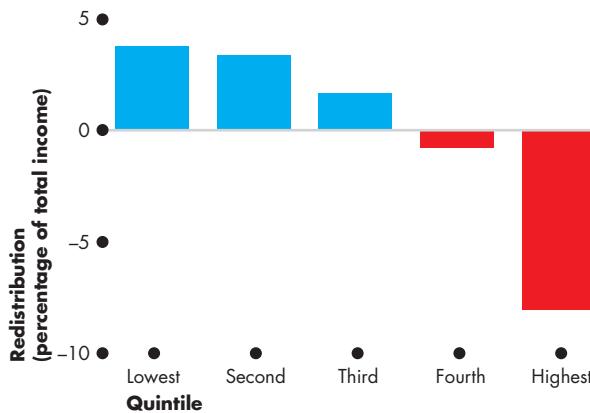
The distribution after taxes and benefits is much less unequal than the market distribution. In 2011, the lowest 20 percent of households received only 1 percent of market income but 4.8 percent of after-tax income. The second-lowest 20 percent of households received 7.2 percent of market income but 10.6 percent of after-tax income. The highest 20 percent of households received 52.3 percent of market income but only 44.2 percent of after-tax income.

Figure 2 highlights the percentage of total income redistributed among the five groups. The share of total income received by the lowest three quintiles (60 percent) of households increased. The share received by the lowest quintile increased by 3.8 percent, and the share received by the second-lowest quintile increased by 3.4 percent. The share of total income received by the fourth quintile fell slightly. And the share of total income received by the highest quintile fell by 8.1 percent of total income.

Canadian students enrolled in the universities in Ontario pay annual tuition fees of around \$5,000. This tuition fee is much less than the cost of a year's education. The cost of a year of university education is about \$20,000. Thus families with members enrolled in these institutions receive a benefit from the government of about \$15,000 per student per



**Figure 1 Income Distribution Before and After Redistribution**



**Figure 2 The Scale of Redistribution**

Source of data: Statistics Canada CANSIM Table 202-0701.

year. Those with several college or university students receive proportionately higher benefits.

Government provision of healthcare to all residents has brought high-quality and high-cost healthcare to millions of people who earn too little to buy such services themselves. As a result, this program has contributed to reducing inequality.

## The Big Tradeoff

The redistribution of income creates what has been called the **big tradeoff**, a tradeoff between equity and efficiency.

You learned in Chapter 5 that there are two views about equity (or fairness): the *fair-rules* view and the *fair-results* view. The fair-rules view doesn't present a tradeoff between equity and efficiency because voluntary transactions are efficient, and even if they result in inequality they are considered fair.

The big tradeoff arises from the fair-results view of equity. On this view, more equal is fairer: less equal is less fair. But there is a tradeoff—a big tradeoff—because redistributing income and wealth to achieve greater equality ends up creating inefficiencies.

There are two sources of inefficiency from redistributing income and wealth:

- Administrative cost
- Deadweight loss

**Administrative Cost** A dollar collected from a rich person does not translate into a dollar received by a poor person. Some of the dollar collected gets used up in the process of redistribution. Tax-collecting agencies such as the Canada Revenue Agency and welfare-administering agencies (as well as tax accountants and lawyers) use skilled labour, computers, and other scarce resources to do their work. The bigger the scale of redistribution, the greater is the opportunity cost of administering it.

But the cost of collecting taxes and making welfare payments is a small part of the total cost of redistribution.

**Deadweight Loss** The bigger cost of redistributing income and wealth arises from allocative inefficiency—from deadweight loss—of taxes and benefits.

Greater equality can be achieved only by taxing productive activities—from taxing work and saving. Taxing people's income from their work and saving lowers the after-tax income they receive. This lower after-tax income makes them work and save less, which in turn results in smaller output and less consumption not only for the rich who pay the taxes but also for the poor who receive the benefits.

It is not only taxpayers who face weaker incentives to work. Benefit recipients also face weaker incentives. In fact, under the welfare arrangements that prevail in Canada today, households that benefit

most from welfare face the weakest incentive to work. When a welfare recipient gets a job, benefits are withdrawn and eligibility for support is withdrawn. In effect, these households face a marginal tax rate of more than 100 percent on their earnings. This arrangement locks poor households in a welfare trap.

So the scale and methods of income redistribution must pay close attention to the incentive effects of taxes and benefits.

## A Major Welfare Challenge

The poorest people in Canada are women who have not completed high school, have a child (or children), and live without a partner. Single mothers present a major welfare challenge. Their numbers are large—approximately 1 million—and their economic plight and the economic prospects for their children are serious.

For physically fit single mothers, the long-term solution to their problem is education and on-the-job training—acquiring human capital. The short-term solution is welfare. But welfare must be designed to minimize the disincentive to pursue the long-term goal. This is the central challenge in designing an effective welfare program.

## REVIEW QUIZ

- 1 How do governments in Canada redistribute income?
- 2 Describe the scale of redistribution in Canada.
- 3 What is the big tradeoff? Why does it arise?
- 4 What is one of the major welfare challenges today and how is it being tackled in Canada?

Work these questions in Study Plan 19.4 and get instant feedback. Do a Key Terms Quiz.

**MyEconLab**

◆ We've examined economic inequality in Canada. We've seen how inequality arises and that on some measures, inequality has been increasing. *Economics in the News* on pp. 456–457 looks at the changing pattern of inequality in Canada's most and least unequal provinces.



# The Most Equal and Unequal Places in Canada

## The Rich Get Richer and Especially in Alberta

January 28, 2013

In a survey of tax filers, Statistics Canada discovered that in 2010 the top 1 percent of tax filers (about 255,000 people) received 10.6 percent of total income. This percentage was down from a peak of 12.1 percent in 2006 but up from 7.0 percent of total income in 1980. The percentage increased to 8.0 percent in the early 1990s and to 11.0 percent by the early 2000s.

Statistics Canada broke the data down by provinces and cities, and the Canadian Centre for Policy Alternatives (CCPA) commented on these numbers. It noted that in the three largest cities—Vancouver, Toronto, and Montreal—a person in the bottom 90 percent made less in 2010 than in 1982.

CCPA senior economist David Macdonald said “No province has managed to become more equal since 1980.”

Both the CCPA and the CBC noted the wide and widening gap in Alberta, the most unequal province. The average among the richest 1 percent of Albertans received an income 18 times that of the average in the bottom 90 percent. The incomes of the top 1 percent of Albertans doubled between 1982 and 2010, while the incomes of the bottom 90 percent of Albertans increased by only \$3,900 over the same years.

Between 1990 and 2010, Alberta’s share of the top 1 percent of filers doubled from 10 percent to 20 percent, while Ontario’s proportion fell from 51 percent to 43 percent.

Prince Edward Island is the most equal province. There, the average person in the top 1 percent receives only 8 times the average of the bottom 90 percent.

With information from Statistics Canada, the CBC, and the Canadian Centre for Policy Alternatives.

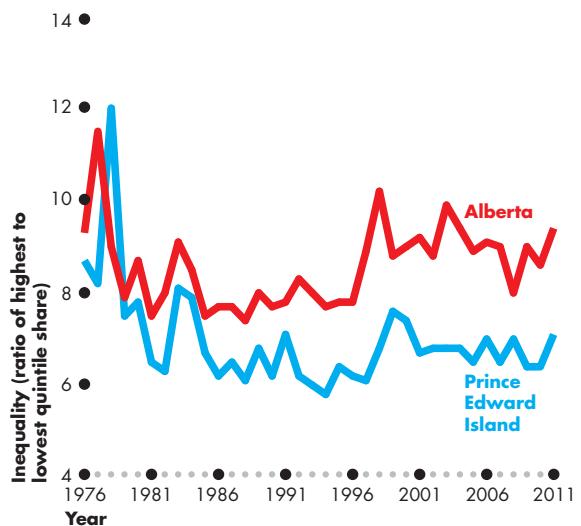
### ESSENCE OF THE STORY

- Statistics Canada has examined the data on income inequality in Canada between 1980 and 2010.
- The gap between the top 1 percent and the rest has been rising.
- In Vancouver, Toronto, and Montreal, the bottom 90 percent made less in 2010 than they did in 1982.
- Income in no province has become more equal since 1980.
- Alberta is the province with the most unequal income distribution, and Prince Edward Island has the most equal distribution.

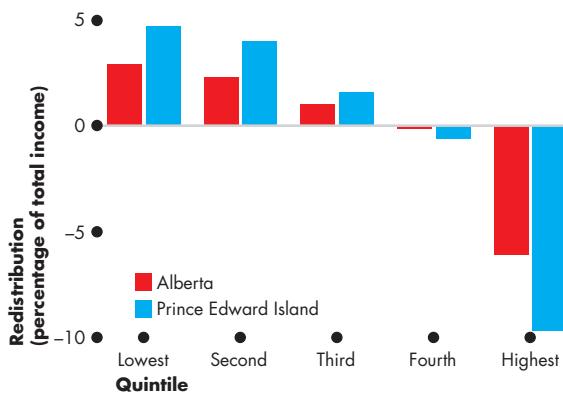
[MyEconLab More Economics in the News](#)

## ECONOMIC ANALYSIS

- The data in the news item provide a picture of inequality that points in one clear direction: The very rich have been getting a lot richer and the rest have either stood still or gone backward.
- Two questions arise: Do all the data point to increased inequality; and if inequality has increased, is that a problem or a sign of a normally functioning market economy?
- The data are not unambiguous about the overall change in inequality.
- The data for Canada as a whole (*Economics in Action* on p. 443 and the Gini ratio, p. 444) show increased inequality during the 1990s and a sharp rise in the income share of the top 1 percent.
- But the broader quintile shares show only a small increase in inequality.
- Another way of looking at what the quintile shares tell us is to find the ratio of the incomes of the top quintile to those of the bottom quintile. That ratio rises with increased inequality.
- Figure 1 shows this ratio for Alberta (the most unequal province) and Prince Edward Island (the most equal province).
- The data in Fig. 1 show that Alberta is indeed more unequal than Prince Edward Island and has become more unequal during the 1990s. But the data show no increased inequality in Prince Edward Island.
- Government redistribution has a big effect on quintile shares, and Fig. 2 shows its effects in Alberta and Prince Edward Island.
- Prince Edward Island, shown by the blue bars, redistributes much more than does Alberta, shown by the red bars.
- Is increased inequality a problem or a sign of a well-functioning economy?
- One check on whether it is a problem is the change in median income. Median income is the income of the family at the centre of the income distribution. The median is not affected by what is happening at the extremes.
- Between 2000 and 2012, median incomes increased by 22 percent in Prince Edward Island and by 34 percent in Alberta, and these numbers are after removing the effects of the rise in the cost of living. Incomes have not stood still.



**Figure 1 Inequality in Alberta and Prince Edward Island Compared**



Source of data: Statistics Canada, CANSIM Table 282-0070.

- One check on whether increased inequality is a problem is the relationship between inequality and median income. Do inequality and high incomes go together?
- They do. The more unequal Alberta has a median family income that is 33 percent higher than in the less unequal Prince Edward Island.
- The comparison of Alberta and Prince Edward Island reminds us about the big tradeoff: A competitive market economy generates inequality, and income (and wealth) can be redistributed but only by measures that lower the average income.

## SUMMARY

### Key Points

#### Measuring Economic Inequality (pp. 440–445)

- In 2011, the mode after-tax household income was between \$30,000 and \$34,999 a year, the median after-tax income was \$50,700, and the mean after-tax income was \$63,000.
- The income distribution is positively skewed.
- In 2011, the poorest 20 percent of households received 4.8 percent of total after-tax income and the wealthiest 20 percent received 44.2 percent of total after-tax income.
- Wealth is distributed more unequally than income because the wealth data exclude the value of human capital.
- Between 1976 and 2011, the distribution of income has become more unequal.
- Education, type of household, and age and sex of householder all influence household income.

Working Problems 1 and 2 will give you a better understanding of economic inequality in Canada.

#### Inequality in the World Economy (pp. 446–447)

- Incomes are distributed most unequally in Brazil and South Africa and least unequally in Finland, Sweden, and some other European economies.
- The Canadian income distribution lies between the extremes.
- The distribution of income across individuals in the global economy is much more unequal than in Canada.
- The global income distribution has been getting less unequal as rapid income growth in China and India has lifted millions from poverty.

Working Problems 3 to 5 will give you a better understanding of economic inequality in the world economy.

### Key Terms

After-tax income, 440  
Big tradeoff, 455  
Gini ratio, 444  
Lorenz curve, 441

Low-income cut-off, 445  
Market income, 440  
Poverty, 445  
Progressive income tax, 453

### MyEconLab Key Terms Quiz

Proportional income tax, 453  
Regressive income tax, 453  
Total income, 440  
Wealth, 442

#### The Sources of Economic Inequality (pp. 448–452)

- Inequality arises from differences in human capital and from contests among superstars.
- Trends in the distribution of human capital and in the rewards to superstars that arise from technological change and globalization can explain some of the trend in increased inequality.
- Inequality might arise from discrimination.
- Inequality between men and women might arise from differences in the degree of specialization.
- Intergenerational transfers of wealth lead to increased inequality, and assortative mating tends to concentrate wealth.

Working Problem 6 will give you a better understanding of the sources of economic inequality.

#### Income Redistribution (pp. 453–455)

- Governments redistribute income through progressive income taxes, income maintenance programs, and subsidized services.
- Redistribution increases the share of total income received by the lowest 60 percent of households and decreases the share of total income received by the two highest quintiles.
- Because the redistribution of income weakens incentives, it creates a tradeoff between equity and efficiency.
- Effective redistribution seeks to support the long-term solution to low income, which is education and job training—acquiring human capital.

Working Problems 7 and 8 will give you a better understanding of income redistribution.



## WORKED PROBLEM

**MyEconLab** You can work this problem in Chapter 19 Study Plan.

The table shows the quintile shares of income in South Africa and Norway.

Households (quintile)	Norway (percentage of total income)	South Africa (percentage of total income)
Lowest	10	3
Second	16	5
Third	19	8
Fourth	22	16
Highest	33	68

### Questions

1. Make a table to show the cumulative percentage of income against the cumulative percentage of households in Norway and find five points on the Lorenz curve for Norway.
2. Is income in Norway distributed more equally or less equally than in South Africa? Explain.
3. If the government of South Africa redistributed income so that its distribution matched that of Norway, which quintiles would see their incomes increase and which would decrease?

### Solutions

1. To make a cumulative distribution table start with the lowest quintile (20 percent of households) who receive 10 percent of total income. Now add the income share of the second 20 percent of households to show that the lowest 40 percent of households receive  $10 + 16 = 26$  percent of income. Repeating: The lowest 60 percent receive  $26 + 19 = 45$  percent of income, the lowest 80 percent receive  $45 + 22 = 67$  percent, and 100 percent receive  $67 + 33 = 100$  percent.

Households		Income	
Percentage	Cumulative percentage	Percentage	Cumulative percentage
Lowest 20	20	10	10
Second 20	40	16	26
Third 20	60	19	45
Fourth 20	80	22	67
Highest 20	100	33	100

The Lorenz curve shows the percentages of total income received by the cumulative percentages of

households. The rows of the table below show the five points. See the blue curve in the figure.

Households (percentage)	Cumulative percentage
Lowest 20	10
Lowest 40	26
Lowest 60	45
Lowest 80	67
All 100	100

**Key Point:** To calculate the cumulative distribution, start with the lowest quintile's share and gradually add the next higher quintile's share.

2. Each quintile in Norway except the highest quintile receives a larger percentage of income than does the corresponding quintile in South Africa. So income is more equally distributed in Norway than in South Africa. See the figure.

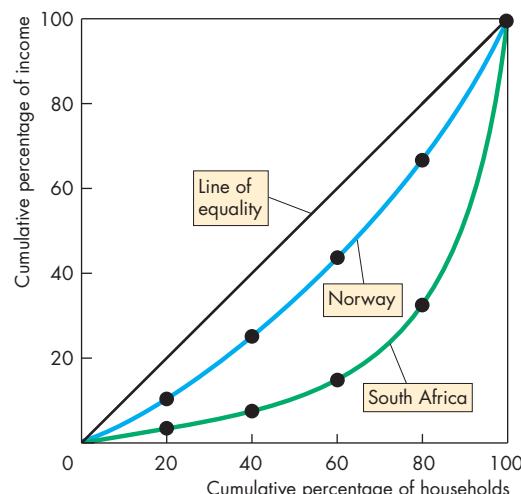
**Key Point:** The closer is the Lorenz curve to the line of equality, the more equal is the distribution.

3. To make South Africa's distribution match Norway's, the lowest quintile would have to receive an additional 7 percent of income. The second quintile would have to receive an additional 11 percent, the third quintile an additional 11 percent, and the fourth quintile an additional 6 percent. The second and third quintiles would receive the biggest increase, and only the highest quintile would have a smaller income.

**Key Point:** To make the distribution more equal, redistribute income from the highest to the others.

### Key Figure

[MyEconLab Interactive Animation](#)





## STUDY PLAN PROBLEMS AND APPLICATIONS

**MyEconLab** You can work Problems 1 to 8 in Chapter 19 Study Plan and get instant feedback.

### Measuring Economic Inequality (Study Plan 19.1)

- What is after-tax income? Describe the distribution of after-tax income in Canada in 2011.
- The table shows after-tax income shares in Canada in 1986.

Households (quintile)	After-tax income (percent of total)
Lowest	5.5
Second	11.4
Third	17.6
Fourth	24.7
Highest	40.8

- Draw a Lorenz curve for Canada in 1986 and compare it with the Lorenz curve in 2011 shown in Fig. 19.3 on p. 441.
- Was Canadian after-tax income distributed more equally or less equally in 2011 than it was in 1986?

### Inequality in the World Economy (Study Plan 19.2)

- Incomes in China and India are a small fraction of incomes in Canada. But incomes in China and India are growing at more than twice the rate of those in Canada.
  - Explain how economic inequality in China and India is changing relative to that in Canada.
  - Explain how the world Lorenz curve and world Gini ratio are changing.

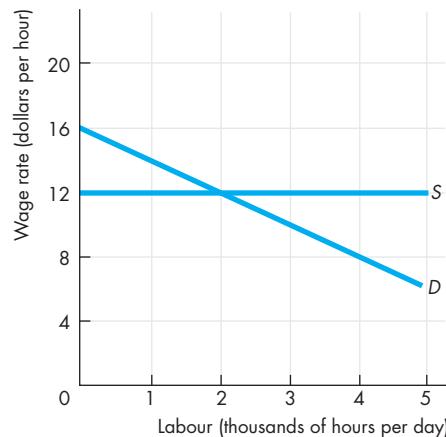
Use the following table to work Problems 4 and 5. The table shows the income shares in the United States and the United Kingdom.

Households (quintile)	U.S. income (percentage of total)	U.K. income (percentage of total)
Lowest	3	3
Second	9	5
Third	15	14
Fourth	23	25
Highest	50	53

- Draw the U.K. Lorenz curve and compare it with the Lorenz curve in Fig. 19.3 on p. 441. In which country is income less equally distributed?
- Draw the U.S. Lorenz curve and compare it with the Lorenz curve in Fig. 19.3 on p. 441. In which country is income less equally distributed?

### The Sources of Economic Inequality (Study Plan 19.3)

- The following figure shows the market for low-skilled labour.



The value of marginal product of high-skilled workers is \$16 an hour greater than that of low-skilled workers at each quantity of labour. The cost of acquiring human capital adds \$12 an hour to the wage that must be offered to attract high-skilled labour.

Compare the equilibrium wage rates of low-skilled labour and high-skilled labour. Explain why the difference between these wage rates equals the cost of acquiring human capital.

### Income Redistribution (Study Plan 19.4)

Use the following table to work Problems 7 and 8. The table shows three redistribution schemes.

Before-tax income (dollars)	Plan A tax (dollars)	Plan B tax (dollars)	Plan C tax (dollars)
10,000	1,000	1,000	2,000
20,000	2,000	4,000	2,000
30,000	3,000	9,000	2,000

- Which scheme has a proportional tax? Which scheme has a regressive tax? Which scheme has a progressive tax?
  - Which scheme will increase economic inequality? Explain why.
  - Which scheme will reduce economic inequality? Explain why.
  - Which scheme will have no effect on economic inequality? Explain why.

## ◆ ADDITIONAL PROBLEMS AND APPLICATIONS

### MyEconLab

You can work these problems in MyEconLab if assigned by your instructor.

#### Measuring Economic Inequality

Use the following table to work Problems 9 and 10. The table shows the distribution of market income in Canada in 2011.

Households (quintiles)	Market income (percentage of total)
Lowest	1.0
Second	7.2
Third	14.6
Fourth	24.9
Highest	52.3

9. a. What is the definition of market income?  
b. Draw the Lorenz curve for the distribution of market income.
10. Compare the distribution of market income with the distribution of after-tax income shown in Fig. 19.3 on p. 441. Which distribution is more unequal and why?

#### Inequality in the World Economy

Use the following table to work Problems 11 to 13. The table shows shares of income in Australia.

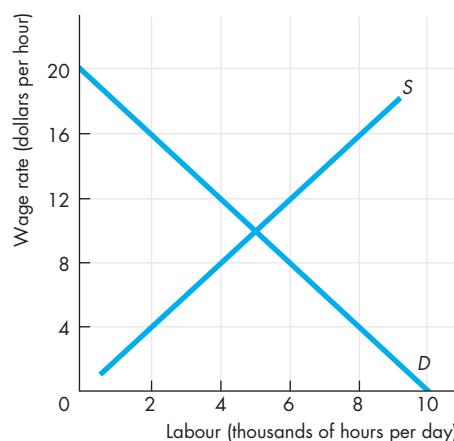
Households (quintile)	Income share (percentage of total)
Lowest	7
Second	13
Third	18
Fourth	24
Highest	38

11. Draw the Lorenz curve for the income distribution in Australia and in Brazil and South Africa (use the data in Fig. 19.7 on p. 446). Is income distributed more equally or less equally in Brazil and South Africa than in Australia?
12. Is the Gini ratio for Australia larger or smaller than that for Brazil and South Africa? Explain your answer.
13. What are some reasons for the differences in the distribution of income in Australia and in Brazil and South Africa?

#### The Sources of Economic Inequality

14. The figure shows the market for a group of workers who are discriminated against. Suppose that other workers in the same industry are not

discriminated against and their value of marginal product is perceived to be twice that of the workers who are discriminated against. Suppose also that the supply of these other workers is 2,000 hours per day less at each wage rate.



- a. What is the wage rate of the workers who are discriminated against?  
b. What is the quantity of workers employed who are discriminated against?  
c. What is the wage rate of the workers who do not face discrimination?  
d. What is the quantity of workers employed who do not face discrimination?

#### 15. Where Women's Pay Trumps Men's

Men work more than women on the job, at least in terms of overall hours. That's just one reason why, in most fields, men's earnings exceed women's earnings. But Warren Farrell found 39 occupations in which women's median earnings exceeded men's earnings by at least 5 percent and in some cases by as much as 43 percent. In fields like engineering, a company may get one woman and seven men applying for a job. If the company wants to hire the woman, it might have to pay a premium to get her. Also, where women can combine technical expertise with people skills—such as those required in sales and where customers prefer dealing with a woman—that's likely to contribute to a premium in pay.

Source: CNN, March 2, 2006

- a. Draw a graph to illustrate why discrimination could result in female workers getting paid more than male workers for some jobs.

- b. Explain how market competition could potentially eliminate this wage differential.
- c. If customers “prefer dealing with a woman” in some markets, how might that lead to a persistent wage differential between men and women?

### Income Redistribution

16. Use the information provided in Problem 9 and in Fig. 19.3 on p. 441.
  - a. What is the percentage of total income that is redistributed from the highest income group?
  - b. What percentages of total income are redistributed to the lower income groups?
17. Describe the effects of increasing the amount of income redistribution in Canada to the point at which the lowest income group receives 15 percent of total income and the highest income group receives 30 percent of total income.

Use the following news clip to work Problems 18 and 19.

### Income Gap Growing

In 2009, people in the highest quintile had 24.6 times as much market income as those in the lowest quintile, but after taxes and transfers the people in the highest quintile had 9.1 times as much income as those in the lowest quintile.

In 1989, the people in the highest quintile had 7.2 times more income after taxes and transfers than those in the lowest quintile.

In 1990, 82.9 percent of the unemployed received unemployment benefits. In 2009, 47.8 percent of the unemployed received unemployment benefits.

Source: Conference Board of Canada, July 13, 2011

18. Explain what the information provided in the news clip implies about the effects of income redistribution policies on the income gap between the richest and poorest Canadians.
19. How have changes in Employment Insurance changed the income gap between the richest and the poorest Canadians?

### Economics in the News

20. After you have studied *Economics in the News* on pp. 456–457, answer the following questions.
  - a. What are the broad facts reported in the news article about the changes in the income distribution in Canada’s three big cities?
  - b. Describe two ways of determining inequality and its trend.
  - c. How does inequality and average income differ in Alberta and Prince Edward Island? What is the relationship between inequality and the average income in these provinces?
  - d. Describe and compare the scale of income redistribution in Alberta and Prince Edward Island.
  - e. What are the implications of the Alberta and Prince Edward Island data for the big tradeoff?

21. **The Best and Worst Degrees by Salary**

Business administration is always a strong contender for honours as the most popular university major. This is no surprise since students think business is the way to make big bucks. But is business administration really as lucrative as students and their parents believe? Nope.

In a new survey by PayScale, Inc. of salaries by degree, business administration didn’t even break into the list of the top 10 or 20 most lucrative degrees. A variety of engineering majors claim eight of the top 10 salary spots with chemical engineering (\$65,700) winning best for starting salaries. Out of 75 undergrad majors, business administration (\$42,900) came in 35th, behind such degrees as occupational therapy (\$61,300), information technology (\$49,400), and economics (\$48,800).

Source: moneywatch.com, July 21, 2009

- a. Why do university graduates with different majors have drastically different starting salaries?
- b. Draw a graph of the labour markets for economics majors and business administration majors to illustrate your explanation of the differences in the starting salaries of these two groups.

# For Whom?

## PART SIX

### UNDERSTANDING FACTOR MARKETS AND INEQUALITY

During the past 35 years, the gap between the richest and the poorest in Canada has widened. But millions in Asia have been lifted from poverty and are now enjoying a high and rapidly rising standard of living. What are the forces that generate these trends? The answer to this question is the forces of demand and supply in factor markets. These forces determine wages, interest rates, rents, and the prices of natural resources. These forces also determine people's incomes.

In Canada, human capital and entrepreneurship are the most prized resources, and their incomes have grown most rapidly. In Asia, labour has seen its wage rates transformed. And in all regions rich in oil, incomes have risen on the back of high and fast-rising energy prices.

Many outstanding economists have advanced our understanding of factor markets and the role they play in helping to resolve the conflict between the demands of humans and the resources available. One of them was Thomas Robert Malthus.

Another was Harold Hotelling, whose prediction of an ever-rising price of nonrenewable natural resources implies an ever-falling rate of their use and an intensifying search for substitutes.

Yet another was Julian Simon, who challenged both the Malthusian gloom and the Hotelling Principle. He believed that people are the “ultimate resource” and predicted that a rising population lessens the pressure on natural resources. A bigger population provides a larger number of resourceful people who can discover more efficient ways of using scarce resources.

**Thomas Robert Malthus (1766–1834), an English clergyman and economist, was an extremely influential social scientist. In his best-selling *An Essay on the Principle of Population*, published in 1798, he predicted that population growth would outstrip food production and said that wars, famine, and disease were inevitable unless population growth was held in check by marrying at a late age and living a celibate life. (He married at 38 a wife of 27—marriage ages that he recommended for others.)**

Malthus had a profound influence on Charles Darwin, who got the key idea that led him to the theory of natural selection from *An Essay on the Principle of Population*. But it was also Malthus' gloomy predictions that made economics the “dismal science.”

*The passion between the sexes has appeared in every age to be so nearly the same, that it may always be considered, in algebraic language, as a given quantity.*

**THOMAS ROBERT MALTHUS**  
*An Essay on the Principle of Population*





TALKING WITH

Raj Chetty\*



RAJ CHETTY is the William Henry Bloomberg Professor of Economics at Harvard University, where he was also an undergraduate, earning his BA *summa cum laude* in 2000, and graduate student, completing his Ph.D. in 2003.

Professor Chetty is also Director of Harvard's Lab for Economic Applications and Policy, Co-Director of the Public Economics Program of the National Bureau of Economic Research, a member of the Congressional Budget Office Panel of Economic Advisers, and editor of the *Journal of Public Economics*.

His list of honours is extraordinarily long and includes the 2013 John Bates Clark Medal of the American Economic Association, awarded to the best economist under 40 years of age; the National Tax Association Best Dissertation Prize in 2003; and the Harris, Hoopes, and Williams Prizes for the best thesis and undergraduate in economics at Harvard in 2000.

He has published more than 20 papers in leading journals on a wide range of policy issues and has come up with interesting answers, some of which he describes here.

Michael Parkin talked with Raj Chetty about his research and what we learn from it about how to design more effective government policies.

*Every economics student learns that tax incidence and deadweight loss depend on elasticities of supply and demand, and that one of the most crucial elasticities is that of the supply of labour. What does your work tell us about this elasticity? Is labour supply elastic or inelastic?*

It is true that labour supply elasticity is a key determinant of the deadweight loss from income taxation. If people are very responsive in how much they work, that is, if labour supply is very elastic with respect to tax rates, then having high tax rates will generate a lot of inefficiency.

My work has shown that the picture is actually quite a bit more complicated than that because there are many other factors that affect how people respond to tax changes beyond what we have in standard economic models.

To take one example, we usually assume that people perfectly understand and pay attention to the

... labour supply might be somewhat elastic in the long run ... [but in the short run] may not be very elastic.

complicated income tax system that we face today. But we have a number of studies showing that, in fact, many people aren't aware of tax rates they face, don't really pay attention to tax changes, and may not, at least in the short run, respond by changing the amount they work when the tax code is changed in complicated ways.

The bottom line is that labour supply might be somewhat elastic in the long run if you've got very high tax rates, say, as in European economies for 50 years consistently. People might start to think "Oh, I don't get to keep so much of my paycheque, maybe it doesn't pay to work." With a short-run tax increase of 5 or 10 percent, our growing sense is that people may not respond as much, and labour supply may not be very elastic.

\*Read the full interview with Raj Chetty in [MyEconLab](#).

**Abatement technology** A production technology that reduces or prevents pollution. (p. 373)

**Absolute advantage** A person has an absolute advantage if that person is more productive than another person. (p. 40)

**After-tax income** Total income minus tax payments by households to governments. (p. 440)

**Allocative efficiency** A situation in which goods and services are produced at the lowest possible cost and in the quantities that provide the greatest possible benefit. We cannot produce more of any good without giving up some of another good that we *value more highly*. (p. 35)

**Anti-combine law** A law that regulates oligopolies and prevents them from becoming monopolies or behaving like monopolies. (p. 356)

**Average cost pricing rule** A rule that sets price to cover cost including normal profit, which means setting the price equal to average total cost. (p. 314)

**Average fixed cost** Total fixed cost per unit of output. (p. 254)

**Average product** The average product of a factor of production. It equals total product divided by the quantity of the factor employed. (p. 249)

**Average total cost** Total cost per unit of output. (p. 254)

**Average variable cost** Total variable cost per unit of output. (p. 254)

**Barrier to entry** A natural or legal constraint that protects a firm from potential competitors. (p. 298)

**Behavioural economics** A study of the ways in which limits on the human brain's ability to compute and implement rational decisions influences economic behaviour—both the decisions that people make and the consequences of those decisions for the way markets work. (p. 192)

**Benefit** The benefit of something is the gain or pleasure that it brings and is determined by preferences. (p. 9)

**Big tradeoff** The tradeoff between efficiency and fairness. (pp. 117, 455)

**Bilateral monopoly** A situation in which a monopoly seller faces a monopsony buyer. (p. 423)

**Black market** An illegal market in which the equilibrium price exceeds the legally imposed price ceiling. (p. 128)

**Budget line** The limit to a household's consumption choices. It marks the boundary between those combinations of goods and services that a household can afford to buy and those that it cannot afford. (pp. 178, 202)

**Capital** The tools, equipment, buildings, and other constructions that businesses use to produce goods and services. (p. 4)

**Capital accumulation** The growth of capital resources, including *human capital*. (p. 38)

**Capture theory** A theory that regulation serves the self-interest of the producer, who captures the regulator and maximizes economic profit. (p. 313)

**Cartel** A group of firms acting together—colluding—to limit output, raise the price, and increase economic profit. (p. 343)

**Ceteris paribus** Other things being equal—all other relevant things remaining the same. (p. 24)

**Change in demand** A change in buyers' plans that occurs when some influence on those plans other than the price of the good changes. It is illustrated by a shift of the demand curve. (p. 58)

**Change in supply** A change in sellers' plans that occurs when some influence on those plans other than the price of the good changes. It is illustrated by a shift of the supply curve. (p. 63)

**Change in the quantity demanded** A change in buyers' plans that occurs when the price of a good changes but all other influences on buyers' plans remain unchanged. It is illustrated by a movement along the demand curve. (p. 61)

**Change in the quantity supplied** A change in sellers' plans that occurs when the price of a good changes but all other influences on sellers' plans remain unchanged. It is illustrated by a movement along the supply curve. (p. 64)

**Coase theorem** The proposition that if property rights exist, if only a small number of parties are involved, and transaction costs are low, then private transactions are efficient, and it doesn't matter who has the property rights. (p. 374)

**Collusive agreement** An agreement between two (or more) producers to form a cartel to restrict output, raise the price, and increase profits. (p. 346)

**Command system** A method of allocating resources by the order (command) of someone in authority. In a firm a managerial hierarchy organizes production. (pp. 106, 229)

**Common resource** A resource that is rival and nonexcludable. (p. 392)

**Comparative advantage** A person or country has a comparative advantage in an activity if that person or country can perform the activity at a lower opportunity cost than anyone else or any other country. (p. 40)

**Competitive market** A market that has many buyers and many sellers, so no single buyer or seller can influence the price. (p. 56)

**Complement** A good that is used in conjunction with another good. (p. 59)

**Constant returns to scale** Features of a firm's technology that lead to constant long-run average cost as output increases. When constant returns to scale are present, the *LRAC* curve is horizontal. (p. 262)

**Consumer equilibrium** A situation in which a consumer has allocated all his or her available income in the way that, given the prices of goods and services, maximizes his or her total utility. (p. 181)

**Consumer surplus** The excess of the benefit received from a good over the amount paid for it. It is calculated as the marginal benefit (or value) of a good minus its price, summed over the quantity bought. (p. 109)

**Contestable market** A market in which firms can enter and leave so easily that firms in the market face competition from *potential* entrants. (p. 354)

**Cooperative equilibrium** The outcome of a game in which the players make and share the monopoly profit. (p. 352)

**Copyright** A government-sanctioned exclusive right granted to an inventor of a good, service, or productive process to produce, use, and sell the invention for a given number of years. (p. 383)

**Cross elasticity of demand** The responsiveness of the demand for a good to a change in the price of a substitute or complement, other things remaining the same. It is calculated as the percentage change in the quantity demanded of the good divided by the percentage change in the price of the substitute or complement. (p. 92)

**Deadweight loss** A measure of inefficiency. It is equal to the decrease in total surplus that results from an inefficient level of production. (p. 114)

**Demand** The entire relationship between the price of the good and the quantity demanded of it when all other influences on buyers' plans remain the same. It is illustrated by a demand curve and described by a demand schedule. (p. 57)

**Demand curve** A curve that shows the relationship between the quantity demanded of a good and its price when all other influences on consumers' planned purchases remain the same. (p. 58)

**Deregulation** The process of removing regulation of prices, quantities, entry, and other aspects of economic activity in a firm or industry. (p. 313)

**Derived demand** Demand for a factor of production—it is derived from the demand for the goods and services produced by that factor. (p. 415)

**Diminishing marginal rate of substitution** The general tendency for a person to be willing to give up less of good  $y$  to get one more unit of good  $x$ , while at the same time remaining indifferent as the quantity of good  $x$  increases. (p. 206)

**Diminishing marginal returns** The tendency for the marginal product of an additional unit of a factor of production to be less than the marginal

product of the previous unit of the factor. (p. 251)

**Diminishing marginal utility** The tendency for marginal utility to decrease as the quantity consumed of a good increases. (p. 180)

**Direct relationship** A relationship between two variables that move in the same direction. (p. 18)

**Diseconomies of scale** Features of a firm's technology that make average total cost rise as output increases—the *LRAC* curve slopes upward. (p. 262)

**Dominant strategy equilibrium** An equilibrium in which the best strategy for each player is to cheat *regardless of the strategy of the other player*. (p. 345)

**Dumping** The sale by a foreign firm of exports at a lower price than the cost of production. (p. 164)

**Dupopoly** An oligopoly market in which two producers of a good or service compete. (p. 342)

**Economic depreciation** The fall in the market value of a firm's capital over a given period. (p. 225)

**Economic efficiency** A situation that occurs when the firm produces a given output at the least cost. (p. 227)

**Economic growth** The expansion of production possibilities. (p. 38)

**Economic model** A description of some aspect of the economic world that includes only those features of the world that are needed for the purpose at hand. (p. 11)

**Economic profit** A firm's total revenue minus its total cost, with total cost measured as the opportunity cost of production. (p. 224)

**Economic rent** Any surplus—consumer surplus, producer surplus, or economic profit. (p. 306)

**Economics** The social science that studies the *choices* that individuals, businesses, governments, and entire societies make as they cope with *scarcity* and the *incentives* that influence and reconcile those choices. (p. 2)

**Economies of scale** Features of a firm's technology that make average total cost fall as output increases—the *LRAC* curve slopes downward. (pp. 238, 262)

**Economies of scope** Decreases in average total cost that occur when a firm uses specialized resources to produce a range of goods and services. (p. 239)

**Efficient** Resource use is efficient if it is *not* possible to make someone better off without making someone else worse off. (p. 5)

**Efficient scale** The quantity at which average total cost is a minimum—the quantity at the bottom of the U-shaped *ATC* curve. (p. 328)

**Elastic demand** Demand with a price elasticity greater than 1; other things remaining the same, the percentage change in the quantity demanded exceeds the percentage change in price. (p. 86)

**Elasticity of supply** The responsiveness of the quantity supplied of a good to a change in its price, other things remaining the same. (p. 94)

**Entrepreneurship** The human resource that organizes the other three factors of production: labour, land, and capital. (p. 4)

**Equilibrium price** The price at which the quantity demanded equals the quantity supplied. (p. 66)

**Equilibrium quantity** The quantity bought and sold at the equilibrium price. (p. 66)

**Excess capacity** A firm has excess capacity if it produces below its efficient scale. (p. 328)

**Excludable** A good or service or a resource is excludable if it is possible to prevent someone from enjoying the benefit of it. (p. 392)

**Exports** The goods and services that we sell to people in other countries. (p. 152)

**Externality** A cost of or a benefit from an action that falls on someone other than the person or firm choosing the action. (p. 370)

**Factors of production** The productive resources used to produce goods and services. (p. 3)

**Firm** An economic unit that hires factors of production and organizes those factors to produce and sell goods and services. (pp. 44, 224)

**Four-firm concentration ratio** A measure of market power that is calculated as the percentage of the value of sales accounted for by the four largest firms in an industry. (p. 234)

**Free-rider problem** The problem that the market would provide an inefficiently small quantity of a public good. (p. 393)

**Game theory** A set of tools for studying strategic behaviour—behaviour that takes into account the expected behaviour of others and the recognition of mutual interdependence. (p. 344)

**Gini ratio** The ratio of the area between the line of equality and the Lorenz curve to the entire area beneath the line of equality. (p. 444)

**Goods and services** The objects that people value and produce to satisfy human wants. (p. 3)

**Herfindahl–Hirschman Index** A measure of market power that is calculated as the square of the market share of each firm (as a percentage) summed over the largest 50 firms (or over all firms if there are fewer than 50) in a market. (p. 234)

**Hotelling Principle** The idea that traders expect the price of a nonrenewable natural resource to rise at a rate equal to the interest rate. (p. 428)

**Human capital** The knowledge and skill that people obtain from education, on-the-job training, and work experience. (p. 3)

**Implicit rental rate** The firm's opportunity cost of using its own capital. (p. 224)

**Import quota** A restriction that limits the maximum quantity of a good that may be imported in a given period. (p. 160)

**Imports** The goods and services that we buy from people in other countries. (p. 152)

**Incentive** A reward that encourages an action or a penalty that discourages one. (p. 2)

**Incentive system** A method of organizing production that uses a

market-like mechanism inside the firm. (p. 229)

**Income effect** The effect of a change in income on buying plans, other things remaining the same. (p. 211)

**Income elasticity of demand** The responsiveness of demand to a change in income, other things remaining the same. It is calculated as the percentage change in the quantity demanded divided by the percentage change in income. (p. 91)

**Indifference curve** A line that shows combinations of goods among which a consumer is *indifferent*. (p. 205)

**Individual transferable quota**

**(ITQ)** A production limit that is assigned to an individual who is free to transfer (sell) the quota to someone else. (p. 402)

**Inelastic demand** A demand with a price elasticity between 0 and 1; the percentage change in the quantity demanded is less than the percentage change in price. (p. 85)

**Inferior good** A good for which demand decreases as income increases. (p. 60)

**Intellectual property rights** Property rights for discoveries owned by creators of knowledge. (p. 383)

**Interest** The income that capital earns. (p. 4)

**Inverse relationship** A relationship between variables that move in opposite directions. (p. 19)

**Labour** The work time and work effort that people devote to producing goods and services. (p. 3)

**Labour union** An organized group of workers that aims to increase the wage rate and influence other job conditions. (p. 422)

**Land** The “gifts of nature” that we use to produce goods and services. (p. 3)

**Law of demand** Other things remaining the same, the higher the price of a good, the smaller is the quantity demanded of it; the lower the price of a good, the larger is the quantity demanded of it. (p. 57)

**Law of diminishing returns** As a firm uses more of a variable factor of production with a given quantity of

the fixed factor of production, the marginal product of the variable factor of production eventually diminishes. (p. 251)

**Law of supply** Other things remaining the same, the higher the price of a good, the greater is the quantity supplied of it; the lower the price of a good, the smaller is the quantity supplied. (p. 62)

**Legal monopoly** A market in which competition and entry are restricted by the granting of a public franchise, government license, patent, or copyright. (p. 298)

**Limit pricing** The practice of setting the price at the highest level that inflicts a loss on an entrant. (p. 355)

**Linear relationship** A relationship between two variables that is illustrated by a straight line. (p. 18)

**Long run** The time frame in which the quantities of *all* factors of production can be varied. (p. 248)

**Long-run average cost curve** The relationship between the lowest attainable average total cost and output when the firm can change both the plant it uses and the quantity of labour it employs. (p. 261)

**Lorenz curve** A curve that graphs the cumulative percentage of income or wealth against the cumulative percentage of households. (p. 441)

**Low-income cutoff** The income level below which a family normally spends 63.6 percent or more of its income on food, shelter, and clothing. (p. 445)

**Macroeconomics** The study of the performance of the national economy and the global economy. (p. 2)

**Margin** When a choice is made by comparing a little more of something with its cost, the choice is made at the margin. (p. 10)

**Marginal benefit** The benefit that a person receives from consuming one more unit of a good or service. It is measured as the maximum amount that a person is willing to pay for one more unit of the good or service. (pp. 10, 36)

**Marginal benefit curve** A curve that shows the relationship between the

marginal benefit of a good and the quantity of that good consumed. (p. 36)

**Marginal cost** The *opportunity cost* of producing *one* more unit of a good or service. It is the best alternative forgone. It is calculated as the increase in total cost divided by the increase in output. (pp. 10, 35, 254)

**Marginal cost pricing rule** A rule that sets the price of a good or service equal to the marginal cost of producing it. (p. 313)

**Marginal external benefit** The benefit from an additional unit of a good or service that people other than the consumer enjoy. (p. 379)

**Marginal external cost** The cost of producing an additional unit of a good or service that falls on people other than the producer. (p. 372)

**Marginal private benefit** The benefit from an additional unit of a good or service that the consumer of that good or service receives. (p. 379)

**Marginal private cost** The cost of producing an additional unit of a good or service that is borne by the producer of that good or service. (p. 372)

**Marginal product** The increase in total product that results from a one-unit increase in the variable input, with all other inputs remaining the same. It is calculated as the increase in total product divided by the increase in the variable input employed, when the quantities of all other inputs remain the same. (p. 249)

**Marginal rate of substitution** The rate at which a person will give up good *y* (the good measured on the *y*-axis) to get an additional unit of good *x* (the good measured on the *x*-axis) while at the same time remaining indifferent (remaining on the same indifference curve) as the quantity of *x* increases. (p. 206)

**Marginal revenue** The change in total revenue that results from a one-unit increase in the quantity sold. It is calculated as the change in total revenue divided by the change in quantity sold. (p. 272)

**Marginal social benefit** The marginal benefit enjoyed by society—by the consumer of a good or service (marginal private benefit) plus the

marginal benefit enjoyed by others (marginal external benefit). (p. 379)

**Marginal social cost** The marginal cost incurred by the producer and by everyone else on whom the cost falls—by society. It is the sum of marginal private cost and marginal external cost. (p. 372)

**Marginal utility** The *change* in total utility resulting from a one-unit increase in the quantity of a good consumed. (p. 179)

**Marginal utility per dollar** The marginal utility from a good that results from spending one more dollar on it. It is calculated as the marginal utility from the good divided by its price. (p. 182)

**Market** Any arrangement that enables buyers and sellers to get information and to do business with each other. (p. 44)

**Market failure** A situation in which a market delivers an inefficient outcome. (p. 114)

**Market income** The wages, interest, rent, and profit earned in factor markets and before paying income taxes. (p. 440)

**Markup** The amount by which the firm's price exceeds its marginal cost. (p. 329)

**Microeconomics** The study of the choices that individuals and businesses make, the way these choices interact in markets, and the influence of governments. (p. 2)

**Minimum efficient scale** The *smallest* quantity of output at which the long-run average cost reaches its lowest level. (p. 263)

**Minimum wage** A regulation that makes the hiring of labour below a specified wage rate illegal. The lowest wage at which a firm may legally hire labour. (p. 131)

**Money** Any commodity or token that is generally acceptable as a means of payment. (p. 44)

**Money price** The number of dollars that must be given up in exchange for a good or service. (p. 56)

**Monopolistic competition** A market structure in which a large number of firms make similar but slightly

different products and compete on product quality, price, and marketing, and firms are free to enter or exit the market. (pp. 233, 324)

**Monopoly** A market structure in which there is one firm, which produces a good or service that has no close substitutes and in which the firm is protected from competition by a barrier preventing the entry of new firms. (pp. 233, 298)

**Monopsony** A market in which there is a single buyer. (p. 423)

**Nash equilibrium** The outcome of a game that occurs when player A takes the best possible action given the action of player B and player B takes the best possible action given the action of player A. (p. 345)

**Natural monopoly** A market in which economies of scale enable one firm to supply the entire market at the lowest possible cost. (p. 298)

**Natural monopoly good** A good that is nonrival and excludable. When buyers can be excluded if they don't pay but the good is nonrival, marginal cost is zero. (p. 392)

**Negative externality** An externality that arises from either production or consumption and that imposes an external cost. (p. 370)

**Negative relationship** A relationship between variables that move in opposite directions. (p. 19)

**Neuroeconomics** The study of the activity of the human brain when a person makes an economic decision. (p. 193)

**Nonexcludable** A good or service or a resource is nonexcludable if it is impossible (or extremely costly) to prevent someone from enjoying its benefits. (p. 392)

**Nonrenewable natural resources** Natural resources that can be used only once. (p. 414)

**Nonrival** A good or service or a resource is nonrival if its use by one person does not decrease the quantity available for someone else. (p. 392)

**Normal good** A good for which demand increases as income increases. (p. 60)

**Normal profit** The return to entrepreneurship is normal profit and it is the profit that an entrepreneur earns *on average*. (p. 225)

**Offshore outsourcing** A Canadian firm buys finished goods, components, or services from firms in other countries. (p. 165)

**Oligopoly** A market structure in which a small number of firms compete. (pp. 233, 342)

**Opportunity cost** The highest-valued alternative that we must give up to get something. (pp. 9, 33)

**Patent** A government-sanctioned exclusive right granted to an inventor of a good, service, or productive process to produce, use, and sell the invention for a given number of years. (p. 383)

**Payoff matrix** A table that shows the payoffs for every possible action by each player for every possible action by each other player. (p. 344)

**Perfect competition** A market in which there are many firms each selling an identical product; there are many buyers; there are no restrictions on entry into the industry; firms in the industry have no advantage over potential new entrants; and firms and buyers are well informed about the price of each firm's product. (pp. 233, 272)

**Perfectly elastic demand** Demand with an infinite price elasticity; the quantity demanded changes by an infinitely large percentage in response to a tiny price change. (p. 85)

**Perfectly inelastic demand** Demand with a price elasticity of zero; the quantity demanded remains constant when the price changes. (p. 85)

**Perfect price discrimination** Price discrimination that occurs when a firm sells each unit of output for the highest price that anyone is willing to pay for it. The firm extracts the entire consumer surplus. (p. 310)

**Pigovian taxes** Taxes that are used as an incentive for producers to cut back on an activity that creates an external cost. (p. 375)

**Positive externality** An externality that arises from either production or consumption and that creates an external benefit. (p. 370)

**Positive relationship** A relationship between two variables that move in the same direction. (p. 18)

**Poverty** A state in which a household's income is too low to be able to buy the quantities of food, shelter, and clothing that are deemed necessary. (p. 445)

**Preferences** A description of a person's likes and dislikes and the intensity of those feelings. (pp. 9, 36, 179)

**Price cap** A regulation that makes it illegal to charge a price higher than a specified level. (p. 128)

**Price cap regulation** A rule that specifies the highest price that the firm is permitted to set—a price ceiling. (p. 315)

**Price ceiling** A regulation that makes it illegal to charge a price higher than a specified level. (p. 128)

**Price discrimination** The practice of selling different units of a good or service for different prices. (p. 299)

**Price effect** The effect of a change in the price of a good on the quantity of the good consumed, other things remaining the same. (p. 209)

**Price elasticity of demand** A units-free measure of the responsiveness of the quantity demanded of a good to a change in its price, when all other influences on buyers' plans remain the same. (p. 84)

**Price floor** A regulation that makes it illegal to trade at a price lower than a specified level. (p. 131)

**Price taker** A firm that cannot influence the price of the good or service it produces. (p. 272)

**Principal–agent problem** The problem of devising compensation rules that induce an *agent* to act in the best interest of a *principal*. (p. 229)

**Principle of minimum differentiation** The tendency for competitors to make themselves similar to appeal to the maximum number of clients or voters. (p. 395)

**Private good** A good or service that is both rival and excludable. (p. 392)

**Producer surplus** The excess of the amount received from the sale of a good or service over the cost of producing it. It is calculated as the price of a good minus the marginal cost (or minimum supply-price), summed over the quantity sold. (p. 111)

**Product differentiation** Making a product slightly different from the product of a competing firm. (pp. 233, 324)

**Production efficiency** A situation in which goods and services are produced at the lowest possible cost. (p. 33)

**Production possibilities frontier** The boundary between those combinations of goods and services that can be produced and those combinations that cannot. (p. 32)

**Production quota** An upper limit to the quantity of a good that may be produced in a specified period. (p. 139)

**Profit** The income earned by entrepreneurship. (p. 4)

**Progressive income tax** A tax on income at an average rate that increases as income increases. (p. 453)

**Property rights** The social arrangements that govern the ownership, use, and disposal of anything that people value. Property rights are enforceable in the courts. (pp. 44, 373)

**Proportional income tax** A tax on income at a constant rate, regardless of the level of income. (p. 453)

**Public good** A good or service that is both nonrival and nonexcludable. It can be consumed simultaneously by everyone and no one can be excluded from enjoying its benefits. (p. 392)

**Public production** The production of a good or service by a public authority that receives its revenue from the government. (p. 380)

**Quantity demanded** The amount of a good or service that consumers plan to buy during a given time period at a particular price. (p. 57)

**Quantity supplied** The amount of a good or service that producers plan to sell during a given time period at a particular price. (p. 62)

**Rate of return regulation** A regulation that requires the firm to justify its price by showing that its return on capital doesn't exceed a specified target rate. (p. 314)

**Rational choice** A choice that compares costs and benefits and achieves the greatest benefit over cost for the person making the choice. (p. 9)

**Rational ignorance** The decision not to acquire information because the cost of doing so exceeds the expected benefit. (p. 396)

**Real income** A household's income expressed as a quantity of goods that the household can afford to buy. (p. 203)

**Regressive income tax** A tax on income at an average rate that decreases as income increases. (p. 453)

**Regulation** Rules administered by a government agency to influence prices, quantities, entry, and other aspects of economic activity in a firm or industry. (p. 313)

**Relative price** The ratio of the price of one good or service to the price of another good or service. A relative price is an opportunity cost. (pp. 56, 203)

**Rent** The income that land earns. (p. 4)

**Rent ceiling** A regulation that makes it illegal to charge a rent higher than a specified level. (p. 128)

**Rent seeking** The lobbying for special treatment by the government to create economic profit or to divert consumer surplus or producer surplus away from others. The pursuit of wealth by capturing economic rent. (pp. 167, 306)

**Rival** A good, service, or a resource is rival if its use by one person decreases the quantity available for someone else. (p. 392)

**Scarcity** Our inability to satisfy all our wants. (p. 2)

**Scatter diagram** A graph that plots the value of one variable against the value of another variable for a number of different values of each variable. (p. 16)

**Search activity** The time spent looking for someone with whom to do business. (p. 128)

**Self-interest** The choices that you think are the best ones available for you are choices made in your self-interest. (p. 5)

**Short run** The time frame in which the quantity of at least one factor of production is fixed and the quantities of the other factors can be varied. The fixed factor is usually capital—that is, the firm uses a given plant. (p. 248)

**Short-run market supply curve** A curve that shows the quantity supplied in a market at each price when each firm's plant and the number of firms remain the same. (p. 278)

**Shutdown point** The price and quantity at which the firm is indifferent between producing the profit-maximizing output and shutting down temporarily. The shutdown point occurs at the price and the quantity at which average variable cost is a minimum. (p. 276)

**Signal** An action taken by an informed person (or firm) to send a message to uninformed people. (p. 332)

**Single-price monopoly** A monopoly that must sell each unit of its output for the same price to all its customers. (p. 299)

**Slope** The change in the value of the variable measured on the  $y$ -axis divided by the change in the value of the variable measured on the  $x$ -axis. (p. 22)

**Social interest** Choices that are the best ones for society as a whole. (p. 5)

**Social interest theory** A theory that the political and regulatory process relentlessly seeks out inefficiency and introduces regulation that eliminates deadweight loss and allocates resources efficiently. (p. 313)

**Strategies** All the possible actions of each player in a game. (p. 344)

**Subsidy** A payment made by the government to a producer. (p. 140)

**Substitute** A good that can be used in place of another good. (p. 59)

**Substitution effect** The effect of a change in price of a good or service

on the quantity bought when the consumer (hypothetically) remains indifferent between the original and the new consumption situations—that is, the consumer remains on the same indifference curve. (p. 212)

**Sunk cost** The past expenditure on a plant that has no resale value. (p. 248)

**Supply** The entire relationship between the price of a good and the quantity supplied of it when all other influences on producers' planned sales remain the same. It is described by a supply schedule and illustrated by a supply curve. (p. 62)

**Supply curve** A curve that shows the relationship between the quantity supplied of a good and its price when all other influences on producers' planned sales remain the same. (p. 62)

**Symmetry principle** A requirement that people in similar situations be treated similarly. (p. 118)

**Tariff** A tax that is imposed by the importing country when an imported good crosses its international boundary. (p. 157)

**Tax incidence** The division of the burden of the tax between the buyer and the seller. (p. 133)

**Technological change** The development of new goods and of better ways of producing goods and services. (p. 38)

**Technological efficiency** A situation that occurs when the firm produces a given output by using the least amount of inputs. (p. 227)

**Technology** Any method of producing a good or service. (p. 226)

**Total cost** The cost of all the productive resources that a firm uses. (p. 253)

**Total fixed cost** The cost of the firm's fixed inputs. (p. 253)

**Total income** Market income plus cash payments to households by governments. (p. 440)

**Total product** The maximum output that a given quantity of labour can produce. (p. 249)

**Total revenue** The value of a firm's sales. It is calculated as the price of the

good multiplied by the quantity sold. (pp. 88, 272)

**Total revenue test** A method of estimating the price elasticity of demand by observing the change in total revenue that results from a change in the price, when all other influences on the quantity sold remain the same. (p. 88)

**Total surplus** The sum of consumer surplus and producer surplus. (p. 112)

**Total utility** The total benefit that a person gets from the consumption of all the different goods and services. (p. 179)

**Total variable cost** The cost of all the firm's variable inputs. (p. 253)

**Tradeoff** A constraint that involves giving up one thing to get something else. (p. 9)

**Tragedy of the commons** The absence of incentives to prevent the

overuse and depletion of a commonly owned resource. (p. 398)

**Transactions costs** The opportunity costs of making trades in a market. The costs that arise from finding someone with whom to do business, of reaching an agreement about the price and other aspects of the exchange, and of ensuring that the terms of the agreement are fulfilled. (pp. 115, 238, 374)

**Unit elastic demand** Demand with a price elasticity of 1; the percentage change in the quantity demanded equals the percentage change in price. (p. 85)

**Utilitarianism** A principle that states that we should strive to achieve "the greatest happiness for the greatest number of people." (p. 116)

**Utility** The benefit or satisfaction that a person gets from the consumption of goods and services. (p. 179)

**Value of marginal product** The value to the firm of hiring one more unit of a factor of production. It is calculated as the price of a unit of output multiplied by the marginal product of the factor of production. (p. 415)

**Voucher** A token that the government provides to households, which they can use to buy specified goods and services. (p. 381)

**Wages** The income that labour earns. (p. 4)

**Wealth** The value of all the things that people own—the market value of their assets—at a point in time. (p. 442)

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Note: Key terms and the pages on which they are defined are **bolded**. References to “*f*” denote a figure and “*t*” denote a table.

## A

- abatement technology**, 373
- Abe, Shinzo, 168
- ability to pay, 58
- ability-to-pay principle, 138
- absolute advantage**, 40
- absolute value, 85
- abuse of dominant position, 356*t*, 359
- accounting profit, 224
- administrative costs, 455
- advertising, 330–333, 332*f*
- affordable quantities, 202
- Africa, 141, 163, 447
- after-tax income**, 440, 443, 443*f*, 454
- age, 444
- agent, 229–230
- Agricultural Revolution, 53
- air pollution, 371, 372–378
- Airbus, 341, 353
- Alberta, and inequality, 454
- Alberta labour market, 430–431
- allocative efficiency**, 35–37, 37*f*
- the Allowance, 453
- the Allowance for the Survivor (AS), 453
- Almunia, Joaquin, 316
- alternatives to the market, 115
- Altimeter Group, 240
- AMD, 341
- Anarchy, State, and Utopia* (Nozick), 118
- anti-combine cases, 356–357
- anti-combine law**, 356–359
- Apple, 239, 290–291, 367
- Asia, 141, 447, 463
- assortative mating, 452
- Athey, Susan, 176
- Atlantic cod, 399
- auctions, 175
- Australia, 141, 403
- auto production, 263
- average cost, 254, 258, 258*f*
- average cost curves, 254–255, 255*t*
- average cost pricing rule**, 314
- average fixed cost**, 254, 259*t*
- average fixed cost curve, 255
- average grades, 252
- average income, 440
- average price, 84–85
- average product**, 249, 249*t*, 258, 258*f*
- average quantity, 84–85
- average total cost**, 254, 259*t*
- average total cost curve, 254–255
- average variable cost**, 254, 259*t*
- average variable cost curve, 254, 255
- axes, 15, 18

## B

- Babolat, 334
- Babolat, Eric, 334
- Balsillie, Jim, 357, 359

- banana supply, 55, 74–75
- bank mergers, 357
- Bank of Canada, 11
- Bank of Montreal, 357
- banking crisis. *See* financial crisis
- Bardaro, Katie, 421
- barriers to entry**, 236, 298–299, 306, 342
- Barro, Robert, 424
- Barry, David, 98
- behavioural economics**, 192–193
- Bell Canada, 166, 341
- Bell Canada Enterprises, 357
- Bell Mobility, 360
- benefit**, 9
  - external benefit, 115, 379–383, 379*f*, 380*f*
  - marginal benefit. *See* marginal benefit
  - marginal external benefit, 379
  - marginal private benefit, 379
  - marginal social benefit, 108*f*, 109, 305, 379
  - measurement of, 9
  - private benefit, 379
- benefits principle, 138
- Bentham, Jeremy, 116, 221
- Berners-Lee, Tim, 223
- best affordable choice, 208–209, 208*f*, 210
- big tradeoff**, 117, 455
- bilateral monopoly**, 423–425
- Biocom, 6
- biomedical engineering, 421
- black market**, 128–129
- Boeing, 341, 353
- BookNet Canada, 214
- Boorstin, Daniel J., 175
- bounded rationality, 192
- bounded self-interest, 192–193
- bounded willpower, 192
- brand names, 333
- Brazil, 3, 3*f*, 71, 163, 446, 446*f*
- break even, 280*f*
- break-even point, 274
- British Columbia Healthy Living Alliance, 194
- British Columbia's carbon tax, 376, 384–385
- Brunet, Richard, 357
- Brussels, 316
- BSE (mad cow disease), 163
- budget equation, 203–204
- budget line**, 178, 178*f*, 202, 202*f*, 203
  - best affordable point, 209
  - budget equation, 203–204
  - and change in prices, 203–204, 204*f*
- Bureau of Labor Statistics, 74
- bureaucrats, 395–396
- business organization, types of, 230–231, 231*f*

## buyers

- penalties, and illegal goods markets, 142–143
- price discrimination among groups of buyers, 307–308
- tax on, 134, 135*f*

## C

- Campolieti, Michele, 132
- Canada
  - anti-combine law, 356
  - charter school, 382
  - concentration in, 235
  - distribution of income, 440, 440*f*, 447
  - exports, 152, 154
  - farm subsidies, 141
  - firms, size distribution of, 232
  - imports, 152, 153
  - Lorenz curve, 446*f*
  - most equal places in, 454–455
  - most unequal places in, 454–455
  - NAFTA. *See* North American Free Trade Agreement (NAFTA)
  - production in, 3*f*
  - production possibilities, 39
  - subsidies, 163
  - wage rates, 420
- Canada Post, 299
- Canada/Quebec Pension Plans, 453
- Canada Revenue Agency (CRA), 117, 224, 455
- Canada Social Transfer (CST), 453
- Canadian Beverage Association, 194
- Canadian Centre for Policy Alternatives (CCPA), 454
- Canadian Food Inspection Agency, 163
- Canadian Pacific, Ltd., 237
- Canadian Radio-Television and Telecommunications Commission (CRTC), 306
- Canadian Restaurant and Foodservices Association, 144
- Canadian Transportation Agency, 313
- Cancún, 163
- cap-and-trade, 376
- capital**, 4, 414
  - demand for capital, 426
  - diminishing marginal product of capital, 260
  - human capital, 443, 448–449, 463
  - implicit rental rate, 224
  - rental rate of capital, 426
  - value of marginal product of capital, 426
- capital accumulation**, 38
- capital rental markets, 426, 426*f*
- capital services, 414
- capital services markets, 414
- capture theory**, 313

carbon emissions, 7, 376, 377, 378  
 carbon tax, 376, 384–385  
 Card, David, 132  
 career interruptions, 448–449  
**cartel, 343**  
 cartels, 359  
 casual labour, 414  
 causation, 18  
 cause and effect, 11  
 cellphone service, 360–361  
 Central America, 141, 163  
 central economic planning, 44  
 central planning, 8  
 centrally planned socialism, 8  
**ceteris paribus, 24–25**  
**change in demand, 58–60, 68, 68f**  
 change in demand and supply in opposite directions, 72–73, 73f  
 change in demand and supply in same direction, 72, 72f  
 changes in both demand and supply, 72–73, 72f, 73f  
 decrease in demand, 68, 285  
 increase in demand, 59f, 68, 284–285  
 labour demand, changes in, 417, 417f  
 and marginal utility, 186  
 and short-run market equilibrium, 279  
 and technology advances, 284–285, 284f  
**change in supply, 63–65, 65f, 70, 70f**  
 change in demand and supply in opposite directions, 72–73, 73f  
 change in demand and supply in same direction, 72, 72f  
 changes in both demand and supply, 72–73, 72f, 73f  
 decrease in supply, 70  
 increase in supply, 64f, 70  
 and state of nature, 64  
 and technological advances, 286–287  
**change in the quantity demanded, 60–61, 61f, 186**  
**change in the quantity supplied, 64–65, 65f**  
 charter school, 382–383  
 cheap foreign labour, 164–165  
 cheating, 140, 348–349, 348f, 349f, 352, 352f  
 Chetty, Raj, 464  
 child labour, 165  
 children, number of, 444  
 China  
     access to markets, 163  
     carbon emissions, 7, 378  
     and centrally planned socialism, 8  
     chocolate consumption, 69  
     income inequality, 447  
     and international trade, 152  
     pollution, 165  
         what is produced, 3, 3f  
 chocolate, 34, 69  
 choice. *See consumer choice*

Chrysler, 357  
 CIBC, 229, 357  
 Cineplex Galaxy, 357, 358  
 circular flows through markets, 44, 45f  
 Clarizio, Frank, 404  
 clean technology, 374–375  
 climate change, 7  
 close substitutes, 207  
 Coase, Ronald, 396, 411  
**Coase theorem, 374**  
 cocoa, 34, 69  
 cod industry, 399  
 coffee, 71, 83, 98–99  
 Collins, Mary, 194  
 collusion, 343, 346–349, 347f  
**collusive agreement, 346, 348**  
 Colombia, 71  
**command system, 106**  
**command systems, 229**  
 commodity markets, 414  
 commodity prices, 414  
**common resources, 115, 392, 398–403**  
 deadweight loss from overuse, 401  
 efficient equilibrium, 401  
 efficient outcome, 401–403  
 individual transferable quota (ITQ), 402–403, 403f  
 marginal external cost, 400  
 marginal private cost, 400  
 marginal social benefit, 400  
 marginal social cost, 400  
 overfishing, 400–401, 400f  
 overuse of, 400–401  
 production quota, 402, 402f  
 property rights, 401–402, 401f  
 sustainable use of renewable resource, 398–399, 398f  
 tragedy of the commons, 398  
**comparative advantage, 40, 42, 152, 165**  
 Competition Act, 356, 356t  
 Competition Bureau, 356, 357, 358, 359  
 Competition Tribunal, 356, 357  
 competitive environment, 233–237  
 competitive equilibrium, 112  
 competitive labour market, 418–419  
**competitive market, 56**  
     efficiency of, 112–115, 112f  
     fairness of, 116–118  
     resource allocation, 108–111  
**complement, 59, 207–208, 449**  
     and cross elasticity of demand, 93–94  
     in production, 63  
 concentration measures, 234–237  
     Canadian economy, concentration in, 235  
     four-firm concentration ratio, 234,  
         234f, 235  
     Herfindahl-Hirschman Index (HHI),  
         234–235  
**constant returns to scale, 262**  
 constraints, 62, 226  
     information constraints, 226  
     market, 226  
     resources, 62  
     technology constraint, 62, 226,  
         249–252  
 consumer choice  
     behavioural economics, 192–193  
     best affordable choice, 208–209, 208f,  
         210  
     change in income, 211f  
     change in price, 209–211  
     choosing at the margin, 182–183  
     consumption choices, 178–180,  
         202–204  
     and efficient use of resources, 288  
     and incentives, 2, 10  
     income effect, 211, 211f, 212–213, 213f  
     inferior goods, 213  
     margin, choosing at, 10  
     neuroeconomics, 193  
     new ways of explaining consumer  
         choice, 192–193  
     predicting consumer choices, 208–213  
     price effect, 209–211, 209f, 212f  
     rational choice, 9  
     self-interest *vs.* social interest, 5–7  
     substitution effect, 212, 212f  
     and sugary drinks, 194–195  
     as tradeoff, 9  
     understanding households' choices, 221  
     utility-maximizing choices, 181–184  
**consumer equilibrium, 181**  
 Consumer Price Index (CPI), 144  
**consumer surplus, 109, 109f**  
     gains from trade, 288  
     with no international trade, 155f, 156f  
     and price discrimination, 311  
     and value, 189  
 consumption  
     negative consumption externalities, 370  
     positive consumption externalities, 370  
 consumption choices, 178–180  
     consumption possibilities, 178, 202–204  
     preferences, 179–180  
 consumption possibilities, 178, 202–204  
 contest, 106  
**contestable market, 354, 355f**  
 contests among superstars, 451–452  
**cooperative equilibrium, 352**  
 coordinates, 15  
 Copenhagen Consensus, 377  
**copyright, 298–299, 382–383**  
 corporation, 231, 231f  
 correlation, 18  
 cost  
     administrative costs, 455  
     average cost, 254, 258, 258f  
     average fixed cost, 254, 259t  
     average total cost, 254, 259t  
     average variable cost, 254, 259t  
     of economic growth, 38  
     external cost, 115, 372, 372f

fixed cost, 259, 259*t*  
 glossary of costs, 259*t*  
 long-run cost, 260–263  
 marginal cost. *See* marginal cost  
 marginal external cost, 372  
 marginal social cost, 305, 372  
 and minimum supply-price, 110  
 oligopoly price-fixing game, 346, 346*f*  
 opportunity cost. *See* opportunity cost  
 output cost, 259*t*  
*vs.* price, 110  
 private cost, 372  
 production costs, 286, 286*f*  
 selling costs, 331–332, 331*f*  
 short-run cost, 253–259  
 sunk cost, 248  
 total cost, 253, 259*t*, 274, 274*f*, 331, 331*f*  
 total fixed cost, 253, 259*t*  
 total product cost, 259*t*  
 total variable cost, 253, 256, 256*f*, 259*t*  
 transactions costs, 115, 238, 374  
 variable cost, 259, 259*t*  
**cost curves**  
 average fixed cost curve, 255  
 average total cost curve, 254–255  
 average variable cost curve, 254, 255  
 checkout cost curves, 256–257  
 long-run average cost curve, 261–262, 262*f*  
 marginal cost curve. *See* marginal cost curve  
 and prices of factors of production, 259  
 and product curves, 256–258  
 shifts in, 258–259  
 and technology, 258–259  
 total cost curves, 253*f*, 303*f*  
**countervailing duties**, 164  
**CPI**. *See* Consumer Price Index (CPI)  
**cross elasticity of demand**, 92–94, 93*f*, 97  
**Cuba**, 8  
**currency markets**, 56  
**curve**, 18  
 curved line, slope of, 23–24, 23*f*, 24*f*

**D**

De Beers, 298, 299  
**deadweight loss**, 114  
 income redistribution, 455  
 minimum wage, 132  
 monopoly, 305  
 from overuse of a common resource, 401  
 and perfect price discrimination, 311  
 pollution, 373  
 and regulation, 313, 314  
 tariffs, 159  
**decision time frames**, 248

degree major, 421  
 degree of substitutability, 207–208, 207*f*  
**Dell**, 283  
**demand**, 57–61  
 change in demand. *See* change in demand  
 change in the quantity demanded, 60–61, 61*f*  
 and consumer surplus, 109, 109*f*  
**demand curve**. *See* demand curve  
**demand schedule**, 58  
**derived demand**, 415  
 elastic demand, 86, 86*f*, 89, 301  
 elasticities of demand. *See* elasticity of demand  
 and expected future income and credit, 60  
 and expected future prices, 59–60  
 for a factor of production, 415–417  
 fundamental determinant of demand, 428  
 fundamental influence, 427  
 and human capital, 448  
 and income, 60  
 income elastic demand, 91, 92  
 income inelastic demand, 91–92  
 individual demand, 108–109, 108*f*  
 inelastic demand, 85, 86*f*, 89, 301  
 labour demand, 415–416, 416*f*, 418  
 law of demand, 57  
 and marginal revenue, 300, 300*f*  
 and marginal social benefit, 400  
 market demand, 108–109, 108*f*  
 market demand for labour, 418  
 for oil, 427  
 oligopoly price-fixing game, 346, 346*f*  
 in perfect competition, 272–273, 273*f*  
 perfectly elastic demand, 85–86, 86*f*, 136, 136*f*  
 perfectly inelastic demand, 85, 86*f*, 135, 135*f*  
 and population, 60  
 and preferences, 60  
 price elasticity of demand. *See* price elasticity of demand  
 and prices of related goods, 59  
 quantity demanded, 57  
 and selling costs, 332  
 speculative influence, 427  
 unit elastic demand, 85, 301  
 willingness to pay and value, 108, 108*f*  
**demand curve**, 57–58, 58*f*, 76, 76*f*  
 elasticity along linear demand curve, 87, 87*f*  
 equation, 76  
 and income effect, 211, 211*f*  
 as marginal benefit curve, 108  
 movement along, 61  
 and price effect, 209*f*, 211  
 shift of, 61  
**demand schedule**, 58

Denmark, 168  
**Department of Finance**, 11  
**Department of the Environment Act**, 375  
 depreciation, 224, 225  
**deregulation**, 313  
**derived demand**, 415  
**developing nations**  
 exploitation of, 165  
 and farm subsidies, 141  
 and market access, 163  
**diamond-water paradox**, 189  
 diminishing marginal product of capital, 260  
**diminishing marginal rate of substitution**, 206  
**diminishing marginal returns**, 251, 400  
**diminishing marginal utility**, 179–180  
**diminishing returns**, 260  
*see also* law of diminishing returns  
**Dimon, Jamie**, 230  
**direct relationship**, 18, 19*f*  
*The Discoverers* (Boorstin), 175  
 discrimination, 130, 450–451, 450*f*  
**diseconomies of scale**, 262  
 Disney Corporation, 311  
 divisible goods, 202  
 DNA sequencing, 287  
 Doha Development Agenda, 163  
 Doha Round, 163  
 domestic jobs, 164  
**dominant-strategy equilibrium**, 345  
 dominant-strategy Nash equilibrium, 350  
 Duflo, Esther, 54  
**dumping**, 164  
 duopolist's dilemma, 349–350  
**duopoly**, 342, 342*f*, 346  
 Duracell, 341  
 Duranton, Gilles, 120  
 Dusunceli, Fazil, 74

**E**

e-books, 214–215  
 e-commerce markets, 56  
 earnings sharing regulation, 315  
 Eastern Europe, 165  
 eBay, 175  
 economic accounting, 224–225, 225*t*  
 economic coordination, 44–45  
**economic depreciation**, 225  
**economic efficiency**, 227–228  
**economic growth**, 38, 38*f*  
 cost of, 38  
 nation's economic growth, 39  
**economic inequality**  
 annual *vs.* lifetime income and wealth, 443  
 and contests among superstars, 451–452  
 and discrimination, 450–451, 450*f*  
 Gini ratio, 444, 444*f*  
 and human capital, 448–449

- economic growth** (*continued*)  
 income distribution, 440, 440*f*  
 income redistribution, 453–455  
 Lorenz curve, 440, 441–442, 441*f*  
 measurement of, 440–445  
 poverty, 445, 445*f*  
 sources of, 448–452  
 trends in inequality, 444  
 understanding, 463  
 and unequal wealth, 452  
 wealth distribution, 442  
 in the world economy, 446–447
- economic instability, 7
- economic loss, in short run, 279–280, 280*f*, 327*f*
- economic model**, 11, 18–21
- economic profit**, 224, 274, 274*f*, 280*f*, 302, 308
- monopolistic competition, in short run, 326, 326*f*
- perfect competition, 272–273
- zero economic profit, 327–328
- economic rent**, 306
- economic way of thinking, 9–10
- economics**, 2
- behavioural economics, 192–193
  - birth of, 53
  - definition of, 2
  - economic way of thinking, 9–10
  - macroeconomics, 2
  - microeconomics, 2
  - neuroeconomics, 193
  - as policy tool, 11
  - scope of economics, 9
  - as social science, 11
  - two big economic questions, 3–7
- economies of scale**, 238–239, 262–263
- economies of scope**, 239
- economies of team production, 239
- education, 444, 448–449
- education efficiency, 382
- efficiency, 116
- see also* efficient
  - of advertising, 333
  - allocative efficiency, 35–37, 37*f*
  - and the big tradeoff, 117
  - of brand names, 333
  - of competitive equilibrium, 112
  - of competitive market, 112–115, 112*f*
  - and consumer choice, 288
  - economic efficiency, 227–228
  - of education, 382
  - and equilibrium, 288
  - fair-results view, 117
  - fair-rules view, 118
  - and monopolistic competition, 329
  - in monopoly, 305, 305*f*
  - perfect competition, 288–289, 288*f*, 305, 305*f*
  - with price discrimination, 311
  - private provision of a public good,
- 394–395, 395*f*
  - and product development, 330
  - production efficiency, 33
  - resources, use of, 35–37, 288
  - and social interest, 5
  - and taxes, 137–138, 137*f*
  - technological efficiency, 227
- efficient**, 5
- see also* efficiency
  - efficient market equilibrium, 374
- efficient scale**, 328
- elastic demand**, 86, 86*f*, 89, 301
- elastic supply, 94–95, 95*f*
- elasticity of demand
- for coffee, 98–99
  - cross elasticity of demand, 92–94, 93*f*, 97
  - income elasticity of demand, 91–92, 97
  - magnitude of, 85
  - and marginal revenue, 301, 301*f*
  - and minus sign, 85
  - and peanut butter markets, 93
  - price elasticity of demand. *See* price elasticity of demand
  - and tax incidence, 135–136, 135*f*
- elasticity of supply**, 94–96, 97
- calculation of, 94–95
  - influencing factors, 95–96
  - and resource substitution possibilities, 95–96
  - and tax incidence, 136, 137*f*
  - time frame for supply decision, 96
- Elgie, Stewart, 384
- Employment and Social Development Canada, 117
- Employment Insurance program, 453
- Employment Insurance tax, 135
- endowment effect, 193
- Energizer, 341
- entrepreneurship**, 4, 225, 414, 463
- entry
- monopolistic competition, 325
  - perfect competition, 281, 282, 282*f*, 283
- the environment
- air quality, 371
  - cap-and-trade, 376
  - carbon emissions, 376, 377, 378
  - clean technology, 374–375
  - climate change, 7
  - global externalities, coping with, 378
  - global greenhouse gas concentrations, 371
  - lax environmental standards, 165
  - pollution, 165, 372–378
- Environment Canada, 371, 375
- equality of opportunity, 118
- equilibrium, 66
- see also* market equilibrium
  - competitive equilibrium, 112
  - consumer equilibrium, 181
  - cooperative equilibrium, 352
  - dominant-strategy equilibrium, 345
- dominant-strategy Nash equilibrium, 350
- and efficiency, 288
- efficient market equilibrium, 374, 401
- labour market equilibrium, 419, 422
- long-run equilibrium, 282*f*, 283
- in market with exports, 154*f*
- in market with imports, 153*f*
- Nash equilibrium, 345, 349–350, 378
- with no international trade, 153*f*, 154*f*
- oil price, 428
- overfishing equilibrium, 400–401
- political equilibrium, 397
- and pollution, amount of, 372–373
- rent-seeking equilibrium, 306, 307*f*
- short-run equilibrium, 279–280
- and tax on sellers, 134
- equilibrium price**, 66, 128, 131
- equilibrium quantity**, 66, 139
- equity, 116
- European Union
- access to markets of developing nations, 163
  - carbon emissions, 7, 378
  - distribution of income, 447
  - farm subsidies, 141
  - regulatory barriers, 163
  - subsidies, 163
- excess capacity**, 328–329, 328*f*
- excludable**, 392, 396
- exit
- monopolistic competition, 325
  - perfect competition, 281–282, 282*f*, 283
- expected future credit, 60
- expected future income, 60
- expected future prices, 59–60, 64
- expenditure, and price elasticity of demand, 90
- export subsidies, 163
- exports**, 152
- Canada, 154, 154*f*
  - gains and losses, 156, 156*f*
- external benefit, 115, 379–383, 379*f*, 380*f*
- external cost, 115, 372, 372*f*
- externality**, 115, 370
- knowledge, 379–383
  - negative consumption externalities, 370
  - negative externality, 370, 372–378
  - negative production externalities, 370
  - in our lives, 370
  - pollution, 372–378
  - positive consumption externalities, 370
  - positive externality, 370, 379–383
  - positive production externalities, 370
- F**
- Facebook, 12, 240, 241, 299
- Facebook Ad Exchange, 240
- factor markets, 44
- anatomy of, 414

- capital rental markets, 426, 426*f*  
 capital services markets, 414  
 labour markets, 414, 418–425  
 land rental markets, 426–427, 427*f*  
 land services markets, 414  
 natural resources market, 414  
 nonrenewable natural resource markets, 427–428, 428*f*  
 understanding, 463
- factors of production, 3, 56, 414**  
*see also* specific factors of production  
 demand for, 415–417  
 factor markets. *See* factor markets  
 firm coordination, 238–239  
 fixed factors of production, 248  
 market coordination, 238  
 prices of, 63, 259, 417  
 taxes, 133*n*  
 value of marginal product, 415, 415*f*, 416*f*
- fair-results view, 116–117  
 big tradeoff, 455  
 rent ceilings, 130
- fair-rules view, 118  
 big tradeoff, 455  
 rent ceilings, 130
- fair shares, 5–6
- fairness, 5  
 of competitive market, 116–118  
 fair-results view, 116–117  
 fair-rules view, 118  
 of minimum wage, 131–132  
 principles of fairness, 116  
 rent ceiling, 130  
 and taxes, 138
- Famous Players, 357, 358
- Fang, Tony, 132
- farm subsidies, 140–141
- federal taxes, 453
- FedEx, 299
- financial capital, 4**  
 financial crisis, 7  
 financial property, 44  
 Finland, 446, 446*f*
- firm, 44, 224**  
 accounting profit, 224  
 constraints, 226  
 decision time frames, 248  
 decisions, 225, 273  
 economic accounting, 224–225, 225*t*  
 economic efficiency, 227–228  
 economic problem of the firm, 224–226  
 firm coordination, 238–239  
 goal of, 224  
 information and organization, 229–232  
 labour demand, 415–416, 416*f*, 417, 417*f*  
 labour demand curve, 416, 416*f*  
 opportunity cost of production, 224–225  
 output decision, 274–277  
 owner's labour services, 225
- price of output, 417  
 price taker, 272  
 pros and cons of different types of firms, 231  
 resources bought in the market, 224  
 resources owned by the firm, 224–225  
 resources supplied by firm's owner, 225  
 size distribution, in Canada, 232  
 supply curve, 277, 277*f*  
 technological efficiency, 227  
 turnover, 236  
 types of business organization, 230–231, 231*f*
- first-come, first-served, 106–107, 115, 130  
 fixed cost, 259, 259*t*  
 flat-rate income tax, 453  
 flow, 442  
 force, 107  
 forgone interest, 225
- four-firm concentration ratio, 234, 234*f*, 235**
- free-rider problem, 378, 393**  
 free trade, 157*f*, 159*f*, 161*f*, 167  
*see also* international trade
- free trade obstacles, 168–169
- Friedman, Milton, 381
- fundamental determinant of demand, 428
- fundamental determinant of supply, 428
- G**
- gains from trade, 40–43, 43*f*  
 achieving gains from trade, 42–43  
 and consumer surplus, 288  
 and offshore outsourcing, 165  
 producer surplus, 288
- game of chicken, 351, 351*f*
- game theory, 344, 367**  
 duopolist's dilemma, 349–350  
 game of chicken, 351, 351*f*  
 games, 344  
 Nash equilibrium, 345, 349–350  
 oligopoly price-fixing game, 346–350  
 payoff matrix, 344, 345*f*, 349, 350*f*  
 prisoners' dilemma, 344–345  
 repeated games, 352–354  
 sequential games, 354–355, 355*f*  
 strategies, 344
- game tree, 354, 355*f*
- Gardiner Expressway, 391, 404–405
- Gates, Bill, 7
- Gateway, 283
- General Agreement on Tariffs and Trade (GATT), 158
- generator shortage case study, 118
- Geneva, 163
- Genner, Noah, 214
- geographical scope of the market, 236
- Germany, 152
- Gini ratio, 444, 444*f*, 447, 447*f***
- global carbon emissions, 378
- global financial crisis. *See* financial crisis
- global greenhouse gas concentrations, 371
- global inequality, 446–447
- global markets, 236  
*see also* international trade
- globalization, 6
- Goetz, Jim, 194
- Goldin, Claudia, 449
- goods, 56  
 classification of, 392, 392*f*  
 divisible goods, 202  
 excludable, 392, 396  
 indivisible goods, 202  
 inferior good, 60, 91, 92, 213  
 natural monopoly good, 392  
 nonexcludable, 392, 396  
 nonrival, 392  
 normal good, 60, 91  
 private good, 392  
 public goods, 115, 378, 392  
*see also* public goods  
 related goods, 59  
 rival, 392
- goods and services, 3**  
*see also* goods; services
- goods markets, 44
- Google, 240, 241, 290, 297, 299, 316–317
- government  
 action in the market. *See* government action in markets  
 intervention. *See* government action in markets  
 licence, 298  
 size and growth, 397
- government action in markets  
 copyright, 382–383  
 in face of external benefits, 380–383  
 market failure and government, 411  
 and markets for illegal goods, 142–143, 142*f*  
 minimum wage, 131–132, 133*f*  
 patents, 382–383  
 private subsidies, 381, 381*f*  
 production quotas, 139–140, 139*f*  
 public production, 380, 381*f*  
 rent ceiling, 128–130  
 subsidies, 140–141, 141*f*  
 taxes, 133–138  
 voucher, 381–382, 382*f*
- graphs  
 axes, 15, 18  
 breaks in the axes, 18  
*ceteris paribus*, 24–25  
 coordinates, 15  
 correlation and causation, 18  
 curve, 18  
 in economic models, 18–21  
 graphing data, 15–18, 15*f*, 16*f*  
 misleading graphs, 18  
 more than two variables, 24–25, 25*f*  
 origin, 15  
 scatter diagram, 16–18, 17*f*

graphs (*continued*)  
 slope, 21, 22–24  
 variables that are unrelated, 21, 21*f*  
 variables that have maximum or minimum, 20, 21*f*  
 variables that move in opposite directions, 19–20  
 variables that move in same direction, 18–19  
 when other things change, 25  
*x*-coordinate, 15  
*y*-coordinate, 15  
**Great Compression**, 443  
**Great Depression**, 166  
 grocery self-checkouts, 256  
 growth. *See* economic growth  
**Guaranteed Income Supplement (GIS)**, 453  
**Gunderson, Morley**, 132

**H**  
 health, safety, and regulation barriers, 163  
**Herfindahl-Hirschman Index (HHI)**, 234–235, 343, 354  
 Hong Kong, 39, 163  
 Hotelling, Harold, 428  
**Hotelling Principle**, 428, 429, 463  
 household type, 444  
 housing market with rent ceiling, 128–130  
 housing shortage, 128  
 Hoxby, Caroline, 412  
 Hubbard, Thomas, 344, 368  
**human capital**, 3, 443, 448–449, 463  
 and capital accumulation, 38  
 measure of, 4*f*  
 Hurricane Katrina, 118  
 Husky Energy Inc., 46–47

**I**  
 IBM, 283, 367  
 Iceland, 403  
 illegal drugs  
 legalization of, 143  
 market for, 142–143, 142*f*  
 taxation of, 143  
 illegal goods markets, 142–143, 142*f*  
**implicit rental rate**, 224, 256  
 import barriers, 163  
**import quota**, 160–161, 160*f*  
**imports**, 152  
 Canada, 153, 153*f*  
 gains and losses, 155, 155*f*  
*In Defense of Monopoly: How Market Power Fosters Creative Production* (McKenzie and Lee), 424

**incentive**, 2, 10  
 to cheat, 140  
 to overproduce, 140  
 incentive pay, 229  
**incentive systems**, 229  
 income

after-tax income, 440, 443, 443*f*, 454  
 annual *vs.* lifetime, 443  
 average income, 440  
 change in income, 204, 204*f*, 211, 211*f*  
 and demand, 60  
 distribution of. *See* income distribution  
 expected future income, 60  
 and labour, 4  
 Lorenz curve, 442*f*  
 market income, 440, 454  
 mean income, 440  
 median income, 440  
 mode income, 440  
 proportion spent on a good, 86–87  
 real income, 203, 204  
 redistribution of. *See* income  
 redistribution  
 rise in income, and marginal utility, 188, 188*f*  
 source of income, 444  
 total income, 440  
*vs.* wealth, 442–443  
 income distribution, 440, 440*f*  
 Canada, 440, 440*f*, 447  
 explanation of trend in, 449, 449*f*  
 selected countries, 446, 446*f*  
**income effect**, 57, 211, 211*f*, 212–213, 213*f*, 419  
 income elastic demand, 91, 92  
**income elasticity of demand**, 91–92, 97  
 income inelastic demand, 91–92  
 income maintenance programs, 453  
 income redistribution, 453–455  
 administrative costs, 455  
 big tradeoff, 455  
 deadweight loss, 455  
 income maintenance programs, 453  
 income taxes, 453  
 major welfare challenge, 455  
 market income *vs.* after-tax income, 454  
 scale of, 454, 454*f*  
 subsidized services, 453–454  
 income taxes, 453  
 increasing marginal returns, 250–251  
 India, 7, 91, 163, 447  
**indifference curve**, 205  
 close substitutes, 207  
 complements, 207–208  
 degree of substitutability, 207–208, 207*f*  
 diminishing marginal rate of substitution, 206  
 flat indifference curve, 206  
 highest attainable indifference curve, 209  
 marginal rate of substitution, 206, 206*f*  
 preference map, 205, 205*f*  
 and preferences, 205–208  
 steep indifference curve, 206  
 individual demand, 108–109, 108*f*  
 individual supply, 110, 110*f*  
**individual transferable quota (ITQ)**, 402–403, 403*f*

indivisible goods, 202  
 Industrial Revolution, 53  
 Industry Canada, 232  
 inefficiency  
 with external benefit, 380*f*  
 with external cost, 373  
 of minimum wage, 132, 133*f*  
 in monopoly, 305, 305*f*  
 overproduction, 141, 373  
 private provision of a public good, 394  
 and production quota, 140  
 public overprovision, 395–396, 395*f*, 397  
 rent ceiling, 129, 129*f*  
**inelastic demand**, 85, 86*f*, 89, 301  
 inelastic supply, 94–95, 95*f*  
 inequality. *See* economic inequality  
 infant industry, 164  
**inferior good**, 60, 91, 92, 213  
 information-age monopolies, 7, 299  
 information constraints, 226  
 Information Revolution, 7, 53  
 innovation, 299  
 inputs, 56  
 Intel Corporation, 341, 354, 367  
 intellectual property, 44  
**intellectual property rights**, 383  
 interdependence, 343, 367  
**interest**, 4, 225  
 intergenerational transfers, 452  
 International Coffee Organization (ICO), 98  
 International Harvester, 283  
 International Monetary Fund, 74  
 international trade  
 case against protection, 164–167  
 current state of, 152  
 drivers of, 152  
 free trade obstacles, 168–169  
 how global markets work, 152–154  
 net gain from trade, 154–155  
 restrictions, 157–163  
 winners and losers, 155–156  
 international trade restrictions  
 case against protection, 164–167  
 cheap foreign labour, competition with, 164–165  
 compensation of losers, 167  
 domestic jobs, 164  
 dumping, 164  
 exploitation of developing nations, 165  
 export subsidies, 163  
 health, safety, and regulation barriers, 163  
 import quota, 160–161, 160*f*  
 infant industry, 164  
 lax environmental standards, 165  
 offshore outsourcing, 165  
 other import barriers, 163  
 reasons for, 166–167  
 rent seeking, 167  
 tariff revenue, 166

tariffs, 157–159, 157f, 159f  
trade wars, avoidance of, 166  
voluntary export restraint, 163  
Internet advertising, 240–241  
the Internet for everyone, 12  
**inverse relationship**, 19, 19f  
invisible hand, 6, 8, 113  
iPhone, 239  
Ireland, 376

**J**

Japan, 163, 168–169  
Japan Pork Producers Association, 168  
Jevons, William Stanley, 192  
job prospects, 421  
joint unlimited liability, 231  
JPMorgan Chase, 230  
just-affordable combinations, 181

**K**

Karns, Scott, 90  
Karns Foods, 90  
Katz, Lawrence, 449  
Kendall, Perry, 194  
Kennesaw State University, 93  
Kenney, Jason, 430  
key money, 128  
Kimberly-Clark, 350  
known oil reserves, 428  
Koiso, Takashi, 168  
Krueger, Alan, 132  
Kuramoto, Hisao, 168  
Kyagalanyi Coffee Ltd., 98

**L**

**labour**, 3  
and income, 4  
owner's labour services, 225  
quality of labour, 3  
labour demand, 415–416, 416f, 417, 417f, 418, 422  
labour demand curve, 416, 416f  
labour force status, 444  
labour market  
Alberta labour market, 430–431  
minimum wage, 131–132  
monopsony, 423–425, 423f, 425f  
labour market equilibrium, 419, 422  
labour markets, 414, 418–425  
competitive labour market, 418–419  
with unions, 422–425  
wage rate differences and trends, 420  
labour services, 414  
labour supply, 418–419, 422  
labour supply curve, 418–419, 418f  
**labour union**, 414, 422–425, 422f  
labour demand, influences on, 422  
labour market equilibrium, 422  
labour supply, influences on, 422  
monopsony, 423–425, 423f, 425f  
Laidler, David, 11

**land**, 3

land rental markets, 426–427, 427f  
land services markets, 414  
**law of demand**, 57  
**law of diminishing returns**, 251, 254  
**law of supply**, 62  
learning-by-doing, 164  
Lee, Dwight R., 424  
legal barrier to entry, 298–299  
**legal monopoly**, 298–299  
legal system, 107  
leisure, opportunity cost of, 419  
Levitt, Steven D., 222  
Lieb, Rebecca, 240  
life-cycle saving patterns, 452  
Life Technologies Corp., 287  
lighthouses, 396  
**limit pricing**, 355  
limited liability, 231, 231f  
line of equality, 442  
linear equation, 26  
**linear relationship**, 18–19, 26, 26f  
liquefied natural gas (LNG) project, 46–47  
living standards. *See* standard of living  
living wage, 116  
Loblaw Companies Limited, 232  
Lockheed Constellation, 382  
Lomborg, Bjørn, 377  
**long run**, 248  
**long-run average cost curve**, 261–262, 262f  
long-run cost, 260–263  
long-run average cost curve, 261–262, 262f  
production function, 260, 260t  
and short-run cost, 260–261  
long-run equilibrium, 282f, 283  
long-run supply, 96  
long-term contracts, 230  
**Lorenz curve**, 440, 441–442, 441f, 442f, 446  
loss comparisons, 276  
lottery, 107, 130  
Lotus Corporation, 380  
**low-income cut-off**, 445  
luxuries, 86, 91

**M**

Macdonald, David, 454  
Maclean, Malcolm, 46  
**macroeconomics**, 2  
majority rule, 106, 115  
Malthus, Thomas Robert, 463  
Mankiw, N. Gregory, 166  
**margin**, 10  
marginal analysis, 275  
**marginal benefit**, 10, 36, 379  
vs. marginal cost, 36  
measures of, 58  
and preferences, 36, 36f  
principle of decreasing marginal benefit, 36

**marginal benefit curve**, 36, 36f, 108  
**marginal cost**, 10, 35, 254, 258, 258f, 259t, 372  
vs. marginal benefit, 36  
and marginal revenue, 302  
minimum supply price, 63  
price and quantity supplied, 62  
and production possibilities frontier, 35, 35f  
and production quota, 140  
and subsidies, 140  
and supply, 109–110  
marginal cost curve, 110, 254, 255f, 303f  
**marginal cost pricing rule**, 313  
**marginal external benefit**, 379  
**marginal external cost**, 372, 400  
**marginal private benefit**, 379  
**marginal private cost**, 372, 400  
**marginal product**, 249, 249t, 251f, 258, 258f  
marginal product curve, 250–251  
marginal product of capital, 260  
**marginal rate of substitution**, 206, 206f, 209  
marginal returns  
diminishing marginal returns, 251, 400  
increasing marginal returns, 250–251  
**marginal revenue**, 272, 273f, 300  
and demand, 300, 300f  
and elasticity, 301, 301f  
and marginal cost, 302  
and price, 300  
marginal revenue curve, 303f  
**marginal social benefit**, 108f, 109, 305, 379  
and demand, 400  
overuse of a common resource, 400  
from a public good, 393, 393f  
marginal social benefit curve, 109, 393, 393f  
**marginal social cost**, 305, 372, 394, 400  
**marginal utility**, 179–180, 180f, 182  
*see also* utility  
change in demand, 186  
change in quantity demanded, 186  
choosing at the margin, 182–183  
diminishing marginal utility, 179–180  
equalizing marginal utility per dollar, 182, 183f, 185–186  
fall in price, 185–186, 186f  
marginal calculations, 182–183  
marginal utility per dollar, 182, 185  
paradox of value, 189, 189f  
positive marginal utility, 179  
power of marginal analysis, 184  
predictions of marginal utility theory, 185–190  
rise in income, 188, 188f  
rise in price, 187, 187f  
utility-maximizing choices, 181–184  
**marginal utility per dollar**, 182

**market, 44**

alternatives to the market, 115  
 buyers and sellers, 56  
 for chocolate and cocoa, 69  
 circular flows through markets, 44, 45f  
 for coffee, 71  
 commodity markets, 414  
 competitive environment, 233–237  
 competitive market, 56  
 constraints, 226  
 contestable market, 354, 355f  
 coordination of decisions, 45  
 currency markets, 56  
 e-commerce markets, 56  
 with exports, 154, 154f  
 factor markets. *See* factor markets  
 geographical scope of the market, 236  
 global markets, 236  
 goods markets, 44  
 how markets work, 175  
 for illegal goods, 142–143, 142f  
 with imports, 153, 153f  
 and industry correspondence, 236–237  
 Internet advertising, 240–241  
 market coordination, 238  
 market structure. *See* market structure  
 national market, 236  
 oil, world and Canadian markets for, 429  
 regional market, 236  
 market capitalism, 8  
 market coordination, 238  
 market demand, 108–109, 108f  
 market demand curve, 108, 108f, 109  
 market demand for labour, 418  
 market equilibrium, 66–67, 66f, 77, 77f  
     equation, 77  
     price above equilibrium, 67  
     price adjustments, 67  
     price as regulator, 66–67  
     price below equilibrium, 67  
**market failure, 114**  
     externalities, 115  
     and monopoly, 115  
     price and quantity regulations, 114  
     public goods and common resources, 115  
     sources of, 114–115  
     taxes and subsidies, 114  
     transactions costs, 115  
     understanding, 411  
 market fundamentals price, 428  
**market income, 440, 454**  
 market power, limiting, 367  
 market price, 106  
 market structure, 236t  
     *see also* specific market structures  
     concentration measures, 234–237  
     monopolistic competition, 233, 236t  
     monopoly, 233, 235, 236t  
     oligopoly, 233, 236t  
     perfect competition, 233, 234, 235, 236t  
     types of markets, 233–234

market supply, 110, 110f  
 market supply curve, 110, 110f, 419  
 market supply of labour, 418–419  
 market value, 225  
 marketing, 324–325, 330–333  
**markup, 328f, 329, 332f**  
 marriage, and wealth concentration, 452  
 Marshall, Alfred, 175  
 Marshall, Mary Paley, 175  
 Martin, Paul, 357  
 Marx, Karl, 8  
 Mathews, Timothy, 93  
 maximum points, 20, 21f  
 maximum profit, 8  
 Mazumdar-Shaw, Kiran, 6  
 McKenna, Jane, 144  
 McKenzie, Richard B., 424  
 mean income, 440  
 measures of concentration. *See* concentration measures  
 median income, 440  
 mergers, 356t, 357  
 Mexico, 165  
     *see also* North American Free Trade Agreement (NAFTA)  
 micro establishments, 232  
**microeconomics, 2**  
 Microsoft, 7, 297, 299, 312, 316, 367, 380  
 Mill, John Stuart, 116  
**minimum efficient scale, 263, 272**  
 minimum points, 20, 21f  
 minimum supply-price, 63, 110  
**minimum wage, 127, 131–132, 131f, 133f, 144–145, 425, 425f**  
 misleading graphs, 18  
 mixed economy, 8  
 mode income, 440  
 model. *See* economic model  
 model economy, 32  
 momentary supply, 96  
**money, 44**  
**money price, 56**  
**monopolistic competition, 233, 236t, 324, 367**  
     advertising, 330–333  
     collusion not possible, 324  
     economic profit in short run, 326, 326f  
     efficiency, 329  
     entry and exit, 325  
     examples of, 325  
     excess capacity, 328–329, 328f  
     ignore other firms, 324  
     large number of firms, 324  
     long-run output and price, 327–328, 327f  
     marketing, 324–325, 330–333  
     markup, 328f, 329  
     *vs.* perfect competition, 328–329, 328f  
     price, competing on, 324  
     price and output, 326–329  
     product development, 330

product differentiation, 324  
 profit maximization, 326–327  
 quality, competing on, 324  
 short-run output and price decision, 326  
 small market share, 324  
 today, 325  
 zero economic profit, 327–328

**monopoly, 233, 235, 298**

bARRIER to entry, 298–299  
 bilateral monopoly, 423–425  
 efficiency, 305, 305f  
 elastic demand, 301  
 good *vs.* bad, 424  
 how monopoly arises, 298–299  
 information-age monopolies, 7, 299  
 and market failure, 115  
 maximization of profit, 302  
 natural monopoly, 298, 298f, 313–315, 342  
 no close substitutes, 298  
 output in, 304, 304f  
*vs.* perfect competition, 304–306  
 price and output decision, 300–303, 302t, 303f  
 price cap regulation, 315, 315f  
 price discrimination, 299, 307–311  
 price in, 304, 304f  
 price-setting strategies, 299  
 rate of return regulation, 314  
 redistribution of surpluses, 306  
 regulation of, 313–315, 314f  
 rent seeking, 306  
 rent-seeking equilibrium, 306, 307f  
 single-price monopoly, 299, 300–303

**monopsony, 423–425, 423f, 425f**

Morgenstern, Oskar, 344  
 Motor Coach Industries (MCI), 281  
 Movea, 334  
 Multifibre Arrangement, 164

**N**

Nash, John, 345  
**Nash equilibrium, 345, 349–350, 378**  
 Nashville Predators, 357, 359  
 National Air Pollution Surveillance Program, 375  
 National Collegiate Athletic Association (NCAA), 424  
 national comparative advantage, 152  
 national defence, 115  
 National Energy Board, 313  
 National Hockey League, 357, 359, 423–425  
 National Hockey League Players' Association, 423–425  
 national market, 236  
 natural barrier to entry, 298  
 natural disaster, 118  
 natural gas production, 46  
**natural monopoly, 298, 298f, 313–315, 342**

**natural monopoly good**, 392  
 natural oligopoly, 342, 342f  
 natural resources, 3, 31  
 natural resources market, 414  
 nature, 64  
 near-slave labour, 165  
 NEC, 283  
 necessities, 86, 91  
 negative consumption externalities, 370  
**negative externality**, 370, 372–378  
 negative production externalities, 370  
**negative relationship**, 19, 19f, 27, 27f  
 negative slope, 22f  
**neuroeconomics**, 193  
 New Zealand, 141, 403  
 Newton, Isaac, 380  
 no close substitutes, 298  
**nonexcludable**, 392, 396  
 nonrenewable natural resource markets, 427–428, 428f  
**nonrenewable natural resources**, 414  
**nonrival**, 392  
**normal good**, 60, 91  
**normal profit**, 225, 272  
 normative statements, 11  
 North American Free Trade Agreement (NAFTA), 163, 164–165, 167  
 North Korea, 8, 106  
 Nozick, Robert, 118  
 NutraSweet, 357

**O**

Occupy Wall Street, 8  
**offshore outsourcing**, 165, 166  
 oil, 427–429  
 Old Age Security (OAS), 453  
**oligopoly**, 233, 236t, 342–343  
 anti-combine law, 356–359  
 barriers to entry, 342  
 cellphone service, 360–361  
 examples of, 343  
 games. *See* game theory  
 interdependence, 343  
 natural oligopoly, 342, 342f  
 price-fixing game, 346–350  
 small number of firms, 343  
 temptation to cooperate, 343  
 today, 343  
**opportunity cost**, 9–10, 33  
 of cocoa, 34  
 and human capital, 448  
 of increase in an activity, 10  
 increasing opportunity cost, 33–34  
 and international trade, 152  
 of leisure, 419  
 and price, 56  
 of production, 224–225, 272  
 and production possibilities frontier, 33–34, 35f  
 ratio, 33  
 and value of search time, 128

origin, 15  
 output  
 and external cost, 372  
 in long run, 281–283  
 in monopolistic competition, 326–329  
 in monopoly, 304, 304f  
 output decision, 274–277  
 in perfect competition, 304  
 production function, 260  
 profit-maximizing output, 275, 275f  
 in short run, 278–280, 326  
 and short-run cost, 253–259, 261f  
 and short-run technology constraint, 249–252  
 single-price monopoly, output decision, 300–303, 302t, 303f  
 output cost, 259t  
 outsourcing, 165, 238  
 overfishing, 400–401, 400f  
 overproduction, 114, 114f, 140, 141, 373  
 overprovision, 395–396, 395f, 397  
 ownership, 229  
 ownership barrier to entry, 298

**P**

Panama disease, 74  
 paper books, 214–215  
 paradox of value, 189, 189f  
 partnership, 231, 231t  
**patents**, 298–299, 382–383  
**payoff matrix**, 344, 345f, 349, 350f  
 PayScale, 421  
 peanut butter, 90, 93  
 percentage change, 85  
**perfect competition**, 233, 234, 235, 236t, 272–273  
 economic profit and revenue, 272–273  
 efficiency, 288–289, 288f, 305, 305f  
 firm decisions, 273  
 firm's output decision, 274–277  
 firm's supply curve, 277, 277f  
 how perfect competition arises, 272  
 long-run output, price, and profit, 281–283  
 marginal analysis and the supply decision, 275  
 marginal revenue, and market price, 272  
*vs.* monopolistic competition, 328–329, 328f  
 output in, 304  
 price in, 273f, 304  
 price taker, 272  
 revenue in, 272–273, 273f  
 short-run output, price, and profit, 278–280  
*vs.* single-price monopoly, 304–306  
 in smartphone apps, 290–291  
 technological advances, 284–287  
 temporary shutdown decision, 276

**perfect price discrimination**, 310, 310f, 311

**perfectly elastic demand**, 85–86, 86f, 136, 136f  
 perfectly elastic supply, 95f, 136  
**perfectly inelastic demand**, 85, 86f, 135, 135f  
 perfectly inelastic supply, 95f, 136  
 personal characteristics, 107  
 P&G, 350  
 Pigou, Arthur Cecil, 375  
**Pigovian taxes**, 375  
 plant, 248  
 policy tool, economics as, 11  
 political equilibrium, 397  
 pollution, 372–378  
 population, and demand, 60  
 pork tariffs, 168–169  
 positive consumption externalities, 370  
**positive externality**, 370, 379–383  
 positive marginal utility, 179  
 positive production externalities, 370  
**positive relationship**, 18, 19f, 27  
 positive slope, 22f  
 positive statements, 11  
 positively skewed distribution, 440  
 potential entry, 236  
**poverty**, 117, 445, 445f, 463  
**PPF**. *See* production possibilities frontier (PPF)  
 preference map, 205, 205f  
**preferences**, 9, 36, 179  
 and consumption choices, 179–180  
 and demand, 60  
 and indifference curves, 205–208  
 and marginal benefit, 36  
 and marginal benefit curve, 36f  
 marginal utility, 179–180, 180f  
*vs.* production possibilities, 36  
 revealing preferences, 184  
 total utility, 179, 180f  
 voter preferences, 397  
 present value, 426  
 price  
 above equilibrium, 67  
 adjustments, 67  
 average price, 84–85  
 below equilibrium, 67  
 change in, and budget line, 203–204, 204f  
 change in, and consumer choice, 209–211  
 change in, predictions of, 68–73  
 commodity prices, 414  
*vs.* cost, 110  
 equilibrium oil price, 428  
 equilibrium price, 66, 128, 131  
 expected future prices, 59–60, 64  
 of factors of production, 63, 259, 417  
 fall in price, and marginal utility, 185–186, 186f  
 of firm's output, 417  
 limit pricing, 355

- price (*continued*)
  - in long run, 281–283
  - and marginal revenue, 300
  - market fundamentals price, 428
  - market price, 106
  - maximum price market will bear, 302–303
  - minimum supply price, 63
  - minimum supply-price, 110
  - money price, 56
  - in monopolistic competition, 324, 326–329
  - in monopoly, 304, 304*f*
  - monopoly price-setting strategies, 299
  - and opportunity cost, 56
  - in perfect competition, 273*f*, 304
  - and production quota, 140
  - as regulator, 66–67
  - of related goods, 59
  - of related goods produced, 63
  - relative price, 56, 57, 203, 204, 209
  - rise in price, and marginal utility, 187, 187*f*
  - in short run, 278–280, 326
  - and shortage, 67
  - single-price monopoly, price decision, 300–303, 302*t*, 303*f*
  - and subsidies, 140
  - and surplus, 67
  - time elapsed since price change, and elasticity, 87
  - vs.* value, 108
- price cap, 128**
- price cap regulation, 315, 315*f***
- price ceiling, 128, 315**
- price differences, 307
- price discrimination, 299, 307–311**
  - airline example, 308–310, 308*f*, 309*f*
  - among groups of buyers, 307–308
  - among units of a good, 308
  - efficiency with, 311
  - increasing profit and producer surplus, 308
  - perfect price discrimination, 310, 310*f*, 311
  - rent seeking with, 311
- price effect, 209–211, 209*f*, 212*f***
- price elasticity of demand, 84–90, 97**
  - see also* elasticity of demand
  - along linear demand curve, 87, 87*f*
  - calculation of, 84–85, 85*f*
  - and expenditure, 90
  - factors influencing, 86–87
  - for food, 89, 89*f*
  - minus sign and elasticity, 85
  - peanut butter, 90
  - percentages and proportions, 85
  - in real world, 89
  - and total revenue, 88, 88*f*
  - units-free measure, 85
- price fixing, 359
- price floor, 131, 139**
- price gouging, 119
- price index, 56, 144
- price regulation, 114
- price taker, 272**
- price wars, 354
- Prince Edward Island, 454
- principal, 229
- principal-agent problem, 229–230**
- principle of decreasing marginal benefit, 36
- principle of increasing marginal cost, 400
- principle of minimum differentiation, 395**
- prisoners' dilemma, 344–345
  - bad outcome, 345
  - the dilemma, 345
  - dominant-strategy equilibrium, 345
  - global carbon emissions, 378
  - Nash equilibrium, 345, 349–350
  - outcome, 345
  - payoff matrix, 344, 345*f*, 349, 350*f*
  - rules, 344
  - strategies, 344
- private benefit, 379
- private cost, 372
- private good, 392**
- private property, 401
- private subsidies, 381, 381*f*
- prizes, 451
- producer surplus, 111, 111*f*, 308**
  - gains from trade, 288
  - with no international trade, 155*f*, 156*f*
  - and price discrimination, 308
- product
  - average product, 249, 249*t*, 258, 258*f*
  - demand for firm's product, 272–273
  - development, 330
  - marginal product, 249, 249*t*, 251*f*, 258, 258*f*
  - total product, 249, 249*t*, 251*f*, 256, 256*f*
  - variety, 329
- product curves, 249–252
  - average product curve, 252, 252*f*
  - and cost curves, 256–258
  - marginal product curve, 250–251
  - total product curve, 250, 250*f*
- product differentiation, 233, 324, 334–335**
- product schedules, 249
- production
  - auto production, 263
  - command systems, 229
  - cutback and temporary shutdown, 281
  - firm coordination, 238–239
  - incentive systems, 229
  - market coordination, 238
  - negative production externalities, 370
  - opportunity cost of production, 224–225, 272
  - positive production externalities, 370
- produce more to cut cost, 263
- public production, 380, 381*f*
  - team production, 239
- production costs, 286, 286*f*
- production efficiency, 33**
- production function, 260, 260*t*
- production possibilities frontier (PPF), 32, 32*f*, 41*f*, 250**
  - cocoa production, 34
  - expanding production possibilities, 46
  - and marginal cost, 35, 35*f*
  - and opportunity cost, 33–34, 35*f*
  - tradeoff along, 33
- production quota, 402, 402*f*
- production quotas, 139–140, 139*f***
- profit, 4**
  - accounting profit, 224
  - economic profit. *See* economic profit
  - increasing, and price discrimination, 308
  - in long run, 281–283
  - maximum profit, 8
  - normal profit, 225, 272
  - in short run, 278–280
- profit maximization
  - collusion, 347, 347*f*
  - monopolistic competition, 326–327
  - product development, 330
  - profit-maximizing output, 275, 275*f*
- progressive income tax, 453**
- prohibition, 143
- property rights, 44, 373–374, 374*f*, 401–402, 401*f***
- proportional income tax, 453**
- proportionate change, 85
- provincial taxes, 453
- public choice theory, 397
- public franchise, 298
- public goods, 115, 378, 392, 393–397**
  - efficient private provision, 394–395, 395*f*
  - efficient quantity, 394, 394*f*
  - free-rider problem, 393
  - government size and growth, 397
  - inefficient private provision, 394
  - inefficient public overprovision, 395–396, 395*f*
  - lighthouses, 396
  - marginal social benefit, 393, 393*f*
  - marginal social cost, 394
  - political equilibrium, 397
  - principle of minimum differentiation, 395
- public production, 380, 381*f***
- Purolator, 299
- Q**
- Qatar, 163
- quality
  - advertising, as signal of quality, 332–333
  - and monopolistic competition, 324

- quantity  
 affordable quantities, 202  
 average quantity, 84–85  
 change in, predictions of, 68–73  
 equilibrium quantity, 139  
 produced, and subsidies, 140  
 public good, efficient quantity of, 394,  
 $394f$   
 unaffordable quantities, 202
- quantity demanded, 57**
- quantity regulation, 114
- quantity supplied, 62**
- Quebec gas prices case, 359
- R**
- Ragan, Christopher, 11
- rate of return regulation, 314, 314**
- rational choice, 9**
- rational ignorance, 396**
- Rawls, John, 117
- real income, 203, 204**
- real property, 44
- recorded music, 190–191
- Reddish, Angela, 11
- redistribution of surpluses, 306
- regional market, 236
- regressive income tax, 453**
- regulation, 313**  
 clean technology, 374–375  
 earnings sharing regulation, 315  
 efficient regulation of a natural monopoly, 313  
 of monopoly, 313–315, 314f  
 price cap regulation, 315, 315f  
 rate of return regulation, 314  
 second-best regulation of a natural monopoly, 314–315
- regulatory barriers, 163
- related goods, 59
- relative price, 56, 57, 203, 204, 209**
- renewable natural resource, 398–399
- rent, 4**
- rent ceiling, 128–130, 129f**  
 black market, 128–129  
 fairness of, 130  
 housing shortage, 128  
 inefficiency, 129, 129f  
 rent control winners, 130  
 search activity, 128
- rent seeking, 167, 306, 311**
- rent-seeking equilibrium, 306, 307f
- rent *vs.* buy decision, 426
- rental market, 414
- rental rate, 414
- rental rate of capital, 426
- repeated games, 352–354
- research and development game of chicken, 351, 351f
- reservation wage rate, 418
- resource allocation  
 in competitive markets, 108–111
- resource allocation methods, 106–107
- resource allocation methods, 106–107  
 command system, 106  
 contest, 106  
 first-come, first-served, 106–107  
 force, 107  
 lottery, 107  
 majority rule, 106  
 market price, 106  
 personal characteristics, 107
- resources  
 bought in the market, 224  
 classification of, 392  
 common resources, 115, 392, 398–403  
 as constraint, 62  
 efficient use of, 35–37, 288  
 misallocated resources, 33  
 natural resources, 3, 31  
 nonrenewable natural resources, 414  
 owned by the firm, 224  
 renewable natural resource, 398–399  
 substitution possibilities, 95–96  
 supplied by firm's owner, 225  
 unused resources, 33
- revenue  
 and economic profit, 272–273  
 marginal revenue. *See* marginal revenue  
 in perfect competition, 272–273, 273f  
 total revenue, 272, 273f, 274, 274f,  
 300
- rival, 392**
- Rogers, 341, 360
- Romer, Paul, 383
- Rosen, Sherwin, 452
- Royal Bank of Canada, 166, 357
- rule of law, 107
- running shoes, 331
- Russia, 7, 46
- S**
- Sam the Record Man, 285
- saving patterns, 452
- scarcity, 2, 32, 130**
- scatter diagram, 16–18, 17f**
- school choices, 382
- search activity, 128**
- Sears Canada, 166
- self-checkouts, 256
- self-interest, 5**  
 bounded self-interest, 192–193  
 and majority rule, 115  
*vs.* selfish actions, 10  
 and social interest, 5–7, 10, 163
- selfish actions, 10
- sellers  
 penalties, and illegal goods market,  
 142, 143  
 tax on, 133–134, 134f
- selling costs, 331–332, 331f
- sequential games, 354–355, 355f
- services, 56, 133n
- Shaw Communications, 313
- Shepherd, William G., 237
- short run, 248**
- short-run cost, 253–259, 261f  
 average cost, 254  
 and long-run cost, 260–261  
 marginal cost, 254  
 total cost, 253
- short-run equilibrium, 279–280, 279f
- short-run market supply curve, 278, 278f**
- short-run supply, 96
- short-run technology constraint, 249–252  
 product curves, 249–252  
 product schedules, 249
- shortage, 67
- shutdown decision, 276, 276f
- shutdown point, 276**
- signal, 332–333**
- Simon, Julian, 463
- single-price monopoly, 299, 300–303**  
*see also* monopoly
- slope, 21, 22**  
 across an arc, 23–24, 24f  
 of a curved line, 23–24, 23f, 24f  
 negative slope, 22f  
 at a point, 23, 23f  
 positive slope, 22f  
 of a relationship, 22–24  
 of a straight line, 22–23, 22f, 26–27,  
 $26f$   
 of total product curve, 250
- smartphone apps, 290–291
- Smith, Adam, 8, 53, 113, 221
- Smoot-Hawley tariff, 166
- social interest, 5**  
 and climate change, 7  
 and economic instability, 7  
 and efficiency, 5  
 and fair shares, 5–6  
 and globalization, 6  
 and information-age monopolies, 7  
 and resource allocation, 108  
 and self-interest, 5–7, 10, 163
- social interest theory, 313, 397**
- social loss  
 import quota, 160–161  
 tariffs, 158–160, 159f
- social science, and economics, 11
- social security, 453
- socialism, 8
- society, and scarcity, 2
- sole proprietorship, 230–231, 231t
- South Africa, 163, 446, 446f
- South America, 141, 163
- Soviet Union, 8
- specialization, 40, 451
- spillover effect, 422
- standard of living, 38
- Starbucks, 248, 264–265
- Statistics Canada, 235, 236, 440, 454

Stern, Nicholas, 377  
 stock, 442  
**straight line**  
 equations of straight lines, 26–27  
 linear relationship, 18–19, 26, 26f  
 negative relationships, 27, 27f  
 position of the line, 27  
 positive relationships, 27  
 slope of, 22–23, 22f, 26–27, 26f  
 $y$ -axis intercept, 26, 26f  
 strategic behaviour, 344  
 strategic interdependence, 367  
**strategies, 344**  
 subsidized services, 453–454  
**subsidy, 114, 140–141, 141f**  
 export subsidies, 163  
 natural monopoly, 314  
 private subsidies, 381, 381f  
**substitutes, 57, 59**  
 close substitutes, 207  
 closeness of, and elasticity of demand, 86  
 and cross elasticity of demand, 92–93  
 degree of substitutability, 207–208, 207f  
 for low-skilled labour, 449  
 no close substitutes, 298  
 in production, 63  
 resource substitution possibilities, 95–96  
**substitution effect, 57, 212, 212f, 419**  
 sugary drinks, 194–195  
**sunk cost, 248**  
 super rich, 451–452  
 superstars, contests among, 451–452  
 suppliers, number of, 64  
**supply, 62–65**  
 change in supply. *See* change in supply  
 change in the quantity supplied, 64–65, 65f  
 cost and minimum supply-price, 110  
 decision, and marginal analysis, 275  
 elastic supply, 94–95, 95f  
 elasticity of supply, 94–96  
 and expected future prices, 64  
 fundamental determinant of supply, 428  
 fundamental influences, 428  
 and human capital, 448  
 individual supply, 110, 110f  
 inelastic supply, 94–95, 95f  
 law of supply, 62  
 long-run supply, 96  
 and marginal cost, 109–110  
 market supply, 110, 110f  
 market supply of labour, 418–419  
 minimum supply price, 63  
 momentary supply, 96  
 and number of suppliers, 64  
 of oil, 427–428  
 perfectly elastic supply, 95f, 136  
 perfectly inelastic supply, 95f, 136  
 and prices of factors of production, 63

and prices of related goods produced, 63  
 and producer surplus, 111, 111f  
 and production quota, 139  
 quantity supplied, 62  
 short-run supply, 96  
 speculative influences, 428  
 and state of nature, 64  
 and subsidies, 140  
 supply curve. *See* supply curve  
 supply schedule, 62  
 and technological change, 64  
 time frame for supply decision, 96  
 unit elastic supply, 95f  
**supply curve, 62, 63f, 76, 76f**  
 equation, 76  
 of firm, 277, 277f  
 as marginal cost curve, 110  
 short-run market supply curve, 278, 278f  
 supply schedule, 62  
 surplus, 67  
 consumer surplus. *See* consumer surplus  
 producer surplus. *See* producer surplus  
 redistribution of surpluses, 306  
 total surplus, 112, 288, 311  
**Sustainable Prosperity, 384**  
 sustainable use of renewable resource, 398–399, 398f  
 Sweden, 446, 446f  
**symmetry principle, 118**

**T**

Tanzania, 91  
 Target, 264  
**tariffs, 157–159**  
 countervailing duties, 164  
 deadweight loss, 159  
 effects of, 157–158, 157f  
 pork tariffs, 168–169  
 reduction in, 158  
 tariff revenue, 166  
 two-part tariff, 313  
 winners, losers and social loss, 158–160, 159f

**tax incidence, 133**  
 and elasticity of demand, 135–136, 135f  
 and elasticity of supply, 136, 137f  
 taxes, 114, 133–138  
 ability-to-pay principle, 138  
 benefits principle, 138  
 buyers, tax on, 134, 135f  
 carbon tax, 376, 384–385  
 and efficiency, 137–138, 137f  
 Employment Insurance tax, 135  
 and equal sharing of burden, 134–135  
 equivalence of tax on buyers and sellers, 134–135  
 evasion, and illegal trading, 143

and fairness, 138  
 on illegal drugs, 143  
 income taxes, 453  
 perfectly elastic demand, 136, 136f  
 perfectly elastic supply, 136  
 perfectly inelastic demand, 135, 135f  
 perfectly inelastic supply, 136  
 Pigovian taxes, 375  
 and pollution, 375–376, 375f  
*vs.* prohibition, 143  
 sellers, tax on, 133–134, 134f  
 on sugary drinks, 194–195  
 tax incidence. *See* tax incidence  
 who pays the most tax, 138

TD Bank, 357  
 team production, 239  
 technological advance. *See* technological change  
**technological change, 38**  
 and changes in demand and supply, 284–287  
 and production costs, 286, 286f  
 and supply, 64  
**technological efficiency, 227**  
**technology, 226**  
 abatement technology, 373  
 clean technology, 374–375  
 as constraint, 62, 226, 249–252  
 and cost curves, 258–259  
 and labour demand, 417  
 short-run technology constraint, 249–252  
 and trends in inequality, 449

Telus, 341, 360  
 temperature, and utility, 190  
 temporary shutdown decision, 276  
 tennis racquets, 334–335  
 theft, 107  
*A Theory of Justice* (Rawls), 117  
 tissue market, 350  
 tit-for-tat strategy, 352  
 Tomchak, Glen, 281  
**total cost, 253, 259t, 274, 274f, 331, 331f**  
 total cost curves, 253f, 303f  
**total fixed cost, 253, 259t**  
**total income, 440**  
**total product, 249, 249t, 251f, 256, 256f**  
 total product cost, 259t  
 total product curve, 250, 250f  
**total revenue, 88, 88f, 272, 273f, 274, 274f, 300**  
 total revenue curve, 301f, 303f  
**total revenue test, 88**  
**total surplus, 112, 288, 311**  
**total utility, 179, 180f, 181**  
**total variable cost, 253, 256, 256f, 259t**  
 trade wars, 166  
**tradeoff, 9**  
 along production possibilities frontier, 33

- big tradeoff, 117, 455  
choice as tradeoff, 9  
traffic flow, 105, 120–121  
**tragedy of the commons**, 398, 399  
training. *See* education  
Trans-Pacific Partnership, 168  
**transactions costs**, 115, 238, 374  
transportation infrastructure, 404–405  
trigger strategy, 352  
Turner, Matthew A., 120  
two big economic questions, 3–7  
two-part tariff, 313
- U**  
Uganda, 98  
unaffordable quantities, 202  
underproduction, 114, 114f, 380  
unemployment  
    benefits, 165  
    and minimum wage, 131, 131f, 132  
unfair results, 116–117  
**unit elastic demand**, 85, 301  
unit elastic supply, 95f  
United Kingdom, 376  
United Nations' Food and Agriculture Organization, 74  
United States  
    access to markets of developing nations, 163  
    carbon emissions, 7, 378  
    charter school, 382–383  
    distribution of income, 447  
    farm subsidies, 141  
    financial crisis, 7  
    and individual transferable quotas, 403  
    and international trade, 152  
    NAFTA. *See* North American Free Trade Agreement (NAFTA)  
    rent ceilings, 130  
    Smoot-Hawley tariff, 166  
    subsidies, 163  
    Sustainable Fishing Act, 403  
units-free measure, 85  
unlimited liability, 230–231  
U.S. Bureau of Labor Statistics, 421  
U.S. Commerce Department, 162  
U.S. Federal Reserve, 7
- U.S. Federal Trade Commission, 316  
U.S. International Trade Commission, 164  
**utilitarianism**, 116–117, 117f  
**utility**, 179  
    recorded music, 190–191  
    schedules, 180  
    temperature, analogy to, 190  
    total utility, 179, 180f, 181  
    units of utility, 184  
    utility-maximizing choices, 181–184  
utility-maximizing choices  
    *see also* marginal utility  
    choosing at the margin, 182–183  
    equalizing marginal utility per dollar, 182, 183f  
    just-affordable combinations, 181  
    marginal calculations, 182–183  
    marginal utility per dollar, 182  
    power of marginal analysis, 184  
    spreadsheet solution, 181  
    utility-maximizing rule, 182
- V**  
value, 108  
    and marginal benefit, 108  
    market value, 225  
    paradox of value, 189, 189f  
    *vs.* price, 108  
**value of marginal product**, 415, 415f, 416f, 427, 428, 448  
value of marginal product of capital, 426  
value of marginal product of land, 426–427  
variable cost, 259, 259t  
variables  
    more than two variables, 24–25, 25f  
    that are unrelated, 21, 21f  
    that have maximum or minimum, 20, 21f  
    that move in opposite directions, 19–20  
    that move in the same direction, 18–19  
Veall, Michael, 443  
Vietnam, 162  
voluntary export restraint, 163  
von Neumann, John, 344, 367
- voters, 397  
**voucher**, 381–382, 382f
- W**  
wage inequality, 420  
wage rates, 420, 448  
**wages**, 4  
wants, 57  
war, 107  
water-diamond paradox, 189  
**wealth**, 442  
    annual *vs.* lifetime, 443  
    distribution of wealth, 444  
    *vs.* income, 442–443  
    intergenerational transfers, 452  
    life-cycle saving patterns, 452  
    Lorenz curve, 442f  
    marriage, and wealth concentration, 452  
    super rich, 451–452  
    unequal wealth, 452  
*Wealth of Nations* (Smith), 53  
welfare challenge, 455  
welfare programs, 453  
willingness to pay, 36, 58, 108  
wire hangers, 162  
wireless companies, 360  
Workers' Compensation, 453  
world Gini ratio, 447, 447f  
world inequality, 446–447  
World Trade Organization (WTO), 163, 164  
Wright, Orville and Wilbur, 382  
Wynne, Kathleen, 144
- X**  
*x*-coordinate, 15
- Y**  
*y*-axis intercept, 26, 26f  
Yahoo, 240  
Yellow Pages, 357  
Young-Scrivner, Annie, 264
- Z**  
zero economic profit, 327–328  
Zuckerberg, Mark, 12, 229

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## NOTES

## Economics in the News

*Economics in the News* boxes show students how to use the economic toolkit to understand the events and issues they are confronted with in the media. An extended Economics in the News at the end of each chapter helps students think like economists by connecting chapter tools and concepts to the world around them.

- 1 The Invisible Hand 6
- The Internet for Everyone 12
- 2 Opportunity Cost of Cocoa 34
- Expanding Production Possibilities 46
- 3 The Markets for Chocolate and Cocoa 69
- The Market for Coffee 71
- Demand and Supply: The Market for Bananas 74
- 4 The Elasticity of Demand for Peanut Butter 90
- More Peanut Butter Demand Elasticities 93
- The Elasticity of Demand for Coffee 98
- 5 Making Traffic Flow Efficiently 120
- 6 Push to Raise the Minimum Wage 144
- 7 The Changing Market for Coat Hangers 162
- Obstacles to Free Trade 168
- 8 Influencing Consumer Choice for Sugary Drinks 194
- 9 Paper Books Versus eBooks 214
- 10 Principals and Agents Get It Wrong 230
- Battling for Markets in Internet Advertising 240
- 11 Checkout Cost Curves 256
- Expanding Capacity at Starbucks 264
- 12 Record Stores Exit 285
- The Falling Cost of Sequencing DNA 287
- Perfect Competition in Smartphone Apps 290
- 13 Microsoft Monopoly 312
- Is Google Misusing Monopoly Power? 316
- 14 Product Differentiation in Tennis Racquets 334
- 15 Airbus Versus Boeing 353
- Oligopoly Games in Cellphone Service 360
- 16 A Carbon Reduction Plan 384
- 17 Maintaining the Transportation Infrastructure 404
- 18 Degree Major and Job Prospects 421
- Resources and Labour Interact 430
- 19 The Most Equal and Unequal Places in Canada 456

## Economics in Action

*Economics in Action* boxes apply economic theory to current events to illustrate the importance of economic forces in the world around us.

- 2 Hong Kong Overtakes Canada 39
- 4 Elastic and Inelastic Demand 89 • Price Elasticities of Demand for Food 89 • Necessities and Luxuries 91 • Income Elastic and Inelastic Demand 92
- 5 Seeing the Invisible Hand 113
- 6 Rent Control Winners: The Rich and Famous 130 • Workers and Consumers Pay the Most Tax 138 • Rich High-Cost Farmers the Winners 141
- 7 We Trade Metals for Consumer Goods 152 • Tariffs Almost Gone 158 • Self-Interest Beats the Social Interest 163
- 8 Maximizing Utility from Recorded Music 190
- 9 Best Affordable Choice of Movies and DVDs 210
- 10 The Size Distribution of Firms in Canada 232 • Concentration in the Canadian Economy 235 • A Competitive Environment 237 • Apple Doesn't Make the iPhone! 239
- 11 How to Pull Up Your Average 252 • Produce More to Cut Cost 263
- 12 Production Cutback and Temporary Shutdown 281 • Entry and Exit 283
- 13 Information-Age Monopolies 299 • Attempting Perfect Price Discrimination 311
- 14 Monopolistic Competition Today 325 • The Cost of Selling a Pair of Shoes 331
- 15 Oligopoly Today 343 • A Game in the Market for Tissues 350 • Mergers Blocked 357 • Cineplex Galaxy Acquires Famous Players 358 • Price Fixing 359 • Abuse of Dominant Position 359
- 16 Opposing Trends: Success and Failure 371 • Taxing Carbon Emissions 376 • A Global Prisoners' Dilemma 378 • Education Efficiency and School Choices 382
- 17 Is a Lighthouse a Public Good? 396 • The Original Tragedy of the Commons 398 • One of Today's Tragedies of the Commons 399 • ITQs Work 403
- 18 Wage Rates in Canada 420 • The World and Canadian Markets for Oil 429
- 19 The Rich Get Richer 443 • School Pays 444 • How Long Does a Spell of Poverty Last? 445 • Income Redistribution: Only the Richest Pay 454

## At Issue

*At Issue* boxes show two sides of a controversial issue and help students apply the economic way of thinking to clarify and debate the issues.

- 1** The Protest Against Market Capitalism 8
- 5** Price Gouging 119
- 6** Does the Minimum Wage Cause Unemployment? 132
- 7** Is Offshore Outsourcing Bad or Good for Canada? 166

- 16** Should We Be Doing More to Reduce Carbon Emissions? 377
- 18** Monopoly Power for Evil or Good? 424