

MICROECONOMICS

CANADA IN THE GLOBAL ENVIRONMENT NINTH EDITION



PARKIN



BADE

MICROECONOMICS

CANADA IN THE GLOBAL ENVIRONMENT **NINTH EDITION**

MyEconLab® Provides the Power of Practice

Optimize your study time with **MyEconLab**, the online assessment and tutorial system. When you take a sample test online, **MyEconLab** gives you targeted feedback and a personalized Study Plan to identify the topics you need to review.

Study Plan

The Study Plan shows you the sections you should study next, gives easy access to practice problems, and provides you with an automatically generated quiz to prove mastery of the course material.

This screenshot shows the 'Study Plan' section of the MyEconLab platform. At the top, there's a navigation bar with 'Account', 'Help & Support', and 'Sign Out'. Below it, the 'MyEconLab' logo is visible. The main area is titled 'Study Plan' under 'Economics > STUDY PLAN'. It displays a message: 'You have earned 0 of 150 mastery points (MP). Practice these sections and then take a Quiz Me to prove mastery and earn more points.' There are two tabs: 'Sections to practice and master' and 'View all chapters'. Under 'Sections to practice and master', there are five items: '0.1 Tutorial Examples for Students', '1.1 Three Key Economic Ideas', '1.2 The Economic Problem That Every Society Must Solve', '1.3 Economic Models', and '1.4 Microeconomics and Macroeconomics'. Each item has a 'Practice' button and a 'Quiz Me' button. On the right side, there's a 'Legend' icon and a 'View progress' link. At the bottom, the 'MyEconLab' logo and 'with KNEWTON Adaptive Learning' are shown.

Unlimited Practice

As you work each exercise, instant feedback helps you understand and apply the concepts. Many Study Plan exercises contain algorithmically generated values to ensure that you get as much practice as you need.

This screenshot shows a 'Homework: Assignment 3' interface. The assignment title is 'Chapter Problem 6' with '0 of 6 complete'. The problem statement is: 'OPEC deadlocked on oil production hike. Oil prices breached the \$100-a-barrel mark Wednesday after OPEC said it could not reach an agreement about raising crude production. Source: CNN Money, June 8, 2011'. The task is to 'Consider the market for oil when oil prices "breached the \$100-a-barrel mark". Draw a demand curve and a supply curve consistent with this information. Label both curves. Draw a point at the equilibrium price and equilibrium quantity. Label it 1.' A green box with a checkmark says 'Excellent!' with the feedback: 'Initially the price of a barrel of oil is greater than \$100. When OPEC members agree to increase production, the supply of oil increases and the supply curve shifts rightward. The equilibrium price of a barrel of oil falls and the equilibrium quantity increases.' Buttons for 'Done', 'Clear All', 'Check Answer', and 'Save' are at the bottom. To the left, there's a sidebar with 'All parts showing' and a 'Help' icon.

Learning Resources

Study Plan problems link to learning resources that further reinforce concepts you need to master.

- **Help Me Solve This** learning aids help you break down a problem much the same way as an instructor would do during office hours. Help Me Solve This is available for select problems.
- **eText links** are specific to the problem at hand so that related concepts are easy to review just when they are needed.
- A **graphing tool** enables you to build and manipulate graphs to better understand how concepts, numbers, and graphs connect.

MyEconLab®

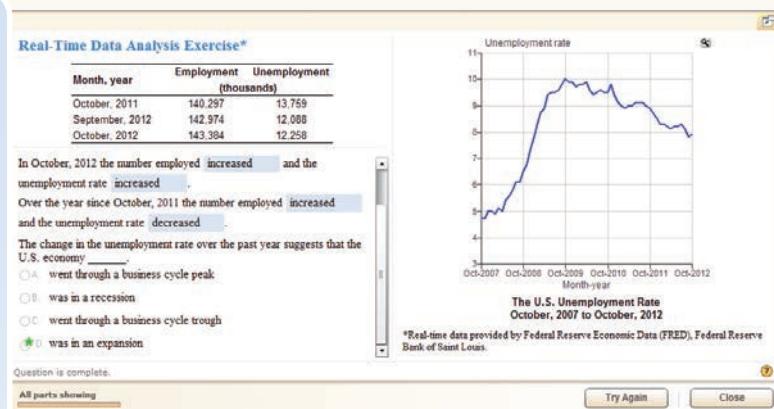
Find out more at www.myeconlab.com

Real-Time Data Analysis Exercises

Up-to-date macro data is a great way to engage in and understand the usefulness of macro variables and their impact on the economy. Real-Time Data Analysis exercises communicate directly with the Federal Reserve Bank of St. Louis's FRED site, so every time FRED posts new data, students see new data.

End-of-chapter exercises accompanied by the Real-Time Data Analysis icon  include Real-Time Data versions in **MyEconLab**.

Select in-text figures labelled **MyEconLab** Real-Time Data update in the electronic version of the text using FRED data.



Real-Time Data Analysis Exercise*

Month, year	Employment (thousands)	Unemployment
October, 2011	140,297	13,759
September, 2012	142,974	12,088
October, 2012	143,384	12,258

In October, 2012 the number employed increased _____ and the unemployment rate increased _____. Over the year since October, 2011 the number employed increased _____ and the unemployment rate decreased _____.

The change in the unemployment rate over the past year suggests that the U.S. economy _____.

- A went through a business cycle peak
- B was in a recession
- C went through a business cycle trough
- D was in an expansion

Question is complete.

All parts showing

The U.S. Unemployment Rate
October, 2007 to October, 2012

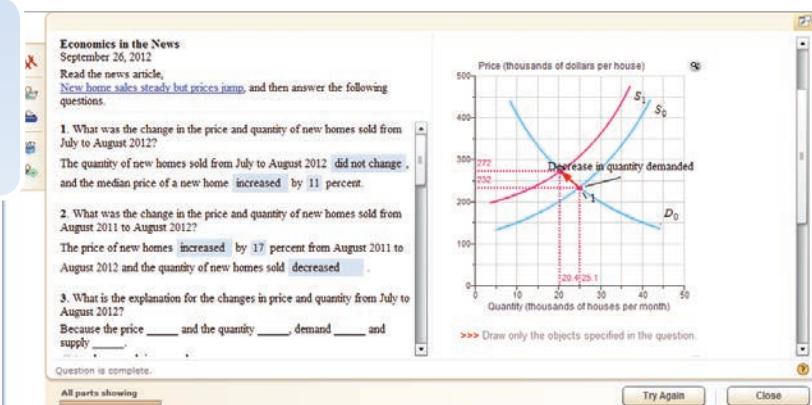
*Real-time data provided by Federal Reserve Economic Data (FRED), Federal Reserve Bank of St. Louis.

Try Again

Close

Current News Exercises

Posted weekly, we find the latest microeconomic and macroeconomic news stories, post them, and write auto-graded multi-part exercises that illustrate the economic way of thinking about the news.



Economics in the News
September 26, 2012
Read the news article, [New home sales steady but prices jump](#), and then answer the following questions.

1. What was the change in the price and quantity of new homes sold from July to August 2012?
The quantity of new homes sold from July to August 2012 did not change, and the median price of a new home increased by 11 percent.

2. What was the change in the price and quantity of new homes sold from August 2011 to August 2012?
The price of new homes increased by 17 percent from August 2011 to August 2012 and the quantity of new homes sold decreased.

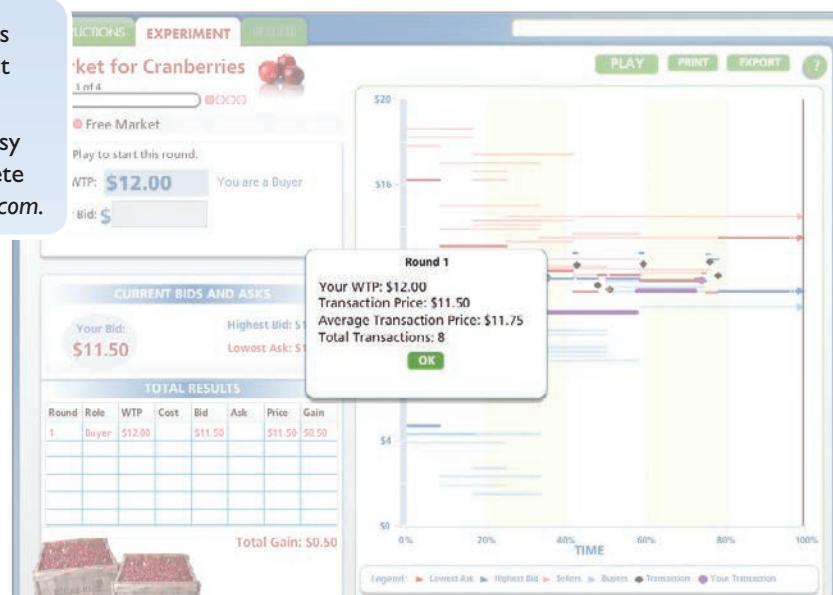
3. What is the explanation for the changes in price and quantity from July to August 2012?
Because the price _____ and the quantity _____ demand _____ and supply _____.

Question is complete.
All parts showing

Interactive Homework Exercises

Participate in a fun and engaging activity that helps promote active learning and mastery of important economic concepts.

Pearson's experiments program is flexible and easy for instructors and students to use. For a complete list of available experiments, visit www.myeconlab.com.



EXPERIMENT

Market for Cranberries
1 of 4

Free Market

Play to start this round.

WTP: \$12.00 You are a Buyer

Bid: \$

CURRENT BIDS AND ASKS

Your Bid: \$11.50
Highest Bid: \$11.50
Lowest Ask: \$11.50

TOTAL RESULTS

Round	Role	WTP	Cost	Bid	Ask	Price	Gain
1	Buyer	\$12.00	\$11.50	\$11.50	\$11.50	\$11.50	\$0.50

Total Gain: \$0.50

Round 1
Your WTP: \$12.00
Transaction Price: \$11.50
Average Transaction Price: \$11.75
Total Transactions: 8

OK

Legend: Lowest Ask, Highest Bid, Sellers, Buyers, Transaction, Your Transaction

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MICROECONOMICS

CANADA IN THE GLOBAL ENVIRONMENT **NINTH EDITION**



MICHAEL PARKIN  ROBIN BADE

PEARSON

Toronto

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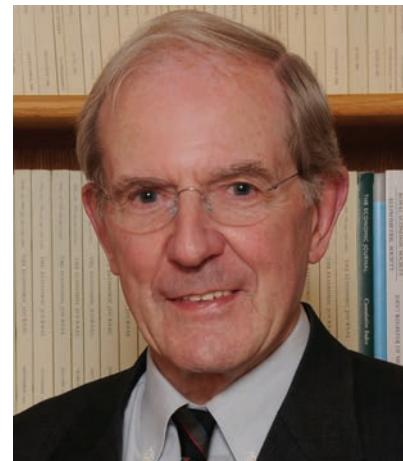
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TO OUR STUDENTS

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Michael Parkin received his training as an economist at the Universities of Leicester and Essex in England. He is Professor Emeritus in the Department of Economics at the University of Western Ontario, Canada. Professor Parkin has held faculty appointments at Brown University, the University of Manchester, the University of Essex, and Bond University. He is a past president of the Canadian Economics Association and has served on the editorial boards of the *American Economic Review* and the *Journal of Monetary Economics* and as managing editor of the *Canadian Journal of Economics*. Professor Parkin's research on macroeconomics, monetary economics, and international economics has resulted in over 160 publications in journals and edited volumes, including the *American Economic Review*, the *Journal of Political Economy*, the *Review of Economic Studies*, the *Journal of Monetary Economics*, and the *Journal of Money, Credit and Banking*. He became most visible to the public with his work on inflation that discredited the use of wage and price controls. Michael Parkin also spearheaded the movement towards European monetary union.



Robin Bade earned degrees in mathematics and economics at the University of Queensland and her Ph.D. at the Australian National University. She has held faculty appointments at the University of Edinburgh in Scotland, at Bond University in Australia, and at the Universities of Manitoba, Toronto, and Western Ontario in Canada. Her research on international capital flows appears in the *International Economic Review* and the *Economic Record*.

Professor Parkin and Dr. Bade are the joint authors of *Foundations of Economics* (Addison Wesley), *Modern Macroeconomics* (Pearson Education Canada), an intermediate text, and have collaborated on many research and textbook writing projects. They are both experienced and dedicated teachers of introductory economics.



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The future is always uncertain. But at some times, and now is one such time, the range of possible futures is enormous. The major sources of this uncertainty are economic policy and global macroeconomic forces. There is uncertainty about the way in which international trade policy will evolve as bilateral deals reshape the competitive landscape. There is uncertainty about exchange rate policy as currency fluctuations bring changes in international relative prices. There is extraordinary uncertainty about monetary policy with the Bank of Canada holding interest rates at historical lows in an attempt to stimulate a flagging economy. And there is uncertainty about fiscal policy as provincial budget deficits interacting with an aging population are ever harder to control. In the global economy, there is uncertainty about when, or even whether, a stagnating European economy will start to show life. And there is uncertainty about how fast China, India, and other developing economies will grow.

Since the global financial crisis of August 2007 moved economics from the business report to the front page, a fall in confidence has gripped producers, consumers, financial institutions, and governments.

Even the idea that the market is an efficient allocation mechanism has come into question. Many thoughtful people worry about increasing income inequality, and some political leaders called for the end of capitalism and the dawn of a new economic order in which tighter regulation reined in unfettered greed.

Rarely do teachers of economics have such a rich feast on which to draw. And rarely are the principles of economics more surely needed to provide the solid foundation on which to think about economic events and navigate the turbulence of economic life.

Although thinking like an economist can bring a clearer perspective to and deeper understanding of today's events, students don't find the economic way of thinking easy or natural. *Microeconomics* seeks to put clarity and understanding in the grasp of the student with a careful and vivid exploration of the tension between self-interest and the social interest, the role and power of incentives—of opportunity cost and marginal benefit—and demonstrating the possibility that markets supplemented by other mechanisms might allocate resources efficiently.

Parkin-Bade students begin to think about issues the way real economists do and learn how to explore policy problems and make better-informed decisions in their own economic lives.

The Ninth Edition Revision

Thoroughly updated, intuitive rather than technical, grounded in data and empirical evidence, extensively illustrated with well-chosen examples and photographs, enlivened with applications that focus on issues at play in today's world, focused on learning by doing, and seamlessly integrated with MyEconLab: These are the hallmarks of this ninth edition of *Microeconomics: Canada in the Global Environment*.

This revision builds on the foundation of the previous edition and retains a thorough and careful presentation of the principles of economics, an emphasis on real-world examples and applications, the development of critical thinking skills, diagrams renowned for clarity, and path-breaking technology.

Most chapters have been thoroughly reworked to achieve even greater clarity and to place greater emphasis on applications to current issues. Some sections of chapters have been removed and other sections added to cover new issues, particularly those that involve current policy problems.

Economics in the News, a weekly feature on MyEconLab, appears in the revised text in two ways. First, the Parkin-Bade hallmark chapter-closing *Reading Between the Lines* is rebranded as *Economics in the News*. Second, additional *Economics in the News* boxes appear at appropriate points within chapters.

The aim of the end-of-chapter news feature is to encourage students to apply the tools they have learned in the chapter by analyzing an article from a newspaper or an online news source. The news article connects with the questions first raised in the chapter opener, and the analysis is reinforced with a related end-of-chapter problem.

Shorter, within-chapter *Economics in the News* boxes present brief news clips, relevant data, questions, and worked solutions. These boxes immediately apply a tool just explained and provide hand-held practice and help in approaching an economic analysis of the news.

A second new feature, **At Issue**, shows two sides of a controversial issue and helps students apply the economic way of thinking to clarify and debate the issues.

A third new feature is a full-page end-of-chapter **Worked Problem**. As part of the chapter review, the student has an opportunity to work a multi-part problem that covers the core content of the chapter and consists of questions, solutions, and key figures. This new feature increases the incentive for the student to learn by doing and actively, rather than passively, review the chapter.

Highpoints of the Revision

In addition to the new features that we have just reviewed, we have built on the strengths of the previous edition by substantially revising the following two topics. They are:

- Price discrimination
- Carbon emissions and climate change externalities

Price Discrimination Chapter 13, Monopoly, has revised coverage of price discrimination, which emphasizes the key idea that price discrimination converts consumer surplus into producer surplus and economic profit. To strengthen this insight, we now begin with a brief explanation of the relationship between producer surplus and economic profit. We then use a carefully constructed model of two separated markets to show how discrimination between them can increase producer surplus. We build on this model to show how perfect price discrimination, if it were possible, would grab the entire consumer surplus and convert it to producer surplus. We illustrate the attempt to move toward perfect price discrimination with applications to Microsoft's pricing of Windows and Disney's pricing of tickets to its theme parks.

Carbon Emissions and Climate Change

Externalities Chapter 16, Externalities, gets a thoroughly new treatment of carbon emission and climate change. We begin by contrasting the success story of local air quality in the major cities with the unrelenting rise in atmospheric carbon concentration. We then explain the three methods of coping with environmental externalities: property rights, mandating the use of clean technologies, and taxing or pricing emissions. We explore the ability of each method to achieve an efficient outcome. We also explore the special challenge that arises from the global rather than national scope of carbon emission. The climate change debate appears in an *At Issue*, which contrasts the views of Nicholas Stern and environmental skeptic Bjørn Lomborg.

Many other chapters have been thoroughly reworked to achieve even greater clarity and to place greater emphasis on applications to current issues. And every chapter now contains a new opening vignette linked directly to an *Economics in the News*, an end-of-chapter problem, and online practice.

All the end-of-chapter *Economics in the News* articles have been updated, and the analysis of the news and the linked problems and applications have been appropriately revised.



Features to Enhance Teaching and Learning

The changes that we have described are adjustments to an already powerful teaching and learning package. Here, we briefly review the features retained from the previous edition.

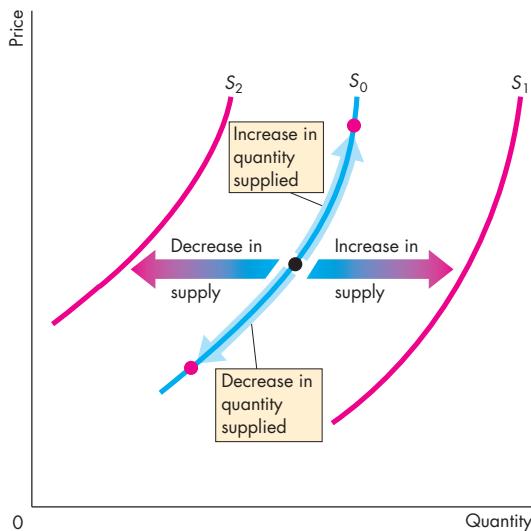
Diagrams That Show the Action

Through the past eight editions, this book has set the standard of clarity in its diagrams; the ninth edition continues to uphold this tradition. Our goal is to show "where the economic action is." The diagrams in this book continue to generate an enormously positive response, which confirms our view that graphical analysis is the most powerful tool available for teaching and learning economics at the principles level.

Because many students find graphs hard to work with, we have developed the entire art program with the study and review needs of the student in mind.

The diagrams feature:

- Original curves consistently shown in blue
- Shifted curves, equilibrium points, and other important features highlighted in red
- Colour-blended arrows to suggest movement
- Graphs paired with data tables
- Diagrams labelled with boxed notes
- Extended captions that make each diagram and its caption a self-contained object for study and review



Economics in Action Boxes

This feature uses boxes within the chapter to provide data and information that links models to real-world economic activity.

Some of the issues covered in these boxes include the best affordable choice of recorded music, movies, and DVDs; the cost of selling a pair of shoes; how Apple doesn't make the iPhone; taxing carbon emissions; how long a spell of poverty lasts; structural unemployment in Canada; how loanable funds fuel a home price bubble; the Canadian business cycle; and the size of the fiscal stimulus multipliers.

Chapter Openers

Each chapter opens with a student-friendly vignette that raises questions to motivate the student and focus the chapter. This chapter-opening story is woven into the main body of the chapter and is explored in the *Economics in the News* feature that closes each chapter.

In-Text Review Quizzes

A review quiz at the end of each major section enables students to determine whether a topic needs further study before moving on. This feature includes a reference to the appropriate MyEconLab study plan and a new **key terms quiz** to help students further test their understanding.

End-of-Chapter Study Material

Each chapter closes with a concise summary organized by major topics, a list of key terms with page references, a worked problem, and problems and applications. These learning tools provide students with a summary for review and exam preparation.

Interviews with Economists

Each part closes with an overview of the chapters and a teaser of an interview with a leading economist whose work correlates to what the student is learning. These interviews explore the education and research of these prominent economists and their advice for those who want to continue the study of economics. This edition has new interviews with Esther Duflo (MIT) and Raj Chetty (Harvard). The 65 past and present interviews we have conducted are available in full in MyEconLab.

For the Instructor

This book enables you to focus on the economic way of thinking and choose your own course structure in your principles course.

Focus on the Economic Way of Thinking

As an instructor, you know how hard it is to encourage a student to think like an economist. But that is your goal. Consistent with this goal, the text focuses on and repeatedly uses the central ideas of choice; tradeoff; opportunity cost; the margin; incentives; the gains from voluntary exchange; the forces of demand, supply, and equilibrium; the pursuit of economic rent; the tension between self-interest and the social interest; and the scope and limitations of government actions.

Flexible Structure

You have preferences for how you want to teach your course, and we've organized this book to enable you to choose your teaching path. The charts on p. xxiii illustrate the book's flexibility. By following the arrows through the charts you can select the path that best fits your preference for course structure. Whether you want to teach a traditional course that blends theory and policy, or one that takes a fast-track through either theory or policy issues, *Microeconomics: Canada in the Global Environment* gives you the choice.

Instructor's Supplemental Resources

The supplements for instructors are:

- Test Bank
- PowerPoint Resources
- Instructor's Manual
- Solutions Manual

Test Bank The ninth edition Test Bank (Test Item File), with more than 3,000 multiple-choice questions, has been prepared by Jeannie Gillmore of the University of Western Ontario. Jeannie has reviewed and edited all existing questions to ensure their clarity and consistency with the ninth edition and incorporated new questions. The new questions follow the style and format of the end-of-chapter text problems and provide the instructor with a whole

new set of testing opportunities and/or homework assignments. Test Item File questions are available in MyEconLab for instructors to use in a test, quiz, or as homework.

Pearson's **Computerized Test Bank** allows instructors to filter and select questions to create quizzes, tests, or homework. Instructors can revise questions or add their own, and may be able to choose print or online options. These questions are also available in Microsoft Word® format.

PowerPoint Resources Our full-colour Microsoft PowerPoint® Presentations for each chapter contain:

- Lecture notes with all the textbook figures animated, tables from the textbook, and speaking notes from the Instructor's Manual
- Large-scale versions of all the textbook figures and tables, animated for instructors to incorporate into their own slide shows
- A set of lecture notes for students, which include animated versions of the textbook figures

The presentations can be used electronically in the classroom or printed to create hard-copy transparency masters. A student version of the lecture notes is also available on MyEconlab.

Instructor's Manual Our Instructor's Manual integrates the teaching and learning resources and serves as a guide to all the supplements. Each chapter contains an overview, a list of what's new in the ninth edition, and ready-to-use lecture notes.

A new user can walk into a classroom armed to deliver a polished lecture. The lecture notes provide an outline of the chapter; concise statements of key material; alternative tables and figures; key terms and definitions; boxes that highlight key concepts, provide an interesting anecdote, or suggest how to handle a difficult idea; and additional discussion questions. The PowerPoint® lecture notes incorporate the chapter outlines and teaching suggestions.

Solutions Manual Our comprehensive Solutions Manual provides instructors with solutions to the Review Quizzes and the end-of-chapter Problems and Applications.

Getting Your Instructor's Resources

Instructors can download supplements from a secure, instructor-only source via the Pearson Canada Higher Education Instructor Resource Centre Web page (www.pearsoncanada.ca/highered). Instructor resources are also available on a DVD.

Instructor's Resource Centre DVD (IRDVD) Fully compatible with Windows and Macintosh, this IRDVD contains Adobe PDF files of the Test Item File, the Solutions Manual, and the Instructor's Manual; PowerPoint resources; and the TestGen. Locate your local Pearson Canada sales representative at <http://catalogue.pearsoned.ca/educator> to request a copy of the IRDVD.

Other Instructor Aids

CourseSmart CourseSmart goes beyond traditional expectations—providing instant, online access to the textbooks and course materials you need at a lower cost for students. And even as students save money, you can save time and hassle with a digital eTextbook that allows you to search for the most relevant content at the very moment you need it. Whether it's evaluating textbooks or creating lecture notes to help students with difficult concepts, CourseSmart can make life a little easier. See how when you visit www.coursesmart.com/instructors.

Learning Solutions Managers Pearson's Learning Solutions Managers work with faculty and campus course designers to ensure that Pearson technology products, assessment tools, and online course materials are tailored to meet your specific needs.

This highly qualified team is dedicated to helping schools take full advantage of a wide range of educational resources by assisting in the integration of a variety of instructional materials and media formats. Your local Pearson Canada sales representative can provide you with more details on this service program.

Pearson Custom Library For enrollments of 25 students or more, you can create your own textbook by choosing the chapters of Parkin-Bade *Microeconomics* that best suit your own course needs. To begin building your custom text, visit www.pearsoncustomlibrary.com.

 **MyEconLab**

The Parkin-Bade MyEconLab has been designed and refined with a single purpose in mind: to create those moments of understanding that transform the difficult into the clear and obvious. With homework, quiz, test, activity, and tutorial options, instructors can manage all their assessment needs in one program.

- All of the Review Quiz questions and end-of-chapter Problems and Applications were recreated as assignable auto-graded exercises with targeted feedback and related “Help Me Solve This” tools by Robin Bade, Jeannie Gillmore of the University of Western Ontario, and Sharmistha Nag of Fairleigh Dickinson University, and were reviewed for accuracy by Trevor Collier of the University of Dayton.
- All of the Review Quiz questions and end-of-chapter Problems and Applications are assignable and automatically graded in MyEconLab.
- The Review Quiz questions and end-of-chapter Study Plan Problems and Applications are available for students to work in the adaptive Study Plan.
- The end-of-chapter Additional Problems and Applications are not available to students in MyEconLab unless assigned by the instructor.
- Many of the problems and applications are algorithmic, draw-graph, and numerical exercises.
- Problems and applications that use real-time data continuously update.
- The Custom Exercise Builder enables instructors to create their own problems for assignment.
- The Gradebook records each student’s performance and time spent on the Tests and Study Plan and generates reports by student or by chapter.
- Test Bank questions are also assignable for test, quiz, or homework and auto-graded in MyEconLab.

Enhanced Pearson eText and New Interactive Features

New for the ninth edition is an enhanced Pearson eText that integrates directly with MyEconLab’s Study Plan, now powered by Knewton Adaptive Learning, and with MyEconLab’s Gradebook.

The enhanced Pearson eText is available within the online course materials and offline via an iPad

app. The eText also allows instructors and students to highlight, bookmark, and take notes. In addition, instructors can create notes and push them out to students.

The new eText includes videos, animations, and problem-solving tools designed to aid comprehension and bring those moments of discovery that stick in the memory.

The features of the enhanced eText include:

- Embedded MyEconLab Study Plan and assessment
- Figure animations
- Interactive graph-drawing exercises
- More *Economics in the News*
- Worked problems
- Key terms quizzes

Embedded MyEconLab Study Plan and Assessment

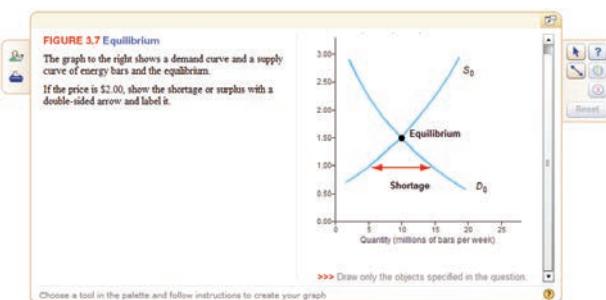
Assessment In the enhanced eText, every Review Quiz question and Study Plan Problem and Application exercise can be worked by the student directly from the eText page on which it occurs. These exercises are auto-graded and feed into MyEconLab’s Adaptive Study Plan, where students receive recommendations based upon their performance. Study Plan links provide opportunities for more practice with problems similar to those in the text and give targeted feedback to guide the student in answering the exercises.

Figure Animations Every textbook figure can be worked through using a step-by-step animation, with audio, to help students learn the intuition behind reading and interpreting graphs. These animations may be used for review or as an instructional aid in the classroom.

More Economics in the News Each in-text *Economics in the News* is reinforced through an extended application of the same analysis. These *Economics in the News* problems are auto-graded and feed into MyEconLab’s Adaptive Study Plan.

Worked Problems Each chapter concludes with a Worked Problem that consists of questions, solutions, and key figures. These problems can be worked in the enhanced eText directly from the Worked Problem page. As the student works through each problem, feedback and just-in-time learning aids help the student develop proficiency with the concept.

Interactive Draw-Graph Exercises For each major figure, a graph-drawing exercise accompanies the step-by-step animation. The student builds and interprets the key graphs and develops understanding by working a multiple-choice question about the graph. Each graph-drawing exercise is auto-graded and feeds into MyEconLab's Adaptive Study Plan.



Key Terms Quizzes Key Terms Quiz links provide opportunities for students to check their knowledge of the definitions and uses of the key terms.

Other MyEconLab Features

MyEconLab also includes the following features:

Adaptive Learning MyEconLab's Study Plan is now powered by a sophisticated adaptive learning engine that tailors learning material to meet the unique needs of each student. MyEconLab's new **Adaptive Learning Study Plan** monitors students' performance on homework, quizzes, and tests and continuously makes recommendations based on that performance.

If a student is struggling with a concept such as supply and demand, or having trouble calculating a price elasticity of demand, the Study Plan provides customized remediation activities—a pathway based on personal proficiencies, the number of attempts, or the difficulty of the questions—to get the student back on track. Students will also receive recommendations for additional practice in the form of rich multimedia learning aids such as videos, an interactive eText, Help Me Solve This tutorials, and graphing tools.

The Study Plan can extrapolate a student's future trouble spots and provide learning material and practice to avoid pitfalls. In addition, students who are showing a high degree of success with the assessment

material are offered a chance to work on future topics based on the professor's course coverage preferences. This personalized and adaptive feedback and support ensures that your students are optimizing their current and future course work and mastering the concepts, rather than just memorizing and guessing answers.

You can learn more about adaptive learning at <http://www.myeconlab.com/product-info/adaptive>.

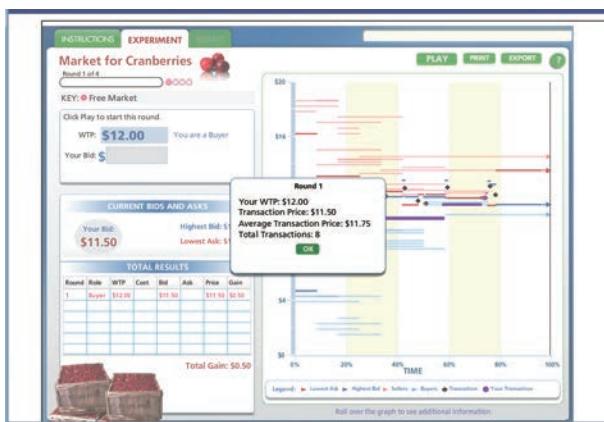
Economics in the News *Economics in the News* is a turnkey solution to bringing current news into the classroom. Updated weekly during the academic year, we upload two relevant articles (one micro, one macro) and provide questions that may be assigned for homework or for classroom discussion.

Current News Each week during the academic year, we upload multi-part microeconomic and macroeconomic exercises, with links to relevant articles, into the MyEconLab assignment manager. These enable instructors to bring current issues and events into the course with easy to assign and auto-graded exercises.

Office Hours Students and instructors can consult the authors using the "Office Hours" links in MyEconLab. The link for students is in Chapter Resources and for Instructors in Instructor Resources/Instructor Tools.

Experiments in MyEconLab Experiments are a fun and engaging way to promote active learning and mastery of important economic concepts. Pearson's Experiments program is flexible and easy for instructors to assign and students to use.

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- Single-player experiments, available to assign, allow your students to play against virtual players from anywhere at any time as long as they have an Internet connection.
- Multi-player experiments allow you to assign and manage a real-time experiment with your class.
- Experiments can be assigned in MyEconLab as homework integrated with pre-questions and post-questions.
- Experiments are auto-graded using algorithms that objectively evaluate a student's economic gain and performance during the experiment.



Digital Interactives A Digital Interactive is a simulation game that immerses the student in an activity that leads to the discovery of a fundamental economic idea or principle. Digital Interactives are designed for use in traditional, online, and hybrid courses, and many incorporate real-time data as well as data display and analysis tools. A Digital Interactive can be presented in class as a visually stimulating, engaging lecture tool, and can be assigned with assessment questions for grading analysis tools.

Learning Catalytics Learning Catalytics is a web-based system for managing the interactive classroom. It is a “bring your own device” platform that supports the peer-instruction teaching method and can also be used to provide the instructor with real-time feedback during class. Instructors can access 18 different question types among which are multiple choice, numerical, sketching, ranking, and highlighting. For more information, visit learningcatalytics.com.

Dynamic Study Modules Dynamic Study Modules, which focus on key topic areas and are available from within MyEconLab, are an additional way for students to obtain tailored help. These modules work by continuously assessing student performance and activity on discrete topics and provide personalized content in real time to reinforce concepts that target each student’s particular strengths and weaknesses.

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discussion, collaboration, and exploring applications to current news and events.

Instructors can register, create, and access all of their MyEconLab courses at www.myeconlab.com.

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Classroom experience will test the value of this book. We would appreciate hearing from instructors and students about how we can continue to improve it in future editions.

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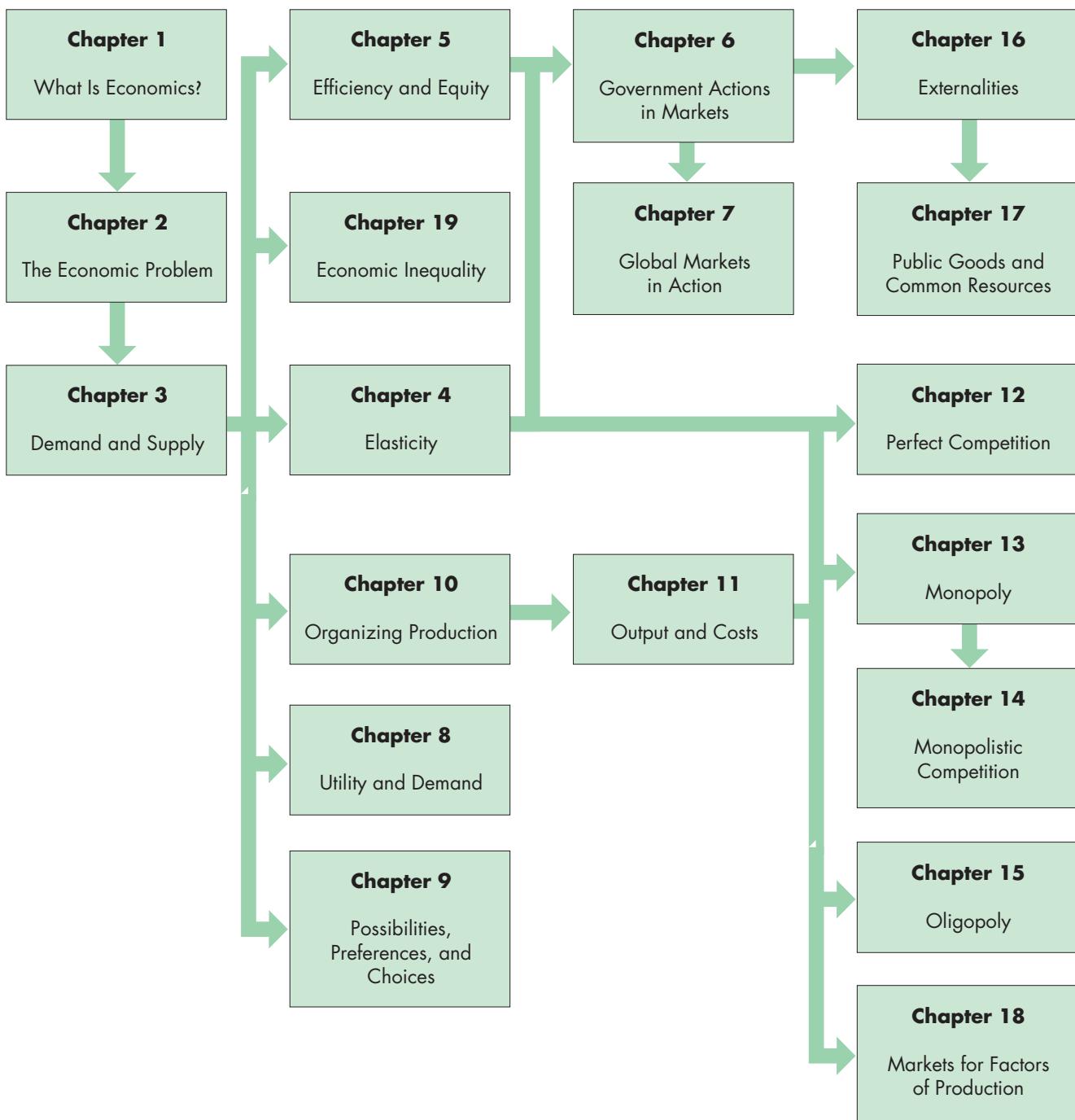
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ALTERNATIVE PATHWAYS THROUGH THE CHAPTERS

Flexibility



Start here ...

... then jump to
any of these ...

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doing the prerequisites indicated

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MICROECONOMICS

CANADA IN THE GLOBAL ENVIRONMENT **NINTH EDITION**

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PART ONE INTRODUCTION



1

WHAT IS ECONOMICS?

After studying this chapter,
you will be able to:

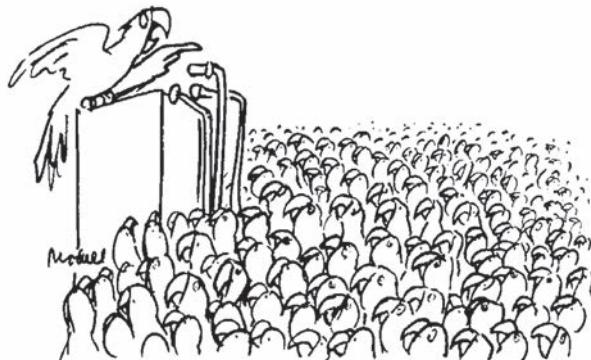
- ◆ Define economics and distinguish between microeconomics and macroeconomics
- ◆ Explain the two big questions of economics
- ◆ Explain the key ideas that define the economic way of thinking
- ◆ Explain how economists go about their work as social scientists and policy advisers

Is economics about money: How people make it and spend it? Is it about business, government, and jobs? Is it about why some people and some nations are rich and others poor? Economics is about all these things. But its core is the study of *choices* and their consequences.

Your life will be shaped by the choices that you make and the challenges that you face. To face those challenges and seize the opportunities they present, you must understand the powerful forces at play. The economics that you're about to learn will become your most reliable guide. This chapter gets you started by describing the questions that economists try to answer and looking at how economists think as they search for the answers.

Definition of Economics

A fundamental fact dominates our lives: We want more than we can get. Our inability to get everything we want is called **scarcity**. Scarcity is universal. It confronts all living things. Even parrots face scarcity!



Not only do I want a cracker—we all want a cracker!

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Think about the things that *you* want and the scarcity that *you* face. You want to go to a good school, college, or university. You want to live in a well-equipped, spacious, and comfortable home. You want the latest smartphone and the fastest Internet connection for your laptop or iPad. You want some sports and recreational gear—perhaps some new running shoes, or a new bike. You want much more time than is available to go to class, do your homework, play sports and games, read novels, go to the movies, listen to music, travel, and hang out with your friends. And you want to live a long and healthy life.

What you can afford to buy is limited by your income and by the prices you must pay. And your time is limited by the fact that your day has 24 hours.

You want some other things that only governments provide. You want to live in a safe neighbourhood in a peaceful and secure world, and enjoy the benefits of clean air, lakes, rivers, and oceans.

What governments can afford is limited by the taxes they collect. Taxes lower people's incomes and compete with the other things they want to buy.

What *everyone* can get—what *society* can get—is limited by the productive resources available. These resources are the gifts of nature, human labour and ingenuity, and all the previously produced tools and equipment.

Because we can't get everything we want, we must make *choices*. You can't afford *both* a laptop *and* an iPhone, so you must *choose* which one to buy. You can't spend tonight *both* studying for your next test *and* going to the movies, so again, you must *choose* which one to do. Governments can't spend a tax dollar on *both* national defence *and* environmental protection, so they must *choose* how to spend that dollar.

Your choices must somehow be made consistent with the choices of *others*. If you choose to buy a laptop, someone else must choose to sell it. Incentives reconcile choices. An **incentive** is a reward that encourages an action or a penalty that discourages one. Prices act as incentives. If the price of a laptop is too high, more will be offered for sale than people want to buy. And if the price is too low, fewer will be offered for sale than people want to buy. But there is a price at which choices to buy and sell are consistent.

Economics is 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.

The subject has two parts:

- Microeconomics
- Macroeconomics

Microeconomics is the study of the choices that individuals and businesses make, the way these choices interact in markets, and the influence of governments. Some examples of microeconomic questions are: Why are people downloading more movies? How would a tax on e-commerce affect eBay?

Macroeconomics is the study of the performance of the national economy and the global economy. Some examples of macroeconomic questions are: Why does the Canadian unemployment rate fluctuate? Can the Bank of Canada make the unemployment rate fall by keeping interest rates low?

REVIEW QUIZ

- 1 List some examples of the scarcity that you face.
- 2 Find examples of scarcity in today's headlines.
- 3 Find an example of the distinction between microeconomics and macroeconomics in today's headlines.

Work these questions in Study Plan 1.1 and get instant feedback. Do a Key Terms Quiz.

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Two Big Economic Questions

Two big questions summarize the scope of economics:

- How do choices end up determining *what, how, and for whom* goods and services are produced?
- Do choices made in the pursuit of *self-interest* also promote the *social interest*?

What, How, and For Whom?

Goods and services are the objects that people value and produce to satisfy wants. *Goods* are physical objects such as cellphones and automobiles. *Services* are tasks performed for people such as cellphone service and auto-repair service.

What? *What* we produce varies across countries and changes over time. In Canada today, agriculture accounts for 2 percent of total production, manufactured goods for 20 percent, and services (retail and wholesale trade, healthcare, and education are the biggest ones) for 78 percent. In contrast, in China today, agriculture accounts for 10 percent of total production, manufactured goods for 45 percent, and services for 45 percent.

Figure 1.1 shows these numbers and also the percentages for Brazil, which fall between those for Canada and China.

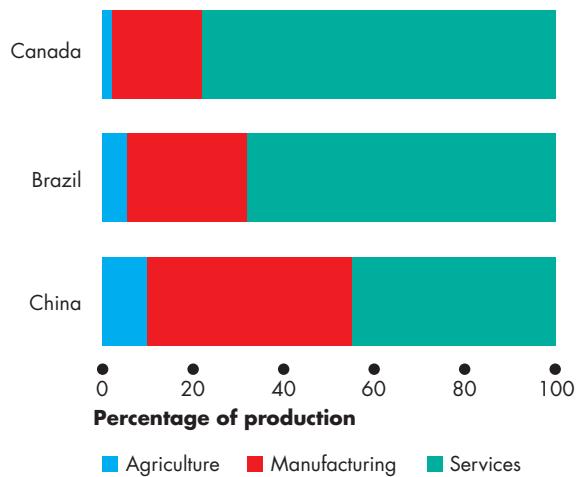
What determines these patterns of production? How do choices end up determining the quantities of cellphones, automobiles, cellphone service, auto-repair service, and the millions of other items that are produced in Canada and around the world?

How? *How* we produce is described by the technologies and resources that we use. The resources used to produce goods and services are called **factors of production**, which are grouped into four categories:

- Land
- Labour
- Capital
- Entrepreneurship

Land The “gifts of nature” that we use to produce goods and services are called **land**. In economics, *land* is what in everyday language we call *natural resources*. It includes land in the everyday sense

FIGURE 1.1 What Three Countries Produce



Agriculture and manufacturing are small percentages of production in rich countries such as Canada and large percentages of production in poorer countries such as China. Most of what is produced in Canada is services.

Source of data: CIA Factbook 2014, Central Intelligence Agency.

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together with minerals, oil, gas, coal, water, air, forests, and fish.

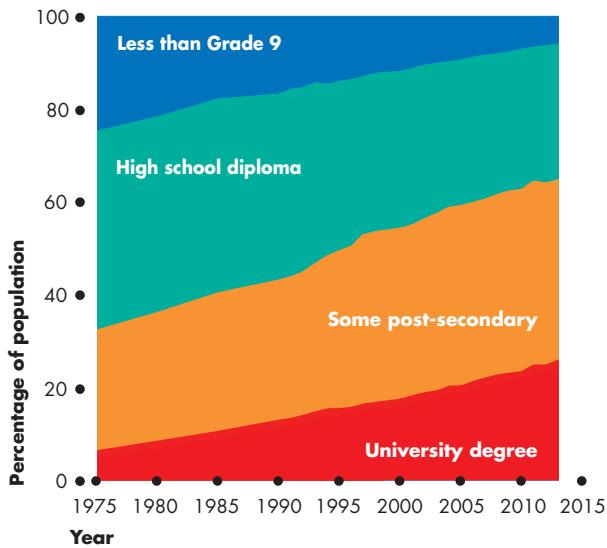
Our land surface and water resources are renewable, and some of our mineral resources can be recycled. But the resources that we use to create energy are nonrenewable—they can be used only once.

Labour The work time and work effort that people devote to producing goods and services is called **labour**. Labour includes the physical and mental efforts of all the people who work on farms and construction sites and in factories, shops, and offices.

The *quality* of labour depends on **human capital**, which is the knowledge and skill that people obtain from education, on-the-job training, and work experience. You are building your own human capital right now as you work on your economics course, and your human capital will continue to grow as you gain work experience.

Human capital expands over time. Today, 93 percent of the adult population of Canada have completed high school and 23 percent have a college or university degree. Figure 1.2 shows these measures of human capital in Canada and its growth over the past 38 years.

FIGURE 1.2 A Measure of Human Capital



In 2013, 25.3 percent of the adult population had a university degree. A further 39 percent had some post-secondary education, and 93.6 percent had completed high school.

Source of data: Statistics Canada.

MyEconLab Animation

Capital The tools, instruments, machines, buildings, and other constructions that businesses use to produce goods and services are called **capital**.

In everyday language, we talk about money, stocks, and bonds as being “capital.” These items are *financial capital*. Financial capital plays an important role in enabling businesses to borrow the funds that they use to buy physical capital. But financial capital is not used to produce goods and services and it is not a factor of production.

Entrepreneurship The human resource that organizes labour, land, and capital is called **entrepreneurship**. Entrepreneurs are the drivers of economic progress. They develop new ideas about what and how to produce, make business decisions, and bear the risks that arise from these decisions.

What determines how the factors of production are used to produce each good and service?

For Whom? *Who* consumes the goods and services that are produced depends on the incomes that people earn. People with large incomes can buy

a wide range of goods and services. People with small incomes have fewer options and can afford a smaller range of goods and services.

People earn their incomes by selling the services of the factors of production they own:

- Land earns **rent**.
- Labour earns **wages**.
- Capital earns **interest**.
- Entrepreneurship earns **profit**.

Which factor of production earns the most income? The answer is labour. Wages and fringe benefits are around 70 percent of total income and the incomes from land, capital, and entrepreneurship share the rest. These shares have been remarkably constant over time.

Knowing how income is shared among the factors of production doesn’t tell us how it is shared among individuals. And the distribution of income among individuals is extremely unequal. You know of some people who earn very large incomes: Dwayne “The Rock” Johnson (Hercules) earned \$46 million in 2013; and Canadian Shea Weber of the Nashville Predators earns \$14 million a year.

You know of even more people who earn very small incomes. Servers at Tim Hortons average \$9 an hour; checkout clerks, cleaners, and textile and leather workers all earn less than \$10 an hour.

You probably know about other persistent differences in incomes. Men, on average, earn more than women; whites earn more than minorities; university graduates earn more than high school graduates.

We can get a good sense of who consumes the goods and services produced by looking at the percentages of total income earned by different groups of people. The 20 percent of people with the lowest incomes earn about 5 percent of total income, while the richest 20 percent earn close to 50 percent of total income. So on average, people in the richest 20 percent earn more than 10 times the incomes of those in the poorest 20 percent. There is even huge inequality within the richest 20 percent, and the top 1 percent earns almost 15 percent of total income.

Why is the distribution of income so unequal?

Economics provides some answers to all these questions about *what*, *how*, and *for whom* goods and services are produced and much of the rest of this book will help you to understand those answers.

We’re now going to look at the second big question of economics: Do choices made in the pursuit of self-interest also promote the social interest?

Do Choices Made in the Pursuit of Self-Interest also Promote the Social Interest?

Every day, you and 35.4 million other Canadians, along with 7.2 billion people in the rest of the world, make economic choices that result in *what*, *how*, and *for whom* goods and services are produced. These choices are made by people who are pursuing their self-interest.

Self-Interest You make a choice in your **self-interest** if you think that choice is the best one available for you. All the choices that people make about how to use their time and other resources are made in the pursuit of self-interest. When you allocate your time or your budget, you do what makes the most sense to you. You might think about how your choices affect other people and take into account how you feel about that, but it is how *you* feel that influences your choice. You order a home-delivery pizza because you're hungry, not because the delivery person needs a job. And when the pizza delivery person shows up at your door, he's not doing you a favour. He's pursuing *his* self-interest and hoping for a tip and another call next week.

The big question is: Is it possible that all the choices that each one of us makes in the pursuit of self-interest could end up achieving an outcome that is best for everyone?

Social Interest An outcome is in the **social interest** if it is best for society as a whole. It is easy to see how you decide what is in *your* self-interest. But how do we decide if something is in the social interest? To help you answer this question, imagine a scene like that in *Economics in the News* on the next page.

Ted, an entrepreneur, creates a new business. He hires a thousand workers and pays them \$20 an hour, \$1 an hour more than they earned in their old jobs. Ted's business is extremely profitable and his own earnings increase by \$1 million per week.

You can see that Ted's decision to create the business is in his self-interest—he gains \$1 million a week. You can also see that for Ted's employees, their decisions to work for Ted are in their self-interest—they gain \$1 an hour (say \$40 a week). And the decisions of Ted's customers must be in their self-interest, otherwise they wouldn't buy from him. But is this outcome in the social interest?

The economist's answer is "Yes." It is in the social interest because it makes everyone better off. There are no losers.

Efficiency and the Social Interest Economists use the everyday word "efficient" to describe a situation that can't be improved upon. Resource use is **efficient** if it is *not* possible to make someone better off without making someone else worse off. If it *is* possible to make someone better off without making anyone worse off, society can be made better off and the situation is not efficient.

In the Ted story everyone is better off, so it improves efficiency and the outcome is in the social interest. But notice that it would also have been efficient if the workers and customers had gained nothing and Ted had gained even more than \$1 million a week. But would that efficient outcome be in the social interest?

Many people have trouble seeing the outcome in which Ted is the only winner as being in the social interest. They say that the social interest requires Ted to share some of his gain either with his workers in higher wages or with his customers in lower prices, or with both groups.

Fair Shares and the Social Interest The idea that the social interest requires "fair shares" is a deeply held one. Think about what you regard as a fair share. To help you, imagine the following game.

I put \$100 on the table and tell someone you don't know and who doesn't know you to *propose* a share of the money between the two of you. If you *accept* the proposed share, you each get the agreed upon shares. If you don't accept the proposed share, you both get nothing.

It would be efficient—you would both be better off—if the proposer offered to take \$99 and leave you with \$1 and you accepted that offer.

But would you accept the \$1? If you are like most people, the idea that the other person gets 99 times as much as you is just too much to stomach. "No way," you say and the \$100 disappears. That outcome is inefficient. You have both given up something.

When the game I've just described is played in a classroom experiment, about half of the players reject offers of below \$30.

So fair shares matter. But what is *fair*? There isn't a crisp definition of fairness to match that of efficiency. Reasonable people have a variety of views about it. Almost everyone agrees that too much inequality is unfair. But how much is too much? And inequality of what: income, wealth, or the *opportunity* to work, earn an income, and accumulate wealth?

You will examine efficiency again in Chapter 2 and efficiency and fairness in Chapter 5.

Questions about the social interest are hard ones to answer and they generate discussion, debate, and disagreement. Four issues in today's world put some flesh on these questions. The issues are:

- Globalization
- Information-age monopolies
- Climate change
- Economic instability

Globalization The term *globalization* means the expansion of international trade, borrowing and lending, and investment.

When Nike produces sports shoes, people in Malaysia get work; and when China Airlines buys new regional jets, Canadians who work at Bombardier build them. While globalization brings expanded production and job opportunities for some workers, it destroys many Canadian jobs. Workers across the manufacturing industries must learn new skills or take service jobs, which are often lower-paid, or retire earlier than previously planned.

Globalization is in the self-interest of those consumers who buy low-cost goods and services produced

in other countries; and it is in the self-interest of the multinational firms that produce in low-cost regions and sell in high-price regions. But is globalization in the self-interest of the low-wage worker in Malaysia who sews your new running shoes and the displaced shoemaker in Toronto? Is it in the social interest?



ECONOMICS IN THE NEWS

The Invisible Hand

From Brewer to Bio-Tech Entrepreneur

Kiran Mazumdar-Shaw trained to become a master brewer and learned about enzymes, the stuff from which bio-pharmaceuticals are made. Discovering it was impossible for a woman in India to become a master brewer, the 25-year-old Kiran decided to create a bio-pharmaceutical business.

Kiran's firm, Biocom, employed uneducated workers who loved their jobs and the living conditions made possible by their high wages. But when a labour union entered the scene and unionized the workers, a furious Kiran fired the workers, automated their jobs, and hired a smaller number of educated workers. Biocom continued to grow and today, Kiran's wealth exceeds \$1 billion.

Kiran has become wealthy by developing and producing bio-pharmaceuticals that improve people's lives. But Kiran is sharing her wealth in creative ways. She has opened a cancer treatment centre to help thousands of patients who are too poor to pay and created a health insurance scheme.

Source: Ariel Levy, "Drug Test,"
The New Yorker, January 2, 2012.

THE QUESTIONS

- Whose decisions in the story were taken in self-interest?
- Whose decisions turned out to be in the social interest?
- Did any of the decisions harm the social interest?

THE ANSWERS

- All the decisions—Kiran's, the workers', the union's, and the firm's customers'—are taken in the pursuit of self-interest.
- Kiran's decisions serve the social interest: She creates jobs that benefit her workers and products that benefit her customers. And her charitable work brings yet further social benefits.
- The labour union's decision might have harmed the social interest because it destroyed the jobs of uneducated workers.



KIRAN MAZUMDAR-SHAW,
FOUNDER AND CEO OF
BIOCOM

Information-Age Monopolies The technological change of the past forty years has been called the *Information Revolution*. Bill Gates, a co-founder of Microsoft, held a privileged position in this revolution. For many years, Windows was the only available operating system for the PC. The PC and Mac competed, but the PC had a huge market share.

An absence of competition gave Microsoft the power to sell Windows at prices far above the cost of production. With lower prices, many more people would have been able to afford and buy a computer.

The information revolution has clearly served your self-interest: It has provided your cellphone, laptop, loads of handy applications, and the Internet. It has also served the self-interest of Bill Gates who has seen his wealth soar.

But did the information revolution best serve the social interest? Did Microsoft produce the best possible Windows operating system and sell it at a price that was in the social interest? Or was the quality too low and the price too high?



Climate Change Burning fossil fuels to generate electricity and to power airplanes, automobiles, and trucks pours a staggering 28 billion tonnes—4 tonnes per person—of carbon dioxide into the atmosphere each year. These carbon emissions, two-thirds of which come from the United States, China, the European Union, Russia, and India, bring global warming and climate change.

Every day, when you make self-interested choices to use electricity and gasoline, you leave your carbon footprint. You can lessen this footprint by walking, riding a bike, taking a cold shower, or planting a tree.

But can each one of us be relied upon to make decisions that affect the Earth's carbon-dioxide concentration in the social interest? Must governments change the incentives we face so that our self-interested choices are also in the social interest? How can governments change incentives? How can we

encourage the use of wind and solar power to replace the burning of fossil fuels that brings climate change?



Economic Instability In 2008, U.S. banks were in trouble. They had made loans that borrowers couldn't repay and they were holding securities the values of which had crashed.

Banks' choices to take deposits and make loans are made in self-interest, but does this lending and borrowing serve the social interest? Do banks lend too much in the pursuit of profit?

When U.S. banks got into trouble in 2008, the U.S. Federal Reserve (the Fed) bailed them out with big loans backed by taxpayer dollars. Did the Fed's bailout of troubled banks serve the social interest? Or might the Fed's rescue action encourage banks to repeat their dangerous lending in the future?

We've looked at four topics and asked many questions that illustrate the potential conflict between the pursuit of self-interest and the social interest. We've asked questions but not answered them because we've not yet explained the economic principles needed to do so. We answer these questions in future chapters.

REVIEW QUIZ

- 1 Describe the broad facts about *what, how, and for whom* goods and services are produced.
- 2 Use headlines from the recent news to illustrate the potential for conflict between self-interest and the social interest.

Work these questions in Study Plan 1.2 and get instant feedback. Do a Key Terms Quiz.

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AT ISSUE

The Protest Against Market Capitalism

Market capitalism is an economic system in which individuals own land and capital and are free to buy and sell land, capital, and goods and services in markets. Markets for goods and services, along with markets for land and capital, coordinate billions of self-interested choices, which determine what, how, and for whom goods and services are produced. A few people earn enormous incomes, many times the average income. There is no supreme planner guiding the use of scarce resources and the outcome is unintended and unforeseeable.

Centrally planned socialism is an economic system in which the government owns all the land and capital, directs workers to jobs, and decides what, how, and for whom to produce. The Soviet Union, several Eastern European countries, and China have used this system in the past but have now abandoned it. Only Cuba and North Korea use this system today. A few bureaucrats in positions of great power receive huge incomes, many times that of an average person.

Our economy today is a **mixed economy**, which is market capitalism with government regulation.

The Protest

The protest against market capitalism takes many forms. Historically, **Karl Marx** and other communist and socialist thinkers wanted to replace it with *socialism* and *central planning*. Today, thousands of people who feel let down by the economic system want less market capitalism and more government regulation. The **Occupy Wall Street** movement, with its focus on the large incomes of the top 1 percent, is a visible example of today's protest. Protesters say:

- Big corporations (especially big banks) have too much power and influence on governments.
- Democratically elected governments can do a better job of allocating resources and distributing income than uncoordinated markets.
- More regulation in the social interest is needed—to serve “human need, not corporate greed.”
- In a market, for every winner, there is a loser.
- Big corporations are the winners. Workers and unemployed people are the losers.



An Occupy Wall Street protester

The Economist's Response

Economists agree that market capitalism isn't perfect. But they argue that it is the best system available and while some government intervention and regulation can help, government attempts to serve the social interest often end up harming it.

Adam Smith (see p. 53), who gave the first systematic account of how market capitalism works, says:

- The self-interest of big corporations is *maximum profit*.
- But an *invisible hand* leads production decisions made in pursuit of self-interest to *unintentionally* promote the social interest.
- Politicians are ill-equipped to regulate corporations or to intervene in markets, and those who think they can improve on the market outcome are most likely wrong.
- In a market, buyers get what they want for less than they would be willing to pay and sellers earn a profit. Both buyers and sellers gain. A market transaction is a “win-win” event.

“It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest.”

The Wealth of Nations,
1776



Adam Smith



The Economic Way of Thinking

The questions that economics tries to answer tell us about the *scope of economics*, but they don't tell us how economists *think* and go about seeking answers to these questions. You're now going to see how economists go about their work.

We're going to look at six key ideas that define the *economic way of thinking*. These ideas are:

- A choice is a *tradeoff*.
- People make *rational choices* by comparing *benefits* and *costs*.
- *Benefit* is what you gain from something.
- *Cost* is what you *must give up* to get something.
- Most choices are "*how-much*" choices made at the *margin*.
- Choices respond to *incentives*.

A Choice Is a Tradeoff

Because we face scarcity, we must make choices. And when we make a choice, we select from the available alternatives. For example, you can spend Saturday night studying for your next test or having fun with your friends, but you can't do both of these activities at the same time. You must choose how much time to devote to each. Whatever choice you make, you could have chosen something else.

You can think about your choices as tradeoffs. A **tradeoff** is an exchange—giving up one thing to get something else. When you choose how to spend your Saturday night, you face a tradeoff between studying and hanging out with your friends.

Making a Rational Choice

Economists view the choices that people make as rational. A **rational choice** is one that compares costs and benefits and achieves the greatest benefit over cost for the person making the choice.

Only the wants of the person making a choice are relevant to determine its rationality. For example, you might like your coffee black and strong but your friend prefers his milky and sweet. So it is rational for you to choose espresso and for your friend to choose cappuccino.

The idea of rational choice provides an answer to the first question: *What goods and services will be produced and in what quantities?* The answer is those that people rationally choose to buy!

But how do people choose rationally? Why do more people choose an iPhone rather than a BlackBerry? Why don't CN and CPR build high-speed tracks so that VIA Rail can run Bombardier super-fast trains like those used in Europe? The answers turn on comparing benefits and costs.

Benefit: What You Gain

The **benefit** of something is the gain or pleasure that it brings and is determined by **preferences**—by what a person likes and dislikes and the intensity of those feelings. If you get a huge kick out of “Leagues of Legends,” that video game brings you a large benefit. And if you have little interest in listening to Yo-Yo Ma playing a Vivaldi cello concerto, that activity brings you a small benefit.

Some benefits are large and easy to identify, such as the benefit that you get from being in school. A big piece of that benefit is the goods and services that you will be able to enjoy with the boost to your earning power when you graduate. Some benefits are small, such as the benefit you get from a slice of pizza.

Economists measure benefit as the most that a person is *willing to give up* to get something. You are willing to give up a lot to be in school. But you would give up only an iTunes download for a slice of pizza.

Cost: What You Must Give Up

The **opportunity cost** of something is the highest-valued alternative that must be given up to get it.

To make the idea of opportunity cost concrete, think about *your* opportunity cost of being in school. It has two components: the things you can't afford to buy and the things you can't do with your time.

Start with the things you can't afford to buy. You've spent all your income on tuition, residence fees, books, and a laptop. If you weren't in school, you would have spent this money on tickets to ball games and movies and all the other things that you enjoy. But that's only the start of your opportunity cost.

You've also given up the opportunity to get a job and earn an income. Suppose that the best job you could get if you weren't in school is working at CIBC as a teller earning \$25,000 a year. Another part of your opportunity cost of being in school is all the things that you could buy with the extra \$25,000 you would have.

As you well know, being a student eats up many hours in class time, doing homework assignments, preparing for tests, and so on. To do all these school activities, you must give up many hours of what would otherwise be leisure time spent with your friends.

So the opportunity cost of being in school is all the good things that you can't afford and don't have the spare time to enjoy. You might want to put a dollar value on that cost or you might just list all the items that make up the opportunity cost.

The examples of opportunity cost that we've just considered are all-or-nothing costs—you're either in school or not in school. Most situations are not like this one. They involve choosing *how much* of an activity to do.

How Much? Choosing at the Margin

You can allocate the next hour between studying and chatting online with your friends, but the choice is not all or nothing. You must decide how many minutes to allocate to each activity. To make this decision, you compare the benefit of a little bit more study time with its cost—you make your choice at the **margin**.

The benefit that arises from an increase in an activity is called **marginal benefit**. For example, your marginal benefit from one more night of study before a test is the boost it gives to your grade. Your marginal benefit doesn't include the grade you're already achieving without that extra night of work.

The *opportunity cost* of an *increase* in an activity is called **marginal cost**. For you, the marginal cost of studying one more night is the cost of not spending that night on your favourite leisure activity.

To make your decisions, you compare marginal benefit and marginal cost. If the marginal benefit from an extra night of study exceeds its marginal cost, you study the extra night. If the marginal cost exceeds the marginal benefit, you don't study the extra night.

Choices Respond to Incentives

Economists take human nature as given and view people as acting in their self-interest. All people—you, other consumers, producers, politicians, and public servants—pursue their self-interest.

Self-interested actions are not necessarily *selfish* actions. You might decide to use your resources in ways that bring pleasure to others as well as to yourself. But a self-interested act gets the most benefit for *you* based on *your* view about benefit.

The central idea of economics is that we can predict the self-interested choices that people make by looking at the *incentives* they face. People undertake those activities for which marginal benefit exceeds marginal cost; and they reject options for which marginal cost exceeds marginal benefit.

For example, your economics instructor gives you a problem set and tells you these problems will be on the next test. Your marginal benefit from working these problems is large, so you diligently work them. In contrast, your math instructor gives you a problem set on a topic that she says will never be on a test. You get little marginal benefit from working these problems, so you decide to skip most of them.

Economists see incentives as the key to reconciling self-interest and social interest. When our choices are *not* in the social interest, it is because of the incentives we face. One of the challenges for economists is to figure out the incentives that result in self-interested choices being in the social interest.

Economists emphasize the crucial role that institutions play in influencing the incentives that people face as they pursue their self-interest. Laws that protect private property and markets that enable voluntary exchange are the fundamental institutions. You will learn as you progress with your study of economics that where these institutions exist, self-interest can indeed promote the social interest.

REVIEW QUIZ

- 1 Explain the idea of a tradeoff and think of three tradeoffs that you have made today.
- 2 Explain what economists mean by rational choice and think of three choices that you've made today that are rational.
- 3 Explain why opportunity cost is the best forgone alternative and provide examples of some opportunity costs that you have faced today.
- 4 Explain what it means to choose at the margin and illustrate with three choices at the margin that you have made today.
- 5 Explain why choices respond to incentives and think of three incentives to which you have responded today.

Work these questions in Study Plan 1.3 and get instant feedback. Do a Key Terms Quiz.

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Economics as Social Science and Policy Tool

Economics is both a social science and a toolkit for advising on policy decisions.

Economist as Social Scientist

As social scientists, economists seek to discover how the economic world works. In pursuit of this goal, like all scientists, economists distinguish between positive and normative statements.

Positive Statements A *positive* statement is about what *is*. It says what is currently believed about the way the world operates. A positive statement might be right or wrong, but we can test it by checking it against the facts. “Our planet is warming because of the amount of coal that we’re burning” is a positive statement. We can test whether it is right or wrong.

A central task of economists is to test positive statements about how the economic world works and to weed out those that are wrong. Economics first got off the ground in the late 1700s, so it is a young science compared with, for example, physics, and much remains to be discovered.

Normative Statements A *normative* statement is about what *ought to be*. It depends on values and cannot be tested. Policy goals are normative statements. For example, “We ought to cut our use of coal by 50 percent” is a normative policy statement. You may agree or disagree with it, but you can’t test it. It doesn’t assert a fact that can be checked.

Unscrambling Cause and Effect Economists are particularly interested in positive statements about cause and effect. Are computers getting cheaper because people are buying them in greater quantities? Or are people buying computers in greater quantities because they are getting cheaper? Or is some third factor causing both the price of a computer to fall and the quantity of computers bought to increase?

To answer such questions, economists create and test economic models. An **economic model** is a description of some aspect of the economic world that includes only those features that are needed for the purpose at hand. For example, an economic model of a cellphone network might include features such as the prices of calls, the number of cellphone users, and the volume of calls. But the model would ignore cellphone colours and ringtones.

A model is tested by comparing its predictions with the facts. But testing an economic model is difficult because we observe the outcomes of the simultaneous change of many factors. To cope with this problem, economists look for natural experiments (situations in the ordinary course of economic life in which the one factor of interest is different and other things are equal or similar); conduct statistical investigations to find correlations; and perform economic experiments by putting people in decision-making situations and varying the influence of one factor at a time to discover how they respond.

Economist as Policy Adviser

Economics is useful. It is a toolkit for advising governments and businesses and for making personal decisions. Some of the most famous economists work partly as policy advisers.

Many leading Canadian economists have advised governments and other organizations on a wide range of economic policy issues. Among them are David Laidler of the University of Western Ontario, Christopher Ragan of McGill University, and Angela Reddish of the University of British Columbia, all of whom have spent time advising the Bank of Canada and the Department of Finance.

All the policy questions on which economists provide advice involve a blend of the positive and the normative. Economics can’t help with the normative part—the policy goal. But it can help to clarify the goal. And for a given goal, economics provides the tools for evaluating alternative solutions—comparing marginal benefits and marginal costs and finding the solution that makes the best use of the available resources.

REVIEW QUIZ

- 1 Distinguish between a positive statement and a normative statement and provide examples.
- 2 What is a model? Can you think of a model that you might use in your everyday life?
- 3 How do economists try to disentangle cause and effect?
- 4 How is economics used as a policy tool?

Work these questions in Study Plan 1.4 and get instant feedback. Do a Key Terms Quiz.

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ECONOMICS IN THE NEWS

The Internet for Everyone

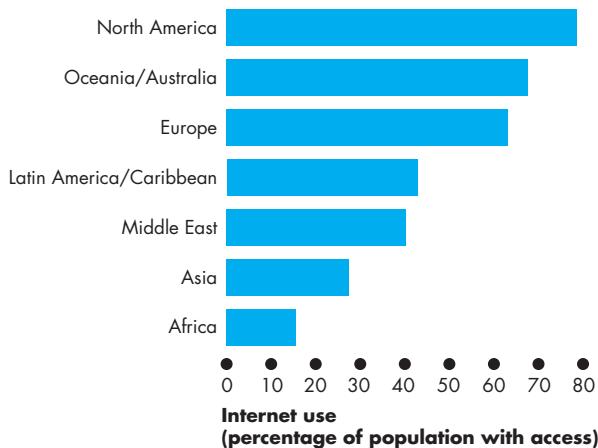
Mark Zuckerberg's Big Idea: The "Next 5 Billion"

Facebook founder Mark Zuckerberg wants to make it so that anyone, anywhere, can get online. To achieve this goal, he has created internet.org, "a global partnership between technology leaders, nonprofits, local communities, and experts who are working together to bring the Internet to the two-thirds of the world's population that don't have it."

Sources: CNN Money, August 21, 2013, and internet.org

THE DATA

- The figure shows that almost 80 percent of Americans and Canadians have Internet access compared to only 16 percent of Africans and 28 percent of Asians.



- Of the 5 billion people who Mark Zuckerberg wants to have Internet access, 1 billion live in Africa and 2.8 billion live in Asia.
- To figure out what it would take for everyone to have Internet access, we must make an assumption about how many people share resources.
- If four people shared, it would cost about \$285 billion for computers and \$115 billion a year for Internet access for everyone to get online.
- Satisfying Mark Zuckerberg's want would cost the equivalent of 400 years of Facebook's 2012 profit, or 1,600 Boeing 787 Dreamliners, or 90 aircraft carriers, or 87 billion Big Macs.

THE QUESTIONS

- What is the fundamental economic problem and how does this news clip illustrate it?
- What are some of the things that might be forgone for more people to get online?
- Why don't more people make the tradeoffs needed to get online?
- Why might it be in Mark Zuckerberg's self-interest to get everyone online?
- Why might it not be in the social interest for everyone to get online?



In Africa, 4 in 5 people lack Internet access.

THE ANSWERS

- The fundamental economic problem is scarcity—the fact that wants exceed the resources available to satisfy them. The news clip illustrates scarcity because Mark Zuckerberg's want for everyone to get online *exceeds* the resources available to satisfy it.
- Some of the scarce resources that are used to produce airplanes, war ships, and Big Macs could be reallocated and used to produce more computers and Internet service.
- People don't make the tradeoffs needed to get online because for them the marginal cost of doing so would exceed the marginal benefit.
- It might be in Mark Zuckerberg's self-interest to get everyone online because that would increase the number of Facebook users and increase the firm's advertising revenues.
- It would not be in the social interest to get everyone online if the marginal cost of an Internet connection exceeded its marginal benefit.

SUMMARY

Key Points

Definition of Economics (p. 2)

- All economic questions arise from scarcity—from the fact that wants exceed the resources available to satisfy them.
- Economics is the social science that studies the choices that people make as they cope with scarcity.
- The subject divides into microeconomics and macroeconomics.

Working Problem 1 will give you a better understanding of the definition of economics.

Two Big Economic Questions (pp. 3–8)

- Two big questions summarize the scope of economics:
 1. How do choices end up determining *what, how, and for whom* goods and services are produced?
 2. When do choices made in the pursuit of *self-interest* also promote the *social interest*?

Working Problems 2 and 3 will give you a better understanding of the two big questions of economics.

The Economic Way of Thinking (pp. 9–10)

- Every choice is a tradeoff—exchanging more of something for less of something else.
- People make rational choices by comparing benefit and cost.
- Cost—*opportunity cost*—is what you must give up to get something.
- Most choices are “how much” choices made at the *margin* by comparing marginal benefit and marginal cost.
- Choices respond to incentives.

Working Problems 4 and 5 will give you a better understanding of the economic way of thinking.

Economics as Social Science and Policy Tool (p. 11)

- Economists distinguish between positive statements—what is—and normative statements—what ought to be.
- To explain the economic world, economists create and test economic models.
- Economics is a toolkit used to provide advice on government, business, and personal economic decisions.

Working Problem 6 will give you a better understanding of economics as social science and policy tool.

Key Terms

Benefit, 9
 Capital, 4
 Economic model, 11
 Economics, 2
 Efficient, 5
 Entrepreneurship, 4
 Factors of production, 3
 Goods and services, 3
 Human capital, 3
 Incentive, 2

Interest, 4
 Labour, 3
 Land, 3
 Macroeconomics, 2
 Margin, 10
 Marginal benefit, 10
 Marginal cost, 10
 Microeconomics, 2
 Opportunity cost, 9
 Preferences, 9

Profit, 4
 Rational choice, 9
 Rent, 4
 Scarcity, 2
 Self-interest, 5
 Social interest, 5
 Tradeoff, 9
 Wages, 4

◆ STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab You can work Problems 1 to 6 in MyEconLab Chapter 1 Study Plan and get instant feedback.

Definition of Economics (Study Plan 1.1)

1. Apple Inc. decides to make iTunes freely available in unlimited quantities.
 - a. Does Apple's decision change the incentives that people face?
 - b. Is Apple's decision an example of a microeconomic or a macroeconomic issue?

Two Big Economic Questions (Study Plan 1.2)

2. Which of the following pairs does not match?
 - a. Labour and wages
 - b. Land and rent
 - c. Entrepreneurship and profit
 - d. Capital and profit
3. Explain how the following news headlines concern self-interest and the social interest.
 - a. Starbucks Expands in China
 - b. McDonald's Moves into Gourmet Coffee
 - c. Food Must Be Labelled with Nutrition Data

The Economic Way of Thinking (Study Plan 1.3)

4. The night before an economics test, you decide to go to the movies instead of staying home and working your MyEconLab Study Plan. You get

50 percent on your test compared with the 70 percent that you normally score.

- a. Did you face a tradeoff?
- b. What was the opportunity cost of your evening at the movies?

5. Cost of Sochi Winter Olympics

The Russian government spent \$6.7 billion on Olympic facilities and \$16.7 billion upgrading Sochi area infrastructure. Sponsors spent \$27.6 billion on hotels and facilities hoping to turn Sochi into a year-round tourist magnet.

Source: *The Washington Post*, February 11, 2014

Was the opportunity cost of the Sochi Olympics \$6.7, \$23.4, or \$51 billion? Explain your answer.

Economics as Social Science and Policy Tool

(Study Plan 1.4)

6. Which of the following statements is positive, which is normative, and which can be tested?
 - a. Canada should cut its imports.
 - b. China is Canada's largest trading partner.
 - c. The federal government should increase the production of biofuels.

◆ ADDITIONAL PROBLEMS AND APPLICATIONS

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

Definition of Economics

7. Rapper Offers Free Tickets for Concert

Eminem will hit the road with Rihanna offering an awesome deal—buy one and get one free!

Source: *Mstars News*, February 24, 2014

When Eminem gave away tickets, what was free and what was scarce? Explain your answer.

as drivers lined up to get the discount of 10 cents a litre.

- a. What is the opportunity cost of a litre of gas? Explain.
- b. To control the crowd, Costco hires traffic police. What is the tradeoff that Costco faces?
11. What might be an incentive for you to take a class in summer school? List some of the benefits and costs involved in your decision. Would your choice be rational?

Economics as Social Science and Policy Tool

12. Look at today's *National Post*. What is the leading economic news story? With which of the big economic questions does it deal and what trade-offs does it discuss or imply?
13. Provide two microeconomic statements and two macroeconomic statements. Classify your statements as positive or normative. Explain why.

Two Big Economic Questions

8. How does the creation of a successful movie influence *what, how, and for whom* goods and services are produced?
9. How does a successful movie illustrate self-interested choices that are also in the social interest?

The Economic Way of Thinking

10. When Costco opened a gas bar just off Highway 401, the neighbourhood was swamped with cars

APPENDIX

Graphs in Economics

**After studying this appendix,
you will be able to:**

- ◆ Make and interpret a scatter diagram
- ◆ Identify linear and nonlinear relationships and relationships that have a maximum and a minimum
- ◆ Define and calculate the slope of a line
- ◆ Graph relationships among more than two variables

Graphing Data

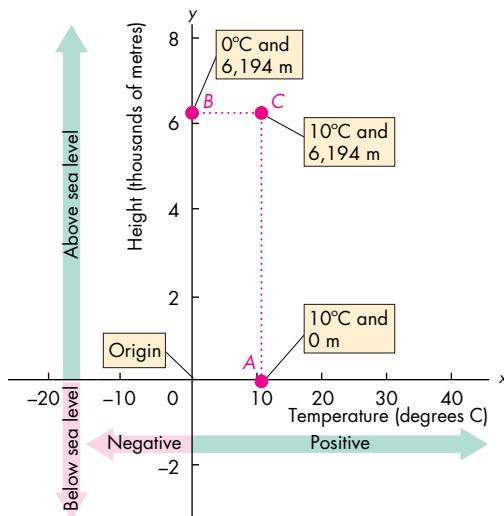
A graph represents a quantity as a distance on a line. In Fig. A1.1, a distance on the horizontal line represents temperature, measured in degrees Celsius. A movement from left to right shows an increase in temperature. The point 0 represents zero degrees Celsius. To the right of 0, the temperature is positive. To the left of 0, the temperature is negative (as indicated by the minus sign). A distance on the vertical line represents height, measured in thousands of metres. The point 0 represents sea level. Points above 0 represent metres above sea level. Points below 0 represent metres below sea level (indicated by a minus sign).

In Fig. A1.1, the two scale lines are perpendicular to each other and are called *axes*. The vertical line is the *y-axis*, and the horizontal line is the *x-axis*. Each axis has a zero point, which is shared by the two axes and called the *origin*.

To make a two-variable graph, we need two pieces of information: the value of the variable *x* and the value of the variable *y*. For example, off the coast of British Columbia, the temperature is 10 degrees—the value of *x*. A fishing boat is located at 0 metres above sea level—the value of *y*. These two bits of information appear as point *A* in Fig. A1.1. A climber at the top of Mount McKinley on a cold day is 6,194 metres above sea level in a zero-degree gale. These two pieces of information appear as point *B*. On a warmer day, a climber might be at the peak of Mt. McKinley when the temperature is 10 degrees, at point *C*.

We can draw two lines, called *coordinates*, from point *C*. One, called the *x*-coordinate, runs from *C* to

FIGURE A1.1 Making a Graph



Graphs have axes that measure quantities as distances. Here, the horizontal axis (*x*-axis) measures temperature, and the vertical axis (*y*-axis) measures height. Point *A* represents a fishing boat at sea level (0 on the *y*-axis) on a day when the temperature is 10°C. Point *B* represents a climber at the top of Mt. McKinley, 6,194 metres above sea level at a temperature of 0°F. Point *C* represents a climber at the top of Mt. McKinley, 6,194 metres above sea level at a temperature of 10°C.

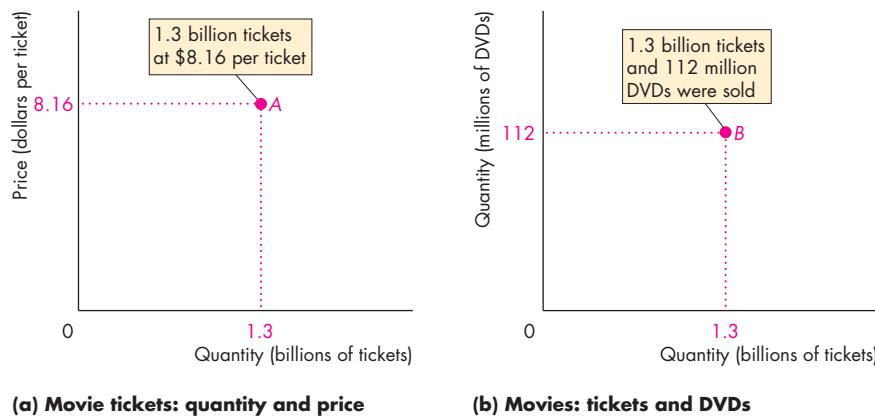
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the vertical axis. This line is called “the *x*-coordinate” because its length is the same as the value marked off on the *x*-axis. The other, called the *y*-coordinate, runs from *C* to the horizontal axis. This line is called “the *y*-coordinate” because its length is the same as the value marked off on the *y*-axis.

We describe a point on a graph by the values of its *x*-coordinate and its *y*-coordinate. For example, at point *C*, *x* is 10 degrees and *y* is 6,194 metres.

A graph like that in Fig. A1.1 can be made using any quantitative data on two variables. The graph can show just a few points, like Fig. A1.1, or many points. Before we look at graphs with many points, let’s reinforce what you’ve just learned by looking at two graphs made with economic data.

Economists measure variables that describe *what*, *how*, and *for whom* goods and services are produced. These variables are quantities produced and prices. Figure A1.2 shows two examples of economic graphs.

FIGURE A1.2 Two Graphs of Economic Data

The graph in part (a) tells us that in 2013, 1.3 billion movie tickets were sold at an average price of \$8.16 per ticket.

The graph in part (b) tells us that in 2013, 1.3 billion movie tickets and 112 million DVDs were sold.

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Figure A1.2(a) is a graph about movie tickets in 2013. The x -axis measures the quantity of movie tickets sold and the y -axis measures the average price of a ticket. Point *A* tells us what the quantity and price were. You can “read” this graph as telling you that in 2013, 1.3 billion movie tickets were sold at an average ticket price of \$8.16.

Figure A1.2(b) is a graph about movie-going and DVD buying. The x -axis measures the quantity of movie tickets sold in 2013 and the y -axis measures the quantity of DVDs sold in the same year. Point *B* tells us what these quantities were. You can “read” this graph as telling you that in 2013, 1.3 billion movie tickets and 112 million DVDs were sold.

The three graphs that you’ve just seen tell you how to make a graph and how to read a data point on a graph, but they don’t improve on the raw data. Graphs become interesting and revealing when they contain a number of data points because then you can visualize the data.

Economists create graphs based on the principles in Figs. A1.1 and A1.2 to reveal, describe, and visualize the relationships among variables. We’re now going to look at some examples. These graphs are called scatter diagrams.

Scatter Diagrams

A **scatter diagram** is a graph that plots the value of one variable against the value of another variable for a number of different values of each variable. Such a graph reveals whether a relationship exists between two variables and describes their relationship.

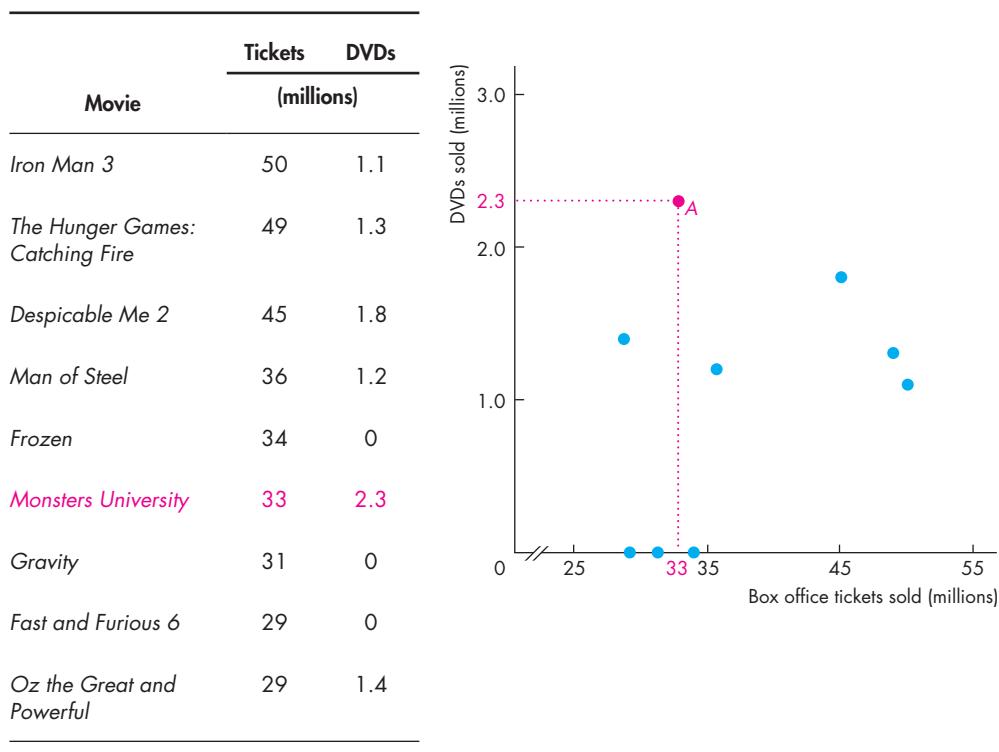
The table in Fig. A1.3 shows some data on two variables: the number of tickets sold at the box office and the number of DVDs sold for nine of the most popular movies in 2013.

What is the relationship between these two variables? Does a big box office success generate a large volume of DVD sales? Or does a box office success mean that fewer DVDs are sold?

We can answer these questions by making a scatter diagram. We do so by graphing the data in the table. In the graph in Fig. A1.3, each point shows the number of box office tickets sold (the x variable) and the number of DVDs sold (the y variable) of one of the movies. There are nine movies, so there are nine points “scattered” within the graph.

The point labelled *A* tells us that *Monsters University* sold 33 million tickets at the box office and 2.3 million DVDs. The points in the graph don’t form a distinct pattern. They suggest that large box office sales do not directly bring large DVD sales. If you want to predict a movie’s DVD sales in a given year with any confidence, you need to know more than the number of tickets sold at the box office in that year.

Figure A1.4 shows two scatter diagrams of economic variables. Part (a) shows the relationship between income and expenditure, on average, from 2003 to 2013. Each point represents income and expenditure in a given year. For example, point *A* shows that in 2006, income was \$35,000 and expenditure was \$25,000. This graph shows that as income increases, so does expenditure, and the relationship is a close one.

FIGURE A1.3 A Scatter Diagram

The table lists the number of tickets sold at the box office and the number of DVDs sold for nine popular movies.

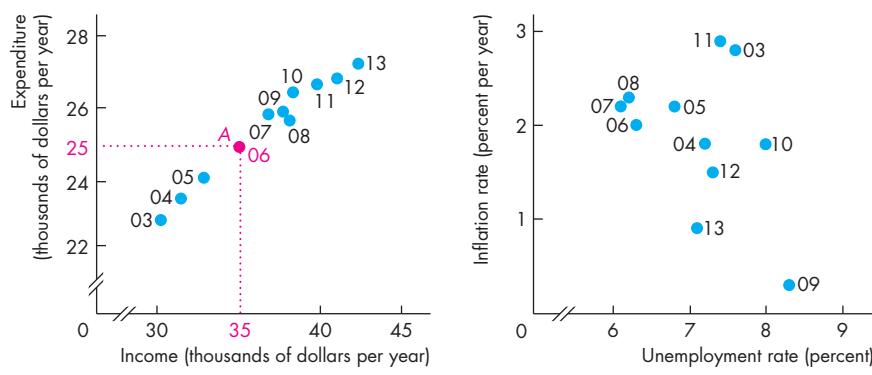
The scatter diagram reveals the relationship between these two variables. Each point shows the values of the variables for a specific movie. For example, point A shows the point for *Monsters University*, which sold 33 million tickets at the box office and 2.3 million DVDs.

The pattern formed by the points shows no tendency for large box office sales to bring greater DVD sales. You cannot predict how many DVDs of a movie will sell in a given year just by knowing its box office sales in that year.

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Figure A1.4(b) shows a scatter diagram of inflation and unemployment in Canada from 2003 to 2013. Here, the points show no relationship between the two variables. For example, when unemployment was high, the inflation rate was high in 2003 and low in 2013.

You can see that a scatter diagram conveys a wealth of information, and it does so in much less space than we have used to describe only some of its features. But you do have to “read” the graph to obtain all this information.

FIGURE A1.4 Two Economic Scatter Diagrams

The scatter diagram in part (a) shows the relationship between income and expenditure from 2003 to 2013. Point A shows that in 2006, income was \$35,000 on the x-axis and expenditure was \$25,000 on the y-axis. This graph shows that as income rises, so does expenditure, and the relationship is a close one.

The scatter diagram in part (b) shows a weak relationship between unemployment and inflation in Canada during most of the years.

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Breaks in the Axes The graph in Fig. A1.4(a) has breaks in its axes, as shown by the small gaps. The breaks indicate that there are jumps from the origin, 0, to the first values recorded.

The breaks are used because the lowest value of income is \$30,000 and the lowest value of expenditure exceeds \$22,000. If we made this graph with no breaks in its axes, there would be a lot of empty space, the points would be crowded into the top right corner, and it would be difficult to see whether a relationship exists between these two variables. By breaking the axes, we are able to bring the relationship into view.

Putting a break in one or both axes is like using a zoom lens to bring the relationship into the centre of the graph and magnify it so that the relationship fills the graph.

Misleading Graphs Breaks can be used to highlight a relationship, but they can also be used to mislead—to make a graph that lies. The most common way of making a graph lie is to put a break in the axis and either to stretch or compress the scale. For example, suppose that in Fig. A1.4(a), the y -axis that measures expenditure ran from zero to \$28,000 while the x -axis was the same as the one shown. The graph would now create the impression that despite a huge increase in income, expenditure had barely changed.

To avoid being misled, it is a good idea to get into the habit of always looking closely at the values and the labels on the axes of a graph before you start to interpret it.

Correlation and Causation A scatter diagram that shows a clear relationship between two variables, such as Fig. A1.4(a), tells us that the two variables have a high correlation. When a high correlation is present, we can predict the value of one variable from the value of the other variable. But correlation does not imply causation.

Sometimes a high correlation does arise from a causal relationship. It is likely that rising income causes rising expenditure (Fig. A1.4a). But a high correlation can mean that two variables have a common cause. For example, ice cream sales and pool drownings are correlated not because one causes the other, but because both are caused by hot weather.

You've now seen how we can use graphs in economics to show economic data and to reveal relationships. Next, we'll learn how economists use graphs to construct and display economic models.

Graphs Used in Economic Models

The graphs used in economics are not always designed to show real-world data. Often they are used to show general relationships among the variables in an economic model.

An *economic model* is a stripped-down, simplified description of an economy or of a component of an economy such as a business or a household. It consists of statements about economic behaviour that can be expressed as equations or as curves in a graph. Economists use models to explore the effects of different policies or other influences on the economy in ways that are similar to the use of model airplanes in wind tunnels and models of the climate.

You will encounter many different kinds of graphs in economic models, but there are some repeating patterns. Once you've learned to recognize these patterns, you will instantly understand the meaning of a graph. Here, we'll look at the different types of curves that are used in economic models, and we'll see some everyday examples of each type of curve. The patterns to look for in graphs are the four cases in which:

- Variables move in the same direction.
- Variables move in opposite directions.
- Variables have a maximum or a minimum.
- Variables are unrelated.

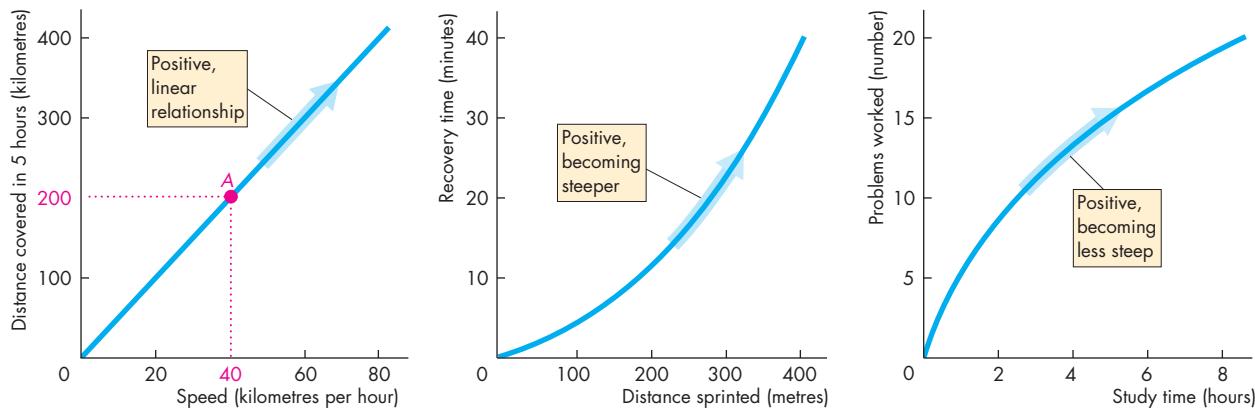
Let's look at these four cases.

Variables That Move in the Same Direction

Figure A1.5 shows graphs of the relationships between two variables that move up and down together. A relationship between two variables that move in the same direction is called a **positive relationship** or a **direct relationship**. A line that slopes upward shows such a relationship.

Figure A1.5 shows three types of relationships: one that has a straight line and two that have curved lines. All the lines in these three graphs are called curves. Any line on a graph—no matter whether it is straight or curved—is called a *curve*.

A relationship shown by a straight line is called a **linear relationship**. Figure A1.5(a) shows a linear relationship between the number of kilometres travelled

FIGURE A1.5 Positive (Direct) Relationships

(a) Positive, linear relationship

(b) Positive, becoming steeper

(c) Positive, becoming less steep

Each part shows a positive (direct) relationship between two variables. That is, as the value of the variable measured on the x-axis increases, so does the value of the variable measured on the y-axis. Part (a) shows a linear positive relationship—as the two variables increase together, we move along a straight line.

Part (b) shows a positive relationship such that as the two variables increase together, we move along a curve that becomes steeper.

Part (c) shows a positive relationship such that as the two variables increase together, we move along a curve that becomes flatter.

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in 5 hours and speed. For example, point A shows that you will travel 200 kilometres in 5 hours if your speed is 40 kilometres an hour. If you double your speed to 80 kilometres an hour, you will travel 400 kilometres in 5 hours.

Figure A1.5(b) shows the relationship between distance sprinted and recovery time (the time it takes the heart rate to return to its normal resting rate). This relationship is an upward-sloping one that starts out quite flat but then becomes steeper as we move along the curve away from the origin. The reason this curve becomes steeper is that the additional recovery time needed from sprinting an additional 100 metres increases. It takes less than 5 minutes to recover from sprinting 100 metres but more than 10 minutes to recover from 200 metres.

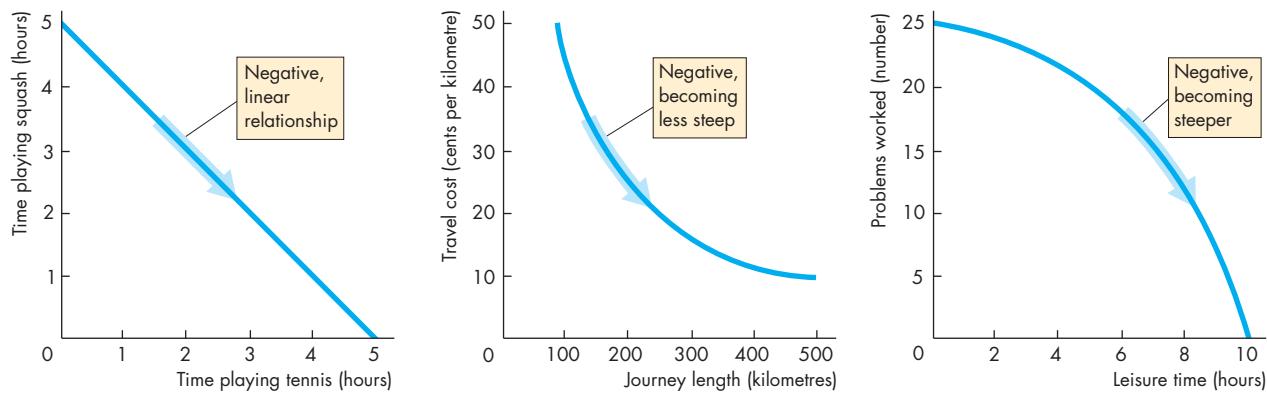
Figure A1.5(c) shows the relationship between the number of problems worked by a student and the amount of study time. This relationship is an upward-sloping one that starts out quite steep and becomes flatter as we move along the curve away from the origin. Study time becomes less productive as the student spends more hours studying and becomes more tired.

Variables That Move in Opposite Directions

Figure A1.6 shows relationships between things that move in opposite directions. A relationship between variables that move in opposite directions is called a **negative relationship** or an **inverse relationship**.

Figure A1.6(a) shows the relationship between the hours spent playing squash and the hours spent playing tennis when the total time available is 5 hours. One extra hour spent playing tennis means one hour less spent playing squash and vice versa. This relationship is negative and linear.

Figure A1.6(b) shows the relationship between the cost per kilometre travelled and the length of a journey. The longer the journey, the lower is the cost per kilometre. But as the journey length increases, even though the cost per kilometre decreases, the fall in the cost per kilometre is smaller, the longer the journey. This feature of the relationship is shown by the fact that the curve slopes downward, starting out steep at a short journey length and then becoming flatter as the journey length increases. This relationship arises because some of the costs are fixed, such as auto insurance, and the fixed costs are spread over a longer journey.

FIGURE A1.6 Negative (Inverse) Relationships**(a) Negative, linear relationship****(b) Negative, becoming less steep****(c) Negative, becoming steeper**

Each part shows a negative (inverse) relationship between two variables. Part (a) shows a linear negative relationship. The total time spent playing tennis and squash is 5 hours. As the time spent playing tennis increases, the time spent playing squash decreases, and we move along a straight line.

Part (b) shows a negative relationship such that as the journey length increases, the travel cost decreases as we move along a curve that becomes less steep.

Part (c) shows a negative relationship such that as leisure time increases, the number of problems worked decreases as we move along a curve that becomes steeper.

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Figure A1.6(c) shows the relationship between the amount of leisure time and the number of problems worked by a student. Increasing leisure time produces an increasingly large reduction in the number of problems worked. This relationship is a negative one that starts out with a gentle slope at a small number of leisure hours and becomes steeper as the number of leisure hours increases. This relationship is a different view of the idea shown in Fig. A1.5(c).

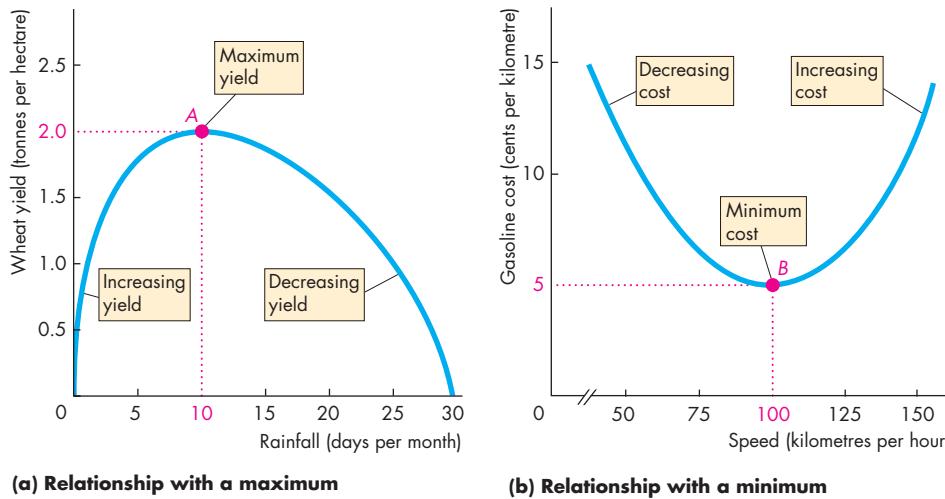
Variables That Have a Maximum or a Minimum

Many relationships in economic models have a maximum or a minimum. For example, firms try to make the maximum possible profit and to produce at the lowest possible cost. Figure A1.7 shows relationships that have a maximum or a minimum.

Figure A1.7(a) shows the relationship between rainfall and wheat yield. When there is no rainfall, wheat will not grow, so the yield is zero. As the rainfall increases up to 10 days a month, the wheat yield increases. With 10 rainy days each month, the wheat

yield reaches its maximum at 2 tonnes per hectare (point A). Rain in excess of 10 days a month starts to lower the yield of wheat. If every day is rainy, the wheat suffers from a lack of sunshine and the yield decreases to zero. This relationship is one that starts out sloping upward, reaches a maximum, and then slopes downward.

Figure A1.7(b) shows the reverse case—a relationship that begins sloping downward, falls to a minimum, and then slopes upward. Most economic costs are like this relationship. An example is the relationship between the cost per kilometre and the speed of the car. At low speeds, the car is creeping in a traffic snarl-up. The number of kilometres per litre is low, so the gasoline cost per kilometre is high. At high speeds, the car is travelling faster than its efficient speed, using a large quantity of gasoline, and again the number of kilometres per litre is low and the gasoline cost per kilometre is high. At a speed of 100 kilometres an hour, the gasoline cost per kilometre is at its minimum (point B). This relationship is one that starts out sloping downward, reaches a minimum, and then slopes upward.

FIGURE A1.7 Maximum and Minimum Points

Part (a) shows a relationship that has a maximum point, A. The curve slopes upward as it rises to its maximum point, is flat at its maximum, and then slopes downward.

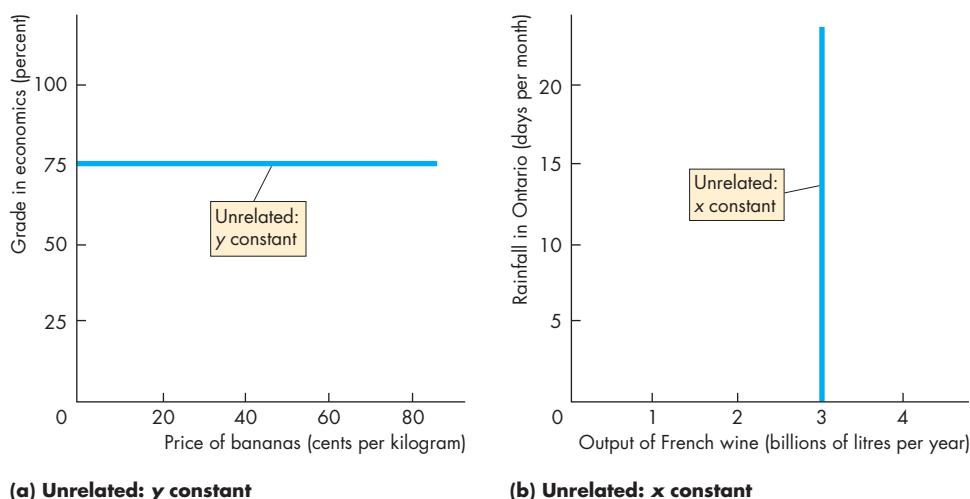
Part (b) shows a relationship with a minimum point, B. The curve slopes downward as it falls to its minimum, is flat at its minimum, and then slopes upward.

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Variables That Are Unrelated

There are many situations in which no matter what happens to the value of one variable, the other variable remains constant. Sometimes we want to show the independence between two variables in a graph, and Fig. A1.8 shows two ways of achieving this.

In describing the graphs in Fig. A1.5 through Fig. A1.7, we have talked about curves that slope upward or slope downward and curves that become less steep or steeper. Let's spend a little time discussing exactly what we mean by *slope* and how we measure the slope of a curve.

FIGURE A1.8 Variables That Are Unrelated

This figure shows how we can graph two variables that are unrelated. In part (a), a student's grade in economics is plotted at 75 percent on the y-axis regardless of the price of bananas on the x-axis. The curve is horizontal.

In part (b), the output of the vineyards of France on the x-axis does not vary with the rainfall in Ontario on the y-axis. The curve is vertical.

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The Slope of a Relationship

We can measure the influence of one variable on another by the slope of the relationship. The **slope** of a relationship is 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. We use the Greek letter Δ (*delta*) to represent “change in.” Thus Δy means the change in the value of the variable measured on the y -axis, and Δx means the change in the value of the variable measured on the x -axis. Therefore the slope of the relationship is

$$\text{Slope} = \frac{\Delta y}{\Delta x}.$$

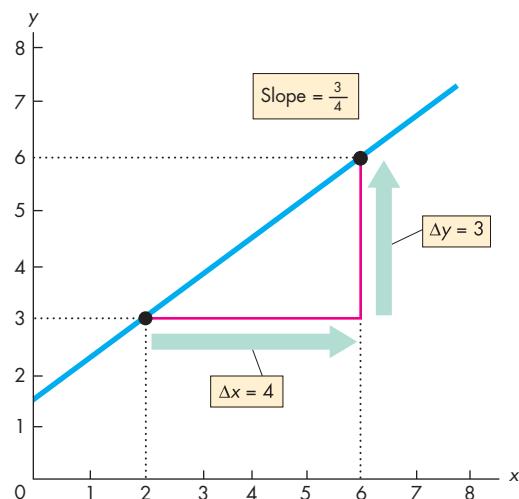
If a large change in the variable measured on the y -axis (Δy) is associated with a small change in the variable measured on the x -axis (Δx), the slope is large and the curve is steep. If a small change in the variable measured on the y -axis (Δy) is associated with a large change in the variable measured on the x -axis (Δx), the slope is small and the curve is flat.

We can make the idea of slope clearer by doing some calculations.

The Slope of a Straight Line

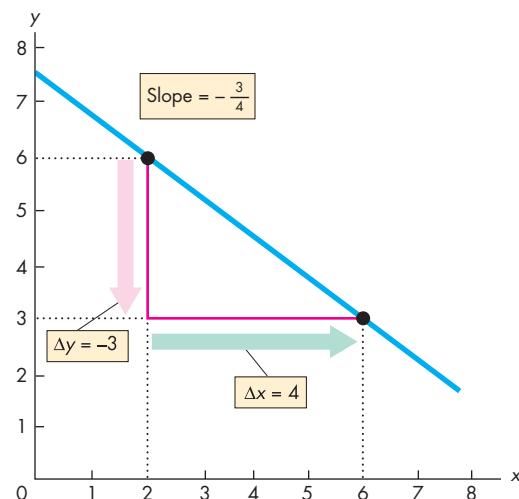
The slope of a straight line is the same regardless of where on the line you calculate it. The slope of a straight line is constant. Let’s calculate the slope of the positive relationship in Fig. A1.9. In part (a),

FIGURE A1.9 The Slope of a Straight Line



To calculate the slope of a straight line, we divide the change in the value of the variable measured on the y -axis (Δy) by the change in the value of the variable measured on the x -axis (Δx) as we move along the line.

Part (a) shows the calculation of a positive slope. When x increases from 2 to 6, Δx equals 4. That change in



x brings about an increase in y from 3 to 6, so Δy equals 3. The slope ($\Delta y/\Delta x$) equals $3/4$.

Part (b) shows the calculation of a negative slope. When x increases from 2 to 6, Δx equals 4. That increase in x brings about a decrease in y from 6 to 3, so Δy equals -3 . The slope ($\Delta y/\Delta x$) equals $-3/4$.

when x increases from 2 to 6, y increases from 3 to 6. The change in x is +4—that is, Δx is 4. The change in y is +3—that is, Δy is 3. The slope of that line is

$$\frac{\Delta y}{\Delta x} = \frac{3}{4}.$$

In part (b), when x increases from 2 to 6, y decreases from 6 to 3. The change in y is *minus* 3—that is, Δy is -3. The change in x is *plus* 4—that is, Δx is 4. The slope of the curve is

$$\frac{\Delta y}{\Delta x} = \frac{-3}{4}.$$

Notice that the two slopes have the same magnitude ($3/4$), but the slope of the line in part (a) is positive ($+3/4 = 3/4$) while that in part (b) is negative ($-3/4 = -3/4$). The slope of a positive relationship is positive; the slope of a negative relationship is negative.

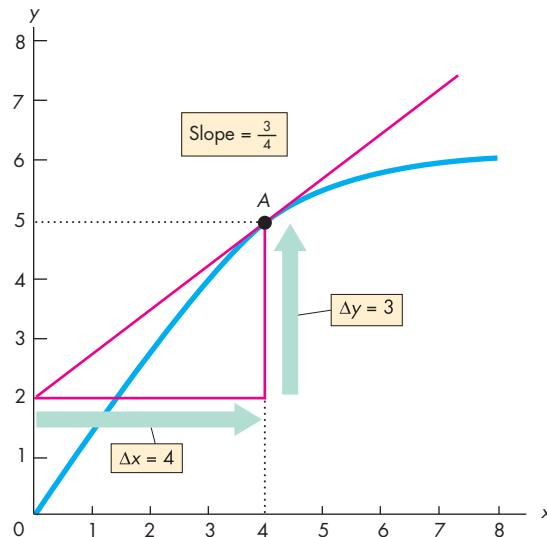
The Slope of a Curved Line

The slope of a curved line is trickier. The slope of a curved line is not constant, so the slope depends on where on the curved line we calculate it. There are two ways to calculate the slope of a curved line: You can calculate the slope at a point, or you can calculate the slope across an arc of the curve. Let's look at the two alternatives.

Slope at a Point To calculate the slope at a point on a curve, you need to construct a straight line that has the same slope as the curve at the point in question. Figure A1.10 shows how this is done. Suppose you want to calculate the slope of the curve at point A . Place a ruler on the graph so that the ruler touches point A and no other point on the curve, then draw a straight line along the edge of the ruler. The straight red line is this line, and it is the tangent to the curve at point A . If the ruler touches the curve only at point A , then the slope of the curve at point A must be the same as the slope of the edge of the ruler. If the curve and the ruler do not have the same slope, the line along the edge of the ruler will cut the curve instead of just touching it.

Now that you have found a straight line with the same slope as the curve at point A , you can calculate the slope of the curve at point A by calculating the slope of the straight line. Along the straight

FIGURE A1.10 Slope at a Point



To calculate the slope of the curve at point A , draw the red line that just touches the curve at A —the tangent. The slope of this straight line is calculated by dividing the change in y by the change in x along the red line. When x increases from 0 to 4, Δx equals 4. That change in x is associated with an increase in y from 2 to 5, so Δy equals 3. The slope of the red line is $3/4$, so the slope of the curve at point A is $3/4$.

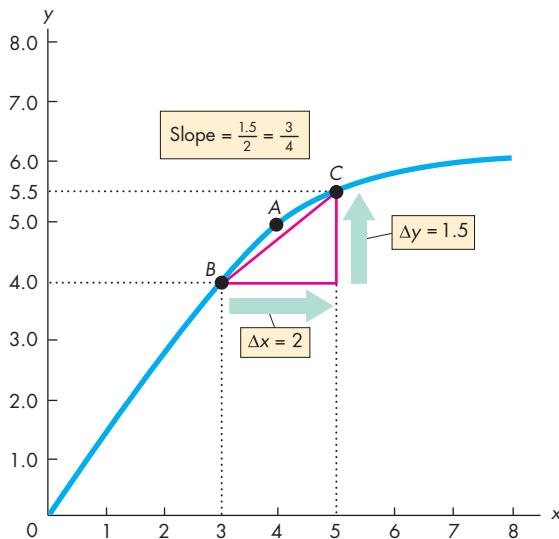
MyEconLab Animation

line, as x increases from 0 to 4 (Δx is 4) y increases from 2 to 5 (Δy is 3). Therefore the slope of the straight line is

$$\frac{\Delta y}{\Delta x} = \frac{3}{4}.$$

So the slope of the curve at point A is $3/4$.

Slope Across an Arc An arc of a curve is a piece of a curve. Figure A1.11 shows the same curve as in Fig. A1.10, but instead of calculating the slope at point A , we are now going to calculate the slope across the arc from point B to point C . You can see that the slope of the curve at point B is greater than at point C . When we calculate the slope across an arc, we are calculating the average slope between two points. As we move along the arc from B to C , x increases from 3 to 5 and y increases from 4.0 to 5.5. The change in x is 2 (Δx is 2), and the change in y is 1.5 (Δy is 1.5).

FIGURE A1.11 Slope Across an Arc

To calculate the average slope of the curve along the arc BC , draw a straight line from point B to point C . The slope of the line BC is calculated by dividing the change in y by the change in x . In moving from B to C , the increase in x is 2 (Δx equals 2) and the change in y is 1.5 (Δy equals 1.5). The slope of the line BC is 1.5 divided by 2, or $3/4$. So the slope of the curve across the arc BC is $3/4$.

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Therefore the slope is

$$\frac{\Delta y}{\Delta x} = \frac{1.5}{2} = \frac{3}{4}.$$

So the slope of the curve across the arc BC is $3/4$.

This calculation gives us the slope of the curve between points B and C . The actual slope calculated is the slope of the straight line from B to C . This slope approximates the average slope of the curve along the arc BC . In this particular example, the slope across the arc BC is identical to the slope of the curve at point A , but the calculation of the slope of a curve does not always work out so neatly. You might have fun constructing some more examples and a few counter examples.

You now know how to make and interpret a graph. So far, we've limited our attention to graphs of two variables. We're now going to learn how to graph more than two variables.

Graphing Relationships Among More Than Two Variables

We have seen that we can graph the relationship between two variables as a point formed by the x - and y -coordinates in a two-dimensional graph. You might be thinking that although a two-dimensional graph is informative, most of the things in which you are likely to be interested involve relationships among many variables, not just two. For example, the amount of ice cream consumed depends on the price of ice cream and the temperature. If ice cream is expensive and the temperature is low, people eat much less ice cream than when ice cream is inexpensive and the temperature is high. For any given price of ice cream, the quantity consumed varies with the temperature; and for any given temperature, the quantity of ice cream consumed varies with its price.

Figure A1.12 shows a relationship among three variables. The table shows the number of litres of ice cream consumed each day at two different temperatures and at a number of different prices of ice cream. How can we graph these numbers?

To graph a relationship that involves more than two variables, we use the *ceteris paribus* assumption.

Ceteris Paribus

Ceteris paribus (often shortened to *cet par*) means “if all other relevant things remain the same.” To isolate the relationship of interest in a laboratory experiment, a scientist holds everything constant except for the variable whose effect is being studied. Economists use the same method to graph a relationship that has more than two variables.

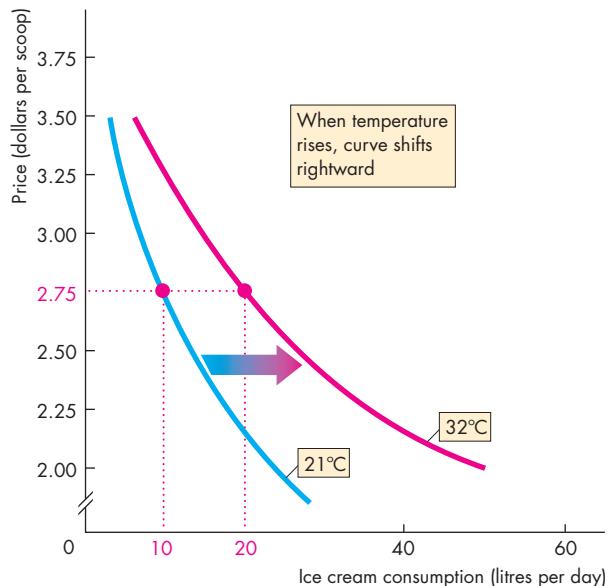
Figure A1.12 shows an example. There, you can see what happens to the quantity of ice cream consumed when the price of ice cream varies but the temperature is held constant.

The curve labelled 21°C shows the relationship between ice cream consumption and the price of ice cream if the temperature remains at 21°C . The numbers used to plot that curve are those in the first two columns of the table. For example, if the temperature is 21°C , 10 litres of ice cream are consumed when the price is \$2.75 a scoop and 18 litres are consumed when the price is \$2.25 a scoop.

The curve labelled 32°C shows the relationship between ice cream consumption and the price of ice cream if the temperature remains at 32°C . The numbers used to plot that curve are those in the first

FIGURE A1.12 Graphing a Relationship Among Three Variables

Price (dollars per scoop)	Ice cream consumption (litres per day)	
	21°C	32°C
2.00	25	50
2.25	18	36
2.50	13	26
2.75	10	20
3.00	7	14
3.25	5	10
3.50	3	6



Ice cream consumption depends on its price and the temperature. The table tells us how many litres of ice cream are consumed each day at different prices and two different temperatures. For example, if the price is \$2.75 a scoop and the temperature is 21°C, 10 litres of ice cream are consumed. But if the temperature is 32°C, 20 litres are consumed.

To graph a relationship among three variables, the value of one variable is held constant. The graph shows the relationship between price and consumption when

the temperature is held constant. One curve holds the temperature at 21°C and the other holds it at 32°C.

A change in the price of ice cream brings a movement along one of the curves—along the blue curve at 21°C and along the red curve at 32°C.

When the temperature rises from 21°C to 32°C, the curve that shows the relationship between consumption and the price shifts rightward from the blue curve to the red curve.

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and third columns of the table. For example, if the temperature is 32°C, 20 litres are consumed when the price is \$2.75 a scoop and 36 litres are consumed when the price is \$2.25 a scoop.

When the price of ice cream changes but the temperature is constant, you can think of what happens in the graph as a movement along one of the curves. At 21°C there is a movement along the blue curve, and at 32°C there is a movement along the red curve.

When Other Things Change

The temperature is held constant along each of the curves in Fig. A1.12, but in reality the temperature changes. When that event occurs, you can think of

what happens in the graph as a shift of the curve. When the temperature rises from 21°C to 32°C, the curve that shows the relationship between ice cream consumption and the price of ice cream shifts rightward from the blue curve to the red curve.

You will encounter these ideas of movements along and shifts of curves at many points in your study of economics. Think carefully about what you've just learned and make up some examples (with assumed numbers) about other relationships.

With what you have learned about graphs, you can move forward with your study of economics. There are no graphs in this book that are more complicated than those that have been explained in this appendix.

MATHEMATICAL NOTE

Equations of Straight Lines

If a straight line in a graph describes the relationship between two variables, we call it a linear relationship. Figure 1 shows the *linear relationship* between a person's expenditure and income. This person spends \$100 a week (by borrowing or spending previous savings) when income is zero. Out of each dollar earned, this person spends 50 cents (and saves 50 cents).

All linear relationships are described by the same general equation. We call the quantity that is measured on the horizontal axis (or x -axis) x , and we call the quantity that is measured on the vertical axis (or y -axis) y . In the case of Fig. 1, x is income and y is expenditure.

A Linear Equation

The equation that describes a straight-line relationship between x and y is

$$y = a + bx.$$

In this equation, a and b are fixed numbers and they are called *constants*. The values of x and y vary, so these numbers are called *variables*. Because the equation describes a straight line, the equation is called a *linear equation*.

The equation tells us that when the value of x is zero, the value of y is a . We call the constant a the y -axis intercept. The reason is that on the graph

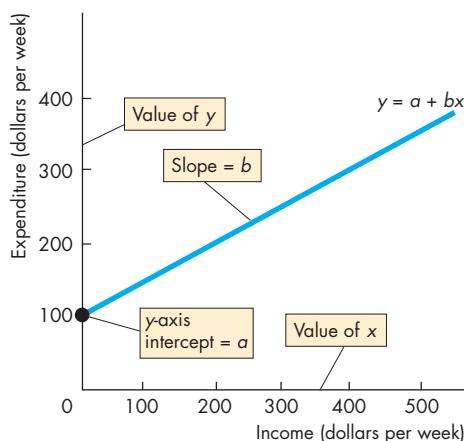


Figure 1 Linear Relationship

the straight line hits the y -axis at a value equal to a . Figure 1 illustrates the y -axis intercept.

For positive values of x , the value of y exceeds a . The constant b tells us by how much y increases above a as x increases. The constant b is the slope of the line.

Slope of the Line

As we explain in the chapter, the *slope* of a relationship is the change in the value of y divided by the change in the value of x . We use the Greek letter Δ (delta) to represent "change in." So Δy means the change in the value of the variable measured on the y -axis, and Δx means the change in the value of the variable measured on the x -axis. Therefore the slope of the relationship is

$$\text{Slope} = \frac{\Delta y}{\Delta x}.$$

To see why the slope is b , suppose that initially the value of x is x_1 , or \$200 in Fig. 2. The corresponding value of y is y_1 , also \$200 in Fig. 2. The equation of the line tells us that

$$y_1 = a + bx_1. \quad (1)$$

Now the value of x increases by Δx to $x_1 + \Delta x$ (or \$400 in Fig. 2). And the value of y increases by Δy to $y_1 + \Delta y$ (or \$300 in Fig. 2).

The equation of the line now tells us that

$$y_1 + \Delta y = a + b(x_1 + \Delta x). \quad (2)$$

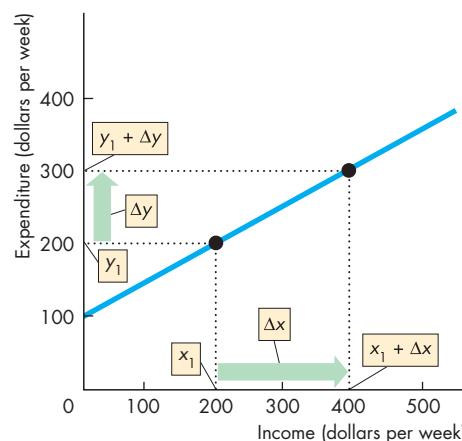


Figure 2 Calculating Slope

To calculate the slope of the line, subtract equation (1) from equation (2) to obtain

$$\Delta y = b\Delta x \quad (3)$$

and now divide equation (3) by Δx to obtain

$$\Delta y/\Delta x = b.$$

So the slope of the line is b .

Position of the Line

The y -axis intercept determines the position of the line on the graph. Figure 3 illustrates the relationship between the y -axis intercept and the position of the line. In this graph, the y -axis measures saving and the x -axis measures income. In this graph, the y -axis measures saving and the x -axis measures income.

When the y -axis intercept, a , is positive, the line hits the y -axis at a positive value of y —as the blue line does. Its y -axis intercept is 100. When the y -axis intercept, a , is zero, the line hits the y -axis at the origin—as the purple line does. Its y -axis intercept is 0. When the y -axis intercept, a , is negative, the line hits the y -axis at a negative value of y —as the red line does. Its y -axis intercept is -100 .

As the equations of the three lines show, the value of the y -axis intercept does not influence the slope of the line. All three lines have a slope equal to 0.5.

Positive Relationships

Figure 1 shows a positive relationship—the two variables x and y move in the same direction. All positive relationships have a slope that is positive. In the

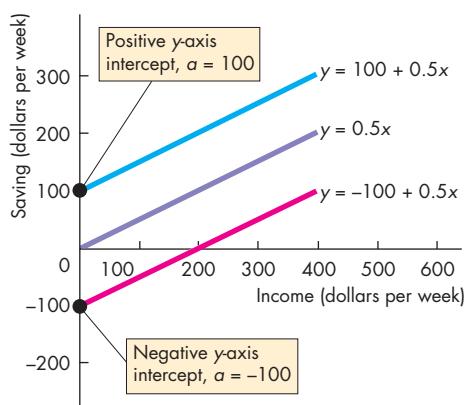


Figure 3 The y -Axis Intercept

equation of the line, the constant b is positive. In this example, the y -axis intercept, a , is 100. The slope b equals $\Delta y/\Delta x$, which in Fig. 2 is 100/200 or 0.5. The equation of the line is

$$y = 100 + 0.5x.$$

Negative Relationships

Figure 4 shows a negative relationship—the two variables x and y move in the opposite direction. All negative relationships have a slope that is negative. In the equation of the line, the constant b is negative. In the example in Fig. 4, the y -axis intercept, a , is 30. The slope, b , equals $\Delta y/\Delta x$, which is $-20/2$ or -10 . The equation of the line is

$$y = 30 + (-10)x$$

or

$$y = 30 - 10x.$$

Example

A straight line has a y -axis intercept of 50 and a slope of 2. What is the equation of this line?

The equation of a straight line is

$$y = a + bx$$

where a is the y -axis intercept and b is the slope. So the equation is

$$y = 50 + 2x.$$

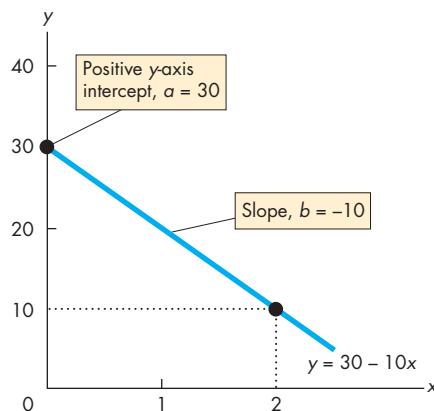


Figure 4 Negative Relationship

REVIEW QUIZ

- 1 Explain how we “read” the three graphs in Figs. A1.1 and A1.2.
- 2 Explain what scatter diagrams show and why we use them.
- 3 Explain how we “read” the three scatter diagrams in Figs. A1.3 and A1.4.
- 4 Draw a graph to show the relationship between two variables that move in the same direction.
- 5 Draw a graph to show the relationship between two variables that move in opposite directions.
- 6 Draw a graph of two variables whose relationship shows (i) a maximum and (ii) a minimum.
- 7 Which of the relationships in Questions 4 and 5 is a positive relationship and which is a negative relationship?
- 8 What are the two ways of calculating the slope of a curved line?
- 9 How do we graph a relationship among more than two variables?
- 10 Explain what change will bring a *movement along* a curve.
- 11 Explain what change will bring a *shift* of a curve.

Work these questions in Study Plan 1.A and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

SUMMARY

Key Points

Graphing Data (pp. 15–18)

- A graph is made by plotting the values of two variables x and y at a point that corresponds to their values measured along the x -axis and the y -axis.
- A scatter diagram is a graph that plots the values of two variables for a number of different values of each.
- A scatter diagram shows the relationship between the two variables. It shows whether they are positively related, negatively related, or unrelated.

Graphs Used in Economic Models (pp. 18–21)

- Graphs are used to show relationships among variables in economic models.
- Relationships can be positive (an upward-sloping curve), negative (a downward-sloping curve), positive and then negative (have a maximum point), negative and then positive (have a minimum point), or unrelated (a horizontal or vertical curve).

The Slope of a Relationship (pp. 22–24)

- The slope of a relationship is calculated as 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—that is, $\Delta y/\Delta x$.
- A straight line has a constant slope.
- A curved line has a varying slope. To calculate the slope of a curved line, we calculate the slope at a point or across an arc.

Graphing Relationships Among More Than Two Variables (pp. 24–25)

- To graph a relationship among more than two variables, we hold constant the values of all the variables except two.
- We then plot the value of one of the variables against the value of another.
- A *cet par* change in the value of a variable on an axis of a graph brings a movement along the curve.
- A change in the value of a variable held constant along the curve brings a shift of the curve.

Key Terms

Ceteris paribus, 24

Direct relationship, 18

Inverse relationship, 19

Linear relationship, 18

Negative relationship, 19

Positive relationship, 18

MyEconLab Key Terms Quiz

Scatter diagram, 16

Slope, 22



STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab

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

Use the following spreadsheet to work Problems 1 to 3. The spreadsheet provides the economic data: Column A is the year, column B is the inflation rate, column C is the interest rate, column D is the growth rate, and column E is the unemployment rate.

	A	B	C	D	E
1	2003	1.6	1.0	2.8	6.0
2	2004	2.3	1.4	3.8	5.5
3	2005	2.7	3.2	3.4	5.1
4	2006	3.4	4.9	2.7	4.6
5	2007	3.2	4.5	1.8	4.6
6	2008	2.9	1.4	-0.3	5.8
7	2009	3.8	0.2	-2.8	9.3
8	2010	-0.3	0.1	2.5	9.6
9	2011	1.6	0.1	1.8	8.9
10	2012	3.1	0.1	2.8	8.1
11	2013	2.1	0.1	1.9	7.4

1. Draw a scatter diagram of the inflation rate and the interest rate. Describe the relationship.
2. Draw a scatter diagram of the growth rate and the unemployment rate. Describe the relationship.
3. Draw a scatter diagram of the interest rate and the unemployment rate. Describe the relationship.

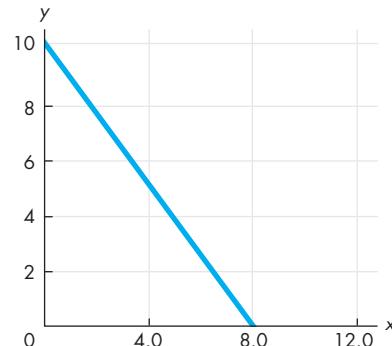
Use the following news clip to work Problems 4 to 6.
LEGO Tops the Box Office

Movie	Theatres (number)	Revenue (dollars per theatre)
<i>The LEGO Movie</i>	3,775	\$16,551
<i>About Last Night</i>	2,253	\$12,356
<i>RoboCop</i>	3,372	\$7,432
<i>The Monuments Men</i>	3,083	\$5,811

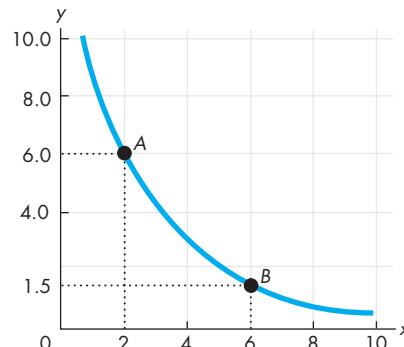
Source: boxofficemojo.com,
Data for weekend of February 14–17, 2014

4. Draw a graph of the relationship between the revenue per theatre on the y -axis and the number of theatres on the x -axis. Describe the relationship.
5. Calculate the slope of the relationship in Problem 4 between 3,775 and 2,253 theatres.
6. Calculate the slope of the relationship in Problem 4 between 2,253 and 3,372 theatres.

7. Calculate the slope of the following relationship.



Use the following relationship to work Problems 8 and 9.



8. Calculate the slope of the relationship at point A and at point B .
9. Calculate the slope across the arc AB .

Use the following table to work Problems 10 and 11. The table gives the price of a balloon ride, the temperature, and the number of rides a day.

Price (dollars per ride)	Balloon rides (number per day)		
	10°C	20°C	30°C
5	32	40	50
10	27	32	40
15	18	27	32

10. Draw a graph to show the relationship between the price and the number of rides when the temperature is 20°C. Describe this relationship.
11. What happens in the graph in Problem 10 if the temperature rises to 30°C?

ADDITIONAL PROBLEMS AND APPLICATIONS

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

Use the following spreadsheet to work Problems 12 to 14. The spreadsheet provides data on oil and gasoline: Column A is the year, column B is the price of oil (dollars per barrel), column C is the price of gasoline (cents per litre), column D is oil production, and column E is the quantity of gasoline refined (both in millions of barrels per day).

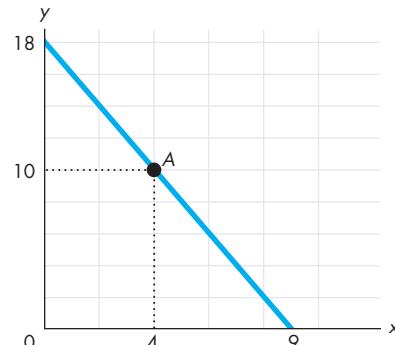
	A	B	C	D	E
1	2003	31	42	5.7	8.9
2	2004	42	50	5.4	9.1
3	2005	57	61	5.2	9.2
4	2006	66	69	5.1	9.3
5	2007	72	75	5.1	9.3
6	2008	100	87	5.0	9.0
7	2009	62	64	5.4	9.0
8	2010	79	75	5.5	9.0
9	2011	95	94	5.7	9.1
10	2012	94	96	6.5	9.0
11	2013	98	93	7.5	9.1

12. Draw a scatter diagram of the price of oil and the quantity of oil produced. Describe the relationship.
13. Draw a scatter diagram of the price of gasoline and the quantity of gasoline refined. Describe the relationship.
14. Draw a scatter diagram of the quantity of oil produced and the quantity of gasoline refined. Describe the relationship.

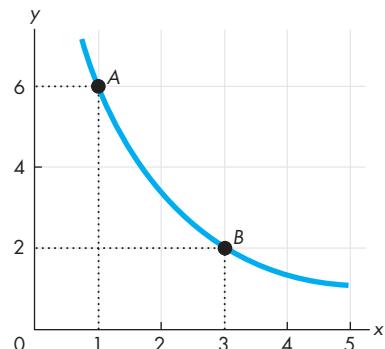
Use the following data to work Problems 15 to 17. Draw a graph that shows the relationship between the two variables x and y :

x	0	1	2	3	4	5
y	25	24	22	18	12	0

15. a. Is the relationship positive or negative?
b. Does the slope of the relationship become steeper or flatter as the value of x increases?
c. Think of some economic relationships that might be similar to this one.
16. Calculate the slope of the relationship between x and y when x equals 3.
17. Calculate the slope of the relationship across the arc as x increases from 4 to 5.
18. Calculate the slope of the curve in the figure in the next column at point A .



Use the following relationship to work Problems 19 and 20.



19. Calculate the slope at point A and at point B .
20. Calculate the slope across the arc AB .

Use the following table to work Problems 21 to 23. The table gives data about umbrellas: price, the number purchased, and rainfall in millimetres (mm).

Price (dollars per umbrella)	Umbrellas (number purchased per day)		
	0 mm	200 mm	400 mm
20	4	7	8
30	2	4	7
40	1	2	4

21. Draw a graph to show the relationship between the price and the number of umbrellas purchased, holding the amount of rainfall constant at 200 mm. Describe this relationship.
22. What happens in the graph in Problem 21 if the price rises and rainfall is constant?
23. What happens in the graph in Problem 21 if the rainfall increases from 200 mm to 400 mm?



2

THE ECONOMIC PROBLEM

After studying this chapter, you will be able to:

- ◆ Define the production possibilities frontier and use it to calculate opportunity cost
- ◆ Distinguish between production possibilities and preferences and describe an efficient allocation of resources
- ◆ Explain how current production choices expand future production possibilities
- ◆ Explain how specialization and trade expand production possibilities
- ◆ Describe the economic institutions that coordinate decisions

Canada has vast oil and natural gas resources and we produce much more energy than we consume. We are an energy-exporting nation. Should we produce and export even more oil and gas? How do we know when we are using our energy and other resources efficiently?

In this chapter, you study an economic model that answers questions about the efficiency of production and trade.

At the end of the chapter, in *Economics in the News*, we'll apply what you learn to explain why it is smart to export some of our oil and gas, but why it might not be smart to increase our energy production.

Production Possibilities and Opportunity Cost

Every working day, in mines, factories, shops, and offices and on farms and construction sites across Canada, 18 million people produce a vast variety of goods and services valued at \$60 billion. But the quantities of goods and services that we can produce are limited by our available resources and by technology. And if we want to increase our production of one good, we must decrease our production of something else—we face a tradeoff. You are now going to study the limits to production.

The **production possibilities frontier (PPF)** is the boundary between those combinations of goods and services that can be produced and those that cannot. To illustrate the *PPF*, we look at a *model economy* in which the quantities produced of only two goods change, while the quantities produced of all the other goods and services remain the same.

Let's look at the production possibilities frontier for cola and pizza, which represent *any* pair of goods or services.

Production Possibilities Frontier

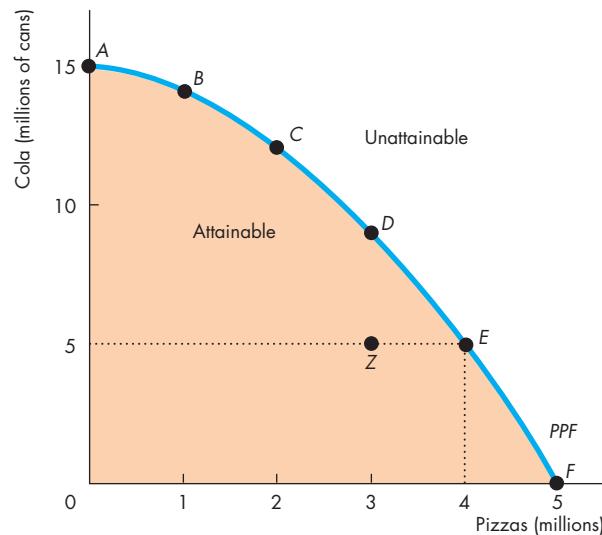
The *production possibilities frontier* for cola and pizza shows the limits to the production of these two goods, given the total resources and technology available to produce them. Figure 2.1 shows this production possibilities frontier. The table lists combinations of the quantities of pizza and cola that can be produced in a month and the figure graphs these combinations. The *x*-axis shows the quantity of pizzas produced, and the *y*-axis shows the quantity of cola produced.

The *PPF* illustrates *scarcity* because the points outside the frontier are *unattainable*. These points describe wants that can't be satisfied.

We can produce at any point *inside* the *PPF* or *on* the *PPF*. These points are *attainable*. For example, we can produce 4 million pizzas and 5 million cans of cola. Figure 2.1 shows this combination as point *E* in the graph and as possibility *E* in the table.

Moving along the *PPF* from point *E* to point *D* (possibility *D* in the table) we produce more cola and less pizza: 9 million cans of cola and 3 million pizzas. Or moving in the opposite direction from point *E* to point *F* (possibility *F* in the table), we produce more pizza and less cola: 5 million pizzas and no cola.

FIGURE 2.1 Production Possibilities Frontier



Possibility	Pizzas (millions)	Cola (millions of cans)
A	0	15
B	1	14
C	2	12
D	3	9
E	4	5
F	5	0

The table lists six production possibilities for cola and pizzas. Row *A* tells us that if we produce no pizzas, the maximum quantity of cola we can produce is 15 million cans. Points *A*, *B*, *C*, *D*, *E*, and *F* in the figure represent the rows of the table. The curve passing through these points is the production possibilities frontier (*PPF*).

The *PPF* separates the attainable from the unattainable. Production is possible at any point *inside* the orange area or *on* the frontier. Points outside the frontier are unattainable. Points inside the frontier, such as point *Z*, are inefficient because resources are wasted or misallocated. At such points, it is possible to use the available resources to produce more of either or both goods.

MyEconLab Animation and Draw Graph

Production Efficiency

We achieve **production efficiency** if we produce goods and services at the lowest possible cost. This outcome occurs at all the points *on* the PPF. At points *inside* the PPF, production is inefficient because we are giving up more than necessary of one good to produce a given quantity of the other good.

For example, at point *Z* in Fig. 2.1, we produce 3 million pizzas and 5 million cans of cola, but we have enough resources to produce 3 million pizzas and 9 million cans of cola. Our pizzas cost more cola than necessary. We can get them for a lower cost. Only when we produce *on* the PPF do we incur the lowest possible cost of production.

Production inside the PPF is *inefficient* because resources are either *unused* or *misallocated* or both.

Resources are *unused* when they are idle but could be working. For example, we might leave some of the factories idle or some workers unemployed.

Resources are *misallocated* when they are assigned to tasks for which they are not the best match. For example, we might assign skilled pizza chefs to work in a cola factory and skilled cola workers to cook pizza in a pizzeria. We could get more pizzas *and* more cola if we reassigned these workers to the tasks that more closely match their skills.

Tradeoff Along the PPF

A choice *along* the PPF involves a *tradeoff*. Tradeoffs like that between cola and pizza arise in every imaginable real-world situation in which a choice must be made. At any given time, we have a fixed amount of labour, land, capital, and entrepreneurship and a given state of technology. We can employ these resources and technology to produce goods and services, but we are limited in what we can produce.

When doctors want to spend more on AIDS and cancer research, they face a tradeoff: more medical research for less of some other things. When Parliament wants to spend more on education and healthcare, it faces a tradeoff: more education and healthcare for less national defence. When an environmental group argues for less logging, it is suggesting a tradeoff: greater conservation of endangered wildlife for less paper. When you want a higher grade on your next test, you face a tradeoff: spend more time studying and less leisure or sleep time.

All the tradeoffs you've just considered involve a cost—an opportunity cost.

Opportunity Cost

The **opportunity cost** of an action is the highest-valued alternative forgone. The PPF makes this idea precise and enables us to calculate opportunity cost. Along the PPF, there are only two goods, so there is only one alternative forgone: some quantity of the other good. To produce more pizzas we must produce less cola. The opportunity cost of producing an additional pizza is the cola we *must* forgo. Similarly, the opportunity cost of producing an additional can of cola is the quantity of pizza we must forgo.

In Fig. 2.1, if we move from point *C* to point *D*, we produce an additional 1 million pizzas but 3 million fewer cans of cola. The additional 1 million pizzas *cost* 3 million cans of cola. Or 1 pizza costs 3 cans of cola. Similarly, if we move from *D* to *C*, we produce an additional 3 million cans of cola but 1 million fewer pizzas. The additional 3 million cans of cola *cost* 1 million pizzas. Or 1 can of cola costs 1/3 of a pizza.

Opportunity Cost Is a Ratio Opportunity cost is a ratio. It is the decrease in the quantity produced of one good divided by the increase in the quantity produced of another good as we move along the production possibilities frontier.

Because opportunity cost is a ratio, the opportunity cost of producing an additional can of cola is equal to the *inverse* of the opportunity cost of producing an additional pizza. Check this proposition by returning to the calculations we've just done. In the move from *C* to *D*, the opportunity cost of a pizza is 3 cans of cola. And in the move from *D* to *C*, the opportunity cost of a can of cola is 1/3 of a pizza. So the opportunity cost of pizza is the inverse of the opportunity cost of cola.

Increasing Opportunity Cost The opportunity cost of a pizza increases as the quantity of pizzas produced increases. The outward-bowed shape of the PPF reflects increasing opportunity cost. When we produce a large quantity of cola and a small quantity of pizza—between points *A* and *B* in Fig. 2.1—the frontier has a gentle slope. An increase in the quantity of pizzas costs a small decrease in the quantity of cola—the opportunity cost of a pizza is a small quantity of cola.

When we produce a large quantity of pizzas and a small quantity of cola—between points *E* and *F* in Fig. 2.1—the frontier is steep. A given increase in the quantity of pizzas *costs* a large decrease in the quantity of cola, so the opportunity cost of a pizza is a large quantity of cola.



ECONOMICS IN THE NEWS

Opportunity Cost of Cocoa

World's Sweet Tooth Heats Up Cocoa

Chocolate consumption is soaring as people in developing countries are getting wealthier. Cocoa farmers are ramping up production to keep the chocolate flowing, but the price of cocoa keeps rising.

Source: *The Wall Street Journal*, February 13, 2014

THE QUESTIONS

- How does the *PPF* illustrate (1) the limits to cocoa production; (2) the tradeoff we must make to increase cocoa production; and (3) the effect of increased chocolate consumption on the cost of producing cocoa?

THE ANSWERS

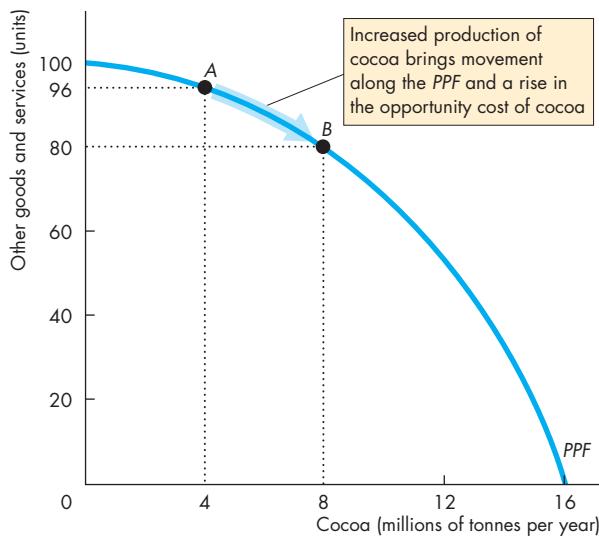
- The figure shows the global *PPF* for cocoa and other goods and services. Point *A* on the *PPF* tells us that if 4 million tonnes of cocoa are produced, a maximum of 96 units of other goods and services can be produced.
- The movement along the *PPF* from *A* to *B* shows the tradeoff we must make to increase cocoa production.
- The slope of the *PPF* measures the opportunity cost of cocoa. If cocoa production increases from zero to 4 million tonnes, the production of other goods and services decreases from 100 units to 96 units. The opportunity cost of 1 tonne of cocoa is 1 unit of other goods and services.

The *PPF* is bowed outward because resources are not all equally productive in all activities. People with many years of experience working for PepsiCo are good at producing cola but not very good at making pizzas. So if we move some of these people from PepsiCo to Domino's, we get a small increase in the quantity of pizzas but a large decrease in the quantity of cola.

Similarly, people who have spent years working at Domino's are good at producing pizzas, but they have no idea how to produce cola. So if we move some people from Domino's to PepsiCo, we get a small increase in the quantity of cola but a large decrease in the quantity of pizzas. The more we produce of either good, the less productive are the additional resources we use and the larger is the opportunity cost of a unit of that good.

How do we choose among the points on the *PPF*? How do we know which point is the best?

- But if cocoa production increases from 4 million tonnes to 8 million tonnes, the production of other goods and services decreases from 96 units to 80 units. The opportunity cost of 1 tonne of cocoa is now 4 units of other goods and services.
- As resources are moved into producing cocoa, labour, land, and capital less suited to the task of cocoa production are used and the cost of the additional cocoa produced increases.



PPF for Cocoa and Other Goods and Services

MyEconLab More Economics in the News

REVIEW QUIZ

- How does the production possibilities frontier illustrate scarcity?
- How does the production possibilities frontier illustrate production efficiency?
- How does the production possibilities frontier show that every choice involves a tradeoff?
- How does the production possibilities frontier illustrate opportunity cost?
- Why is opportunity cost a ratio?
- Why does the *PPF* bow outward and what does that imply about the relationship between opportunity cost and the quantity produced?

Work these questions in Study Plan 2.1 and get instant feedback. Do a Key Terms Quiz.

MyEconLab

Using Resources Efficiently

We achieve *production efficiency* at every point on the *PPF*, but which of these points is best? The answer is the point on the *PPF* at which goods and services are produced in the quantities that provide the greatest possible benefit. When goods and services are produced at the lowest possible cost and in the quantities that provide the greatest possible benefit, we have achieved **allocative efficiency**.

The questions that we raised when we reviewed the four big issues in Chapter 1 are questions about allocative efficiency. To answer such questions, we must measure and compare costs and benefits.

The PPF and Marginal Cost

The **marginal cost** of a good is the opportunity cost of producing one more unit of it. We calculate marginal cost from the slope of the *PPF*. As the quantity of pizzas produced increases, the *PPF* gets steeper and the marginal cost of a pizza increases. Figure 2.2 illustrates the calculation of the marginal cost of a pizza.

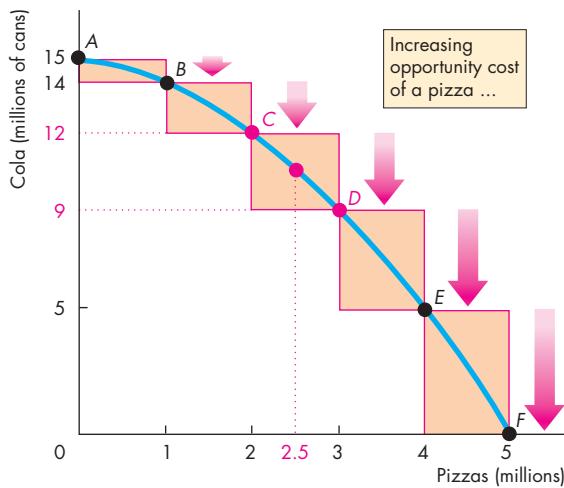
Begin by finding the opportunity cost of pizza in blocks of 1 million pizzas. The cost of the first million pizzas is 1 million cans of cola; the cost of the second million pizzas is 2 million cans of cola; the cost of the third million pizzas is 3 million cans of cola, and so on. The bars in part (a) illustrate these calculations.

The bars in part (b) show the cost of an average pizza in each of the 1 million pizza blocks. Focus on the third million pizzas—the move from *C* to *D* in part (a). Over this range, because 1 million pizzas cost 3 million cans of cola, one of these pizzas, on average, costs 3 cans of cola—the height of the bar in part (b).

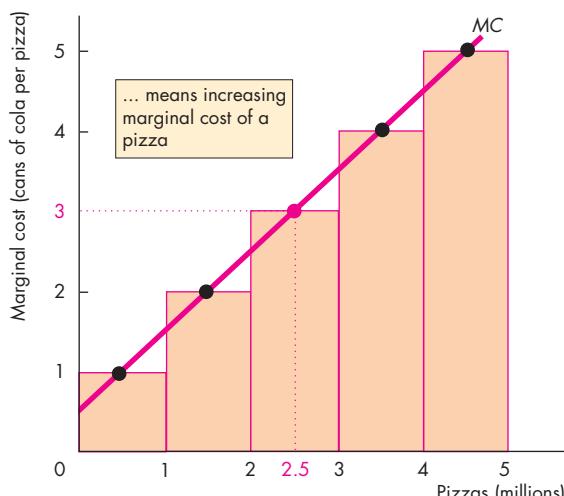
Next, find the opportunity cost of each additional pizza—the marginal cost of a pizza. The marginal cost of a pizza increases as the quantity of pizzas produced increases. The marginal cost at point *C* is less than it is at point *D*. On average over the range from *C* to *D*, the marginal cost of a pizza is 3 cans of cola. But it exactly equals 3 cans of cola only in the middle of the range between *C* and *D*.

The red dot in part (b) indicates that the marginal cost of a pizza is 3 cans of cola when 2.5 million pizzas are produced. Each black dot in part (b) is interpreted in the same way. The red curve that passes through these dots, labelled *MC*, is the marginal cost curve. It shows the marginal cost of a pizza at each quantity of pizzas as we move along the *PPF*.

FIGURE 2.2 The *PPF* and Marginal Cost



(a) *PPF and opportunity cost*



(b) *Marginal cost*

Marginal cost is calculated from the slope of the *PPF*. As the quantity of pizzas produced increases, the *PPF* gets steeper and the marginal cost of a pizza increases. The bars in part (a) show the opportunity cost of pizza in blocks of 1 million pizzas. The bars in part (b) show the cost of an average pizza in each of these 1 million blocks. The red curve, *MC*, shows the marginal cost of a pizza at each point along the *PPF*. This curve passes through the centre of each of the bars in part (b).

MyEconLab Animation

Preferences and Marginal Benefit

The **marginal benefit** from a good or service is the benefit received from consuming one more unit of it. This benefit is subjective. It depends on people's **preferences**—people's likes and dislikes and the intensity of those feelings.

Marginal benefit and preferences stand in sharp contrast to marginal cost and production possibilities. Preferences describe what people like and want and the production possibilities describe the limits or constraints on what is feasible.

We need a concrete way of illustrating preferences that parallels the way we illustrate the limits to production using the *PPF*.

The device that we use to illustrate preferences is the **marginal benefit curve**, which is a curve that shows the relationship between the marginal benefit from a good and the quantity consumed of that good. Note that the *marginal benefit curve is unrelated to the PPF* and cannot be derived from it.

We measure the marginal benefit from a good or service by the most that people are *willing to pay* for an additional unit of it. The idea is that you are willing to pay less for a good than it is worth to you but you are not willing to pay more: The most you are willing to pay for something is its marginal benefit.

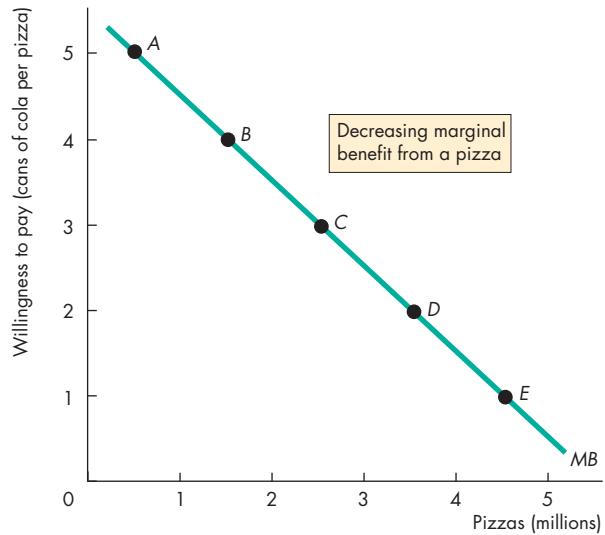
It is a general principle that the more we have of any good or service, the smaller is its marginal benefit and the less we are willing to pay for an additional unit of it. This tendency is so widespread and strong that we call it a principle—the *principle of decreasing marginal benefit*.

The basic reason why marginal benefit decreases is that we like variety. The more we consume of any one good or service, the more we tire of it and would prefer to switch to something else.

Think about your willingness to pay for a pizza. If pizza is hard to come by and you can buy only a few slices a year, you might be willing to pay a high price to get an additional slice. But if pizza is all you've eaten for the past few days, you are willing to pay almost nothing for another slice.

You've learned to think about cost as opportunity cost, not as a dollar cost. You can think about marginal benefit and willingness to pay in the same way. The marginal benefit, measured by what you are willing to pay for something, is the quantity of other goods and services that you are willing to forgo. Let's continue with the example of cola and pizza and illustrate preferences this way.

FIGURE 2.3 Preferences and the Marginal Benefit Curve



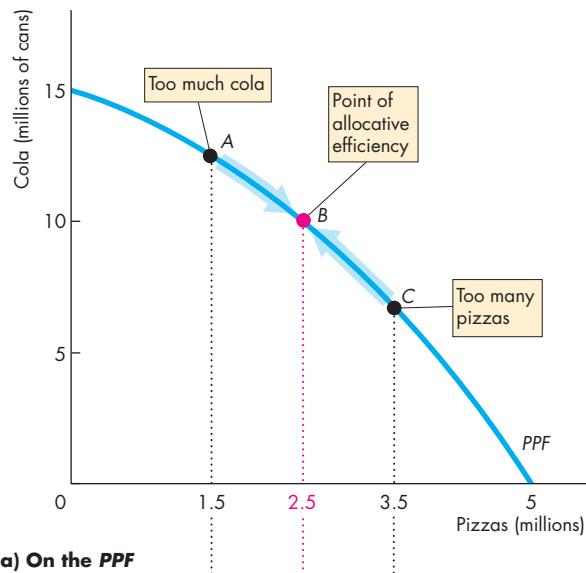
Possibility	Pizzas (millions)	Willingness to pay (cans of cola per pizza)
A	0.5	5
B	1.5	4
C	2.5	3
D	3.5	2
E	4.5	1

The smaller the quantity of pizzas available, the more cola people are willing to give up for an additional pizza. With 0.5 million pizzas available, people are willing to pay 5 cans of cola per pizza. But with 4.5 million pizzas, people are willing to pay only 1 can of cola per pizza. Willingness to pay measures marginal benefit. A universal feature of people's preferences is that marginal benefit decreases.

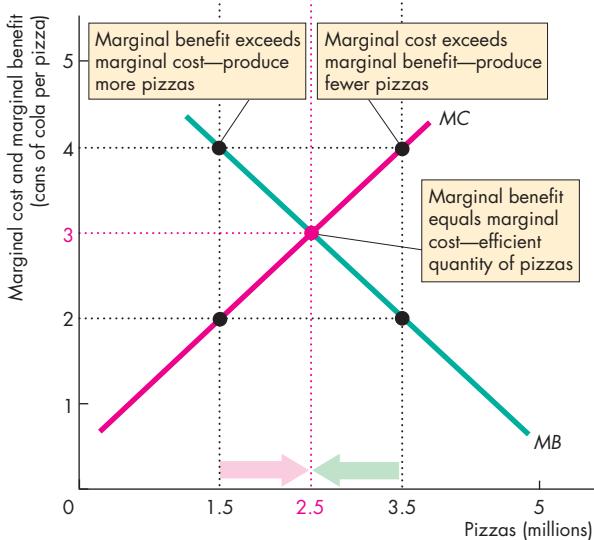
MyEconLab Animation

Figure 2.3 illustrates preferences as the willingness to pay for pizza in terms of cola. In row A, with 0.5 million pizzas available, people are willing to pay 5 cans of cola per pizza. As the quantity of pizzas increases, the amount that people are willing to pay for a pizza falls. With 4.5 million pizzas available, people are willing to pay only 1 can of cola per pizza.

Let's now use the concepts of marginal cost and marginal benefit to describe allocative efficiency.

FIGURE 2.4 Efficient Use of Resources

(a) On the PPF



(b) Marginal benefit equals marginal cost

The greater the quantity of pizzas produced, the smaller is the marginal benefit (MB) from pizza—the less cola people are willing to give up to get an additional pizza. But the greater the quantity of pizzas produced, the greater is the marginal cost (MC) of a pizza—the more cola people must give up to get an additional pizza. When marginal benefit equals marginal cost, resources are being used efficiently.

[MyEconLab Animation](#)

Allocative Efficiency

At *any* point on the PPF , we cannot produce more of one good without giving up some other good. At the *best* point on the PPF , we cannot produce more of one good without giving up some other good that provides greater benefit. We are producing at the point of allocative efficiency—the point on the PPF that we prefer above all other points.

Suppose in Fig. 2.4 we produce 1.5 million pizzas. In part (b), the marginal cost of a pizza is 2 cans of cola and the marginal benefit from a pizza is 4 cans of cola. Because someone values an additional pizza more highly than it costs to produce, we can get more value from our resources by moving some of them out of producing cola and into producing pizza.

Now suppose we produce 3.5 million pizzas. The marginal cost of a pizza is now 4 cans of cola, but the marginal benefit from a pizza is only 2 cans of cola. Because the additional pizza costs more to produce than anyone thinks it is worth, we can get more value from our resources by moving some of them away from producing pizza and into producing cola.

Suppose we produce 2.5 million pizzas. Marginal cost and marginal benefit are now equal at 3 cans of cola. This allocation of resources between pizzas and cola is efficient. If more pizzas are produced, the forgone cola is worth more than the additional pizzas. If fewer pizzas are produced, the forgone pizzas are worth more than the additional cola.

REVIEW QUIZ

- 1 What is marginal cost? How is it measured?
- 2 What is marginal benefit? How is it measured?
- 3 How does the marginal benefit from a good change as the quantity produced of that good increases?
- 4 What is allocative efficiency and how does it relate to the production possibilities frontier?
- 5 What conditions must be satisfied if resources are used efficiently?

Work these questions in Study Plan 2.2 and get instant feedback. Do a Key Terms Quiz. [MyEconLab](#)

You now understand the limits to production and the conditions under which resources are used efficiently. Your next task is to study the expansion of production possibilities.

Economic Growth

During the past 30 years, production per person in Canada has doubled. The expansion of production possibilities is called **economic growth**. Economic growth increases our *standard of living*, but it doesn't overcome scarcity and avoid opportunity cost. To make our economy grow, we face a tradeoff—the faster we make production grow, the greater is the opportunity cost of economic growth.

The Cost of Economic Growth

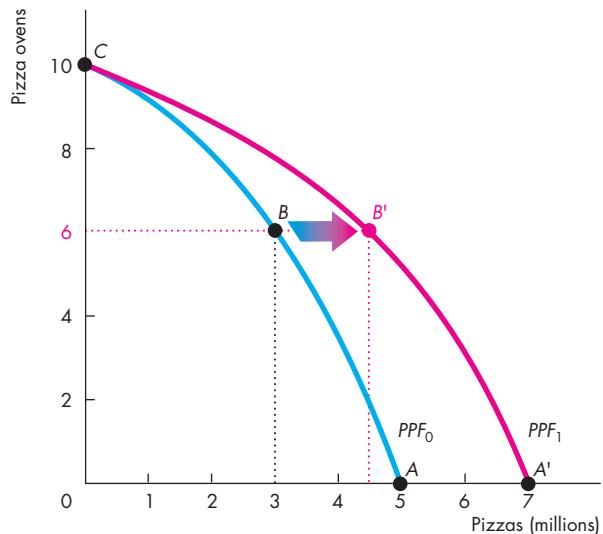
Economic growth comes from technological change and capital accumulation. **Technological change** is the development of new goods and of better ways of producing goods and services. **Capital accumulation** is the growth of capital resources, including *human capital*.

Technological change and capital accumulation have vastly expanded our production possibilities. We can produce automobiles that provide us with more transportation than was available when we had only horses and carriages. We can produce satellites that provide global communications on a much larger scale than that available with the earlier cable technology. But if we use our resources to develop new technologies and produce capital, we must decrease our production of consumption goods and services. New technologies and new capital have an opportunity cost. Let's look at this opportunity cost.

Instead of studying the *PPF* of pizzas and cola, we'll hold the quantity of cola produced constant and examine the *PPF* for pizzas and pizza ovens. Figure 2.5 shows this *PPF* as the blue curve PPF_0 . If we devote no resources to producing pizza ovens, we produce at point A . If we produce 3 million pizzas, we can produce 6 pizza ovens at point B . If we produce no pizza, we can produce 10 ovens at point C .

The amount by which our production possibilities expand depends on the resources we devote to technological change and capital accumulation. If we devote no resources to this activity (point A), our *PPF* remains the blue curve PPF_0 in Fig. 2.5. If we cut the current pizza production and produce 6 ovens (point B), then in the future, we'll have more capital and our *PPF* will rotate outward to the position shown by the red curve PPF_1 . The fewer resources we use for producing pizza and the more resources we use for producing ovens, the greater is the expansion of our future production possibilities.

FIGURE 2.5 Economic Growth



PPF_0 shows the limits to the production of pizzas and pizza ovens, with the production of all other goods and services remaining the same. If we devote no resources to producing pizza ovens and produce 5 million pizzas, our production possibilities will remain the same at PPF_0 . But if we decrease pizza production to 3 million and produce 6 ovens, at point B , our production possibilities expand. After one period, the *PPF* rotates outward to PPF_1 and we can produce at point B' , a point outside the original PPF_0 . We can rotate the *PPF* outward, but we cannot avoid opportunity cost. The opportunity cost of producing more pizzas in the future is fewer pizzas today.

MyEconLab Animation and Draw Graph

Economic growth brings enormous benefits in the form of increased consumption in the future, but economic growth is not free and it doesn't abolish scarcity.

In Fig. 2.5, to make economic growth happen we must use some resources to produce new ovens, which leaves fewer resources to produce pizzas. To move to B' in the future, we must move from A to B today. The opportunity cost of more pizzas in the future is fewer pizzas today. Also, on the new *PPF*, we still face a tradeoff and opportunity cost.

The ideas about economic growth that we have explored in the setting of the pizza industry also apply to nations. Hong Kong and Canada provide a striking case study.

Economics in Action

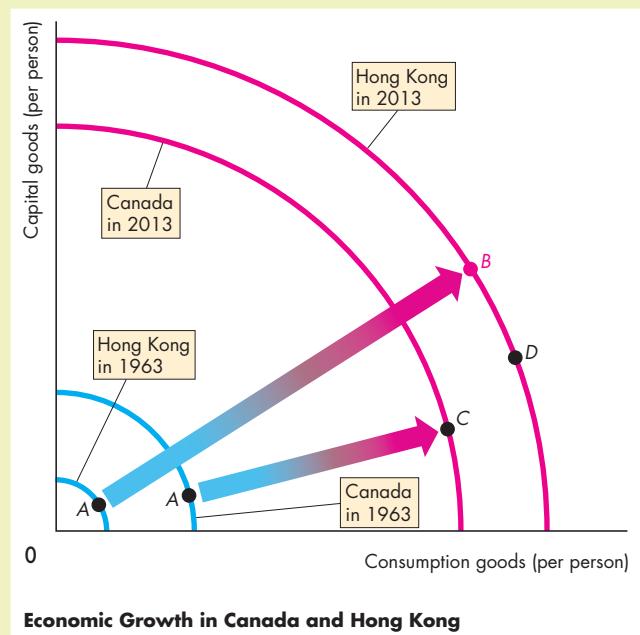
Hong Kong Overtakes Canada

In 1963, the production possibilities per person in Canada were more than three times those in Hong Kong (see the figure). Canada devotes one-fifth of its resources to accumulating capital, and in 1963, Canada was at point *A* on its PPF. Hong Kong devotes one-third of its resources to accumulating capital, and in 1963, Hong Kong was at point *A* on its PPF.

Since 1963, both economies have experienced economic growth, but because Hong Kong devotes a bigger fraction of its resources to accumulating capital, its production possibilities have expanded more quickly.

By 2013, production possibilities per person in Hong Kong had *overtaken* those in Canada. If Hong Kong continues to devote more resources to accumulating capital (at point *B* on its 2013 PPF) than Canada does, Hong Kong will continue to grow more rapidly than Canada. But if Hong Kong decreases its capital accumulation (moving to point *D* on its 2013 PPF), then its rate of economic growth will slow.

Hong Kong is typical of the fast-growing Asian economies, which include Taiwan, Thailand, South Korea, China, and India. Production possibilities



expand in these countries by between 5 percent and almost 10 percent a year.

If such high economic growth rates are maintained, these other Asian countries will continue to catch up with and eventually overtake Canada, as Hong Kong has done.

A Nation's Economic Growth

The experiences of Canada and Hong Kong make a striking example of the effects of our choices about consumption and capital accumulation on the rate of economic growth.

If an economy devotes all its factors of production to producing consumption goods and services and none to advancing technology and accumulating capital, its production possibilities in the future will be the same as they are today.

To expand production possibilities in the future, a nation or an economy must devote fewer resources to producing current consumption goods and services and some resources to accumulating capital and developing new technologies. As production possibilities expand, consumption in the future can increase. The decrease in today's consumption is the opportunity cost of tomorrow's increase in consumption.

REVIEW QUIZ

- 1 What generates economic growth?
- 2 How does economic growth influence the production possibilities frontier?
- 3 What is the opportunity cost of economic growth?
- 4 Explain why Hong Kong has experienced faster economic growth than Canada.
- 5 Does economic growth overcome scarcity?

Work these questions in Study Plan 2.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

Next, we're going to study another way in which we expand our production possibilities—the amazing fact that *both* buyers and sellers gain from specialization and trade.

Gains from Trade

People can produce for themselves all the goods and services that they consume, or they can produce one good or a few goods and trade with others. Producing only one good or a few goods is called *specialization*. We are going to learn how people gain by specializing in the production of the good in which they have a *comparative advantage* and trading with others.

Comparative Advantage and Absolute Advantage

A person has a **comparative advantage** in an activity if that person can perform the activity at a lower opportunity cost than anyone else. Differences in opportunity costs arise from differences in individual abilities and from differences in the characteristics of other resources.

No one excels at everything. One person is an outstanding pitcher but a poor catcher; another person is a brilliant lawyer but a poor teacher. In almost all human endeavours, what one person does easily, someone else finds difficult. The same applies to land and capital. One plot of land is fertile but has no mineral deposits; another plot of land has outstanding views but is infertile. One machine has great precision but is difficult to operate; another is fast but often breaks down.

Although no one excels at everything, some people excel and can outperform others in a large number of activities—perhaps even in all activities. A person who is more productive than others has an **absolute advantage**.

Absolute advantage involves comparing productivities—production per hour—whereas comparative advantage involves comparing opportunity costs.

A person who has an absolute advantage does not have a *comparative* advantage in every activity. John Grisham is a better lawyer and a better author of fast-paced thrillers than most people. He has an absolute advantage in these two activities. But compared to others, he is a better writer than lawyer, so his *comparative* advantage is in writing.

Because ability and resources vary from one person to another, people have different opportunity costs of producing various goods. These differences in opportunity cost are the source of comparative advantage.

Let's explore the idea of comparative advantage by looking at two smoothie bars: one operated by Liz and the other operated by Joe.

Joe's Smoothie Bar Joe produces smoothies and salads in a small, low-tech bar. He has only one blender, and it's a slow, old machine that keeps stopping. Even if Joe uses all his resources to produce smoothies, he can produce only 6 an hour—see Table 2.1. But Joe is good at making salads, and if he uses all his resources in this activity, he can produce 30 salads an hour.

Joe's ability to make smoothies and salads is the same regardless of how he splits an hour between the two tasks. He can make a salad in 2 minutes or a smoothie in 10 minutes. For each additional smoothie Joe produces, he must decrease his production of salads by 5. And for each additional salad he produces, he must decrease his production of smoothies by 1/5 of a smoothie. So

Joe's opportunity cost of producing 1 smoothie is
5 salads,

and

Joe's opportunity cost of producing 1 salad is 1/5
of a smoothie.

Joe's customers buy smoothies and salads in equal quantities. So Joe spends 50 minutes of each hour making smoothies and 10 minutes of each hour making salads. With this division of his time, Joe produces 5 smoothies and 5 salads an hour.

Figure 2.6(a) illustrates the production possibilities at Joe's smoothie bar—Joe's *PPF*.

Joe's *PPF* is linear (not outward bowed) because his ability to produce salads and smoothies is the same no matter how he divides his time between the two activities. Joe's opportunity cost of a smoothie is constant—it is the same at all quantities of smoothies produced.

TABLE 2.1 Joe's Production Possibilities

Item	Minutes to produce 1	Quantity per hour
Smoothies	10	6
Salads	2	30

Liz's Smoothie Bar Liz also produces smoothies and salads but in a high-tech bar that is much more productive than Joe's. Liz can turn out either a smoothie or a salad every 2 minutes—see Table 2.2.

If Liz spends all her time making smoothies, she can produce 30 an hour. And if she spends all her time making salads, she can also produce 30 an hour.

Liz's ability to make smoothies and salads, like Joe's, is the same regardless of how she divides her time between the two tasks. She can make a salad in 2 minutes or a smoothie in 2 minutes. For each additional smoothie Liz produces, she must decrease her production of salads by 1. And for each additional salad she produces, she must decrease her production of smoothies by 1. So

Liz's opportunity cost of producing 1 smoothie is 1 salad,

and

Liz's opportunity cost of producing 1 salad is 1 smoothie.

TABLE 2.2 Liz's Production Possibilities

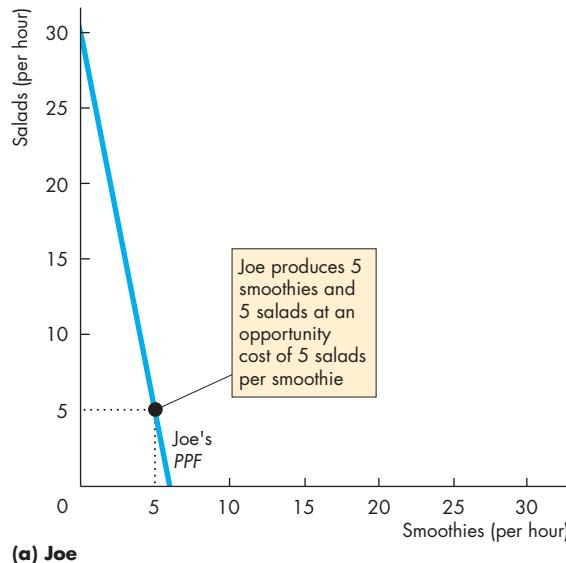
Item	Minutes to produce 1	Quantity per hour
Smoothies	2	30
Salads	2	30

Liz's customers buy smoothies and salads in equal quantities, so she splits her time equally between the two items and produces 15 smoothies and 15 salads an hour.

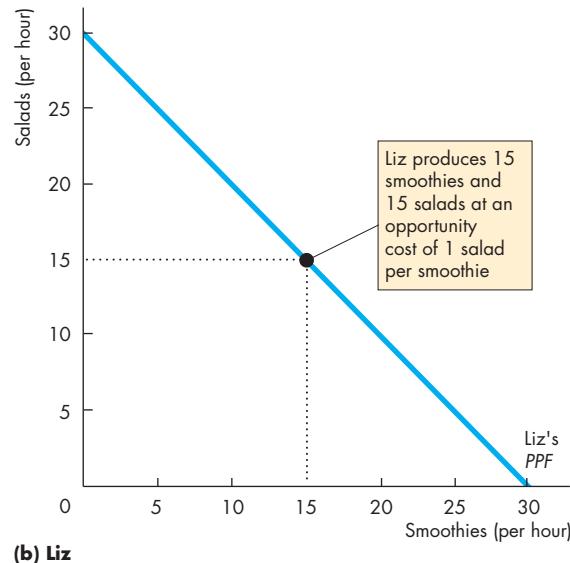
Figure 2.6(b) illustrates the production possibilities at Liz's smoothie bar—Liz's *PPF*.

Like Joe's, Liz's *PPF* is linear because her ability to produce salads and smoothies is the same no matter how she divides her time between the two activities. Liz's opportunity cost of a smoothie is 1 salad at all quantities of smoothies produced.

FIGURE 2.6 The Production Possibilities Frontiers



Joe can produce 30 salads per hour, 1 every two minutes, if he produces no smoothies. Or, he can produce 6 smoothies per hour, 1 every 10 minutes, if he produces no salads. Joe's customers buy equal quantities of salads and smoothies, so Joe produces 5 of each. His opportunity cost of a smoothie is 5 salads.



Liz can produce 30 salads or 30 smoothies per hour, 1 of either item every two minutes. Liz's customers buy equal quantities of salads and smoothies, so she produces 15 of each. Liz's opportunity cost of a smoothie is 1 salad.

Joe's Comparative Advantage In which of the two activities does Joe have a comparative advantage? To answer this question, first recall the definition of comparative advantage. A person has a comparative advantage when that person's opportunity cost of producing a good is lower than another person's opportunity cost of producing that same good.

Joe's opportunity cost of producing a salad is only 1/5 of a smoothie, while Liz's opportunity cost of producing a salad is 1 smoothie. So Joe has a comparative advantage in producing salads.

Liz's Comparative Advantage If Joe has a comparative advantage in producing salads, Liz must have a comparative advantage in producing smoothies. Check the numbers. For Joe, a smoothie costs 5 salads, and for Liz, a smoothie costs only 1 salad. So Liz has a comparative advantage in making smoothies.

Achieving the Gains from Trade

Liz and Joe run into each other one evening in a singles bar. After a few minutes of getting acquainted, Liz tells Joe about her amazing smoothie business. Her only problem, she tells Joe, is that she would like to produce more because potential customers leave when her lines get too long.

Joe doesn't want to risk spoiling a blooming relationship by telling Liz about his own struggling business, but he takes the risk. Joe explains to Liz that he spends 50 minutes of every hour making 5 smoothies and 10 minutes making 5 salads. Liz's eyes pop. "Have I got a deal for you!" she exclaims.

Liz's Proposal Here's the deal that Liz sketches on a paper napkin. Joe stops making smoothies and allocates all his time to producing salads; Liz stops making salads and allocates all her time to producing smoothies. That is, they both specialize in producing the good in which they have a comparative advantage. Together they produce 30 smoothies and 30 salads—see Table 2.3(b).

They then trade. Liz suggests trading at a price of 2 salads per smoothie. For her, that is a good deal because she can produce a smoothie at a cost of 1 salad and sell it to Joe for 2 salads. It is also a good deal for Joe because he can produce a salad at a cost of 1/5th of a smoothie and sell it to Liz for 1/2 a smoothie.

Liz explains that any price above 1 salad per smoothie is good for her and any price below 5 salads per smoothie is good for Joe, so a price of 2 salads per smoothie lets them both gain, as she now describes.

TABLE 2.3 Liz and Joe Gain from Trade

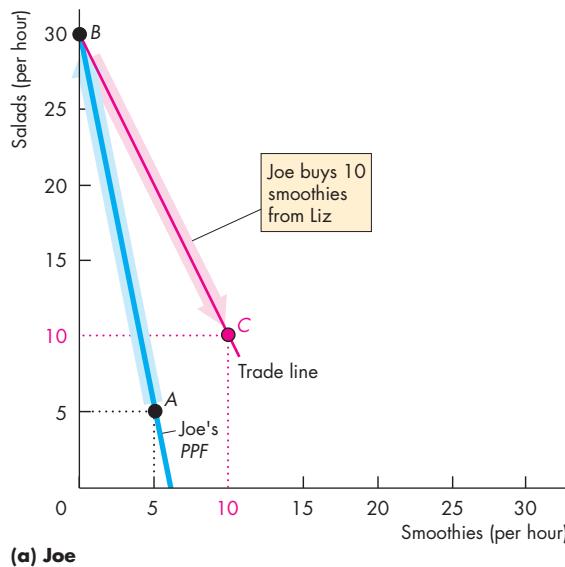
(a) Before trade	Liz	Joe
Smoothies	15	5
Salads	15	5
(b) Specialization	Liz	Joe
Smoothies	30	0
Salads	0	30
(c) Trade	Liz	Joe
Smoothies	sell 10	buy 10
Salads	buy 20	sell 20
(d) After trade	Liz	Joe
Smoothies	20	10
Salads	20	10
(e) Gains from trade	Liz	Joe
Smoothies	+5	+5
Salads	+5	+5

At the proposed price, Liz offers to sell Joe 10 smoothies in exchange for 20 salads. Equivalently, Joe sells Liz 20 salads in exchange for 10 smoothies—see Table 2.3(c).

After this trade, Joe has 10 salads—the 30 he produces minus the 20 he sells to Liz. He also has the 10 smoothies that he buys from Liz. So Joe now has increased the quantities of smoothies and salads that he can sell to his customers—see Table 2.3(d).

Liz has 20 smoothies—the 30 she produces minus the 10 she sells to Joe. She also has the 20 salads that she buys from Joe. Liz has increased the quantities of smoothies and salads that she can sell to her customers—see Table 2.3(d). Both Liz and Joe gain 5 smoothies and 5 salads an hour—see Table 2.3(e).

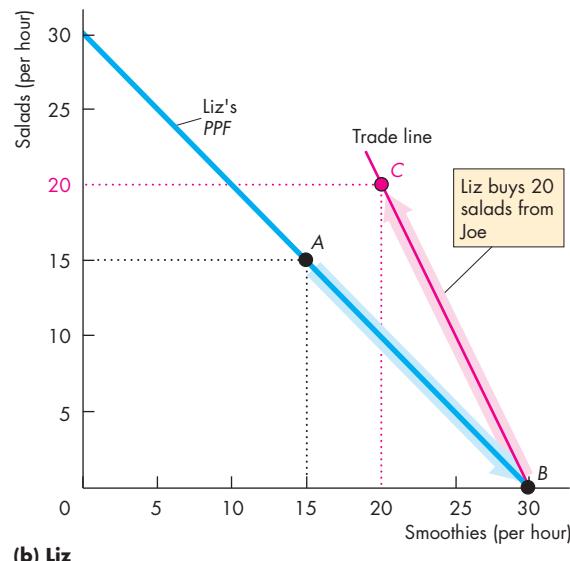
Illustrating Liz's Idea To illustrate her idea, Liz grabs a fresh napkin and draws the graphs in Fig. 2.7. First, she sketches Joe's PPF in part (a) and shows the point at which he is producing before they meet.

FIGURE 2.7 The Gains from Trade

(a) Joe

Initially, Joe produces at point A on his PPF in part (a), and Liz produces at point A on her PPF in part (b). Joe's opportunity cost of producing a salad is less than Liz's, so Joe has a comparative advantage in producing salads. Liz's opportunity cost of producing a smoothie is less than Joe's, so Liz has a comparative advantage in producing smoothies.

If Joe specializes in making salads, he produces 30 salads and no smoothies at point B on his PPF. If Liz specializes



(b) Liz

in making smoothies, she produces 30 smoothies and no salads at point B on her PPF. They exchange salads for smoothies along the red "Trade line." Liz buys salads from Joe for less than her opportunity cost of producing them. Joe buys smoothies from Liz for less than his opportunity cost of producing them. Each goes to point C—a point outside his or her PPF. With specialization and trade, Joe and Liz gain 5 smoothies and 5 salads each with no extra resources.

MyEconLab Animation and Draw Graph

Recall that he is producing 5 smoothies and 5 salads an hour at point A.

She then sketches her own PPF in part (b), and marks the point A at which she is producing 15 smoothies and 15 salads an hour.

She then shows what happens when they each specialize in producing the good in which they have a comparative advantage. Joe specializes in producing salads and produces 30 salads and no smoothies at point B on his PPF. Liz specializes in producing smoothies and produces 30 smoothies and no salads at point B on her PPF.

They then trade smoothies and salads at a price of 2 salads per smoothie or 1/2 a smoothie per salad. The red "Trade line" that Liz draws on each part of the figure illustrates the tradeoff that each faces at the proposed price.

Liz now shows Joe the amazing outcome of her idea. After specializing and trading, Joe gets 10 smoothies and 10 salads at point C—a gain of 5 smoothies and 5 salads. He moves to a point outside

his PPF. And Liz gets 20 smoothies and 20 salads at point C—also a gain of 5 smoothies and 5 salads—and moves to a point outside her PPF.

Despite Liz being more productive than Joe, both gain from specializing at producing the good in which they have a comparative advantage and trading.

REVIEW QUIZ

- 1 What gives a person a comparative advantage?
- 2 Distinguish between comparative advantage and absolute advantage.
- 3 Why do people specialize and trade?
- 4 What are the gains from specialization and trade?
- 5 What is the source of the gains from trade?

Work these questions in Study Plan 2.4 and get instant feedback. Do a Key Terms Quiz.

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Economic Coordination

For 7 billion people to specialize and produce millions of different goods and services, individual choices must somehow be coordinated. Two competing coordination systems have been used: central economic planning and markets (see *At Issue*, p. 8).

Central economic planning works badly because economic planners don't know people's production possibilities and preferences, so production ends up *inside* the PPF and the wrong things are produced.

Decentralized coordination works best, but to do so it needs four complementary social institutions. They are:

- Firms
- Markets
- Property rights
- Money

Firms

A **firm** is an economic unit that hires factors of production and organizes them to produce and sell goods and services.

Firms coordinate a huge amount of economic activity. For example, Loblaws buys or rents large buildings, equips them with storage shelves and checkout lanes, and hires labour. Loblaws directs the labour and decides what goods to buy and sell.

But Galen Weston would not have become one of the wealthiest people in Canada if Loblaws produced everything that it sells. He became rich by specializing in providing retail services and buying from other firms that specialize in producing goods (just as Liz and Joe did). This trade needs markets.

Markets

In ordinary speech, the word *market* means a place where people buy and sell goods such as fish, meat, fruits, and vegetables.

In economics, a **market** is any arrangement that enables buyers and sellers to get information and to do business with each other. An example is the world oil market, which is not a place but a network of producers, consumers, wholesalers, and brokers who buy and sell oil. In the world oil market, decision makers make deals by using the Internet. Enterprising individuals and firms, each pursuing their own self-interest, have profited by making markets—by

standing ready to buy or sell items in which they specialize. But markets can work only when property rights exist.

Property Rights

The social arrangements that govern the ownership, use, and disposal of anything that people value are called **property rights**. *Real property* includes land and buildings—the things we call property in ordinary speech—and durable goods such as plant and equipment. *Financial property* includes stocks and bonds and money in the bank. *Intellectual property* is the intangible product of creative effort. This type of property includes books, music, computer programs, and inventions of all kinds and is protected by copyrights and patents.

Where property rights are enforced, people have the incentive to specialize and produce the goods and services in which they have a comparative advantage. Where people can steal the production of others, resources are devoted not to production but to protecting possessions.

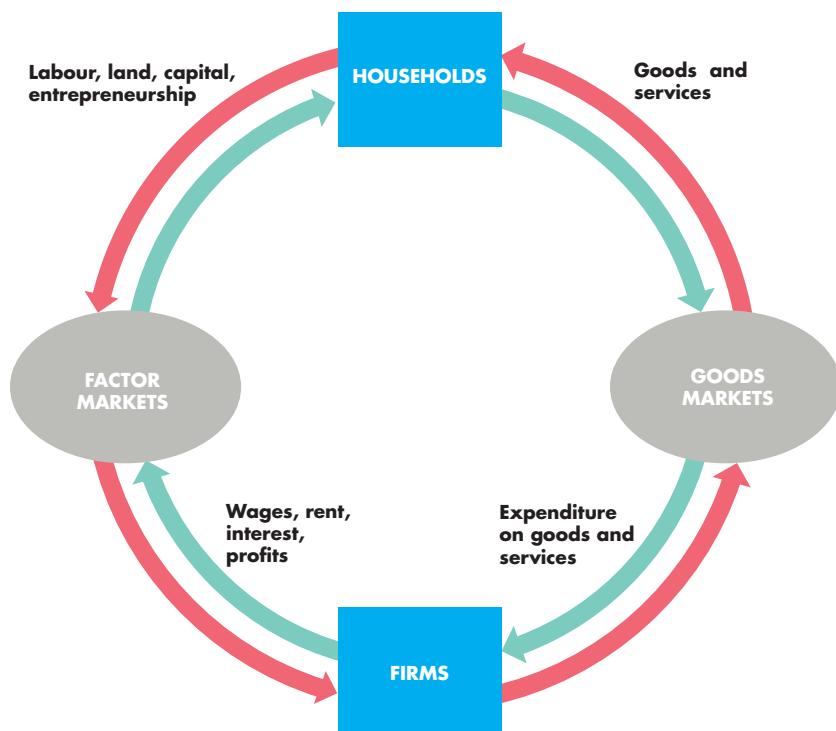
Money

Money is any commodity or token that is generally acceptable as a means of payment. Liz and Joe don't need money. They can exchange salads and smoothies. In principle, trade in markets can exchange any item for any other item. But you can perhaps imagine how complicated life would be if we exchanged goods for other goods. The “invention” of money makes trading in markets much more efficient.

Circular Flows Through Markets

Trading in markets for goods and services and factors of production creates a circular flow of expenditures and incomes. Figure 2.8 shows the circular flows. Households specialize and choose the quantities of labour, land, capital, and entrepreneurial services to sell or rent to firms. Firms choose the quantities of factors of production to hire. These (red) flows go through the *factor markets*. Households choose the quantities of goods and services to buy, and firms choose the quantities to produce. These (red) flows go through the *goods markets*. Households receive incomes and make expenditures on goods and services (the green flows).

How do markets coordinate all these decisions?

FIGURE 2.8 Circular Flows in the Market Economy

Households and firms make economic choices and markets coordinate these choices.

Households choose the quantities of labour, land, capital, and entrepreneurial services to sell or rent to firms in exchange for wages, rent, interest, and profits.

Households also choose how to spend their incomes on the various types of goods and services available.

Firms choose the quantities of factors of production to hire and the quantities of goods and services to produce.

Goods markets and factor markets coordinate these choices of households and firms.

The counterclockwise red flows are real flows—the flow of factors of production from households to firms and the flow of goods and services from firms to households.

The clockwise green flows are the payments for the red flows. They are the flow of incomes from firms to households and the flow of expenditure on goods and services from households to firms.

[MyEconLab Animation](#)

Coordinating Decisions

Markets coordinate decisions through price adjustments. Suppose that some people who want to buy hamburgers are not able to do so. To make buying and selling plans the same, either more hamburgers must be offered for sale or buyers must scale down their appetites (or both). A rise in the price of a hamburger produces this outcome. It encourages producers to offer more hamburgers for sale and encourages some people to change their lunch plans. When the price is right, buying plans and selling plans match.

Alternatively, suppose that more hamburgers are available than people want to buy. In this case, more hamburgers must be bought or fewer hamburgers must be offered for sale (or both). A fall in the price of a hamburger achieves this outcome. It encourages people to buy more hamburgers and it encourages firms to produce a smaller quantity of hamburgers.

REVIEW QUIZ

- 1 Why are social institutions such as firms, markets, property rights, and money necessary?
- 2 What are the main functions of markets?
- 3 What are the flows in the market economy that go from firms to households and the flows from households to firms?

Work these questions in Study Plan 2.5 and get instant feedback. Do a Key Terms Quiz.

[MyEconLab](#)

◆ You have now begun to see how economists approach economic questions. You can see all around you the lessons you've learned in this chapter. *Economics in the News* on pp. 46–47 provides an opportunity to apply the PPF model to deepen your understanding of why Canada produces more energy than it consumes and exports the rest.

Expanding Production Possibilities

Husky Energy Inc Eyes Atlantic Canada LNG Project to Export to Europe, Indonesia

Financial Post

April 3, 2014

Husky Energy Inc. is mulling a liquefied natural gas (LNG) project in Canada's Atlantic Coast amid interest from European countries looking to diversify their natural gas supplies away from Russia.

"We are constantly looking at ways to monetize some of our gas discoveries," Malcolm Maclean, Husky's senior vice-president for the Atlantic region, said in an interview on the sidelines of a conference in Toronto. "We are looking at a world-class LNG project exporting to Europe or even Indonesia. We are in very early [stages]. We are looking at preliminary studies and need to further appraise some of the discoveries to date. In the Atlantic region, the focus has been very much on oil, not really gas." ...

Natural gas production from the Atlantic may present a new growth avenue for Husky, which has seen its oil production decline from Atlantic fields, despite significant new discoveries. Husky's production from the Atlantic fell to 40,800 barrels per day in the fourth quarter, from 45,700 [barrels a day] during the same period in 2012, partly due to the maturing White Rose fields.

Last year, the company made major discoveries at Bay du Nord and Harpoon in the Atlantic region along with its Norwegian partner Statoil SA.

The companies are accelerating appraisal of the two discoveries, along with the Mizzen field discovery, which is expected to contain as much as 200 million barrels of oil. The Bay du Nord alone may contain 400 million barrels of crude oil, according to a company presentation. ...

Written by Yadullah Hussain. Material reprinted with the express permission of National Post, a division of Postmedia Network Inc.

ESSENCE OF THE STORY

- Husky Energy Inc. is thinking about producing liquefied natural gas (LNG) on the Atlantic Coast for export to Europe and Indonesia.
- The firm's production of oil from its existing Atlantic field is shrinking, but it expects both natural gas and oil production to expand.
- Husky and a partner say they have discovered new Atlantic reserves they believe contain up to 600 million barrels of crude oil.

ECONOMIC ANALYSIS

- Husky Energy Inc. is Canada's third-largest producer of oil and gas.
- Canada has hundreds of oil and gas producers, and in 2013 the industry's output was the equivalent of 7 million barrels per day.
- Canada consumed 5 million barrels per day and exported 2 million barrels.
- We can explain Canada's oil and gas production, consumption, and exports using the ideas you have learned in this chapter.
- Figure 1 shows how the discovery of new oil and gas reserves changes Canada's production possibilities.
- The blue curve PPF_0 shows what our production possibilities would be without the discovery of new reserves.
- The discovery of new reserves expands production possibilities and the PPF becomes the red PPF_{2013} . At each quantity of other goods and services (measured on the y-axis), Canada can produce more oil and gas (measured on the x-axis).
- Figure 2 shows the point on PPF_{2013} at which Canada produced in 2013. It produced 7 million barrels (equivalent) of oil and gas and 30 units of other goods and services a day at point A.
- The slope of the PPF at point A measures the opportunity cost of oil and gas—the units of other goods and services that must be forgone to get another million barrels per day.
- Canada can sell oil and gas to other countries and the terms on which that trade occurs is shown by the red "Trade line." This line is like that for trade between Joe and Liz in Fig. 2.7.
- In 2013, Canada consumed 5 million barrels of oil and gas a day at point B, a point outside its PPF , and exported 2 million barrels a day, as shown by the blue arrow.

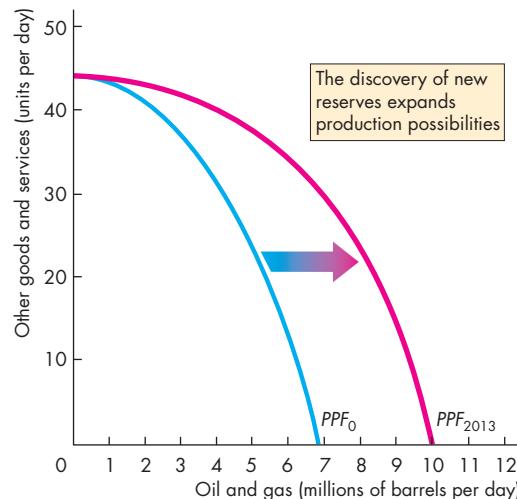


Figure 1 Oil and Gas Production Possibilities Expand

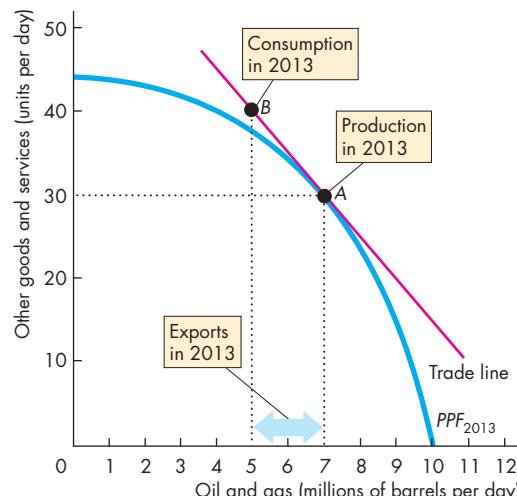


Figure 2 Production, Exports, and Consumption of Oil and Gas in 2013



SUMMARY

Key Points

Production Possibilities and Opportunity Cost

(pp. 32–34)

- The production possibilities frontier is the boundary between production levels that are attainable and those that are not attainable when all the available resources are used to their limits.
- Production efficiency occurs at points on the production possibilities frontier.
- Along the production possibilities frontier, the opportunity cost of producing more of one good is the amount of the other good that must be given up.
- The opportunity cost of all goods increases as the production of the good increases.

Working Problems 1 to 3 will give you a better understanding of production possibilities and opportunity cost.

Using Resources Efficiently

- Allocative efficiency occurs when goods and services are produced at the least possible cost and in the quantities that bring the greatest possible benefit.
- The marginal cost of a good is the opportunity cost of producing one more unit of it.
- The marginal benefit from a good is the benefit received from consuming one more unit of it and is measured by the willingness to pay for it.
- The marginal benefit of a good decreases as the amount of the good available increases.
- Resources are used efficiently when the marginal cost of each good is equal to its marginal benefit.

Working Problems 4 to 6 will give you a better understanding of the efficient use of resources.

Key Terms

- Absolute advantage, 40
- Allocative efficiency, 35
- Capital accumulation, 38
- Comparative advantage, 40
- Economic growth, 38
- Firm, 44

- Marginal benefit, 36
- Marginal benefit curve, 36
- Marginal cost, 35
- Market, 44
- Money, 44
- Opportunity cost, 33

MyEconLab Key Terms Quiz

- Preferences, 36
- Production efficiency, 33
- Production possibilities frontier, 32
- Property rights, 44
- Technological change, 38

Economic Growth

(pp. 38–39)

- Economic growth, which is the expansion of production possibilities, results from capital accumulation and technological change.
- The opportunity cost of economic growth is forgone current consumption.
- The benefit of economic growth is increased future consumption.

Working Problem 7 will give you a better understanding of economic growth.

Gains from Trade

(pp. 40–43)

- A person has a comparative advantage in producing a good if that person can produce the good at a lower opportunity cost than everyone else.
- People gain by specializing in the activity in which they have a comparative advantage and trading with others.

Working Problems 8 and 9 will give you a better understanding of the gains from trade.

Economic Coordination

(pp. 44–45)

- Firms coordinate a large amount of economic activity, but there is a limit to the efficient size of a firm.
- Markets coordinate the economic choices of people and firms.
- Markets can work efficiently only when property rights exist.
- Money makes trading in markets more efficient.

Working Problem 10 will give you a better understanding of economic coordination.

WORKED PROBLEM

MyEconLab You can work this problem in Chapter 2 Study Plan.

Leisure Island has 50 hours of labour a day that it can use to produce entertainment and good food. The table shows the maximum quantity of each good that it can produce with different quantities of labour.

Labour (hours)	Entertainment (shows per week)	Good food (meals per week)
0	0	0
10	2	5
20	4	9
30	6	12
40	8	14
50	10	15

Questions

1. Can Leisure Island produce 4 shows and 14 meals a week?
2. If Leisure Island produces 4 shows and 9 meals a week, is production efficient?
3. If Leisure Island produces 8 shows and 5 meals a week, do the people of Leisure Island face a tradeoff?
4. Suppose that Leisure Island produces 4 shows and 12 meals a week. Calculate the opportunity cost of producing 2 additional shows a week.

Solutions

1. To produce 4 shows it would use 20 hours and to produce 14 meals it would use 40 hours, so to produce 4 shows and 14 meals a week, Leisure Island would use 60 hours of labour. Leisure Island has only 50 hours of labour available, so it cannot produce 4 shows and 14 meals a week.

Key Point: Production is *unattainable* if it uses more resources than are available.

2. When Leisure Island produces 4 shows it uses 20 hours of labour and when it produces 9 meals it uses 20 hours. In total, it uses 40 hours, which is *less than* the 50 hours of labour available. So Leisure Island's production is not efficient.

Key Point: Production is *efficient* only if the economy uses all its resources.

3. When Leisure Island produces 8 shows and 5 meals, it uses 50 hours of labour. Leisure Island is using all its resources, so to produce more of either good, it would face a tradeoff.

Key Point: An economy faces a *tradeoff* only when it uses all the available resources.

4. When Leisure Island produces 4 shows and 12 meals a week, it uses 50 hours of labour. To

produce 2 additional shows a week, Leisure Island faces a tradeoff and incurs an opportunity cost.

To produce 2 additional shows a week, Leisure Island moves 10 hours of labour from good food production, which decreases the quantity of meals from 12 to 9 a week—a decrease of 3 meals. That is, to get 2 additional shows a week Leisure Island *must give up* 3 meals a week. The opportunity cost of the 2 additional shows is 3 meals a week.

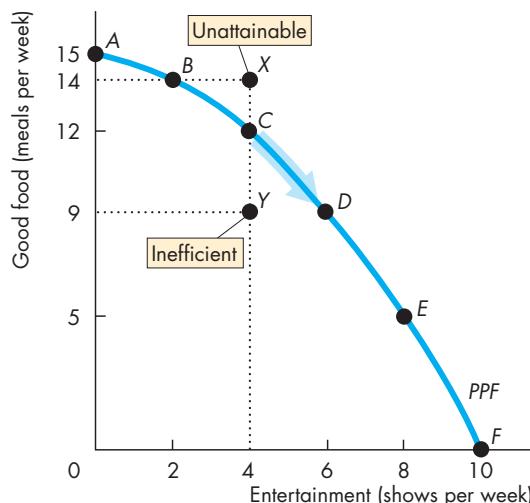
Key Point: When an economy is using all its resources and it decides to increase production of one good, it incurs an opportunity cost equal to the quantity of the good that it *must forgo*.

Key Figure

Each row of the following table sets out the combination of shows and meals that Leisure Island can produce in a week when it uses 50 hours of labour.

	Entertainment (shows per week)	Good food (meals per week)
A	0	15
B	2	14
C	4	12
D	6	9
E	8	5
F	10	0

Points A through F plot these combinations of shows and meals. The blue curve through these points is Leisure Island's *PPF*. Point X (4 shows and 14 meals in Question 1) is unattainable; Point Y (4 shows and 9 meals in Question 2) is inefficient. Point E (8 shows and 5 meals in Question 3) is on the *PPF* and the arrow illustrates the tradeoff and the calculation of opportunity cost of 2 additional shows a week.



MyEconLab Interactive Animation

◆ STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab You can work Problems 1 to 10 in Chapter 2 Study Plan and get instant feedback.

Production Possibilities and Opportunity Cost (Study Plan 2.1)

Use the following information to work Problems 1 to 3. Brazil produces ethanol from sugar, and the land used to grow sugar can be used to grow food crops. The table sets out Brazil's production possibilities for ethanol and food crops:

Ethanol (barrels per day)		Food crops (tonnes per day)
70	and	0
64	and	1
54	and	2
40	and	3
22	and	4
0	and	5

1. a. Draw a graph of Brazil's *PPF* and explain how your graph illustrates scarcity.
b. If Brazil produces 40 barrels of ethanol a day, how much food must it produce to achieve production efficiency?
c. Why does Brazil face a tradeoff on its *PPF*?
2. a. If Brazil increases ethanol production from 40 barrels per day to 54 barrels a day, what is the opportunity cost of the additional ethanol?
b. If Brazil increases food production from 2 tonnes per day to 3 tonnes per day, what is the opportunity cost of the additional food?
c. What is the relationship between your answers to parts (a) and (b)?
3. Does Brazil face an increasing opportunity cost of ethanol? What feature of Brazil's *PPF* illustrates increasing opportunity cost?

Using Resources Efficiently (Study Plan 2.2)

Use the table above to work Problems 4 and 5.

4. Define marginal cost and calculate Brazil's marginal cost of producing a tonne of food when the quantity produced is 2.5 tonnes per day.
5. Define marginal benefit. Explain how it is measured and why the data in the table does not enable you to calculate Brazil's marginal benefit from food.
6. Distinguish between *production efficiency* and *allocative efficiency*. Explain why many production possibilities achieve production efficiency but only one achieves allocative efficiency.

Economic Growth (Study Plan 2.3)

7. A farm grows wheat and produces pork. The marginal cost of producing each of these products increases as more of it is produced.
 - a. Make a graph that illustrates the farm's *PPF*.
 - b. The farm adopts a new technology that allows it to use fewer resources to fatten pigs. On your graph sketch the impact of the new technology on the farm's *PPF*.
 - c. With the farm using the new technology described in part (b), has the opportunity cost of producing a tonne of wheat increased, decreased, or remained the same? Explain and illustrate your answer.
 - d. Is the farm more efficient with the new technology than it was with the old one? Why?

Gains from Trade (Study Plan 2.4)

8. In an hour, Sue can produce 40 caps or 4 jackets and Tessa can produce 80 caps or 4 jackets.
 - a. Calculate Sue's opportunity cost of producing a cap.
 - b. Calculate Tessa's opportunity cost of producing a cap.
 - c. Who has a comparative advantage in producing caps?
 - d. If Sue and Tessa specialize in producing the good in which they have a comparative advantage and then trade 1 jacket for 15 caps, who gains from the specialization and trade?
9. Suppose that Tessa buys a new machine that enables her to make 20 jackets an hour. (She can still make only 80 caps per hour.)
 - a. Who now has a comparative advantage in producing jackets?
 - b. Can Sue and Tessa still gain from trade?
 - c. Would Sue and Tessa still be willing to trade 1 jacket for 15 caps? Explain your answer.

Economic Coordination (Study Plan 2.5)

10. For 50 years, Cuba has had a centrally planned economy in which the government makes the big decisions on how resources will be allocated.
 - a. Why would you expect Cuba's production possibilities (per person) to be smaller than those of Canada?
 - b. What are the social institutions that Cuba might lack that help Canada to achieve allocative efficiency?



ADDITIONAL PROBLEMS AND APPLICATIONS

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

Production Possibilities and Opportunity Cost

Use the following table to work Problems 11 and 12.

Suppose that Yucatan's production possibilities are:

Food (kilograms per month)		Sunscreen (litres per month)
300	and	0
200	and	50
100	and	100
0	and	150

11. a. Draw a graph of Yucatan's PPF and explain how your graph illustrates a tradeoff.
b. If Yucatan produces 150 kilograms of food per month, how much sunscreen must it produce if it achieves production efficiency?
c. What is Yucatan's opportunity cost of producing (i) 1 kilogram of food and (ii) 1 litre of sunscreen?
d. What is the relationship between your answers to part (c)?
12. What feature of a PPF illustrates increasing opportunity cost? Explain why Yucatan's opportunity cost does or does not increase.

Using Resources Efficiently

13. In Problem 11, what is the marginal cost of 1 kilogram of food in Yucatan when the quantity produced is 150 kilograms per day? What is special about the marginal cost of food in Yucatan?
14. The table describes the preferences in Yucatan.

Sunscreen (litres per month)	Willingness to pay (kilograms of food per litre)
25	3
75	2
125	1

- a. What is the marginal benefit from sunscreen and how is it measured?
b. Use the table in Problem 11. What does Yucatan produce to achieve allocative efficiency?

Downtown Music Stores Squeezed out of Business

Music retailing is changing: Sony Music and Amazon are selling online, discount stores are selling at low prices, and downtown music retailers are all struggling.

Source: *The Economist*, January 20, 2007

- a. Draw the PPF curves for downtown music retailers and online music retailers before and after the Internet became available.

- b. Draw the marginal cost and marginal benefit curves for downtown music retailers and online music retailers before and after the Internet became available.
- c. Explain how changes in production possibilities, preferences, or both have changed the way in which recorded music is retailed.

Use the following news clip to work Problems 16 and 17.

Malaria Eradication Back on the Table

In response to the Gates Malaria Forum in October 2007, countries are debating the pros and cons of eradication. Dr. Arata Kochi of the World Health Organization believes that with enough money malaria cases could be cut by 90 percent, but it would be very expensive to eliminate the remaining 10 percent of cases, so countries should not strive to eradicate malaria.

Source: *The New York Times*, March 4, 2008

16. Is Dr. Kochi talking about *production efficiency* or *allocative efficiency* or both?
17. Make a graph with the percentage of malaria cases eliminated on the *x*-axis and the marginal cost and marginal benefit of driving down malaria cases on the *y*-axis. On your graph:
 - (i) Draw a marginal cost curve and marginal benefit curve that are consistent with Dr. Kochi's opinion.
 - (ii) Identify the quantity of malaria eradicated that achieves allocative efficiency.

Economic Growth

18. Capital accumulation and technological change bring economic growth: Production that was unattainable yesterday becomes attainable today; production that is unattainable today will become attainable tomorrow. Why doesn't economic growth bring an end to scarcity one day?
19. **Toyota Plans to Build a Better Company**
Toyota will continue to produce 3 million cars per year and will use the balance of its resources to upgrade its workers' skills and create new technology. In three years' time, Toyota plans to produce better cars and be more productive.

- Source: *Financial Post*, April 7, 2014
- a. What is the opportunity cost of Toyota upgrading its workers' skills and creating new technology?

- b. Sketch Toyota's *PPF* and mark its production point in 2014. Now show on your graph Toyota's *PPF* in 2018.

Gains from Trade

Use the following data to work Problems 20 and 21. Kim can produce 40 pies or 400 cakes an hour. Liam can produce 100 pies or 200 cakes an hour.

20. a. Calculate Kim's opportunity cost of a pie and Liam's opportunity cost of a pie.
- b. If each spends 30 minutes of each hour producing pies and 30 minutes producing cakes, how many pies and cakes does each produce?
- c. Who has a comparative advantage in producing (i) pies and (ii) cakes?
21. a. Draw a graph of Kim's *PPF* and Liam's *PPF* and show the point at which each produces when they spend 30 minutes of each hour producing pies and 30 minutes producing cakes.
- b. On your graph, show what Kim produces and what Liam produces when they specialize.
- c. When they specialize and trade, what are the total gains from trade?
- d. If Kim and Liam share the total gains equally, what trade takes place between them?
22. Tony and Patty produce skis and snowboards. The tables show their production possibilities. Tony produces 5 snowboards and 40 skis a week; Patty produces 10 snowboards and 5 skis a week.

Tony's Production Possibilities		
Snowboards (units per week)		Skis (units per week)
25	and	0
20	and	10
15	and	20
10	and	30
5	and	40
0	and	50

Patty's Production Possibilities		
Snowboards (units per week)		Skis (units per week)
20	and	0
10	and	5
0	and	10

- a. Who has a comparative advantage in producing (i) snowboards and (ii) skis?
- b. If Tony and Patty specialize and trade 1 snowboard for 1 ski, what are the gains from trade?

Economic Coordination

23. On a graph of the circular flows in the market economy indicate the real and money flows in which the following items belong:
 - a. You buy an iPad from the Apple Store.
 - b. Apple Inc. pays the designers of the iPad.
 - c. Apple Inc. decides to expand and rents an adjacent building.
 - d. You buy a new e-book from Amazon.
 - e. Apple Inc. hires a student as an intern during the summer.

Economics in the News

24. After you have studied *Economics in the News* on pp. 46–47, answer the following questions.
 - a. How does the discovery of new oil and gas reserves change Canada's *PPF*?
 - b. How do technological advances in the production of other goods and services change Canada's *PPF*?
 - c. How are Husky's discoveries changing Canada's opportunity cost of producing oil and gas?
 - d. When technological advances in the production of other goods and services occur, how does the opportunity cost of producing oil and gas change? Does it increase or decrease?

Lots of Little Screens

Inexpensive broadband access has created a generation of television producers for whom the Internet is their native medium. As they redirect the focus from TV to computers, cellphones, and iPods, the video market is developing into an open digital network.

Source: *The New York Times*, December 2, 2007

- a. How has inexpensive broadband changed the production possibilities of video entertainment and other goods and services?
- b. Sketch a *PPF* for video entertainment and other goods and services before broadband.
- c. Show how the arrival of inexpensive broadband has changed the *PPF*.
- d. Sketch a marginal benefit curve for video entertainment.
- e. Show how the new generation of TV producers for whom the Internet is their native medium might have changed the marginal benefit from video entertainment.
- f. Explain how the efficient quantity of video entertainment has changed.

Your Economic Revolution

Three periods in human history stand out as ones of economic revolution. The first, the *Agricultural Revolution*, occurred 10,000 years ago. In what is today Iraq, people learned to domesticate animals and plant crops. People stopped roaming in search of food and settled in villages, towns, and cities where they specialized in the activities in which they had a comparative advantage and developed markets in which to exchange their products. Wealth increased enormously.

Economics was born during the *Industrial Revolution*, which began in England during the 1760s. For the first time, people began to apply science and create new technologies for the manufacture of textiles and iron, to create steam engines, and to boost the output of farms.

You are studying economics at a time that future historians will call the *Information Revolution*. Over the entire world, people are embracing new information technologies and prospering on an unprecedented scale.

During all three economic revolutions, many have prospered but others have been left behind. It is the range of human progress that poses the greatest question for economics and the one that Adam Smith addressed in the first work of economic science: What causes the differences in wealth among nations?

Many people had written about economics before Adam Smith, but he made economics a science. Born in 1723 in Kirkcaldy, a small fishing town near Edinburgh, Scotland, Smith was the only child of the town's customs officer. Lured from his professorship (he was a full professor at 28) by a wealthy Scottish duke who gave him a pension of £300 a year—10 times the average income at that time—Smith devoted 10 years to writing his masterpiece: An Inquiry into the Nature and Causes of the Wealth of Nations, published in 1776.

Why, Adam Smith asked, are some nations wealthy while others are poor? He was pondering these questions at the height of the Industrial Revolution, and he answered by emphasizing the power of the division of labour and free markets in raising labour productivity.

To illustrate his argument, Adam Smith described two pin factories. In the first, one person, using the hand tools available in the 1770s, could make 20 pins a day. In the other, by using those same hand tools but breaking the process into a number of individually small operations in which people specialize—by the division of labour—10 people could make a staggering 48,000 pins a day. One draws out

PART ONE

UNDERSTANDING THE SCOPE OF ECONOMICS

Every individual who intends only his own gain is led by an invisible hand to promote an end (the public good) which was no part of his intention.

ADAM SMITH
The Wealth of Nations



the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it. Three specialists make the head, and a fourth attaches it. Finally, the pin is polished and packaged.

But a large market is needed to support the division of labour: One factory employing 10 workers would need to sell more than 15 million pins a year to stay in business!



TALKING WITH

Esther Duflo*



ESTHER DUFLO is the Abdul Latif Jameel Professor of Poverty Alleviation and Development Economics at the Massachusetts Institute of Technology. Among her many honours are the 2010 John Bates Clark Medal for the best economist under 40 and the Financial Times and Goldman Sachs Business Book of the Year Award in 2011 for her book (with Abhijit Banerjee) *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. Professor Duflo's research seeks to advance our understanding of the economic choices of the extremely poor by conducting massive real-world experiments.

Professor Duflo was an undergraduate student of history and economics at École Normale Supérieure and completed a master's degree at DELTA in Paris before moving to the United States. She earned her Ph.D. in economics at MIT in 1999.

Michael Parkin and Robin Bade talked with her about her work, which advances our understanding of the economic choices and condition of the very poor.

Professor Duflo, what's the story about how you became an economist and in particular the architect of experiments designed to understand the economic choices of the very poor?

When I was a kid, I was exposed to many stories and images of poor children: through my mothers' engagement as a doctor in a small NGO dealing with child victims of war and through books and stories about children living all around the world.

I remember asking myself how I could justify my luck of being born where I was. I had a very exaggerated idea of what it was to be poor, but this idea caused sufficient discomfort that I knew

I had to do something about it, if I could. Quite by accident, I discovered that economics was the way in which I could actually be useful: While spending a year in Russia teaching French and studying history, I realized that academic economists have the ability to intervene in the world while keeping enough sanity to analyze it. I thought this would be ideal for me and I have never regretted it. I have the best job in the world.

**... imagine living on under a dollar
a day after your rent is paid in
Seattle or Denver. Not easy!**

The very poor who you study are people who live on \$1 a day or \$2 a day. ... Is \$1 a day a true measure that includes everything these poor people consume?

For defining the poverty line, we don't include the cost of housing. The poor also get free goods, sometimes of bad quality (education, healthcare) and the value of those is also not included. Other than that, yes, it is everything.

Moreover, you have to realize this is everything, taking into account the fact that life is much cheaper in many poor countries because salaries are lower, so anything that is made and consumed locally (e.g., a haircut) is cheaper.

For example, in India, the purchasing power of a dollar (in terms of the real goods you can buy) is about 3 times what it is in the United States. So the poverty line we use for India is 33 cents per day, not a dollar.

All told, you really have to imagine living on under a dollar a day after your rent is paid in Seattle or Denver. Not easy!

*Read the full interview with Esther Duflo in [MyEconLab](#).



3

DEMAND AND SUPPLY

After studying this chapter, you will be able to:

- ◆ Describe a competitive market and think about a price as an opportunity cost
- ◆ Explain the influences on demand
- ◆ Explain the influences on supply
- ◆ Explain how demand and supply determine prices and quantities bought and sold
- ◆ Use the demand and supply model to make predictions about changes in prices and quantities

A disease that kills banana trees is jumping continents and left unchecked will bring a big drop in banana production. What will happen to the price of bananas if the disease isn't contained? The demand and supply model answers this question.

This model that you're about to study is the main tool of economics. It explains how prices are determined and how they guide the use of resources to influence *What, How, and For Whom* goods and services are produced.

Economics in the News at the end of the chapter answers the question about the price of bananas.

Markets and Prices

When you need a new pair of running shoes, want a bagel and a latte, plan to upgrade your cellphone, or need to fly home for Thanksgiving, you must find a place where people sell those items or offer those services. The place in which you find them is a *market*. You learned in Chapter 2 (p. 44) that a market is any arrangement that enables buyers and sellers to get information and to do business with each other.

A market has two sides: buyers and sellers. There are markets for *goods* such as apples and hiking boots, for *services* such as haircuts and tennis lessons, for *factors of production* such as computer programmers and earthmovers, and for other manufactured *inputs* such as memory chips and auto parts. There are also markets for money such as Japanese yen and for financial securities such as Yahoo! stock. Only our imagination limits what can be traded in markets.

Some markets are physical places where buyers and sellers meet and where an auctioneer or a broker helps to determine the prices. Examples of this type of market are live car and house auctions and the wholesale fish, meat, and produce markets.

Some markets are groups of people spread around the world who never meet and know little about each other but are connected through the Internet or by telephone and fax. Examples are the e-commerce markets and the currency markets.

But most markets are unorganized collections of buyers and sellers. You do most of your trading in this type of market. An example is the market for basketball shoes. The buyers in this \$3 billion-a-year market are the 45 million Canadians and Americans who play basketball (or who want to make a fashion statement). The sellers are the tens of thousands of retail sports equipment and footwear stores. Each buyer can visit several different stores, and each seller knows that the buyer has a choice of stores.

Markets vary in the intensity of competition that buyers and sellers face. In this chapter, we're going to study a **competitive market**—a market that has many buyers and many sellers, so no single buyer or seller can influence the price.

Producers offer items for sale only if the price is high enough to cover their opportunity cost. And consumers respond to changing opportunity cost by seeking cheaper alternatives to expensive items.

We are going to study how people respond to prices and the forces that determine prices. But

to pursue these tasks, we need to understand the relationship between a price and an opportunity cost.

In everyday life, the *price* of an object is the number of dollars that must be given up in exchange for it. Economists refer to this price as the **money price**.

The *opportunity cost* of an action is the highest-valued alternative forgone. If, when you buy a cup of coffee, the highest-valued thing you forgo is some gum, then the opportunity cost of the coffee is the *quantity* of gum forgone. We can calculate the quantity of gum forgone from the money prices of the coffee and the gum.

If the money price of coffee is \$1 a cup and the money price of gum is 50¢ a pack, then the opportunity cost of one cup of coffee is two packs of gum. To calculate this opportunity cost, we divide the price of a cup of coffee by the price of a pack of gum and find the *ratio* of one price to the other. The ratio of one price to another is called a **relative price**, and a *relative price is an opportunity cost*.

We can express the relative price of coffee in terms of gum or any other good. The normal way of expressing a relative price is in terms of a “basket” of all goods and services. To calculate this relative price, we divide the money price of a good by the money price of a “basket” of all goods (called a *price index*). The resulting relative price tells us the opportunity cost of the good in terms of how much of the “basket” we must give up to buy it.

The demand and supply model that we are about to study determines *relative prices*, and the word “price” means *relative* price. When we predict that a price will fall, we do not mean that its *money* price will fall—although it might. We mean that its *relative* price will fall. That is, its price will fall *relative* to the average price of other goods and services.

REVIEW QUIZ

- 1 What is the distinction between a money price and a relative price?
- 2 Explain why a relative price is an opportunity cost.
- 3 Think of examples of goods whose relative price has risen or fallen by a large amount.

Work these questions in Study Plan 3.1 and get instant feedback. Do a Key Terms Quiz. 

Let's begin our study of demand and supply, starting with demand.



Demand

If you demand something, then you:

1. Want it.
2. Can afford it.
3. Plan to buy it.

Wants are the unlimited desires or wishes that people have for goods and services. How many times have you thought that you would like something “if only you could afford it” or “if it weren’t so expensive”? Scarcity guarantees that many—perhaps most—of our wants will never be satisfied. Demand reflects a decision about which wants to satisfy.

The **quantity demanded** of a good or service is the amount that consumers plan to buy during a given time period at a particular price. The quantity demanded is not necessarily the same as the quantity actually bought. Sometimes the quantity demanded exceeds the amount of goods available, so the quantity bought is less than the quantity demanded.

The quantity demanded is measured as an amount per unit of time. For example, suppose that you buy one cup of coffee a day. The quantity of coffee that you demand can be expressed as 1 cup per day, 7 cups per week, or 365 cups per year.

Many factors influence buying plans, and one of them is the price. We look first at the relationship between the quantity demanded of a good and its price. To study this relationship, we keep all other influences on buying plans the same and we ask: How, other things remaining the same, does the quantity demanded of a good change as its price changes?

The law of demand provides the answer.

The Law of Demand

The **law of demand** states:

Other things remaining the same, the higher the price of a good, the smaller is the quantity demanded; and the lower the price of a good, the greater is the quantity demanded.

Why does a higher price reduce the quantity demanded? For two reasons:

- Substitution effect
- Income effect

Substitution Effect When the price of a good rises, other things remaining the same, its *relative* price—its opportunity cost—rises. Although each good is unique, it has *substitutes*—other goods that can be used in its place. As the opportunity cost of a good rises, the incentive to economize on its use and switch to a substitute becomes stronger.

Income Effect When a price rises, other things remaining the same, the price rises *relative* to income. Faced with a higher price and an unchanged income, people cannot afford to buy all the things they previously bought. They must decrease the quantities demanded of at least some goods and services. Normally, the good whose price has increased will be one of the goods that people buy less of.

To see the substitution effect and the income effect at work, think about the effects of a change in the price of an energy bar. Several different goods are substitutes for an energy bar. For example, an energy drink could be consumed instead of an energy bar.

Suppose that an energy bar initially sells for \$3 and then its price falls to \$1.50. People now substitute energy bars for energy drinks—the substitution effect. And with a budget that now has some slack from the lower price of an energy bar, people buy even more energy bars—the income effect. The quantity of energy bars demanded increases for these two reasons.

Now suppose that an energy bar initially sells for \$3 and then the price doubles to \$6. People now buy fewer energy bars and more energy drinks—the substitution effect. And faced with a tighter budget, people buy even fewer energy bars—the income effect. The quantity of energy bars demanded decreases for these two reasons.

Demand Curve and Demand Schedule

You are now about to study one of the two most used curves in economics: the demand curve. You are also going to encounter one of the most critical distinctions: the distinction between *demand* and *quantity demanded*.

The term **demand** refers to the entire relationship between the price of a good and the quantity demanded of that good. Demand is illustrated by the demand curve and the demand schedule. The term *quantity demanded* refers to a point on a demand curve—the quantity demanded at a particular price.

Figure 3.1 shows the demand curve for energy bars. A **demand curve** shows the relationship between the quantity demanded of a good and its price when all other influences on consumers' planned purchases remain the same.

The table in Fig. 3.1 is the demand schedule for energy bars. A *demand schedule* lists the quantities demanded at each price when all the other influences on consumers' planned purchases remain the same. For example, if the price of a bar is 50¢, the quantity demanded is 22 million a week. If the price is \$2.50, the quantity demanded is 5 million a week. The other rows of the table show the quantities demanded at prices of \$1.00, \$1.50, and \$2.00.

We graph the demand schedule as a demand curve with the quantity demanded on the x -axis and the price on the y -axis. The points on the demand curve labelled A through E correspond to the rows of the demand schedule. For example, point A on the graph shows a quantity demanded of 22 million energy bars a week at a price of 50¢ a bar.

Willingness and Ability to Pay Another way of looking at the demand curve is as a willingness-and-ability-to-pay curve. The willingness and ability to pay is a measure of *marginal benefit*.

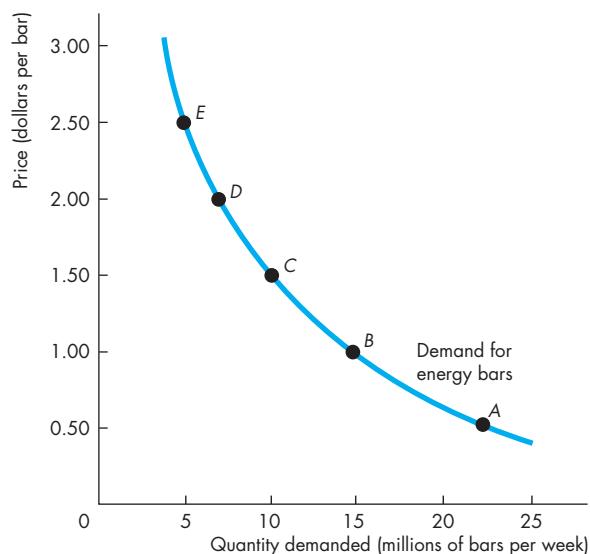
If a small quantity is available, the highest price that someone is willing and able to pay for one more unit is high. But as the quantity available increases, the marginal benefit of each additional unit falls and the highest price that someone is willing and able to pay also falls along the demand curve.

In Fig. 3.1, if only 5 million energy bars are available each week, the highest price that someone is willing to pay for the 5 millionth bar is \$2.50. But if 22 million energy bars are available each week, someone is willing to pay 50¢ for the last bar bought.

A Change in Demand

When any factor that influences buying plans changes, other than the price of the good, there is a **change in demand**. Figure 3.2 illustrates an increase in demand. When demand increases, the demand curve shifts rightward and the quantity demanded at each price is greater. For example, at \$2.50 a bar, the quantity demanded on the original (blue) demand curve is 5 million energy bars a week. On the new (red) demand curve, at \$2.50 a bar, the quantity demanded is 15 million bars a week. Look closely at the numbers in the table and check that the quantity demanded at each price is greater.

FIGURE 3.1 The Demand Curve

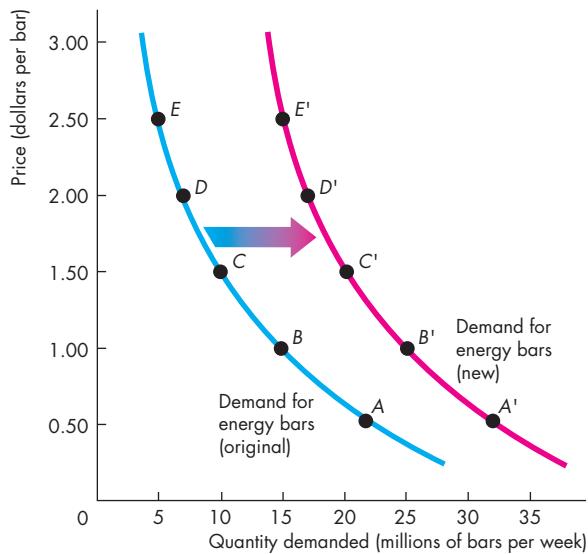


	Price (dollars per bar)	Quantity demanded (millions of bars per week)
A	0.50	22
B	1.00	15
C	1.50	10
D	2.00	7
E	2.50	5

The table shows a demand schedule for energy bars. At a price of 50¢ a bar, 22 million bars a week are demanded; at a price of \$1.50 a bar, 10 million bars a week are demanded. The demand curve shows the relationship between quantity demanded and price, other things remaining the same. The demand curve slopes downward: As the price falls, the quantity demanded increases.

The demand curve can be read in two ways. For a given price, the demand curve tells us the quantity that people plan to buy. For example, at a price of \$1.50 a bar, people plan to buy 10 million bars a week. For a given quantity, the demand curve tells us the maximum price that consumers are willing and able to pay for the last bar available. For example, the maximum price that consumers will pay for the 15 millionth bar is \$1.00.

MyEconLab Animation

FIGURE 3.2 An Increase in Demand

Original demand schedule Original income		New demand schedule New higher income	
	Quantity demanded (millions of bars per week)		Quantity demanded (millions of bars per week)
Price (dollars per bar)		Price (dollars per bar)	
A	22	A'	32
B	15	B'	25
C	10	C'	20
D	7	D'	17
E	5	E'	15

A change in any influence on buying plans other than the price of the good itself results in a new demand schedule and a shift of the demand curve. A change in income changes the demand for energy bars. At a price of \$1.50 a bar, 10 million bars a week are demanded at the original income (row C of the table) and 20 million bars a week are demanded at the new higher income (row C'). A rise in income increases the demand for energy bars. The demand curve shifts *rightward*, as shown by the shift arrow and the resulting red curve.

MyEconLab Animation

Six main factors bring changes in demand. They are changes in:

- The prices of related goods
- Expected future prices
- Income
- Expected future income and credit
- Population
- Preferences

Prices of Related Goods The quantity of energy bars that consumers plan to buy depends in part on the prices of substitutes for energy bars. A **substitute** is a good that can be used in place of another good. For example, a bus ride is a substitute for a train ride; a hamburger is a substitute for a hot dog; and an energy drink is a substitute for an energy bar. If the price of a substitute for an energy bar rises, people buy less of the substitute and more energy bars. For example, if the price of an energy drink rises, people buy fewer energy drinks and more energy bars. The demand for energy bars increases.

The quantity of energy bars that people plan to buy also depends on the prices of complements with energy bars. A **complement** is a good that is used in conjunction with another good. Hamburgers and fries are complements, and so are energy bars and exercise. If the price of an hour at the gym falls, people buy more gym time *and more* energy bars.

Expected Future Prices If the expected future price of a good rises and if the good can be stored, the opportunity cost of obtaining the good for future use is lower today than it will be in the future when people expect the price to be higher. So people retime their purchases—they substitute over time. They buy more of the good now before its price is expected to rise (and less afterward), so the demand for the good today increases.

For example, suppose that a Florida frost damages the season's orange crop. You expect the price of orange juice to rise, so you fill your freezer with enough frozen juice to get you through the next six months. Your current demand for frozen orange juice has increased, and your future demand has decreased.

Similarly, if the expected future price of a good falls, the opportunity cost of buying the good today is high relative to what it is expected to be in the future. So again, people retime their purchases. They buy less of the good now before its price is expected

to fall, so the demand for the good decreases today and increases in the future.

Computer prices are constantly falling, and this fact poses a dilemma. Will you buy a new computer now, in time for the start of the school year, or will you wait until the price has fallen some more? Because people expect computer prices to keep falling, the current demand for computers is less (and the future demand is greater) than it otherwise would be.

Income Consumers' income influences demand. When income increases, consumers buy more of most goods; and when income decreases, consumers buy less of most goods. Although an increase in income leads to an increase in the demand for *most* goods, it does not lead to an increase in the demand for *all* goods. A **normal good** is one for which demand increases as income increases. An **inferior good** is one for which demand decreases as income increases. As incomes increase, the demand for air travel (a normal good) increases and the demand for long-distance bus trips (an inferior good) decreases.

Expected Future Income and Credit When expected future income increases or credit becomes easier to get, demand for a good might increase now. For example, a salesperson gets the news that she will receive a big bonus at the end of the year, so she goes into debt and buys a new car right now, rather than waiting until she receives the bonus.

Population Demand also depends on the size and the age structure of the population. The larger the population, the greater is the demand for all goods and services; the smaller the population, the smaller is the demand for all goods and services.

For example, the demand for parking spaces, running shoes, movies, or just about anything that you can imagine is much greater in the Greater Toronto Area (population 6 million) than it is in Thunder Bay, Ontario (population 146,000).

Also, the larger the proportion of the population in an age group, the greater is the demand for the goods and services used by that group. For example, in 2010, there were 2.3 million 20-to-24-year-olds in Canada compared with 2.1 million in 2000. As a result, the demand for university places in 2010 was greater than in 2000. During this period, the number of Canadians aged 90 years or more than doubled and the demand for nursing home services increased.

TABLE 3.1 The Demand for Energy Bars

The Law of Demand

The quantity of energy bars demanded

<i>Decreases if:</i>	<i>Increases if:</i>
■ The price of an energy bar rises	■ The price of an energy bar falls

Changes in Demand

The demand for energy bars

<i>Decreases if:</i>	<i>Increases if:</i>
<ul style="list-style-type: none"> ■ The price of a substitute falls ■ The price of a complement rises ■ The expected future price of an energy bar falls ■ Income falls* ■ Expected future income falls or credit becomes harder to get* ■ The population decreases 	<ul style="list-style-type: none"> ■ The price of a substitute rises ■ The price of a complement falls ■ The expected future price of an energy bar rises ■ Income rises* ■ Expected future income rises or credit becomes easier to get* ■ The population increases

*An energy bar is a normal good.

Preferences

Demand depends on preferences. *Preferences* determine the value that people place on each good and service. Preferences depend on such things as the weather, information, and fashion. For example, greater health and fitness awareness has shifted preferences in favour of energy bars, so the demand for energy bars has increased.

Table 3.1 summarizes the influences on demand and the direction of those influences.

A Change in the Quantity Demanded Versus a Change in Demand

Changes in the influences on buying plans bring either a change in the quantity demanded or a change in demand. Equivalently, they bring either a movement along the demand curve or a shift of the demand curve. The distinction between a change in

the quantity demanded and a change in demand is the same as that between a movement along the demand curve and a shift of the demand curve.

A point on the demand curve shows the quantity demanded at a given price, so a movement along the demand curve shows a **change in the quantity demanded**. The entire demand curve shows demand, so a shift of the demand curve shows a *change in demand*. Figure 3.3 illustrates these distinctions.

Movement Along the Demand Curve If the price of the good changes but no other influence on buying plans changes, we illustrate the effect as a movement along the demand curve.

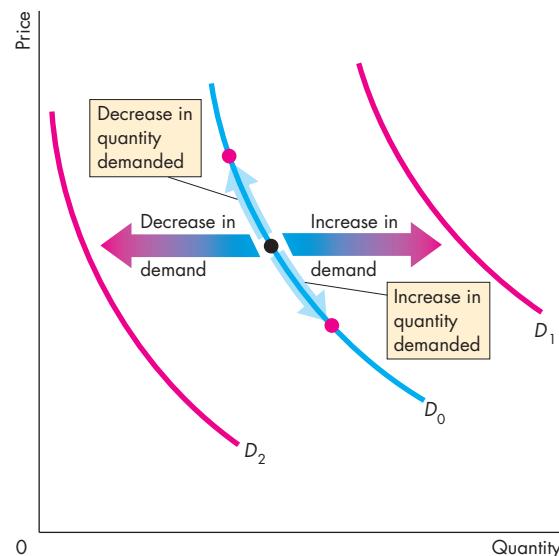
A fall in the price of a good increases the quantity demanded of it. In Fig. 3.3, we illustrate the effect of a fall in price as a movement down along the demand curve D_0 .

A rise in the price of a good decreases the quantity demanded of it. In Fig. 3.3, we illustrate the effect of a rise in price as a movement up along the demand curve D_0 .

A Shift of the Demand Curve If the price of a good remains constant but some other influence on buying plans changes, there is a change in demand for that good. We illustrate a change in demand as a shift of the demand curve. For example, if more people work out at the gym, consumers buy more energy bars regardless of the price of a bar. That is what a rightward shift of the demand curve shows—more energy bars are demanded at each price.

In Fig. 3.3, there is a *change in demand* and the demand curve shifts when any influence on buying plans changes, other than the price of the good. Demand *increases* and the demand curve *shifts rightward* (to the red demand curve D_1) if the price of a substitute rises, the price of a complement falls, the expected future price of the good rises, income increases (for a normal good), expected future income or credit increases, or the population increases. Demand *decreases* and the demand curve *shifts leftward* (to the red demand curve D_2) if the price of a substitute falls, the price of a complement rises, the expected future price of the good falls, income decreases (for a normal good), expected future income or credit decreases, or the population decreases. (For an inferior good, the effects of changes in income are in the opposite direction to those described above.)

FIGURE 3.3 A Change in the Quantity Demanded Versus a Change in Demand



When the price of the good changes, there is a movement along the demand curve and a *change in the quantity demanded*, shown by the blue arrows on demand curve D_0 . When any other influence on buying plans changes, there is a shift of the demand curve and a *change in demand*. An increase in demand shifts the demand curve rightward (from D_0 to D_1). A decrease in demand shifts the demand curve leftward (from D_0 to D_2).

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REVIEW QUIZ

- 1 Define the quantity demanded of a good or service.
- 2 What is the law of demand and how do we illustrate it?
- 3 What does the demand curve tell us about the price that consumers are willing to pay?
- 4 List all the influences on buying plans that change demand, and for each influence, say whether it increases or decreases demand.
- 5 Why does demand not change when the price of a good changes with no change in the other influences on buying plans?

Work these questions in Study Plan 3.2 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**



Supply

If a firm supplies a good or service, the firm:

1. Has the resources and technology to produce it.
2. Can profit from producing it.
3. Plans to produce it and sell it.

A supply is more than just having the *resources* and the *technology* to produce something. *Resources and technology* are the constraints that limit what is possible.

Many useful things can be produced, but they are not produced unless it is profitable to do so. Supply reflects a decision about which technologically feasible items to produce.

The **quantity supplied** of a good or service is the amount that producers plan to sell during a given time period at a particular price. The quantity supplied is not necessarily the same amount as the quantity actually sold. Sometimes the quantity supplied is greater than the quantity demanded, so the quantity sold is less than the quantity supplied.

Like the quantity demanded, the quantity supplied is measured as an amount per unit of time. For example, suppose that GM produces 1,000 cars a day. The quantity of cars supplied by GM can be expressed as 1,000 a day, 7,000 a week, or 365,000 a year. Without the time dimension, we cannot tell whether a particular quantity is large or small.

Many factors influence selling plans, and again one of them is the price of the good. We look first at the relationship between the quantity supplied of a good and its price. Just as we did when we studied demand, to isolate the relationship between the quantity supplied of a good and its price, we keep all other influences on selling plans the same and ask: How does the quantity supplied of a good change as its price changes when other things remain the same?

The law of supply provides the answer.

The Law of Supply

The **law of supply** states:

Other things remaining the same, the higher the price of a good, the greater is the quantity supplied; and the lower the price of a good, the smaller is the quantity supplied.

Why does a higher price increase the quantity supplied? It is because *marginal cost increases*. As the quantity produced of any good increases, the marginal cost of producing the good increases. (See Chapter 2, p. 35 to review marginal cost.)

It is never worth producing a good if the price received for the good does not at least cover the marginal cost of producing it. When the price of a good rises, other things remaining the same, producers are willing to incur a higher marginal cost, so they increase production. The higher price brings forth an increase in the quantity supplied.

Let's now illustrate the law of supply with a supply curve and a supply schedule.

Supply Curve and Supply Schedule

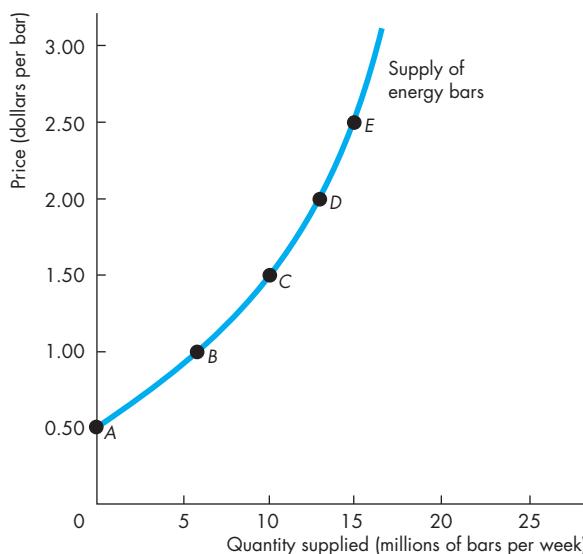
You are now going to study the second of the two most used curves in economics: the supply curve. You're also going to learn about the critical distinction between *supply* and *quantity supplied*.

The term **supply** refers to the entire relationship between the price of a good and the quantity supplied of it. Supply is illustrated by the supply curve and the supply schedule. The term *quantity supplied* refers to a point on a supply curve—the quantity supplied at a particular price.

Figure 3.4 shows the supply curve of energy bars. A **supply curve** shows the relationship between the quantity supplied of a good and its price when all other influences on producers' planned sales remain the same. The supply curve is a graph of a supply schedule.

The table in Fig. 3.4 sets out the supply schedule for energy bars. A *supply schedule* lists the quantities supplied at each price when all the other influences on producers' planned sales remain the same. For example, if the price of an energy bar is 50¢, the quantity supplied is zero—in row A of the table. If the price of an energy bar is \$1.00, the quantity supplied is 6 million energy bars a week—in row B. The other rows of the table show the quantities supplied at prices of \$1.50, \$2.00, and \$2.50.

To make a supply curve, we graph the quantity supplied on the *x*-axis and the price on the *y*-axis. The points on the supply curve labelled A through E correspond to the rows of the supply schedule. For example, point A on the graph shows a quantity supplied of zero at a price of 50¢ an energy bar. Point E shows a quantity supplied of 15 million bars at \$2.50 an energy bar.

FIGURE 3.4 The Supply Curve

	Price (dollars per bar)	Quantity supplied (millions of bars per week)
A	0.50	0
B	1.00	6
C	1.50	10
D	2.00	13
E	2.50	15

The table shows the supply schedule of energy bars. For example, at a price of \$1.00, 6 million bars a week are supplied; at a price of \$2.50, 15 million bars a week are supplied. The supply curve shows the relationship between the quantity supplied and the price, other things remaining the same. The supply curve slopes upward: As the price of a good increases, the quantity supplied increases.

A supply curve can be read in two ways. For a given price, the supply curve tells us the quantity that producers plan to sell at that price. For example, at a price of \$1.50 a bar, producers are planning to sell 10 million bars a week. For a given quantity, the supply curve tells us the minimum price at which producers are willing to sell one more bar. For example, if 15 million bars are produced each week, the lowest price at which a producer is willing to sell the 15 millionth bar is \$2.50.

Minimum Supply Price The supply curve can be interpreted as a minimum-supply-price curve—a curve that shows the lowest price at which someone is willing to sell. This lowest price is the *marginal cost*.

If a small quantity is produced, the lowest price at which someone is willing to sell one more unit is low. But as the quantity produced increases, the marginal cost of each additional unit rises, so the lowest price at which someone is willing to sell an additional unit rises along the supply curve.

In Fig. 3.4, if 15 million bars are produced each week, the lowest price at which someone is willing to sell the 15 millionth bar is \$2.50. But if 10 million bars are produced each week, someone is willing to accept \$1.50 for the last bar produced.

A Change in Supply

When any factor that influences selling plans other than the price of the good changes, there is a **change in supply**. Six main factors bring changes in supply. They are changes in:

- The prices of factors of production
- The prices of related goods produced
- Expected future prices
- The number of suppliers
- Technology
- The state of nature

Prices of Factors of Production The prices of the factors of production used to produce a good influence its supply. To see this influence, think about the supply curve as a minimum-supply-price curve. If the price of a factor of production rises, the lowest price that a producer is willing to accept for that good rises, so supply decreases. For example, during 2008, as the price of jet fuel increased, the supply of air travel decreased. Similarly, a rise in the minimum wage decreases the supply of hamburgers.

Prices of Related Goods Produced The prices of related goods that firms produce influence supply. For example, if the price of an energy drink rises, firms switch production from bars to drinks. The supply of energy bars decreases. Energy bars and energy drinks are *substitutes in production*—goods that can be produced by using the same resources. If the price of beef rises, the supply of cowhide increases. Beef and cowhide are *complements in production*—goods that must be produced together.

Expected Future Prices If the expected future price of a good rises, the return from selling the good in the future increases and is higher than it is today. So supply decreases today and increases in the future.

The Number of Suppliers The larger the number of firms that produce a good, the greater is the supply of the good. As new firms enter an industry, the supply in that industry increases. As firms leave an industry, the supply in that industry decreases.

Technology The term “technology” is used broadly to mean the way that factors of production are used to produce a good. A technology change occurs when a new method is discovered that lowers the cost of producing a good. For example, new methods used in the factories that produce computer chips have lowered the cost and increased the supply of chips.

The State of Nature The state of nature includes all the natural forces that influence production. It includes the state of the weather and, more broadly, the natural environment. Good weather can increase the supply of many agricultural products and bad weather can decrease their supply. Extreme natural events such as earthquakes, tornadoes, and hurricanes can also influence supply.

Figure 3.5 illustrates an increase in supply. When supply increases, the supply curve shifts rightward and the quantity supplied at each price is larger. For example, at \$1.00 per bar, on the original (blue) supply curve, the quantity supplied is 6 million bars a week. On the new (red) supply curve, the quantity supplied is 15 million bars a week. Look closely at the numbers in the table in Fig. 3.5 and check that the quantity supplied is larger at each price.

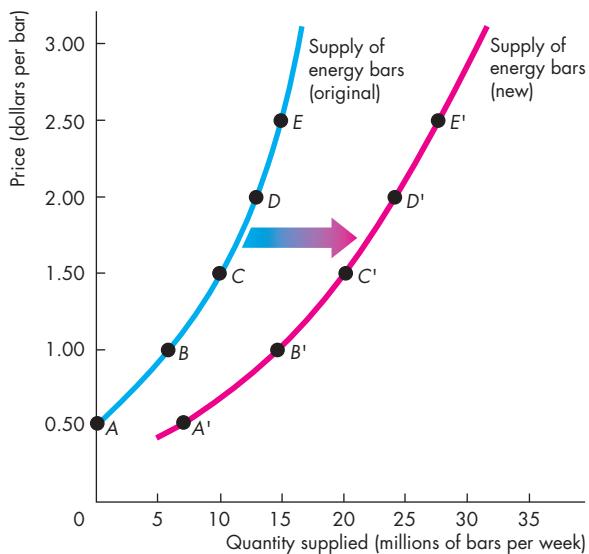
Table 3.2 summarizes the influences on supply and the directions of those influences.

A Change in the Quantity Supplied Versus a Change in Supply

Changes in the influences on selling plans bring either a change in the quantity supplied or a change in supply. Equivalently, they bring either a movement along the supply curve or a shift of the supply curve.

A point on the supply curve shows the quantity supplied at a given price. A movement along the supply curve shows a **change in the quantity supplied**. The entire supply curve shows supply. A shift of the supply curve shows a *change in supply*.

FIGURE 3.5 An Increase in Supply



Original supply schedule Old technology		New supply schedule New technology			
Price (dollars per bar)	Quantity supplied (millions of bars per week)		Price (dollars per bar)	Quantity supplied (millions of bars per week)	
A	0.50	0	A'	0.50	7
B	1.00	6	B'	1.00	15
C	1.50	10	C'	1.50	20
D	2.00	13	D'	2.00	25
E	2.50	15	E'	2.50	27

A change in any influence on selling plans other than the price of the good itself results in a new supply schedule and a shift of the supply curve. For example, a new, cost-saving technology for producing energy bars changes the supply of energy bars. At a price of \$1.50 a bar, 10 million bars a week are supplied when producers use the old technology (row C of the table) and 20 million energy bars a week are supplied when producers use the new technology (row C'). An advance in technology *increases* the supply of energy bars. The supply curve shifts *rightward*, as shown by the shift arrow and the resulting red curve.

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Figure 3.6 illustrates and summarizes these distinctions. If the price of the good changes and other things remain the same, there is a *change in the quantity supplied* of that good. If the price of the good falls, the quantity supplied decreases and there is a movement down along the supply curve S_0 . If the price of the good rises, the quantity supplied increases and there is a movement up along the supply curve S_0 . When any other influence on selling plans changes, the supply curve shifts and there is a *change in supply*. If supply increases, the supply curve shifts rightward to S_1 . If supply decreases, the supply curve shifts leftward to S_2 .

TABLE 3.2 The Supply of Energy Bars

The Law of Supply

The quantity of energy bars supplied

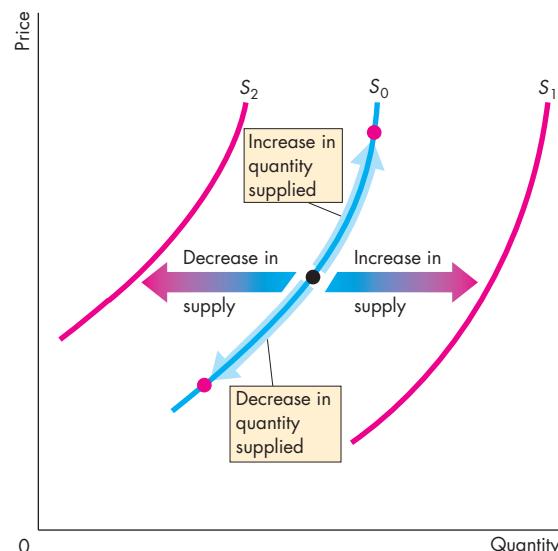
Decreases if:	Increases if:
■ The price of an energy bar falls	■ The price of an energy bar rises

Changes in Supply

The supply of energy bars

Decreases if:	Increases if:
<ul style="list-style-type: none"> ■ The price of a factor of production used to produce energy bars rises ■ The price of a substitute in production rises ■ The price of a complement in production falls ■ The expected future price of an energy bar rises ■ The number of suppliers of bars decreases ■ A technology change decreases energy bar production ■ A natural event decreases energy bar production 	<ul style="list-style-type: none"> ■ The price of a factor of production used to produce energy bars falls ■ The price of a substitute in production falls ■ The price of a complement in production rises ■ The expected future price of an energy bar falls ■ The number of suppliers of bars increases ■ A technology change increases energy bar production ■ A natural event increases energy bar production

FIGURE 3.6 A Change in the Quantity Supplied Versus a Change in Supply



When the price of the good changes, there is a movement along the supply curve and a *change in the quantity supplied*, shown by the blue arrows on supply curve S_0 . When any other influence on selling plans changes, there is a shift of the supply curve and a *change in supply*. An increase in supply shifts the supply curve rightward (from S_0 to S_1), and a decrease in supply shifts the supply curve leftward (from S_0 to S_2).

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REVIEW QUIZ

- 1 Define the quantity supplied of a good or service.
- 2 What is the law of supply and how do we illustrate it?
- 3 What does the supply curve tell us about the producer's minimum supply price?
- 4 List all the influences on selling plans, and for each influence, say whether it changes supply.
- 5 What happens to the quantity of cellphones supplied and the supply of cellphones if the price of a cellphone falls?

Work these questions in Study Plan 3.3 and get instant feedback. Do a Key Terms Quiz.

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Now we're going to combine demand and supply and see how prices and quantities are determined.

Market Equilibrium

We have seen that when the price of a good rises, the quantity demanded *decreases* and the quantity supplied *increases*. We are now going to see how the price adjusts to coordinate buying plans and selling plans and achieve an equilibrium in the market.

An *equilibrium* is a situation in which opposing forces balance each other. Equilibrium in a market occurs when the price balances buying plans and selling plans. The **equilibrium price** is the price at which the quantity demanded equals the quantity supplied. The **equilibrium quantity** is the quantity bought and sold at the equilibrium price. A market moves toward its equilibrium because

- Price regulates buying and selling plans.
- Price adjusts when plans don't match.

Price as a Regulator

The price of a good regulates the quantities demanded and supplied. If the price is too high, the quantity supplied exceeds the quantity demanded. If the price is too low, the quantity demanded exceeds the quantity supplied. There is one price at which the quantity demanded equals the quantity supplied. Let's work out what that price is.

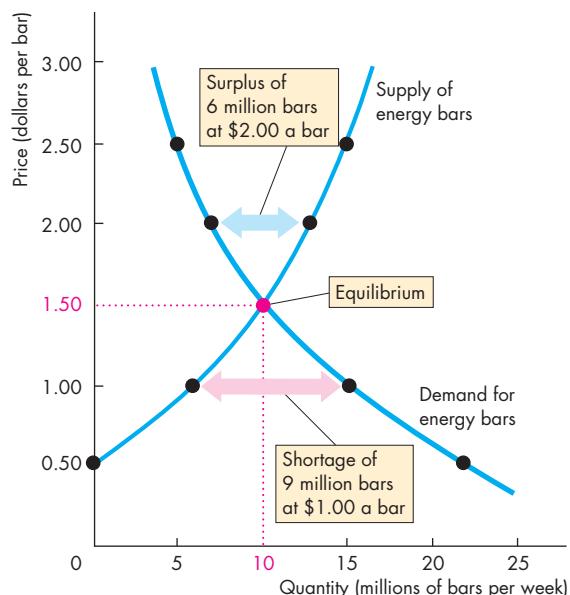
Figure 3.7 shows the market for energy bars. The table shows the demand schedule (from Fig. 3.1) and the supply schedule (from Fig. 3.4). If the price is 50¢ a bar, the quantity demanded is 22 million bars a week but no bars are supplied. There is a shortage of 22 million bars a week. The final column of the table shows this shortage. At a price of \$1.00 a bar, there is still a shortage but only of 9 million bars a week.

If the price is \$2.50 a bar, the quantity supplied is 15 million bars a week but the quantity demanded is only 5 million. There is a surplus of 10 million bars a week.

The one price at which there is neither a shortage nor a surplus is \$1.50 a bar. At that price, the quantity demanded equals the quantity supplied: 10 million bars a week. The equilibrium price is \$1.50 a bar, and the equilibrium quantity is 10 million bars a week.

Figure 3.7 shows that the demand curve and the supply curve intersect at the equilibrium price of \$1.50 a bar. At each price *above* \$1.50 a bar, there is a surplus of bars. For example, at \$2.00 a bar, the surplus is

FIGURE 3.7 Equilibrium



Price (dollars per bar)	Quantity demanded	Quantity supplied	Shortage (-) or surplus (+)
	(millions of bars per week)		
0.50	22	0	-22
1.00	15	6	-9
1.50	10	10	0
2.00	7	13	+6
2.50	5	15	+10

The table lists the quantity demanded and the quantity supplied as well as the shortage or surplus of bars at each price. If the price is \$1.00 a bar, 15 million bars a week are demanded and 6 million bars are supplied. There is a shortage of 9 million bars a week, and the price rises.

If the price is \$2.00 a bar, 7 million bars a week are demanded and 13 million bars are supplied. There is a surplus of 6 million bars a week, and the price falls.

If the price is \$1.50 a bar, 10 million bars a week are demanded and 10 million bars are supplied. There is neither a shortage nor a surplus, and the price does not change. The price at which the quantity demanded equals the quantity supplied is the equilibrium price, and 10 million bars a week is the equilibrium quantity.

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6 million bars a week, as shown by the blue arrow. At each price *below* \$1.50 a bar, there is a shortage of bars. For example, at \$1.00 a bar, the shortage is 9 million bars a week, as shown by the red arrow.

Price Adjustments

You've seen that if the price is below equilibrium there is a shortage, and that if the price is above equilibrium there is a surplus. But can we count on the price to change and eliminate a shortage or a surplus? We can, because such price changes are beneficial to both buyers and sellers. Let's see why the price changes when there is a shortage or a surplus.

A Shortage Forces the Price Up Suppose the price of an energy bar is \$1. Consumers plan to buy 15 million bars a week, and producers plan to sell 6 million bars a week. Consumers can't force producers to sell more than they plan, so the quantity that is actually offered for sale is 6 million bars a week. In this situation, powerful forces operate to increase the price and move it toward the equilibrium price. Some producers, noticing lines of unsatisfied consumers, raise the price. Some producers increase their output. As producers push the price up, the price rises toward its equilibrium. The rising price reduces the shortage because it decreases the quantity demanded and increases the quantity supplied. When the price has increased to the point at which there is no longer a shortage, the forces moving the price stop operating and the price comes to rest at its equilibrium.

A Surplus Forces the Price Down Suppose the price of a bar is \$2. Producers plan to sell 13 million bars a week, and consumers plan to buy 7 million bars a week. Producers cannot force consumers to buy more than they plan, so the quantity that is actually bought is 7 million bars a week. In this situation, powerful forces operate to lower the price and move it toward the equilibrium price. Some producers, unable to sell the quantities of energy bars they planned to sell, cut their prices. In addition, some producers scale back production. As producers cut the price, the price falls toward its equilibrium. The falling price decreases the surplus because it increases the quantity demanded and decreases the quantity supplied. When the price has fallen to the point at which there is no longer a surplus, the forces moving the price stop operating and the price comes to rest at its equilibrium.

The Best Deal Available for Buyers and Sellers

When the price is below equilibrium, it is forced upward. Why don't buyers resist the increase and refuse to buy at the higher price? The answer is because they value the good more highly than its current price and they can't satisfy their demand at the current price. In some markets—for example, the markets that operate on eBay—the buyers might even be the ones who force the price up by offering to pay a higher price.

When the price is above equilibrium, it is bid downward. Why don't sellers resist this decrease and refuse to sell at the lower price? The answer is because their minimum supply price is below the current price and they cannot sell all they would like to at the current price. Sellers willingly lower the price to gain market share.

At the price at which the quantity demanded and the quantity supplied are equal, neither buyers nor sellers can do business at a better price. Buyers pay the highest price they are willing to pay for the last unit bought, and sellers receive the lowest price at which they are willing to supply the last unit sold.

When people freely make offers to buy and sell and when demanders try to buy at the lowest possible price and suppliers try to sell at the highest possible price, the price at which trade takes place is the equilibrium price—the price at which the quantity demanded equals the quantity supplied. The price coordinates the plans of buyers and sellers, and no one has an incentive to change it.

REVIEW QUIZ

- 1 What is the equilibrium price of a good or service?
- 2 Over what range of prices does a shortage arise? What happens to the price when there is a shortage?
- 3 Over what range of prices does a surplus arise? What happens to the price when there is a surplus?
- 4 Why is the price at which the quantity demanded equals the quantity supplied the equilibrium price?
- 5 Why is the equilibrium price the best deal available for both buyers and sellers?

Work these questions in Study Plan 3.4 and get instant feedback. Do a Key Terms Quiz.

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Predicting Changes in Price and Quantity

The demand and supply model that we have just studied provides us with a powerful way of analyzing influences on prices and the quantities bought and sold. According to the model, a change in price stems from a change in demand, a change in supply, or a change in both demand and supply. Let's look first at the effects of a change in demand.

An Increase in Demand

If more people join health clubs, the demand for energy bars increases. The table in Fig. 3.8 shows the original and new demand schedules for energy bars as well as the supply schedule of energy bars.

The increase in demand creates a shortage at the original price, and to eliminate the shortage the price must rise.

Figure 3.8 shows what happens. The figure shows the original demand for and supply of energy bars. The original equilibrium price is \$1.50 an energy bar, and the equilibrium quantity is 10 million energy bars a week. When demand increases, the demand curve shifts rightward. The equilibrium price rises to \$2.50 an energy bar, and the quantity supplied increases to 15 million energy bars a week, as highlighted in the figure. There is an *increase in the quantity supplied* but *no change in supply*—a movement along, but no shift of, the supply curve.

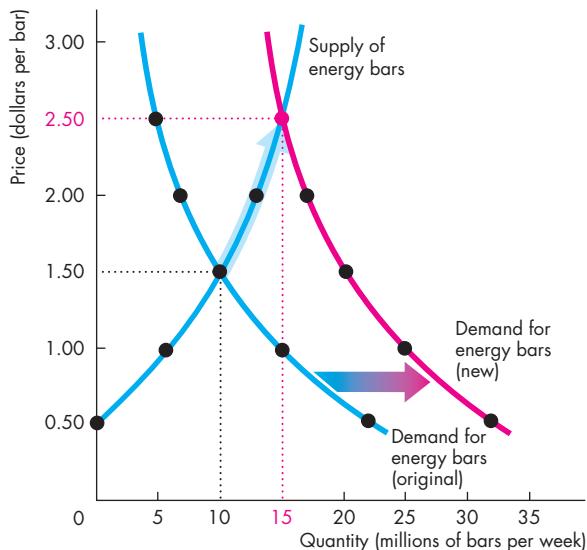
A Decrease in Demand

We can reverse this change in demand. Start at a price of \$2.50 a bar with 15 million energy bars a week being bought and sold, and then work out what happens if demand decreases to its original level. Such a decrease in demand might arise if people switch to energy drinks (a substitute for energy bars). The decrease in demand shifts the demand curve leftward. The equilibrium price falls to \$1.50 a bar, the quantity supplied decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make our first two predictions:

- When demand increases, the price rises and the quantity increases.
- When demand decreases, the price falls and the quantity decreases.

FIGURE 3.8 The Effects of a Change in Demand



Price (dollars per bar)	Quantity demanded (millions of bars per week)		Quantity supplied (millions of bars per week)
	Original	New	
0.50	22	32	0
1.00	15	25	6
1.50	10	20	10
2.00	7	17	13
2.50	5	15	15

Initially, the demand for energy bars is the blue demand curve. The equilibrium price is \$1.50 a bar, and the equilibrium quantity is 10 million bars a week. When more health-conscious people do more exercise, the demand for energy bars increases and the demand curve shifts rightward to become the red curve.

At \$1.50 a bar, there is now a shortage of 10 million bars a week. The price of a bar rises to a new equilibrium of \$2.50. As the price rises to \$2.50, the quantity supplied increases—shown by the blue arrow on the supply curve—to the new equilibrium quantity of 15 million bars a week. Following an increase in demand, the quantity supplied increases but supply does not change—the supply curve does not shift.

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ECONOMICS IN THE NEWS

The Markets for Chocolate and Cocoa

World's Sweet Tooth Heats Up Cocoa

With rising incomes in China and other fast-growing economies, the consumption of chocolate and the cocoa from which it is made is soaring. And the price of cocoa is soaring too.

Source: *The Wall Street Journal*, February 3, 2014

THE DATA

Year	Quantity of Cocoa (millions of tonnes per year)	Price (dollars per tonne)
2010	4	1,500
2014	5	3,000

THE QUESTIONS

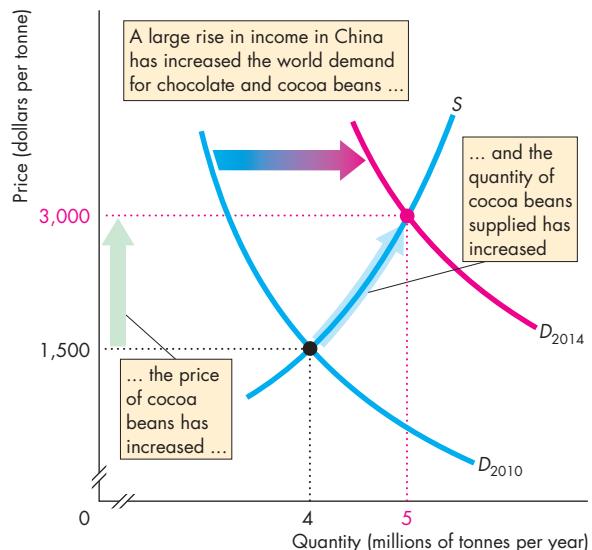
- What does the data table tell us?
- Why did the price of cocoa increase? Is it because demand changed or supply changed, and in which direction?

THE ANSWERS

- The data table tells us that from 2010 to 2014, both the quantity of cocoa produced and the price of cocoa increased.
- An increase in demand brings an increase in the quantity and a rise in the price.
- An increase in supply brings an increase in the quantity and a fall in the price.
- Because both the quantity of cocoa and the price of cocoa increased, there must have been an increase in the demand for cocoa.
- The demand for cocoa increases if cocoa is a normal good and incomes increase.
- Cocoa is a normal good and the news clip says that incomes are rising fast in China and some other countries. These increases in income have brought an increase in the demand for cocoa.
- The figure illustrates the market for cocoa in 2010 and 2014. The supply curve S shows the supply of cocoa.
- In 2010, the demand curve was D_{2010} , the price was \$1,500 per tonne, and the quantity of cocoa traded was 4 million tonnes.



- By 2014, the higher incomes in China and other countries had increased the demand for cocoa to D_{2014} . The price rose to \$3,000 per tonne and the quantity traded increased to 5 million tonnes.
- The higher price brought an increase in the quantity of cocoa supplied, which is shown by the movement upward along the supply curve.



The Market for Cocoa Beans

An Increase in Supply

When Nestlé (the producer of PowerBar) and other energy bar producers switch to a new cost-saving technology, the supply of energy bars increases. Figure 3.9 shows the new supply schedule (the same one that was shown in Fig. 3.5). What are the new equilibrium price and quantity? The price falls to \$1.00 a bar, and the quantity increases to 15 million bars a week. You can see why by looking at the quantities demanded and supplied at the old price of \$1.50 a bar. The new quantity supplied at that price is 20 million bars a week, and there is a surplus. The price falls. Only when the price is \$1.00 a bar does the quantity supplied equal the quantity demanded.

Figure 3.9 illustrates the effect of an increase in supply. It shows the demand curve for energy bars and the original and new supply curves. The initial equilibrium price is \$1.50 a bar, and the equilibrium quantity is 10 million bars a week. When supply increases, the supply curve shifts rightward. The equilibrium price falls to \$1.00 a bar, and the quantity demanded increases to 15 million bars a week, highlighted in the figure. There is an *increase in the quantity demanded but no change in demand*—a movement along, but no shift of, the demand curve.

A Decrease in Supply

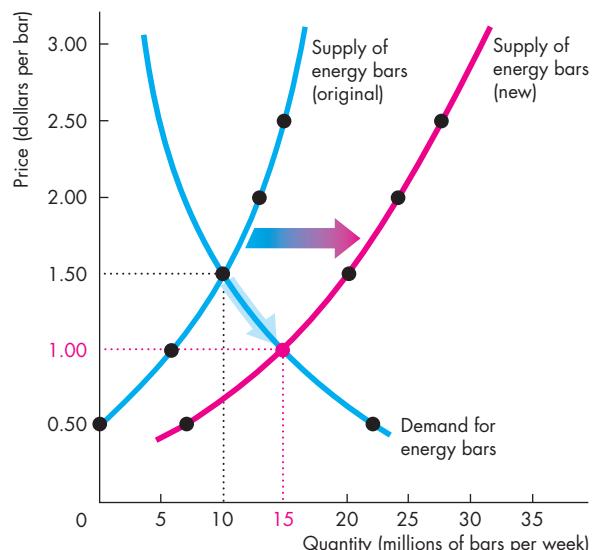
Start out at a price of \$1.00 a bar with 15 million bars a week being bought and sold. Then suppose that the cost of labour or raw materials rises and the supply of energy bars decreases. The decrease in supply shifts the supply curve leftward. The equilibrium price rises to \$1.50 a bar, the quantity demanded decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make two more predictions:

1. When supply increases, the price falls and the quantity increases.
2. When supply decreases, the price rises and the quantity decreases.

You've now seen what happens to the price and the quantity when either demand or supply changes while the other one remains unchanged. In real markets, both demand and supply can change together. When this happens, to predict the changes in price and quantity, we must combine the effects that you've just seen. That is your final task in this chapter.

FIGURE 3.9 The Effects of a Change in Supply



Price (dollars per bar)	Quantity demanded (millions of bars per week)	Quantity supplied (millions of bars per week)	
		Original	New
0.50	22	0	7
1.00	15	6	15
1.50	10	10	20
2.00	7	13	25
2.50	5	15	27

Initially, the supply of energy bars is shown by the blue supply curve. The equilibrium price is \$1.50 a bar, and the equilibrium quantity is 10 million bars a week. When the new cost-saving technology is adopted, the supply of energy bars increases and the supply curve shifts rightward to become the red curve.

At \$1.50 a bar, there is now a surplus of 10 million bars a week. The price of an energy bar falls to a new equilibrium of \$1.00 a bar. As the price falls to \$1.00, the quantity demanded increases—shown by the blue arrow on the demand curve—to the new equilibrium quantity of 15 million bars a week. Following an increase in supply, the quantity demanded increases but demand does not change—the demand curve does not shift.

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ECONOMICS IN THE NEWS

The Market for Coffee

Coffee Price Slides

With plentiful crops in Brazil and a recovery in Colombian production, the price of arabica beans has fallen.

Source: *The Financial Times*, October 24, 2013

THE DATA

Year	Quantity (millions of tonnes per year)	Price (dollars per kilogram)
2013	134	12.00
2014	145	10.00

THE QUESTIONS

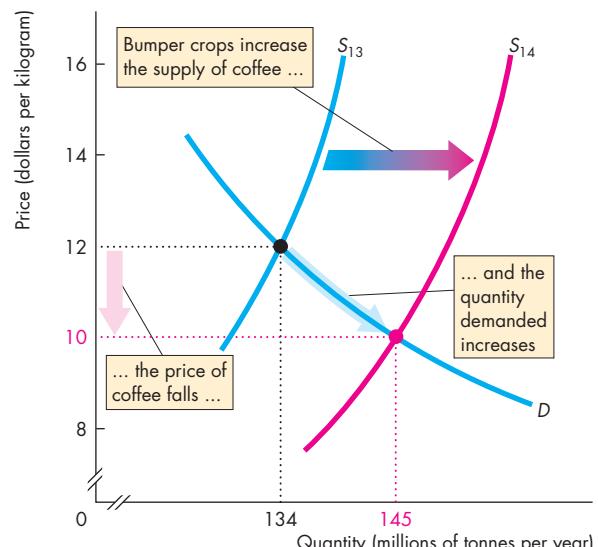
- What does the data table tell us?
- Why did the price of coffee decrease? Is it because demand changed or supply changed, and in which direction?

THE ANSWERS

- The data table tells us that during 2014, the quantity of coffee produced increased and the average price of coffee fell.
- An increase in demand brings an increase in the quantity and a rise in the price.
- An increase in supply brings an increase in the quantity and a fall in the price.
- Because the quantity of coffee increased and the price fell, there must have been an increase in the supply of coffee.
- The supply of coffee increases if the crop yields increase or if producers increase their plantings.
- The news clip says Brazilian crop was plentiful and Colombian production recovered. These increases in production brought an increase in the supply of coffee.
- The figure illustrates the market for coffee in 2013 and 2014. The demand curve D shows the demand for coffee.
- In 2013, the supply curve was S_{13} , the average price was \$12.00 per kilogram, and the quantity of coffee traded was 134 million tonnes.
- In 2014, the increased coffee production in Brazil and Colombia increased the supply of coffee to S_{14} .



- The average price fell to \$10.00 per kilogram and the quantity traded increased to 145 million tonnes.
- The lower price brought an increase in the quantity of coffee demanded, which is shown by the movement along the demand curve.



The Market for Coffee in 2013–2014

Changes in Both Demand and Supply

You now know how a change in demand or a change in supply changes the equilibrium price and quantity. But sometimes, events occur that change both demand and supply. When both demand and supply change, we find the resulting change in the equilibrium price and equilibrium quantity by combining the separate cases you've just studied.

Four cases need to be considered. Both demand and supply might increase or decrease, and demand or supply might increase and the other decrease.

Both Demand and Supply Change in the Same Direction

When demand and supply change in the same direction, the equilibrium quantity changes in that same direction, but to predict whether the price rises or falls, we need to know the magnitudes of the changes in demand and supply.

If demand increases by more than supply increases, the price rises. But if supply increases by more than demand increases, the price falls.

Figure 3.10(a) shows the case when both demand and supply increase and by the same amount. The

equilibrium quantity increases. But because the increase in demand equals the increase in supply, neither a shortage nor a surplus arises so the price doesn't change. A bigger increase in demand would have created a shortage and a rise in the price; a bigger increase in supply would have created a surplus and a fall in the price.

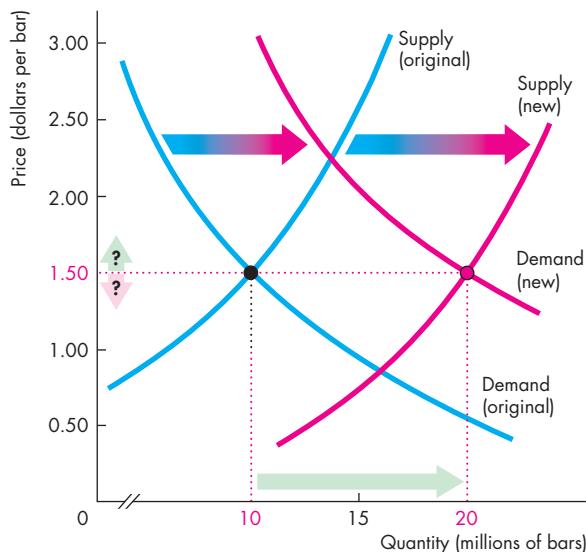
Figure 3.10(b) shows the case when both demand and supply decrease by the same amount. Here the equilibrium quantity decreases and again the price might either rise or fall.

Both Demand and Supply Change in Opposite Directions

When demand and supply change in opposite directions, we can predict how the price changes, but we need to know the magnitudes of the changes in demand and supply to say whether the equilibrium quantity increases or decreases.

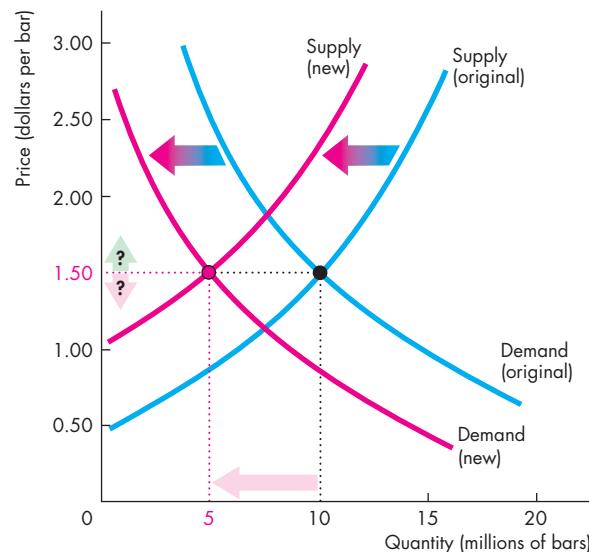
If demand changes by more than supply, the equilibrium quantity changes in the same direction as the change in demand. But if supply changes by more than demand, the equilibrium quantity changes in the same direction as the change in supply.

FIGURE 3.10 The Effects of Changes in Both Demand and Supply in the Same Direction



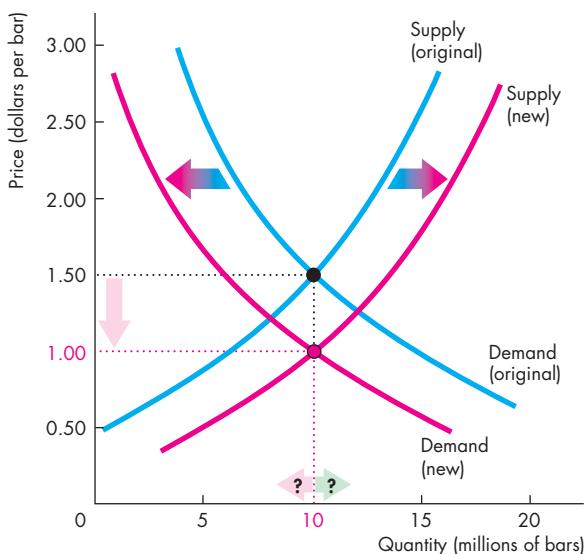
(a) Increase in both demand and supply

An increase in demand shifts the demand curve rightward to become the red new demand curve and an increase in supply shifts the supply curve rightward to become the red new supply curve. The price might rise or fall, but the quantity increases.

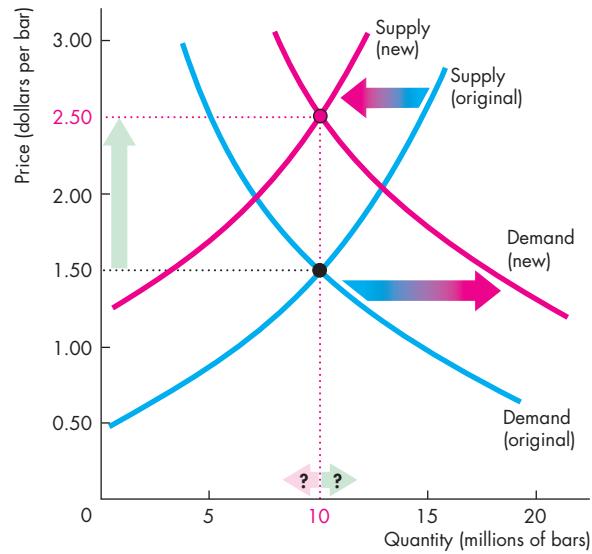


(b) Decrease in both demand and supply

A decrease in demand shifts the demand curve leftward to become the red new demand curve and a decrease in supply shifts the supply curve leftward to become the red new supply curve. The price might rise or fall, but the quantity decreases.

FIGURE 3.11 The Effects of Changes in Both Demand and Supply in Opposite Directions**(a) Decrease in demand; increase in supply**

A decrease in demand shifts the demand curve leftward to become the red new demand curve and an increase in supply shifts the supply curve rightward to become the red new supply curve. The price falls, but the quantity might increase or decrease.

**(b) Increase in demand; decrease in supply**

An increase in demand shifts the demand curve rightward to become the red new demand curve and a decrease in supply shifts the supply curve leftward to become the red new supply curve. The price rises, but the quantity might increase or decrease.

[MyEconLab Animation](#)

Figure 3.11(a) illustrates what happens when demand decreases and supply increases by the *same* amount. At the initial price, there is a surplus, so the price falls. A decrease in demand decreases the quantity and an increase in supply increases the quantity, so when these changes occur together, we can't say what happens to the quantity unless we know the magnitudes of the changes.

Figure 3.11(b) illustrates what happens when demand increases and supply decreases by the same amount. In this case, at the initial price, there is a shortage, so the price rises. An increase in demand increases the quantity and a decrease in supply decreases the quantity, so again, when these changes occur together, we can't say what happens to the quantity unless we know the magnitudes of the changes in demand and supply.

For all the cases in Figures 3.10 and 3.11 where you "can't say" what happens to price or quantity, draw some examples that go in each direction.

REVIEW QUIZ

What is the effect on the price and quantity of MP3 players (such as the iPod) if:

- 1 The price of a PC falls or the price of an MP3 download rises? (Draw the diagrams!)
- 2 More firms produce MP3 players or electronics workers' wages rise? (Draw the diagrams!)
- 3 Any two of the events in questions 1 and 2 occur together? (Draw the diagrams!)

Work these questions in Study Plan 3.5 and get instant feedback.

[MyEconLab](#)

◆ To complete your study of demand and supply, take a look at *Economics in the News* on pp. 74–75, which explains what would happen to the price of bananas if a disease that kills plants were to jump continents to Central America. Try to get into the habit of using the demand and supply model to understand the changes in prices in your everyday life.

Demand and Supply: The Market for Bananas

Banana Supply Seen at Risk as Disease Spreads

Bloomberg News

April 9, 2014

A disease damaging banana crops in Southeast Asia has spread to the Middle East and Africa, posing risks to world supply and trade totaling \$8.9 billion, according to the United Nations' Food and Agriculture Organization.

The TR4 strain of Panama disease, a soil-born fungus that attacks plant roots, is deadly for the Cavendish banana that makes up about 95 percent of supplies to importers, including North America and Europe, Fazil Dusunceli, an agriculture officer at the FAO, said. ...

While the disease hasn't reached top Latin America exporters such as Ecuador, Costa Rica or Colombia, TR4 was discovered in Jordan and Mozambique, indicating it moved beyond Asia, he said.

"The export market is dominated by the Cavendish, and it is unfortunately susceptible to this particular race of the disease," Dusunceli said. "This is serious for the medium term, but at the same time we should avoid panicking too."

Global exports reached a record value in 2011 and totaled 18.7 million tonnes, making bananas the world's most widely-traded fruit, according to the most recent FAO data. The U.S. is the top importer, followed by Belgium, the data show. Belgium's Port of Antwerp is the world's largest banana port, it says.

Consumer prices for bananas were 131.8 cents a kilogram in February, 2.2 percent higher than an almost three-year low reached in October at 128.9 cents a kilogram, according to data from the Bureau of Labor Statistics. The export price of bananas from Ecuador, the world's biggest shipper, and Central America for North American destinations was \$966.85 a tonne in March, the highest in 18 months, according to the International Monetary Fund. ...

Written by Whitney McFerron. Copyright © 2014. Used by permission of Bloomberg News. All rights reserved.

ESSENCE OF THE STORY

- The consumer price of bananas was 131.8 cents per kilogram in February 2014.
- About 95 percent of bananas traded are a variety called Cavendish.
- Cavendish banana plants can be destroyed by the TR4 strain of Panama disease.
- TR4 hasn't reached Latin America, but it has jumped from Asia to the Middle East and Africa.
- Fazil Dusunceli of the United Nations' Food and Agriculture Organization says "This is serious for the medium term, but at the same time we should avoid panicking too."

ECONOMIC ANALYSIS

- In the market for bananas, a decrease in world production would decrease supply.
- A decrease in the supply of bananas would raise their price, decrease the equilibrium quantity, and decrease the quantity of bananas demanded.
- We can see the likely price increase by looking at previous events in the banana market.
- Figure 1 shows the price of bananas since 2004. You can see that there was a big temporary jump in the price in 2008.
- That jump in price was *not* caused by a decrease in banana production because as Fig. 2 shows, banana production has increased every year since 2004 except for 2012.
- What happened in 2008? The answer is a spike in the price of oil.
- Transporting bananas from plantations in Central and South America to your neighbourhood grocery store uses a lot of fuel. So when the cost of fuel increased in 2008, the cost of delivering bananas increased, and the consumer price of bananas increased.
- A decrease in supply caused by the TR4 disease would have a similar effect on the banana market to what happened in 2008.
- Figure 3 illustrates this effect. The supply of bananas decreases from S_N (normal) to S_D (disease), the price rises, the equilibrium quantity decreases, and the quantity of bananas demanded decreases.

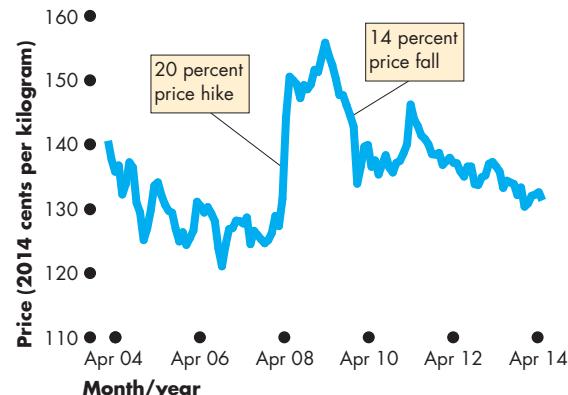


Figure 1 The Price of Bananas: 2004–2014

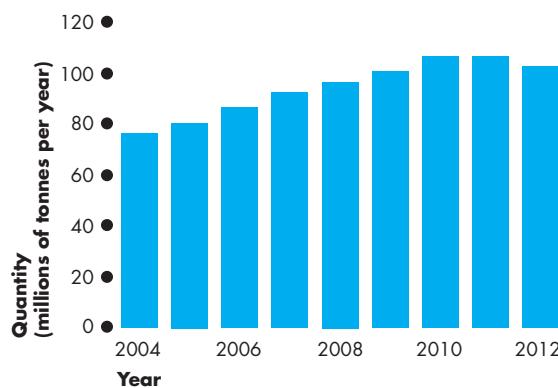


Figure 2 Banana Production: 2004–2012

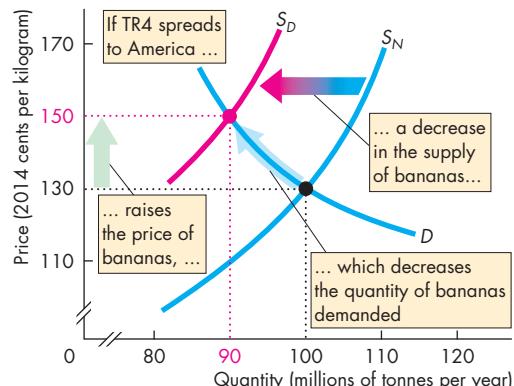


Figure 3 The Market for Bananas

MATHEMATICAL NOTE

Demand, Supply, and Equilibrium

Demand Curve

The law of demand says that as the price of a good or service falls, the quantity demanded of that good or service increases. We can illustrate the law of demand by drawing a graph of the demand curve or writing down an equation. When the demand curve is a straight line, the following equation describes it:

$$P = a - bQ_D,$$

where P is the price and Q_D is the quantity demanded. The a and b are positive constants.

The demand equation tells us three things:

1. The price at which no one is willing to buy the good (Q_D is zero). That is, if the price is a , then the quantity demanded is zero. You can see the price a in Fig. 1. It is the price at which the demand curve hits the y -axis—what we call the demand curve's "y-intercept."
2. As the price falls, the quantity demanded increases. If Q_D is a positive number, then the price P must be less than a . As Q_D gets larger, the price P becomes smaller. That is, as the quantity increases, the maximum price that buyers are willing to pay for the last unit of the good falls.
3. The constant b tells us how fast the maximum price that someone is willing to pay for the good falls as the quantity increases. That is, the constant b tells us about the steepness of the demand curve. The equation tells us that the slope of the demand curve is $-b$.

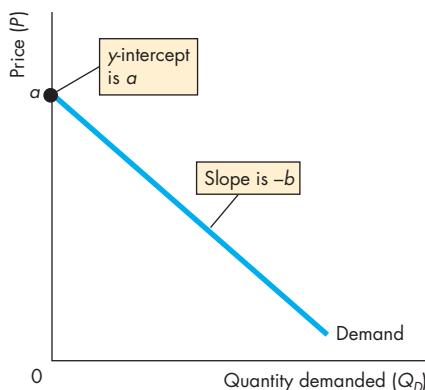


Figure 1 Demand Curve

Supply Curve

The law of supply says that as the price of a good or service rises, the quantity supplied of that good or service increases. We can illustrate the law of supply by drawing a graph of the supply curve or writing down an equation. When the supply curve is a straight line, the following equation describes it:

$$P = c + dQ_S,$$

where P is the price and Q_S is the quantity supplied. The c and d are positive constants.

The supply equation tells us three things:

1. The price at which sellers are not willing to supply the good (Q_S is zero). That is, if the price is c , then no one is willing to sell the good. You can see the price c in Fig. 2. It is the price at which the supply curve hits the y -axis—what we call the supply curve's "y-intercept."
2. As the price rises, the quantity supplied increases. If Q_S is a positive number, then the price P must be greater than c . As Q_S increases, the price P becomes larger. That is, as the quantity increases, the minimum price that sellers are willing to accept for the last unit rises.
3. The constant d tells us how fast the minimum price at which someone is willing to sell the good rises as the quantity increases. That is, the constant d tells us about the steepness of the supply curve. The equation tells us that the slope of the supply curve is d .

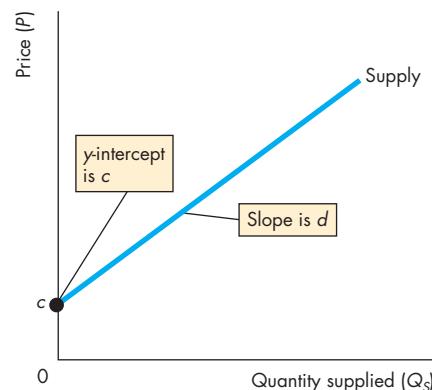


Figure 2 Supply Curve

Market Equilibrium

Demand and supply determine market equilibrium. Figure 3 shows the equilibrium price (P^*) and equilibrium quantity (Q^*) at the intersection of the demand curve and the supply curve.

We can use the equations to find the equilibrium price and equilibrium quantity. The price of a good adjusts until the quantity demanded Q_D equals the quantity supplied Q_S . So at the equilibrium price (P^*) and equilibrium quantity (Q^*),

$$Q_D = Q_S = Q^*.$$

To find the equilibrium price and equilibrium quantity, substitute Q^* for Q_D in the demand equation and Q^* for Q_S in the supply equation. Then the price is the equilibrium price (P^*), which gives

$$P^* = a - bQ^*$$

$$P^* = c + dQ^*.$$

Notice that

$$a - bQ^* = c + dQ^*.$$

Now solve for Q^* :

$$a - c = bQ^* + dQ^*$$

$$a - c = (b + d)Q^*$$

$$Q^* = \frac{a - c}{b + d}.$$

To find the equilibrium price P^* , substitute for Q^* in either the demand equation or the supply equation.

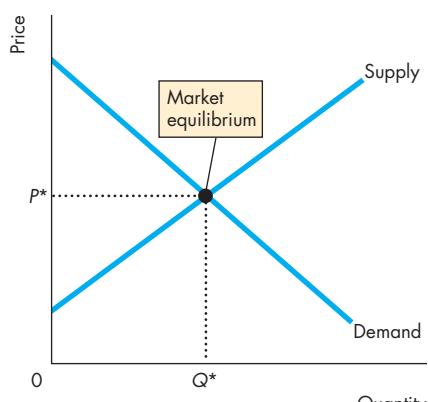


Figure 3 Market Equilibrium

Using the demand equation, we have

$$P^* = a - b\left(\frac{a - c}{b + d}\right)$$

$$P^* = \frac{a(b + d) - b(a - c)}{b + d}$$

$$P^* = \frac{ad + bc}{b + d}.$$

Alternatively, using the supply equation, we have

$$P^* = c + d\left(\frac{a - c}{b + d}\right)$$

$$P^* = \frac{c(b + d) + d(a - c)}{b + d}$$

$$P^* = \frac{ad + bc}{b + d}.$$

An Example

The demand for ice-cream cones is

$$P = 800 - 2Q_D.$$

The supply of ice-cream cones is

$$P = 200 + 1Q_S.$$

The price of a cone is expressed in cents, and the quantities are expressed in cones per day.

To find the equilibrium price (P^*) and equilibrium quantity (Q^*), substitute Q^* for Q_D and Q_S and P^* for P . That is,

$$P^* = 800 - 2Q^*$$

$$P^* = 200 + 1Q^*.$$

Now solve for Q^* :

$$800 - 2Q^* = 200 + 1Q^*$$

$$600 = 3Q^*$$

$$Q^* = 200.$$

And

$$P^* = 800 - 2(200)$$

$$= 400.$$

The equilibrium price is \$4 a cone, and the equilibrium quantity is 200 cones per day.



SUMMARY

Key Points

Markets and Prices (p. 56)

- A competitive market is one that has so many buyers and sellers that no single buyer or seller can influence the price.
- Opportunity cost is a relative price.
- Demand and supply determine relative prices.

Working Problem 1 will give you a better understanding of markets and prices.

Demand (pp. 57–61)

- Demand is the relationship between the quantity demanded of a good and its price when all other influences on buying plans remain the same.
- The higher the price of a good, other things remaining the same, the smaller is the quantity demanded—the law of demand.
- Demand depends on the prices of related goods (substitutes and complements), expected future prices, income, expected future income and credit, the population, and preferences.

Working Problems 2 to 4 will give you a better understanding of demand.

Supply (pp. 62–65)

- Supply is the relationship between the quantity supplied of a good and its price when all other influences on selling plans remain the same.
- The higher the price of a good, other things remaining the same, the greater is the quantity supplied—the law of supply.

- Supply depends on the prices of factors of production used to produce a good, the prices of related goods produced, expected future prices, the number of suppliers, technology, and the state of nature.

Working Problems 5 and 6 will give you a better understanding of supply.

Market Equilibrium (pp. 66–67)

- At the equilibrium price, the quantity demanded equals the quantity supplied.
- At any price above the equilibrium price, there is a surplus and the price falls.
- At any price below the equilibrium price, there is a shortage and the price rises.

Working Problem 7 will give you a better understanding of market equilibrium.

Predicting Changes in Price and Quantity (pp. 68–73)

- An increase in demand brings a rise in the price and an increase in the quantity supplied. A decrease in demand brings a fall in the price and a decrease in the quantity supplied.
- An increase in supply brings a fall in the price and an increase in the quantity demanded. A decrease in supply brings a rise in the price and a decrease in the quantity demanded.
- An increase in demand and an increase in supply bring an increased quantity but an uncertain price change. An increase in demand and a decrease in supply bring a higher price but an uncertain change in quantity.

Working Problems 8 to 10 will give you a better understanding of predicting changes in price and quantity.

Key Terms

- Change in demand, 58
- Change in supply, 63
- Change in the quantity demanded, 61
- Change in the quantity supplied, 64
- Competitive market, 56
- Complement, 59
- Demand, 57

- Demand curve, 58
- Equilibrium price, 66
- Equilibrium quantity, 66
- Inferior good, 60
- Law of demand, 57
- Law of supply, 62
- Money price, 56
- Normal good, 60

MyEconLab Key Terms Quiz

- Quantity demanded, 57
- Quantity supplied, 62
- Relative price, 56
- Substitute, 59
- Supply, 62
- Supply curve, 62

WORKED PROBLEM

MyEconLab You can work this problem in Chapter 3 Study Plan.

The table sets out the demand and supply schedules for roses on a normal weekend.

Price (dollars per rose)	Quantity demanded	Quantity supplied
	(roses per week)	
6.00	150	60
7.00	100	100
8.00	70	130
9.00	50	150

Questions

- If the price of a rose is \$6, describe the situation in the rose market. Explain how the price adjusts.
- If the price of a rose is \$9, describe the situation in the rose market. Explain how the price adjusts.
- What is the market equilibrium?
- Rose sellers know that Mother's Day is next weekend and they expect the price to be higher, so they withhold 60 roses from the market this weekend. What is the price this weekend?
- On Mother's Day, demand increases by 160 roses. What is the price of a rose on Mother's Day?

Solutions

- At \$6 a rose, the quantity demanded is 150 and the quantity supplied is 60. The quantity demanded exceeds the quantity supplied and there is a *shortage* of 90 roses. With people lining up and a shortage, the price rises above \$6 a rose.

Key Point: When a shortage exists, the price rises.

- At \$9 a rose, the quantity demanded is 50 and the quantity supplied is 180. The quantity supplied exceeds the quantity demanded and there is a *surplus* of 130 roses. With slow sales of roses and a surplus, the price falls to below \$9 a rose.

Key Point: When a surplus exists, the price falls.

- Market equilibrium occurs at the price at which the quantity demanded *equals* the quantity supplied. That price is \$7 a rose. The equilibrium quantity of roses is 100 a week. Point A on the figure.

Key Point: At market equilibrium, there is no shortage or surplus.

- Sellers expect a higher price next weekend, so they decrease the supply this weekend by 60 roses at each price. Create the new table:

Price (dollars per rose)	Quantity demanded	Quantity supplied
	(roses per week)	
6.00	150	0
7.00	100	40
8.00	70	70
9.00	50	90

At \$7 a rose, there was a shortage of 60 roses, so the price rises to \$8 a rose at which the quantity demanded equals the quantity supplied (Point B).

Key Point: When supply decreases, the price rises.

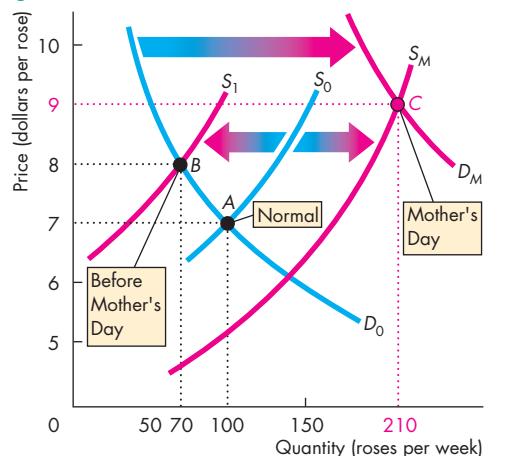
- Demand increases by 160 roses. Sellers plan to increase the normal supply by the 60 roses withheld last weekend. Create the new table:

Price (dollars per rose)	Quantity demanded	Quantity supplied
	(roses per week)	
6.00	310	120
7.00	260	160
8.00	230	190
9.00	210	210

At \$7 a rose, there is a shortage of 100 roses, so the price rises. It rises until at \$9 a rose, the quantity demanded equals the quantity supplied. The price on Mother's Day is \$9 a rose. (Point C)

Key Point: When demand increases by more than supply, the price rises.

Key Figure



MyEconLab Interactive Animation



STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab You can work Problems 1 to 10 in Chapter 3 Study Plan and get instant feedback.

Markets and Prices (Study Plan 3.1)

- In April 2014, the money price of a litre of milk was \$2.01 and the money price of a litre of gasoline was \$1.30. Calculate the real price of a litre of gasoline in terms of milk.

Demand (Study Plan 3.2)

- The price of food increased during the past year.
 - Explain why the law of demand applies to food just as it does to other goods and services.
 - Explain how the substitution effect influences food purchases when the price of food rises and other things remain the same.
 - Explain how the income effect influences food purchases and provide some examples of the income effect.
- Which of the following goods are likely substitutes and which are likely complements? (You may use an item more than once.)
 - coal, oil, natural gas, wheat, corn, pasta, pizza, sausage, skateboard, roller blades, video game, laptop, iPad, cellphone, text message, email
- As the average income in China continues to increase, explain how the following would change:
 - The demand for beef
 - The demand for rice

Supply (Study Plan 3.3)

- In 2013, the price of corn fell and some corn farmers switched from growing corn in 2014 to growing soybeans.
 - Does this fact illustrate the law of demand or the law of supply? Explain your answer.
 - Why would a corn farmer grow soybeans?
- Dairies make low-fat milk from full-cream milk, and in the process they produce cream, which is made into ice cream. The following events occur one at a time:
 - The wage rate of dairy workers rises.
 - The price of cream rises.
 - The price of low-fat milk rises.
 - With a drought forecasted, dairies raise their expected price of low-fat milk next year.
 - New technology lowers the cost of producing ice cream.

Explain the effect of each event on the supply of low-fat milk.

Market Equilibrium (Study Plan 3.4)

- The demand and supply schedules for gum are:

Price (cents per pack)	Quantity demanded (millions of packs a week)	Quantity supplied (millions of packs a week)
20	180	60
40	140	100
60	100	140
80	60	180

- Suppose that the price of gum is 70¢ a pack. Describe the situation in the gum market and explain how the price adjusts.
- Suppose that the price of gum is 30¢ a pack. Describe the situation in the gum market and explain how the price adjusts.

Predicting Changes in Price and Quantity (Study Plan 3.5)

- The following events occur one at a time:
 - The price of crude oil rises.
 - The price of a car rises.
 - All speed limits on highways are abolished.
 - Robots cut car production costs.

Explain the effect of each of these events on the market for gasoline.

- In Problem 7, a fire destroys some factories that produce gum and the quantity of gum supplied decreases by 40 million packs a week at each price.
 - Explain what happens in the market for gum and draw a graph to illustrate the changes.
 - If, at the same time as the fire, the teenage population increases and the quantity of gum demanded increases by 40 million packs a week at each price. What is the new market equilibrium? Illustrate these changes on your graph.
- Tim Hortons' Risks**

Tim Hortons has exploded to become a dominant player among quick-serve restaurants. In 2001, it took the risk by switching to centralized production of baked goods, which lowered its labour costs and increased its sales volume.

Source: *Financial Post*, August 12, 2010

Draw a graph to show the effect of lower labour costs on the price of Tim's baked goods and the quantity sold.



ADDITIONAL PROBLEMS AND APPLICATIONS

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

Markets and Prices

11. What features of the world market for crude oil make it a competitive market?
12. The money price of a textbook is \$90 and the money price of the Wii game *Super Mario Galaxy* is \$45.
 - a. What is the opportunity cost of a textbook in terms of the Wii game?
 - b. What is the relative price of the Wii game in terms of textbooks?

Demand

13. The price of gasoline has increased during the past year.
 - a. Explain why the law of demand applies to gasoline just as it does to all other goods and services.
 - b. Explain how the substitution effect influences gasoline purchases and provide some examples of substitutions that people might make when the price of gasoline rises and other things remain the same.
 - c. Explain how the income effect influences gasoline purchases and provide some examples of the income effects that might occur when the price of gasoline rises and other things remain the same.
14. Think about the demand for the three game consoles: Xbox One, PlayStation 4, and Wii U. Explain the effect of each of the following events on the demand for Xbox One games and the quantity of Xbox One games demanded, other things remaining the same. The events are:
 - a. The price of an Xbox One falls.
 - b. The prices of a PlayStation 4 and a Wii U fall.
 - c. The number of people writing and producing Xbox One games increases.
 - d. Consumers' incomes increase.
 - e. Programmers who write code for Xbox One games become more costly to hire.
 - f. The expected future price of an Xbox One game falls.
 - g. A new game console that is a close substitute for Xbox One comes onto the market.

Supply

15. Classify the following pairs of goods and services as substitutes in production, complements in production, or neither.
 - a. Bottled water and health club memberships
 - b. French fries and baked potatoes
 - c. Leather boots and leather shoes
 - d. Hybrids and SUVs
 - e. Diet coke and regular coke
16. When a timber mill makes logs from trees it also produces sawdust, which is used to make plywood.
 - a. Explain how a rise in the price of sawdust influences the supply of logs.
 - b. Explain how a rise in the price of sawdust influences the supply of plywood.

17. New Maple Syrup Sap Method

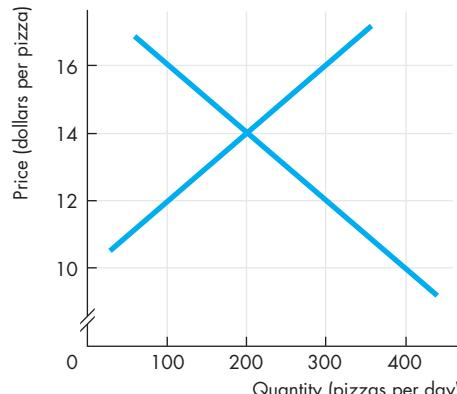
With the new way to tap maple trees, farmers could produce 10 times as much maple syrup per acre.

Source: cbc.ca, February 5, 2014

Will the new method change the supply of maple syrup or the quantity supplied of maple syrup, other things remaining the same? Explain.

Market Equilibrium

Use the following figure to work Problems 18 and 19.



18. a. Label the curves. Which curve shows the willingness to pay for a pizza?
 - b. If the price of a pizza is \$16, is there a shortage or a surplus and does the price rise or fall?

- c. Sellers want to receive the highest possible price, so why would they be willing to accept less than \$16 a pizza?
19. a. If the price of a pizza is \$12, is there a shortage or a surplus and does the price rise or fall?
- b. Buyers want to pay the lowest possible price, so why would they be willing to pay more than \$12 for a pizza?
20. The demand and supply schedules for potato chips are:

Price (cents per bag)	Quantity demanded	Quantity supplied
	(millions of bags per week)	
50	160	130
60	150	140
70	140	150
80	130	160
90	120	170
100	110	180

- a. Draw a graph of the potato chip market and mark in the equilibrium price and quantity.
- b. If the price is 60¢ a bag, is there a shortage or a surplus, and how does the price adjust?

Predicting Changes in Price and Quantity

21. In Problem 20, a new dip increases the quantity of potato chips that people want to buy by 30 million bags per week at each price.
- a. Does the demand for chips change? Does the supply of chips change? Describe the change.
- b. How do the equilibrium price and equilibrium quantity of chips change?
22. In Problem 20, if a virus destroys potato crops and the quantity of potato chips produced decreases by 40 million bags a week at each price, how does the supply of chips change?
23. If the virus in Problem 22 hits just as the new dip in Problem 21 comes onto the market, how do the equilibrium price and equilibrium quantity of chips change?
24. **Strawberry Prices Drop as Late Harvest Hits Market**

Shoppers bought strawberries in March for \$1.25 a pound rather than the \$3.49 a pound they paid last year. With the price so low, some growers removed their strawberry plants to make way for spring melons; others froze their harvests and sold them to juice and jam makers.

Source: *USA Today*, April 5, 2010

- a. Explain how the market for strawberries would have changed if growers had not removed their plants but offered locals “you pick for free.”
- b. Describe the changes in demand and supply in the market for strawberry jam.

25. “Popcorn Movie” Experience Gets Pricier

Cinemas are raising the price of popcorn. Demand for field corn, which is used for animal feed, corn syrup, and ethanol, has increased and its price has exploded. That’s caused some farmers to shift from growing popcorn to easier-to-grow field corn.

Source: *USA Today*, May 24, 2008

Explain and illustrate graphically the events described in the news clip in the market for

- a. Popcorn
b. Movie tickets

26. Watch Out for Rising Dry-Cleaning Bills

In the past year, the price of dry-cleaning solvent doubled. More than 4,000 dry cleaners across the United States disappeared as budget-conscious consumers cut back. This year the price of hangers used by dry cleaners is expected to double.

Source: *CNN Money*, June 4, 2012

- a. Explain the effect of rising solvent prices on the market for dry cleaning.
- b. Explain the effect of consumers becoming more budget conscious along with the rising price of solvent on the price of dry cleaning.
- c. If the price of hangers does rise this year, do you expect additional dry cleaners to disappear? Explain why or why not.

Economics in the News

27. After you have studied *Economics in the News* on pp. 74–75, answer the following questions.
- a. What would happen to the price of bananas if TR4 spread to Central America?
- b. What are some of the substitutes for bananas and what would happen to demand, supply, price, and quantity in the markets for these items if TR4 spread to Central America?
- c. What are some of the complements of bananas and what would happen to demand, supply, price, and quantity in the markets for these items if TR4 spread to Central America?
- d. When the price of bananas increased in 2008, did it rise by as much as the rise in the price of oil? Why or why not?
- e. Why would the expectation of the future arrival of TR4 in Central Americas have little or no effect on today’s price of bananas?



4

ELASTICITY

After studying this chapter, you will be able to:

- ◆ Define, calculate, and explain the factors that influence the price elasticity of demand
- ◆ Define, calculate, and explain the factors that influence the income elasticity of demand and the cross elasticity of demand
- ◆ Define, calculate, and explain the factors that influence the elasticity of supply

In 2013, coffee production soared and the price tumbled. Despite the increased production, coffee producers saw their revenue fall. How does the quantity of coffee produced influence the price of coffee and the revenue of coffee producers?

To answer this and similar questions, we use the neat tool that you study in this chapter: elasticity.

At the end of the chapter, in *Economics in the News*, we use the concept of elasticity to answer the question about the market for coffee. But we begin by explaining elasticity in another familiar setting: the market for pizza.

Price Elasticity of Demand

You know that when supply decreases, the equilibrium price rises and the equilibrium quantity decreases. But does the price rise by a large amount and the quantity decrease by a little? Or does the price barely rise and the quantity decrease by a large amount?

The answer depends on the responsiveness of the quantity demanded of a good to a change in its price. If the quantity demanded is not very responsive to a change in the price, the price rises a lot and the equilibrium quantity doesn't change much. If the quantity demanded is very responsive to a change in the price, the price barely rises and the equilibrium quantity changes a lot.

You might think about the responsiveness of the quantity demanded of a good to a change in its price in terms of the slope of the demand curve. If the demand curve is steep, the quantity demanded of the good isn't very responsive to a change in the price. If the demand curve is almost flat, the quantity demanded is very responsive to a change in the price.

But the slope of a demand curve depends on the units in which we measure the price and the quantity—we can make the curve steep or almost flat just by changing the units in which we measure the price and the quantity. Also we often want to compare the demand for different goods and services and quantities of these goods are measured in unrelated units. For example, a pizza producer might want to compare the demand for pizza with the demand for soft drinks. Which quantity demanded is more responsive to a price change? This question can't be answered by comparing the slopes of two demand curves. The units of measurement of pizza and soft drinks are unrelated. But the question *can* be answered with a measure of responsiveness that is *independent* of units of measurement. Elasticity is such a measure.

The **price elasticity of demand** is 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 buying plans remain the same.

Calculating Price Elasticity of Demand

We calculate the *price elasticity of demand* by using the formula:

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}.$$

To calculate the price elasticity of demand for pizza, we need to know the quantity demanded of pizza at two different prices, when all other influences on buying plans remain the same.

Figure 4.1 zooms in on a section of the demand curve for pizza and shows how the quantity demanded responds to a small change in price. Initially, the price is \$20.50 a pizza and 9 pizzas an hour are demanded—the original point. The price then falls to \$19.50 a pizza, and the quantity demanded increases to 11 pizzas an hour—the new point. When the price falls by \$1 a pizza, the quantity demanded increases by 2 pizzas an hour.

To calculate the price elasticity of demand, we express the change in price as a percentage of the *average price* and the change in the quantity demanded as a percentage of the *average quantity*. By using the average price and average quantity, we calculate the elasticity at a point on the demand curve midway between the original point and the new point.

The original price is \$20.50 and the new price is \$19.50, so the price change is \$1 and the average price is \$20 a pizza. Call the percentage change in the price $\% \Delta P$, then

$$\% \Delta P = \Delta P / P_{ave} \times 100 = (\$1/\$20) \times 100 = 5\%.$$

The original quantity demanded is 9 pizzas and the new quantity demanded is 11 pizzas, so the quantity change is 2 pizzas and the average quantity demanded is 10 pizzas. Call the percentage change in the quantity demanded $\% \Delta Q$, then

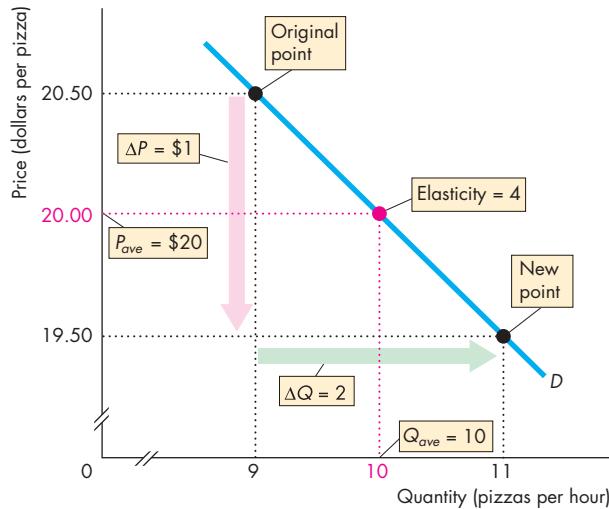
$$\% \Delta Q = \Delta Q / Q_{ave} \times 100 = (2/10) \times 100 = 20\%.$$

The price elasticity of demand equals the percentage change in the quantity demanded (20 percent) divided by the percentage change in price (5 percent) and is 4. That is,

$$\begin{aligned}\text{Price elasticity of demand} &= \frac{\% \Delta Q}{\% \Delta P} \\ &= \frac{20\%}{5\%} = 4.\end{aligned}$$

Average Price and Quantity Notice that we use the *average* price and *average* quantity. We do this because it gives the most precise measurement of elasticity—at the *midpoint* between the original price and the new price. If the price falls from \$20.50 to \$19.50, the \$1 price change is 4.9 percent of \$20.50. The 2 pizza change in quantity is 22.2 percent of 9 pizzas, the original quantity. So if we use

FIGURE 4.1 Calculating the Elasticity of Demand



The elasticity of demand is calculated by using the formula:^{*}

$$\begin{aligned} \text{Price elasticity of demand} &= \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}} \\ &= \frac{\% \Delta Q}{\% \Delta P} \\ &= \frac{\% \Delta Q / Q_{\text{ave}}}{\% \Delta P / P_{\text{ave}}} \\ &= \frac{2/10}{1/20} = 4. \end{aligned}$$

This calculation measures the elasticity at an average price of \$20 a pizza and an average quantity of 10 pizzas an hour.

* In the formula, the Greek letter delta (Δ) stands for "change in" and $\%$ stands for "percentage change in."

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these numbers, the price elasticity of demand is 22.2 divided by 4.9, which equals 4.5. But if the price rises from \$19.50 to \$20.50, the \$1 price change is 5.1 percent of \$19.50. The 2 pizza change in quantity is 18.2 percent of 11 pizzas, the original quantity. So if we use these numbers, the price elasticity of demand is 18.2 divided by 5.1, which equals 3.6.

By using percentages of the *average* price and *average* quantity, we get the *same value* for the elasticity regardless of whether the price falls from \$20.50 to \$19.50 or rises from \$19.50 to \$20.50.

Percentages and Proportions Elasticity is the ratio of two percentage changes, so when we divide one percentage change by another, the 100s cancel. A percentage change is a *proportionate* change multiplied by 100. The proportionate change in price is $\Delta P/P_{\text{ave}}$, and the proportionate change in quantity demanded is $\Delta Q/Q_{\text{ave}}$. So if we divide $\Delta Q/Q_{\text{ave}}$ by $\Delta P/P_{\text{ave}}$ we get the same answer as we get by using percentage changes.

A Units-Free Measure Now that you've calculated a price elasticity of demand, you can see why it is a *units-free measure*. Elasticity is a units-free measure because the percentage change in each variable is independent of the units in which the variable is measured. The ratio of the two percentages is a number without units.

Minus Sign and Elasticity When the price of a good rises, the quantity demanded *decreases*. Because a *positive* change in price brings a *negative* change in the quantity demanded, the price elasticity of demand is a negative number. But it is the magnitude, or *absolute value*, of the price elasticity of demand that tells us how responsive the quantity demanded is. So to compare price elasticities of demand, we use the *magnitude* of the elasticity and ignore the minus sign.

Inelastic and Elastic Demand

If the quantity demanded remains constant when the price changes, then the price elasticity of demand is zero and the good is said to have a **perfectly inelastic demand**. One good that has a very low price elasticity of demand (perhaps zero over some price range) is insulin. Insulin is of such importance to some diabetics that if the price rises or falls, they do not change the quantity they buy.

If the percentage change in the quantity demanded equals the percentage change in the price, then the price elasticity equals 1 and the good is said to have a **unit elastic demand**.

Between perfectly inelastic demand and unit elastic demand is a general case in which *the percentage change in the quantity demanded is less than the percentage change in the price*. In this case, the price elasticity of demand is between zero and 1 and the good is said to have an **inelastic demand**. Food and shelter are examples of goods with inelastic demand.

If the quantity demanded changes by an infinitely large percentage in response to a tiny price change, then the price elasticity of demand is infinity and the good is said to have a **perfectly elastic demand**. An example of a good that has a very high elasticity of

demand (almost infinite) is a soft drink from two campus machines located side by side. If the two machines offer the same soft drinks for the same price, some people buy from one machine and some from the other. But if one machine's price is higher than the other's, by even a small amount, no one buys from the machine with the higher price. Drinks from the two machines are perfect substitutes. The demand for a good that has a perfect substitute is perfectly elastic.

Between unit elastic demand and perfectly elastic demand is another general case in which *the percentage change in the quantity demanded exceeds the percentage change in price*. In this case, the price elasticity of demand is greater than 1 and the good is said to have an **elastic demand**. Automobiles and furniture are examples of goods that have elastic demand.

Figure 4.2 shows three demand curves that cover the entire range of possible elasticities of demand that you've just reviewed. In Fig. 4.2(a), the quantity demanded is constant regardless of the price, so this demand is perfectly inelastic. In Fig. 4.2(b), the percentage change in the quantity demanded equals the percentage change in price, so this demand is unit elastic. In Fig. 4.2(c), the price is constant regardless of the quantity demanded, so this figure illustrates a perfectly elastic demand.

You now know the distinction between elastic and inelastic demand. But what determines whether the demand for a good is elastic or inelastic?

The Factors that Influence the Elasticity of Demand

The elasticity of demand for a good depends on:

- The closeness of substitutes
- The proportion of income spent on the good
- The time elapsed since the price change

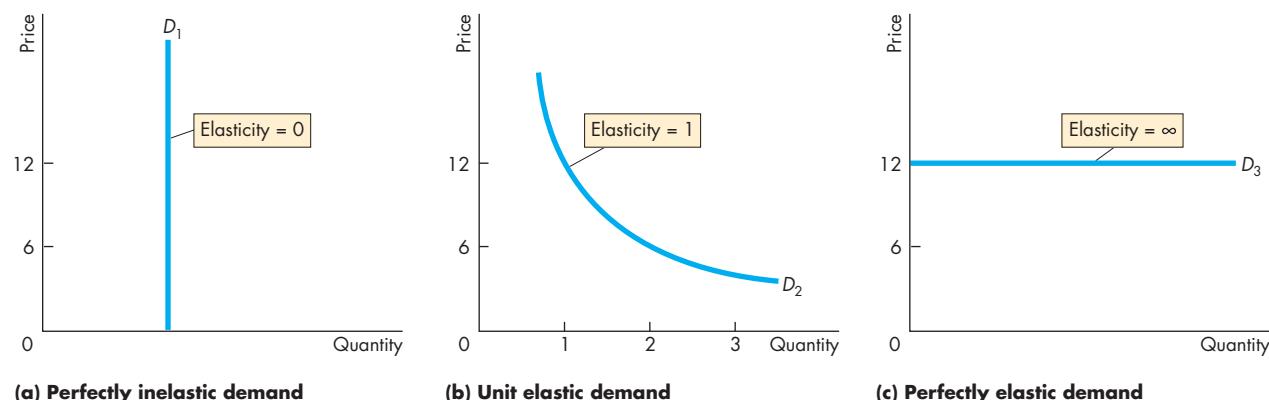
Closeness of Substitutes The closer the substitutes for a good, the more elastic is the demand for it. Oil as fuel or raw material for chemicals has no close substitutes so the demand for oil is inelastic. Plastics are close substitutes for metals, so the demand for metals is elastic.

The degree of substitutability depends on how narrowly (or broadly) we define a good. For example, a smartphone has no close substitutes, but an Apple iPhone is a close substitute for a Samsung Galaxy. So the elasticity of demand for smartphones is lower than the elasticity of demand for an iPhone or a Galaxy.

In everyday language we call goods such as food and shelter *necessities* and goods such as exotic vacations *luxuries*. A necessity has poor substitutes, so it generally has an inelastic demand. A luxury usually has many substitutes, one of which is not buying it. So a luxury generally has an elastic demand.

Proportion of Income Spent on the Good Other things remaining the same, the greater the proportion of income spent on a good, the more elastic (or less inelastic) is the demand for it.

FIGURE 4.2 Inelastic and Elastic Demand



Each demand illustrated here has a constant elasticity. The demand curve in part (a) illustrates the demand for a good that has a zero elasticity of demand. The demand curve in

part (b) illustrates the demand for a good with a unit elasticity of demand. And the demand curve in part (c) illustrates the demand for a good with an infinite elasticity of demand.

Think about your own elasticity of demand for chewing gum and housing. If the price of gum rises, you consume almost as much as before. Your demand for gum is inelastic. If apartment rents rise, you look for someone to share with. Your demand for housing is not as inelastic as your demand for gum. Why the difference? Housing takes a big chunk of your budget, and gum takes little. You barely notice the higher price of gum, while the higher rent puts your budget under severe strain.

Time Elapsed Since Price Change The longer the time that has elapsed since a price change, the more elastic is demand. When the price of oil increased by 400 percent during the 1970s, people barely changed the quantity of oil and gasoline they bought. But gradually, as more efficient auto and airplane engines were developed, the quantity bought decreased. The demand for oil became more elastic as more time elapsed following the huge price hike.

Elasticity Along a Linear Demand Curve

Elasticity of demand is not the same as slope. And a good way to see this fact is by studying a demand curve that has a constant slope but a varying elasticity.

The demand curve in Fig. 4.3 is linear, which means that it has a constant slope. Along this demand curve, a \$5 rise in the price brings a decrease of 10 pizzas an hour.

But the price elasticity of demand is not constant along this demand curve. To see why, let's calculate some elasticities.

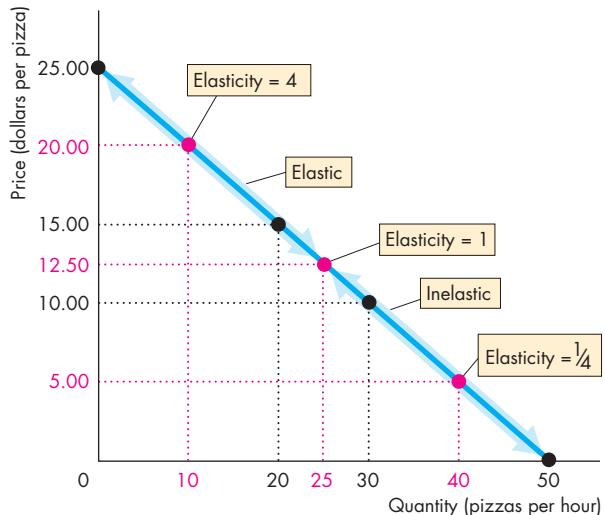
At the midpoint of the demand curve, the price is \$12.50 and the quantity is 25 pizzas per hour. If the price rises from \$10 to \$15 a pizza the quantity demanded decreases from 30 to 20 pizzas an hour and the average price and average quantity are at the midpoint of the demand curve. So

$$\begin{aligned}\text{Price elasticity of demand} &= \frac{10/25}{5/12.50} \\ &= 1.\end{aligned}$$

That is, at the midpoint of a linear demand curve, the price elasticity of demand is 1.

At prices *above* the midpoint, the price elasticity of demand is greater than 1: Demand is elastic. To see that demand is elastic, let's calculate the elasticity when the price rises from \$15 to \$25 a pizza. You can see that quantity demanded decreases from 20 to zero pizzas an hour. The average price is \$20 a pizza, and

FIGURE 4.3 Elasticity Along a Linear Demand Curve



On a linear demand curve, demand is unit elastic at the midpoint (elasticity is 1), elastic above the midpoint, and inelastic below the midpoint.

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the average quantity is 10 pizzas. Putting these numbers into the elasticity formula:

$$\begin{aligned}\text{Price elasticity of demand} &= \frac{\Delta Q/Q_{ave}}{\Delta P/P_{ave}} \\ &= \frac{20/10}{10/20} \\ &= 4.\end{aligned}$$

That is, the price elasticity of demand at an average price of \$20 a pizza is 4.

At prices *below* the midpoint, the price elasticity of demand is less than 1: Demand is inelastic. For example, if the price rises from zero to \$10 a pizza, the quantity demanded decreases from 50 to 30 pizzas an hour. The average price is now \$5 and the average quantity is 40 pizzas an hour. So

$$\begin{aligned}\text{Price elasticity of demand} &= \frac{20/40}{10/5} \\ &= 1/4.\end{aligned}$$

That is, the price elasticity of demand at an average price of \$5 a pizza is 1/4.

Total Revenue and Elasticity

The **total revenue** from the sale of a good equals the price of the good multiplied by the quantity sold. When a price changes, total revenue also changes. But a cut in the price does not always decrease total revenue. The change in total revenue depends on the elasticity of demand in the following way:

- If demand is elastic, a 1 percent price cut increases the quantity sold by more than 1 percent and total revenue increases.
- If demand is inelastic, a 1 percent price cut increases the quantity sold by less than 1 percent and total revenue decreases.
- If demand is unit elastic, a 1 percent price cut increases the quantity sold by 1 percent and total revenue does not change.

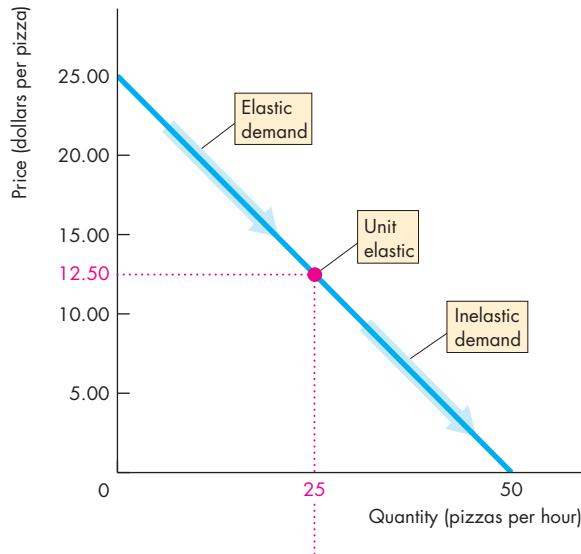
In Fig. 4.4(a), over the price range \$25 to \$12.50 a pizza, demand is elastic. At a price of \$12.50 a pizza, demand is unit elastic. Over the price range from \$12.50 a pizza to zero, demand is inelastic.

Figure 4.4(b) shows total revenue. At a price of \$25, the quantity sold is zero, so total revenue is zero. At a price of zero, the quantity demanded is 50 pizzas an hour and total revenue is again zero. A price cut in the elastic range brings an increase in total revenue—the percentage increase in the quantity demanded is greater than the percentage decrease in price. A price cut in the inelastic range brings a decrease in total revenue—the percentage increase in the quantity demanded is less than the percentage decrease in price. At unit elasticity, total revenue is at a maximum.

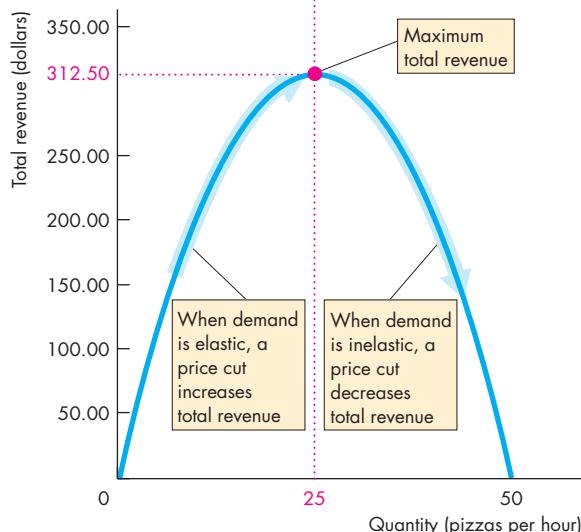
Figure 4.4 shows how we can use this relationship between elasticity and total revenue to estimate elasticity using the total revenue test. The **total revenue test** is a method of estimating the price elasticity of demand by observing the change in total revenue that results from a change in the price, when all other influences on the quantity sold remain the same.

- If a price cut increases total revenue, demand is elastic.
- If a price cut decreases total revenue, demand is inelastic.
- If a price cut leaves total revenue unchanged, demand is unit elastic.

FIGURE 4.4 Elasticity and Total Revenue



(a) Demand



(b) Total revenue

When demand is elastic, in the price range from \$25 to \$12.50, a decrease in price (part a) brings an increase in total revenue (part b). When demand is inelastic, in the price range from \$12.50 to zero, a decrease in price (part a) brings a decrease in total revenue (part b). When demand is unit elastic, at a price of \$12.50 (part a), total revenue is at a maximum (part b).

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Economics in Action

Elastic and Inelastic Demand

The real-world price elasticities of demand in the table range from 1.52 for metals, the item with the most elastic demand in the table, to 0.05 for oil, the item with the most inelastic demand in the table. The demand for food is also inelastic.

Oil and food, which have poor substitutes and inelastic demand, might be classified as necessities. Furniture and motor vehicles, which have good substitutes and elastic demand, might be classified as luxuries.

Price Elasticities of Demand

Good or Service	Elasticity
Elastic Demand	
Metals	1.52
Electrical engineering products	1.39
Mechanical engineering products	1.30
Furniture	1.26
Motor vehicles	1.14
Instrument engineering products	1.10
Transportation services	1.03
Inelastic Demand	
Gas, electricity, and water	0.92
Chemicals	0.89
Clothing	0.64
Banking and insurance services	0.56
Housing services	0.55
Agricultural and fish products	0.42
Books, magazines, and newspapers	0.34
Food	0.12
Cigarettes	0.11
Soft drinks	0.05
Oil	0.05

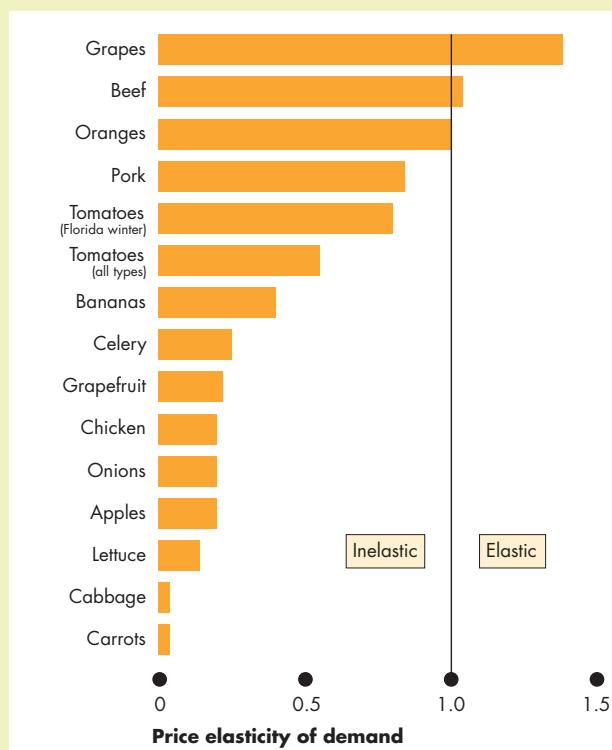
Sources of data: Ahsan Mansur and John Whalley, "Numerical Specification of Applied General Equilibrium Models: Estimation, Calibration, and Data," in *Applied General Equilibrium Analysis*, eds. Herbert E. Scarf and John B. Shoven (New York: Cambridge University Press, 1984), 109; Henri Theil, ChingFan Chung, and James L. Seale, Jr., *Advances in Econometrics, Supplement I*, 1989, *International Evidence on Consumption Patterns* (Greenwich, Conn.: JAI Press Inc., 1989); Emilia Papoulia and Robert Sorensen, "What Determines the Elasticity of Industry Demand," *International Journal of Industrial Organization*, 1986; and Geoffrey Heal, Columbia University, Web site.

Price Elasticities of Demand for Food

The price elasticity of demand for food in the United States is estimated to be 0.12. This elasticity is an average over all types of food. The demand for most food items is inelastic, but there is a wide range of elasticities as the figure below shows for a range of fruits, vegetables, and meats.

The demand for grapes and the demand for beef are elastic. The demand for oranges is unit elastic. These food items, especially grapes and beef, have many good substitutes. Florida winter tomatoes have closer substitutes than tomatoes in general, so the demand for the Florida winter variety is more elastic (less inelastic) than the demand for tomatoes.

Carrots and cabbage, on which we spend a very small proportion of income, have an almost zero elastic demand.



Price Elasticities of Demand for Food

Sources of data: Kuo S. Huang, *U.S. demand for food: A complete system of price and income effects*, U.S. Dept. of Agriculture, Economic Research Service, Washington, DC, 1985; J. Scott Shonkwiler and Robert D. Emerson, "Imports and the Supply of Winter Tomatoes: An Application of Rational Expectations," *American Journal of Agricultural Economics*, Vol. 64, No. 4 (Nov., 1982), pp. 634–641; and Kuo S. Huang, "A Further Look at Flexibilities and Elasticities," *American Journal of Agricultural Economics*, Vol. 76, No. 2 (May, 1994), pp. 313–317.



ECONOMICS IN THE NEWS

The Elasticity of Demand for Peanut Butter

Peanut Butter Prices to Rise 30 to 40 Percent

Scott Karns, president and CEO of Karns Foods, said “People are still going to need it for their family. It’s still an extremely economical item.” Patty Nolan, who is on a fixed income, said “I love peanut butter so I’m using a little less so I don’t go through it.”

Source: *The Patriot-News*, November 2, 2011

THE DATA

Year	Quantity (millions of tonnes per year)	Price (dollars per kilogram)
2011	350	4.00
2012	300	5.60

THE QUESTIONS

- Does the news clip imply that the demand for peanut butter is elastic or inelastic?
- If the data are two points on the demand curve for peanut butter, what is the price elasticity of demand?

THE ANSWERS

- The two remarks in the news clip suggest that the quantity of peanut butter demanded will decrease when the price rises, but not by much. The demand for peanut butter is inelastic.

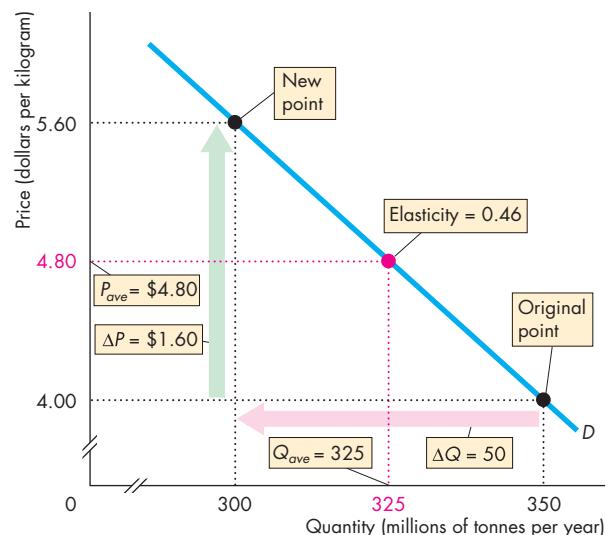
Your Expenditure and Your Elasticity

When the price of a good changes, the change in your expenditure on the good depends on *your elasticity of demand*.

- If your demand for the good is elastic, a 1 percent price cut increases the quantity you buy by more than 1 percent and your expenditure on the item increases.
- If your demand for the good is inelastic, a 1 percent price cut increases the quantity you buy by less than 1 percent and your expenditure on the item decreases.
- If your demand for the good is unit elastic, a 1 percent price cut increases the quantity you buy by 1 percent and your expenditure on the item does not change.

So if you spend more on an item when its price falls, your demand for that item is elastic; if you spend the same amount, your demand is unit elastic; and if you spend less, your demand is inelastic.

- The data table says the price of peanut butter increased by \$1.60 with an average price of \$4.80, so the price increased by 33.3 percent. The quantity demanded decreased by 50 million tonnes with an average quantity of 325 million tonnes, so the quantity demanded decreased by 15.4 percent. The price elasticity of demand is 15.4 percent divided by 33.3 percent, which equals 0.46.



Calculating the Price Elasticity of Demand for Peanut Butter

MyEconLab More Economics in the News

REVIEW QUIZ

- Why do we need a units-free measure of the responsiveness of the quantity demanded of a good or service to a change in its price?
- Define the price elasticity of demand and show how it is calculated.
- What makes the demand for some goods elastic and the demand for other goods inelastic?
- Why is the demand for a luxury generally more elastic (or less inelastic) than the demand for a necessity?
- What is the total revenue test?

Work these questions in Study Plan 4.1 and get instant feedback. Do a Key Terms Quiz.

MyEconLab

You've now completed your study of the *price elasticity of demand*. Two other elasticity concepts tell us about the effects of other influences on demand. Let's look at these other elasticities of demand.

More Elasticities of Demand

Suppose the economy is expanding and people are enjoying rising incomes. You know that a change in income changes demand. So this increased prosperity brings an increase in the demand for most types of goods and services. By how much will a rise in income increase the demand for pizza? This question is answered by the income elasticity of demand.

Income Elasticity of Demand

The **income elasticity of demand** is a measure of the responsiveness of the demand for a good or service to a change in income, other things remaining the same. It tells us by how much a demand curve shifts at a given price.

The income elasticity of demand is calculated by using the formula:

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Income elasticities of demand can be positive or negative and they fall into three interesting ranges:

- Positive and greater than 1 (*normal* good, income elastic)
- Positive and less than 1 (*normal* good, income inelastic)
- Negative (*inferior* good)

Income Elastic Demand Suppose that the price of pizza is constant and 9 pizzas an hour are bought. Then incomes rise from \$975 to \$1,025 a week. No other influence on buying plans changes and the quantity of pizzas sold increases to 11 an hour.

The change in the quantity demanded is +2 pizzas. The average quantity is 10 pizzas, so the quantity demanded increases by 20 percent. The change in income is +\$50 and the average income is \$1,000, so incomes increase by 5 percent. The income elasticity of demand for pizza is

$$\frac{20\%}{5\%} = 4.$$

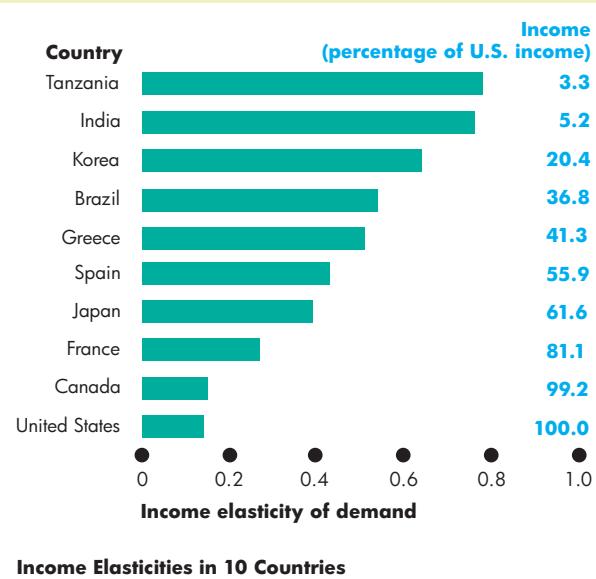
The demand for pizza is income elastic. The percentage increase in the quantity of pizza demanded exceeds the percentage increase in income.

Economics in Action

Necessities and Luxuries

The demand for a necessity such as food or clothing is income inelastic, while the demand for a luxury such as airline and foreign travel is income elastic. But what is a necessity and what is a luxury depends on the level of income. For people with a low income, food and clothing can be luxuries. So the level of income has a big effect on income elasticities of demand.

The figure shows this effect on the income elasticity of demand for food in 10 countries. In countries with low incomes, such as Tanzania and India, the income elasticity of demand for food is high. In countries with high incomes, such as Canada, the income elasticity of demand for food is low. That is, as income increases, the income elasticity of demand for food decreases. Low-income consumers spend a larger percentage of any increase in income on food than do high-income consumers.



Income Inelastic Demand If the income elasticity of demand is positive but less than 1, demand is income inelastic. The percentage increase in the quantity demanded is positive but less than the percentage increase in income.

Whether demand is income elastic or income inelastic has an important implication for the percentage of income spent on a good. If the demand for a good is *income elastic*, the percentage

Economics in Action

Income Elastic and Inelastic Demand

The table shows some real-world income elasticities of demand and confirms that a necessity such as food or clothing is income inelastic, while the demand for a luxury such as airline travel is income elastic.

Some Real-World Income Elasticities of Demand

Income Elastic Demand

Airline travel	5.82
Movies	3.41
Foreign travel	3.08
Electricity	1.94
Restaurant meals	1.61
Local buses and trains	1.38
Haircuts	1.36
Automobiles	1.07

Income Inelastic Demand

Tobacco	0.86
Alcoholic drinks	0.62
Furniture	0.53
Clothing	0.51
Newspapers and magazines	0.38
Telephone	0.32
Food	0.14

Sources of data: H.S. Houthakker and Lester D. Taylor, *Consumer Demand in the United States* (Cambridge, Mass.: Harvard University Press, 1970); and Henri Theil, Ching-Fan Chung, and James L. Seale, Jr., *Advances in Econometrics, Supplement 1, 1989, International Evidence on Consumption Patterns* (Greenwich, Conn.: JAI Press, Inc., 1989).

of income spent on that good *increases* as income increases. And if the demand for a good is *income inelastic*, the percentage of income spent on that good *decreases* as income increases.

Inferior Goods If the income elasticity of demand is negative, the good is an *inferior* good. The quantity demanded of an inferior good and the amount spent on it *decrease* when income increases. Goods in this category include small motorcycles, potatoes, and rice. Low-income consumers buy these goods and spend a large percentage of their incomes on them.

Cross Elasticity of Demand

The burger shop next to your pizzeria has just raised the price of its burger. You know that pizzas and burgers are substitute. You also know that when the price of a substitute for pizza *rises*, the demand for pizza *increases*. But how big is the influence of the price of burgers on the demand for pizza?

You know, too, that pizza and soft drinks are complements. And you know that if the price of a complement of pizza *rises*, the demand for pizza *decreases*. So you wonder, by how much will a rise in the price of a soft drink decrease the demand for your pizza?

To answer this question, you need to know about the cross elasticity of demand for pizza. Let's examine this elasticity measure.

We measure the influence of a change in the price of a substitute or complement by using the concept of the cross elasticity of demand. The **cross elasticity of demand** is a measure of the responsiveness of the demand for a good to a change in the price of a substitute or complement, other things remaining the same.

We calculate the *cross elasticity of demand* by using the formula:

$$\text{Cross elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of a substitute or complement}}.$$

The cross elasticity of demand can be positive or negative. If the cross elasticity of demand is *positive*, demand and the price of the other good change in the *same* direction, so the two goods are *substitutes*. If the cross elasticity of demand is *negative*, demand and the price of the other good change in *opposite* directions, so the two goods are *complements*.

Substitutes Suppose that the price of pizza is constant and people buy 9 pizzas an hour. Then the price of a burger rises from \$1.50 to \$2.50. No other influence on buying plans changes and the quantity of pizzas bought increases to 11 an hour.

The change in the quantity demanded at the current price is +2 pizzas—the new quantity, 11 pizzas, minus the original quantity, 9 pizzas. The average quantity is 10 pizzas. So the quantity of pizzas demanded increases by 20 percent. That is,

$$\Delta Q/Q_{ave} \times 100 = (+2/10) \times 100 = +20\%.$$

The change in the price of a burger, a substitute for pizza, is +\$1—the new price, \$2.50, minus the original price, \$1.50. The average price is \$2 a burger. So the price of a burger rises by 50 percent. That is,

$$\Delta P/P_{ave} \times 100 = (+\$1/\$2) \times 100 = +50\%.$$

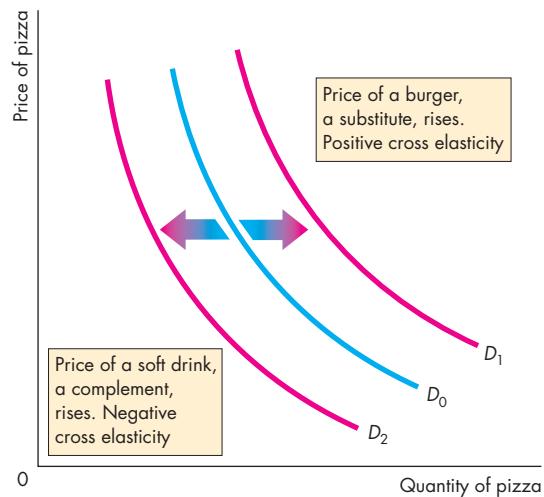
So the cross elasticity of demand for pizza with respect to the price of a burger is:

$$\frac{+20\%}{+50\%} = 0.4.$$

Figure 4.5 illustrates the cross elasticity of demand. Because pizza and burgers are substitutes, when the price of a burger rises, the demand for pizza increases. The demand curve for pizza shifts rightward from D_0 to D_1 . Because a *rise* in the price of a burger brings an *increase* in the demand for pizza, the cross elasticity of demand for pizza with respect to the price of a burger is *positive*. Both the price and the quantity change in the same direction.

Complements Now suppose that the price of pizza is constant and 11 pizzas an hour are bought. Then the price of a soft drink rises from \$1.50 to \$2.50. No other influence on buying plans changes and the quantity of pizzas bought falls to 9 an hour.

FIGURE 4.5 Cross Elasticity of Demand



A burger is a *substitute* for pizza. When the price of a burger rises, the demand for pizza increases and the demand curve for pizza shifts rightward from D_0 to D_1 . The cross elasticity of demand is *positive*.

A soft drink is a *complement* of pizza. When the price of a soft drink rises, the demand for pizza decreases and the demand curve for pizza shifts leftward from D_0 to D_2 . The cross elasticity of demand is *negative*.

[MyEconLab Animation and Draw Graph](#)



ECONOMICS IN THE NEWS

More Peanut Butter Demand Elasticities

Peanut Butter Related Markets

Professor Timothy Mathews teaches economics at Kennesaw State University, Georgia, the nation's number one peanut producing state. The data table below shows his guesses about some demand elasticities for peanut butter.

Source: Timothy Mathews

THE DATA

Income elasticity	- 0.31
Cross elasticity peanut butter and grape jelly	- 0.27
Cross elasticity peanut butter and cheese	+ 0.18

THE QUESTIONS

- What do the data provided tell us about the demand for peanut butter? Is it a normal good?

- Is grape jelly a substitute for or a complement of peanut butter? Is cheese a substitute for or a complement of peanut butter?

THE ANSWERS

- The income elasticity of demand for peanut butter is *negative*, which means that peanut butter is an *inferior good*. People buy less peanut butter as income rises.
- The cross elasticity of demand of peanut butter with respect to the price of grape jelly is *negative*, which means that peanut butter and grape jelly are *complements*.
- The cross elasticity of demand of peanut butter with respect to the price of cheese is *positive*, which means that peanut butter and cheese are *substitutes*.

[MyEconLab More Economics in the News](#)

The change in the quantity demanded is the opposite of what we've just calculated: The quantity of pizzas demanded decreases by 20 percent (-20%).

The change in the price of a soft drink, a rise of \$1 from \$1.50 to \$2.50, is the same as the change in the price of a burger that we've just calculated. That is, the price rises by 50 percent ($+50\%$).

So the cross elasticity of demand for pizza with respect to the price of a soft drink is

$$\frac{-20\%}{+50\%} = -0.4.$$

Because pizza and soft drinks are complements, when the price of a soft drink rises, the demand for pizza decreases.

In Fig. 4.5, when the price of soft drinks rises the demand curve for pizza shifts leftward from D_0 to D_2 . Because a *rise* in the price of a soft drink brings a *decrease* in the demand for pizza, the cross elasticity of demand for pizza with respect to the price of a soft drink is *negative*. The price and quantity change in *opposite* directions.

The magnitude of the cross elasticity of demand determines how far the demand curve shifts. The larger the cross elasticity (absolute value), the greater is the change in demand and the larger is the shift in the demand curve.

If two items are close substitutes, such as two brands of spring water, the cross elasticity is large. If two items are close complements, such as movies and popcorn, the cross elasticity is large.

If two items are somewhat unrelated to each other, such as newspapers and orange juice, the cross elasticity is small—perhaps even zero.



REVIEW QUIZ

- 1 What does the income elasticity of demand measure?
- 2 What does the sign (positive/negative) of the income elasticity tell us about a good?
- 3 What does the cross elasticity of demand measure?
- 4 What does the sign (positive/negative) of the cross elasticity of demand tell us about the relationship between two goods?

Work these questions in Study Plan 4.2 and get instant feedback. Do a Key Terms Quiz.

[MyEconLab](#)

Elasticity of Supply

You know that when demand increases, the equilibrium price rises and the equilibrium quantity increases. But does the price rise by a large amount and the quantity increase by a little? Or does the price barely rise and the quantity increase by a large amount?

The answer depends on the responsiveness of the quantity supplied to a change in the price. If the quantity supplied is not very responsive to price, then an increase in demand brings a large rise in the price and a small increase in the equilibrium quantity. If the quantity supplied is highly responsive to price, then an increase in demand brings a small rise in the price and a large increase in the equilibrium quantity.

The problems that arise from using the slope of the supply curve to indicate responsiveness are the same as those we considered when discussing the responsiveness of the quantity demanded, so we use a units-free measure—the elasticity of supply.

Calculating the Elasticity of Supply

The **elasticity of supply** measures the responsiveness of the quantity supplied to a change in the price of a good when all other influences on selling plans remain the same. It is calculated by using the formula:

$$\text{Elasticity of supply} = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}.$$

We use the same method that you learned when you studied the elasticity of demand. (Refer back to p. 84 to check this method.)

Elastic and Inelastic Supply If the elasticity of supply is greater than 1, we say that supply is elastic; and if the elasticity of supply is less than 1, we say that supply is inelastic.

Suppose that when the price rises from \$20 to \$21, the quantity supplied increases from 10 to 20 pizzas per hour. The price rise is \$1 and the average price is \$20.50, so the price rises by 4.9 percent of the average price. The quantity increases from 10 to 20 pizzas an hour, so the increase is 10 pizzas, the average quantity is 15 pizzas, and the quantity

increases by 67 percent. The elasticity of supply is equal to 67 percent divided by 4.9 percent, which equals 13.67. Because the elasticity of supply exceeds 1 (in this case by a lot), supply is elastic.

In contrast, suppose that when the price rises from \$20 to \$30, the quantity of pizza supplied increases from 10 to 13 per hour. The price rise is \$10 and the average price is \$25, so the price rises by 40 percent of the average price. The quantity increases from 10 to 13 pizzas an hour, so the increase is 3 pizzas, the average quantity is 11.5 pizzas an hour, and the quantity increases by 26 percent. The elasticity of supply is equal to 26 percent divided by 40 percent, which equals 0.65. Now, because the elasticity of supply is less than 1, supply is inelastic.

Figure 4.6 shows the range of elasticities of supply. If the quantity supplied is fixed regardless of the price, the supply curve is vertical and the elasticity of supply is zero. Supply is perfectly inelastic. This case is shown in Fig. 4.6(a). A special intermediate case occurs when the percentage change in price equals the percentage change in quantity. Supply is then unit elastic. This case is shown in Fig. 4.6(b). No matter how steep the supply curve is, if it is linear and passes through the origin, supply is unit elastic. If there is a price at which sellers are willing to offer any quantity for sale, the supply curve is horizontal and the elasticity of supply is infinite. Supply is perfectly elastic. This case is shown in Fig. 4.6(c).

The Factors That Influence the Elasticity of Supply

The elasticity of supply of a good depends on:

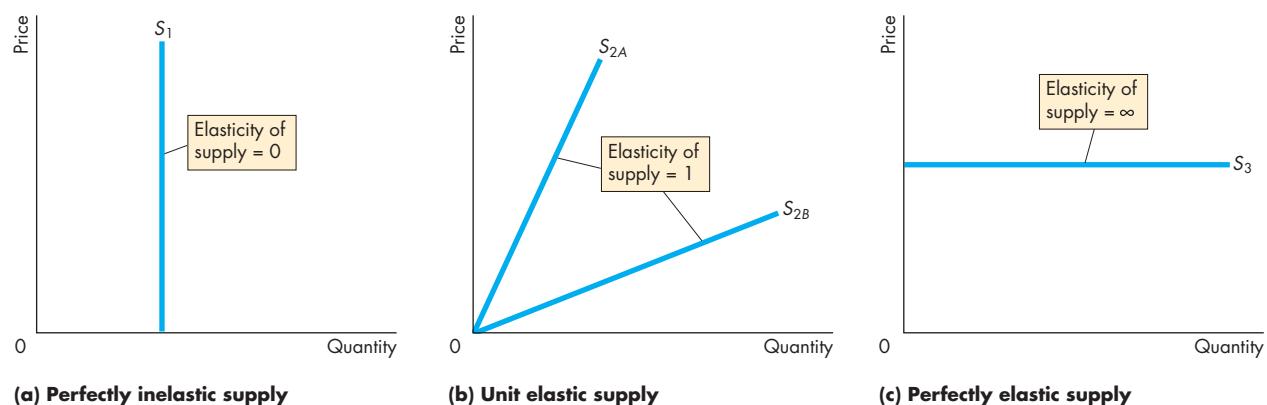
- Resource substitution possibilities
- Time frame for the supply decision

Resource Substitution Possibilities Some goods and services can be produced only by using unique or rare productive resources. These items have a low, perhaps even a zero, elasticity of supply. Other goods and services can be produced by using commonly available resources that could be allocated to a wide variety of alternative tasks. Such items have a high elasticity of supply.

A Van Gogh painting is an example of a good with a vertical supply curve and a zero elasticity of supply. At the other extreme, wheat can be grown on land that is almost equally good for growing corn, so it is just as easy to grow wheat as corn. The opportunity cost of wheat in terms of forgone corn is almost constant. As a result, the supply curve of wheat is almost horizontal and its elasticity of supply is very large. Similarly, when a good is produced in many different countries (for example, sugar and beef), the supply of the good is highly elastic.

The supply of most goods and services lies between these two extremes. The quantity produced

FIGURE 4.6 Inelastic and Elastic Supply



Each supply illustrated here has a constant elasticity. The supply curve in part (a) illustrates the supply of a good that has a zero elasticity of supply. Each supply curve in part (b) illustrates the supply of a good with a unit elasticity of

supply. All linear supply curves that pass through the origin illustrate supplies that are unit elastic. The supply curve in part (c) illustrates the supply of a good with an infinite elasticity of supply.

can be increased but only by incurring a higher cost. If a higher price is offered, the quantity supplied increases. Such goods and services have an elasticity of supply between zero and infinity.

Time Frame for the Supply Decision To study the influence of the amount of time elapsed since a price change, we distinguish three time frames of supply:

- Momentary supply
- Short-run supply
- Long-run supply

Momentary Supply When the price of a good changes, the immediate response of the quantity supplied is determined by the *momentary supply* of that good.

Some goods, such as fruits and vegetables, have a perfectly inelastic momentary supply—a vertical supply curve. The quantities supplied depend on crop-planting decisions made earlier. In the case of oranges, for example, planting decisions have to be made many years in advance of the crop being available. Momentary supply is perfectly inelastic because, on a given day, no matter what the price of oranges, producers cannot change their output. They have picked, packed, and shipped their crop to market, and the quantity available for that day is fixed.

In contrast, some goods have a perfectly elastic momentary supply. Long-distance phone calls are an example. When many people simultaneously make a call, there is a big surge in the demand for telephone cables, computer switching, and satellite time. The quantity supplied increases, but the price remains constant. Long-distance carriers monitor fluctuations in demand and reroute calls to ensure that the quantity supplied equals the quantity demanded without changing the price.

Short-Run Supply The response of the quantity supplied to a price change when only *some* of the possible adjustments to production can be made is determined by *short-run supply*. Most goods have an inelastic short-run supply. To increase output in the short run, firms must work their labour force overtime and perhaps hire additional workers. To decrease their output in the short run, firms either lay off workers or reduce their hours of work. With the passage of time, firms can make more adjustments, perhaps training additional workers or buying additional tools and other equipment.

For the orange grower, if the price of oranges falls, some pickers can be laid off and oranges left on the trees to rot. Or if the price of oranges rises, the grower can use more fertilizer and improved irrigation to increase the yield of the existing trees.

But an orange grower can't change the number of trees producing oranges in the short run.

Long-Run Supply The response of the quantity supplied to a price change after *all* the technologically possible ways of adjusting supply have been exploited is determined by *long-run supply*. For most goods and services, long-run supply is elastic and perhaps perfectly elastic.

For the orange grower, the long run is the time it takes new tree plantings to grow to full maturity—about 15 years. In some cases, the long-run adjustment occurs only after a completely new production plant has been built and workers have been trained to operate it—typically a process that might take several years.

REVIEW QUIZ

- 1 Why do we need a units-free measure of the responsiveness of the quantity supplied of a good or service to a change in its price?
- 2 Define the elasticity of supply and show how it is calculated.
- 3 What are the main influences on the elasticity of supply that make the supply of some goods elastic and the supply of other goods inelastic?
- 4 Provide examples of goods or services whose elasticities of supply are (a) zero, (b) greater than zero but less than infinity, and (c) infinity.
- 5 How does the time frame over which a supply decision is made influence the elasticity of supply? Explain your answer.

Work these questions in Study Plan 4.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

◆ You have now learned about the elasticities of demand and supply. Table 4.1 summarizes all the elasticities that you've met in this chapter. In the next chapter, we study the efficiency of competitive markets. But first study *Economics in the News* on pp. 98–99, which puts the elasticity of demand to work and looks at the market for coffee.

TABLE 4.1 A Compact Glossary of Elasticities**Price Elasticities of Demand****A relationship is described as**

	When its magnitude is	Which means that
Perfectly elastic	Infinity	The smallest possible increase in price causes an infinitely large decrease in the quantity demanded*
Elastic	Less than infinity but greater than 1	The percentage decrease in the quantity demanded exceeds the percentage increase in price
Unit elastic	1	The percentage decrease in the quantity demanded equals the percentage increase in price
Inelastic	Less than 1 but greater than zero	The percentage decrease in the quantity demanded is less than the percentage increase in price
Perfectly inelastic	Zero	The quantity demanded is the same at all prices

Cross Elasticities of Demand**A relationship is described as**

	When its value is	Which means that
Close substitutes	Large	The smallest possible increase in the price of one good causes an infinitely large increase in the quantity demanded* of the other good
Substitutes	Positive	If the price of one good increases, the quantity demanded of the other good also increases
Unrelated goods	Zero	If the price of one good increases, the quantity demanded of the other good remains the same
Complements	Negative	If the price of one good increases, the quantity demanded of the other good decreases

Income Elasticities of Demand**A relationship is described as**

	When its value is	Which means that
Income elastic (normal good)	Greater than 1	The percentage increase in the quantity demanded is greater than the percentage increase in income*
Income inelastic (normal good)	Less than 1 but greater than zero	The percentage increase in the quantity demanded is greater than zero but less than the percentage increase in income
Negative (inferior good)	Less than zero	When income increases, quantity demanded decreases

Elasticities of Supply**A relationship is described as**

	When its magnitude is	Which means that
Perfectly elastic	Infinity	The smallest possible increase in price causes an infinitely large increase in the quantity supplied*
Elastic	Less than infinity but greater than 1	The percentage increase in the quantity supplied exceeds the percentage increase in the price
Unit elastic	1	The percentage increase in the quantity supplied equals the percentage increase in the price
Inelastic	Greater than zero but less than 1	The percentage increase in the quantity supplied is less than the percentage increase in the price
Perfectly inelastic	Zero	The quantity supplied is the same at all prices

*In each description, the directions of change may be reversed. For example, in the perfectly elastic demand case, the smallest possible *decrease* in price causes an infinitely large *increase* in the quantity demanded.



The Elasticity of Demand for Coffee

Drop in Global Coffee Prices Shrinks Farmers' Revenue

Daily Monitor

November 6, 2013

Global coffee prices have continued on a downward trend, casting a gloomy picture on ... farmers' income.

Latest records from the International Coffee Organization (ICO) show the drop has continued even as the new coffee calendar begins.

By close of October, ICO [average price] dropped to 100.38 cents, down from the 111.82 cents per pound in September. ...

In an interview with the *Daily Monitor*, Mr David Barry, the managing director of Kyagalanyi Coffee Ltd, Uganda's leading coffee exporting Company, said: "We may not know what's ahead of us but trends show a further fall in prices and everyone has to brave for this."

The drop in price has been attributed to increased production, with the biggest producers being Brazil and Vietnam whose production reached 90 million bags, with the latter posting 60 million bags and the former 30 million.

Crop year 2012/13 has now closed in all exporting countries and according to available information, total production is estimated at 145.2 million bags. This is 12.8 million bags more than 2011/12, representing a 9.6 percent increase. ...

Written by Dorothy Nakaweesi. Copyright © 2013 by *Daily Monitor*. Used by permission of Dorothy Nakaweesi.

ESSENCE OF THE STORY

- Global coffee prices fell from 111.82 cents per pound in September 2013 to 100.38 cents per pound in November 2013.
- The fall in price was the result of increased production.
- Output in Brazil, the world's largest producer, was 60 million bags, and in Vietnam, the second-largest producer, it was 30 million bags.
- For the crop year 2012/13, total production was estimated at 145.2 million bags.
- Production in 2012/13 was 12.8 million bags more than 2011/12, a 9.6 percent increase.

ECONOMIC ANALYSIS

- The table below summarizes data provided by the International Coffee Organization. The data supplements and updates some of the information in the news article.

Summary of Coffee Data

Year	Quantity produced (millions of bags)	Price (U.S. cents per pound)
2012	134	135
2013	145	100

- Figure 1 provides yet more data and shows that after falling through 2013, the price of coffee climbed steeply in 2014.
- The price of coffee fluctuates because the supply of coffee fluctuates. And the price fluctuates by much more than the quantity of coffee produced because the demand for coffee is inelastic.
- The news headline provides the first clue that demand is inelastic: When the price falls, revenue shrinks. This information enables us to use the *total revenue test*: "If a price cut decreases total revenue, then demand is inelastic."
- We can estimate the price elasticity of demand for coffee, assuming that demand didn't change, by using the events in the market in 2012 and 2013.
- Figure 2 illustrates the global market for coffee in these two years. The demand curve for coffee is D , and in 2012 the supply curve of coffee was S_{12} . The equilibrium price was 135 cents per pound, and the equilibrium quantity was 134 million bags.
- In 2013, supply increased to S_{13} , the price fell to 100 cents per pound, and the quantity increased to 145 million bags.
- Figure 3 focuses on the demand curve and summarizes the elasticity calculation. The price fell by 35 cents, which is 30 percent of the average price of 117 cents. The quantity demanded increased by 11 million bags, which is 7.9 percent of the average quantity.
- The price elasticity of demand is 7.9 percent/30 percent, which equals 0.26. A 1 percent fall in price brings a 0.26 percent increase in the quantity demanded. And a 1 percent increase in the quantity brings a fall in price equal to $1/0.26$, or almost 4 percent.
- When demand is inelastic, a small percentage change in supply brings a large percentage change in price.



Figure 1 The Coffee-Price Roller Coaster

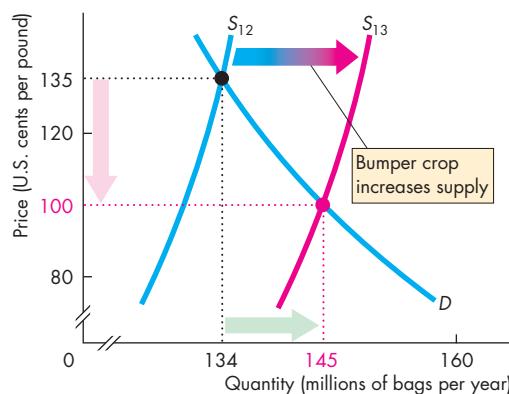


Figure 2 The Market for Coffee: 2012 and 2013

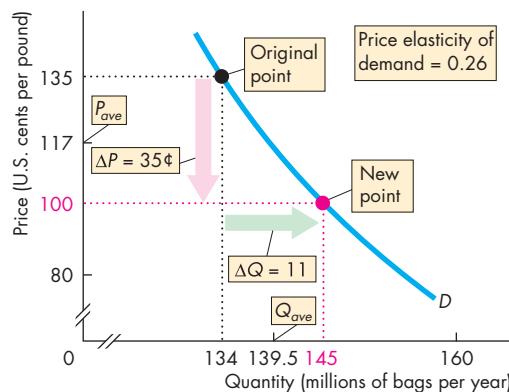


Figure 3 The Price Elasticity of Demand for Coffee



SUMMARY

Key Points

Price Elasticity of Demand (pp. 84–90)

- Elasticity is a measure of the responsiveness of the quantity demanded of a good to a change in its price, other things remaining the same.
- Price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in the price.
- The larger the magnitude of the price elasticity of demand, the greater is the responsiveness of the quantity demanded to a given price change.
- If demand is elastic, a cut in price leads to an increase in total revenue. If demand is unit elastic, a cut in price leaves total revenue unchanged. And if demand is inelastic, a cut in price leads to a decrease in total revenue.
- Price elasticity of demand depends on how easily one good serves as a substitute for another, the proportion of income spent on the good, and the length of time elapsed since the price change.

Working Problems 1 to 5 will give you a better understanding of the price elasticity of demand.

More Elasticities of Demand (pp. 91–94)

- Income elasticity of demand measures the responsiveness of demand to a change in income, other things remaining the same. For a normal good, the income elasticity of demand is positive. For an inferior good, the income elasticity of demand is negative.
- When the income elasticity of demand is greater than 1 (income elastic), the percentage of income spent on the good increases as income increases.
- When the income elasticity of demand is less than 1 (income inelastic or inferior), the percentage

of income spent on the good decreases as income increases.

- Cross elasticity of demand measures the responsiveness of the demand for one good to a change in the price of a substitute or a complement, other things remaining the same.
- The cross elasticity of demand with respect to the price of a substitute is positive. The cross elasticity of demand with respect to the price of a complement is negative.

Working Problems 6 to 8 will give you a better understanding of cross and income elasticities of demand.

Elasticity of Supply (pp. 94–96)

- Elasticity of supply measures the responsiveness of the quantity supplied of a good to a change in its price, other things remaining the same.
- The elasticity of supply is usually positive and ranges between zero (vertical supply curve) and infinity (horizontal supply curve).
- Supply decisions have three time frames: momentary, short run, and long run.
- Momentary supply refers to the response of the quantity supplied to a price change at the instant that the price changes.
- Short-run supply refers to the response of the quantity supplied to a price change after some of the technologically feasible adjustments in production have been made.
- Long-run supply refers to the response of the quantity supplied to a price change when all the technologically feasible adjustments in production have been made.

Working Problem 9 will give you a better understanding of the elasticity of supply.

Key Terms

Cross elasticity of demand, 92
 Elastic demand, 86
 Elasticity of supply, 94
 Income elasticity of demand, 91

Inelastic demand, 85
 Perfectly elastic demand, 85
 Perfectly inelastic demand, 85
 Price elasticity of demand, 84

MyEconLab Key Terms Quiz

Total revenue, 88
 Total revenue test, 88
 Unit elastic demand, 85

WORKED PROBLEM

MyEconLab You can work this problem in Chapter 4 Study Plan.

A rise in the price of a smoothie from \$2 to \$3 results in a fall in the quantity of smoothies demanded from 220 million to 180 million a day and at today's price of a muffin, \$1.50, the quantity of muffins demanded increases from 80 million to 100 million a day.

Questions

- Calculate the percentage change in the price of a smoothie and the percentage change in the quantity demanded of smoothies.
- Calculate the price elasticity of demand for smoothies.
- Is the demand for smoothies elastic or inelastic?
- Calculate the cross elasticity of demand for muffins with respect to the price of a smoothie.

Solutions

- The price of a smoothie rises by \$1 and the quantity demanded falls by 40 million a day.

To calculate the percentage changes in the price and quantity demanded use the average price and average quantity. The figure illustrates the calculations.

The average price of a smoothie is \$2.50, so the percentage change in the price was $(\$1/\$2.50) \times 100$, or 40 percent.

The average quantity of smoothies is 200 million, so the percentage change in the quantity demanded was $(40 \text{ million}/200 \text{ million}) \times 100$, or 20 percent.

Key Point: When working with elasticity, the percentage change in the price and quantity is the percentage of the average price and average quantity.

- The price elasticity of demand is the ratio of the percentage change in the quantity to the percentage change in price.

To calculate the price elasticity of demand for smoothies divide the percentage change in quantity by the percentage change in the price. The ratio of two percentage changes is just a number.

Key Point: The price elasticity calculated is the price elasticity of demand at the price midway between the original and the new prices. That is, it calculates the elasticity at the average price.

- The price elasticity of demand for smoothies is *less than* 1, so the demand is inelastic.

Key Point: When the percentage change in the quantity is *less than* the percentage change in the price, demand is inelastic and the price elasticity of demand is less than 1.

- To calculate the cross elasticity of demand for muffins with respect to the price of a smoothie divide the percentage change in quantity of muffins demanded by the percentage change in the price of a smoothie.

When the price of a smoothie rises by 40 percent, the quantity of muffins demanded increases from 80 million to 100 million, a change of 20 million.

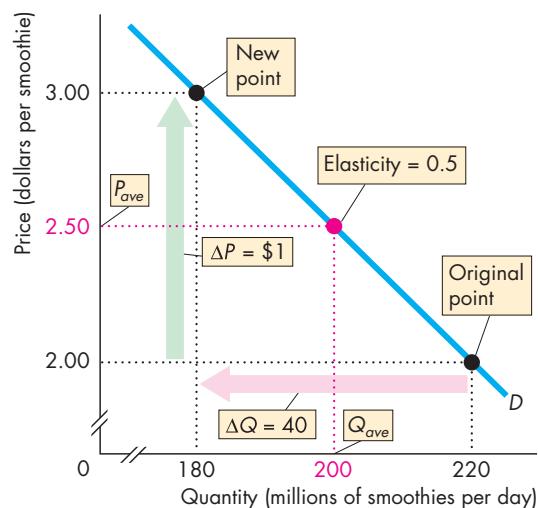
The average quantity of muffins is 90 million, so the percentage change in the quantity of muffins is $(20 \text{ million}/90 \text{ million}) \times 100$, which equals 22.2 percent.

The cross elasticity of demand for muffins with respect to the price of a smoothie equals 22.2 percent/40 percent, which equals 0.55.

The cross elasticity of demand for muffins with respect to the price of a smoothie is *positive*, which means that muffins and smoothies are substitutes—just as you thought!

Key Point: The cross elasticity of demand is positive for substitutes and negative for complements.

Key Figure



MyEconLab Interactive Animation

◆ STUDY PLAN PROBLEMS AND APPLICATIONS

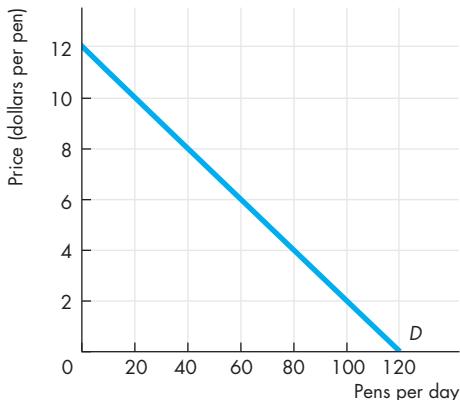
MyEconLab You can work Problems 1 to 9 in Chapter 4 Study Plan and get instant feedback.

Price Elasticity of Demand (Study Plan 4.1)

1. Rain spoils the strawberry crop, the price rises from \$4 to \$6 a box, and the quantity demanded decreases from 1,000 to 600 boxes a week.
 - a. Calculate the price elasticity of demand over this price range.
 - b. Describe the demand for strawberries.
2. If the quantity of dental services demanded increases by 10 percent when the price of dental services falls by 10 percent, is the demand for dental services inelastic, elastic, or unit elastic?
3. The demand schedule for hotel rooms is:

Price (dollars per room per night)	Quantity demanded (millions of rooms per night)
200	100
250	80
400	50
500	40
800	25

- a. What happens to total revenue when the price falls from \$400 to \$250 a room per night and from \$250 to \$200 a room per night?
- b. Is the demand for hotel rooms elastic, inelastic, or unit elastic?
4. The figure shows the demand for pens.



Calculate the elasticity of demand when the price rises from \$4 to \$6 a pen. Over what price range is the demand for pens elastic?

5. In 2003, when music downloading first took off, Universal Music slashed the average price of a

CD from \$21 to \$15. The company expected the price cut to boost the quantity of CDs sold by 30 percent, other things remaining the same.

- a. What was Universal Music's estimate of the price elasticity of demand for CDs?
- b. If you were making the pricing decision at Universal Music, what would be your pricing decision? Explain your decision.

More Elasticities of Demand (Study Plan 4.2)

6. When Judy's income increased from \$130 to \$170 a week, she increased her demand for concert tickets by 15 percent and decreased her demand for bus rides by 10 percent. Calculate Judy's income elasticity of demand for (a) concert tickets and (b) bus rides.
7. If a 12 percent rise in the price of orange juice decreases the quantity of orange juice demanded by 22 percent and increases the quantity of apple juice demanded by 14 percent, calculate the:
 - a. Price elasticity of demand for orange juice.
 - b. Cross elasticity of demand for apple juice with respect to the price of orange juice.
8. If a rise in the price of sushi from 98¢ to \$1.02 a piece decreases the quantity of soy sauce demanded from 101 units to 99 units an hour and decreases the quantity of sushi demanded by 1 percent an hour, calculate the:
 - a. Price elasticity of demand for sushi.
 - b. Cross elasticity of demand for soy sauce with respect to the price of sushi.

Elasticity of Supply (Study Plan 4.3)

9. The table sets out the supply schedule of jeans.

Price (dollars per pair)	Quantity supplied (millions of pairs per year)
120	24
125	28
130	32
135	36

- a. Calculate the elasticity of supply when the price rises from \$125 to \$135 a pair.
- b. Calculate the elasticity of supply when the average price is \$125 a pair.
- c. Is the supply of jeans elastic, inelastic, or unit elastic?



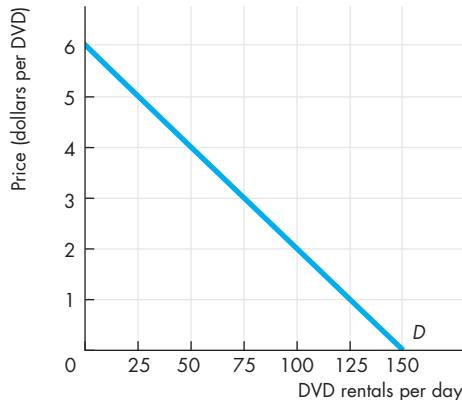
ADDITIONAL PROBLEMS AND APPLICATIONS

MyEconLab

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

Price Elasticity of Demand

10. With higher fuel costs, airlines raised their average fare from 75¢ to \$1.25 per passenger kilometre and the number of passenger kilometres decreased from 2.5 million a day to 1.5 million a day.
 - a. What is the price elasticity of demand for air travel over this price range?
 - b. Describe the demand for air travel.
11. The figure shows the demand for DVD rentals.



- a. Calculate the elasticity of demand when the price of a DVD rental rises from \$3 to \$5.
- b. At what price is the elasticity of demand for DVD rentals equal to 1?

Use the following table to work Problems 12 to 14. The demand schedule for computer chips is:

Price (dollars per chip)	Quantity demanded (millions of chips per year)
200	50
250	45
300	40
350	35
400	30

12. a. What happens to total revenue if the price falls from \$400 to \$350 a chip and from \$350 to \$300 a chip?
b. At what price is total revenue at a maximum?
13. At an average price of \$350, is the demand for chips elastic, inelastic, or unit elastic? Use the total revenue test to answer this question.
14. At \$250 a chip, is the demand for chips elastic or inelastic? Use the total revenue test to answer this question.

15. Your price elasticity of demand for bananas is 4. If the price of bananas rises by 5 percent, what is:

- a. The percentage change in the quantity of bananas you buy?
- b. The change in your expenditure on bananas?

As Gasoline Prices Soar, Drivers Slowly Adapt

As gas prices rose in March 2008, people drove shorter distances than in March 2007. Realizing that prices were not going down, drivers adapted to higher energy costs. We spend 3.7 percent of disposable income on transportation fuels. How much we spend on gasoline depends on the choices we make: what car we drive, where we live, how much time we spend driving, and where we choose to go. For many people, higher energy costs mean fewer restaurant meals, deferred weekend outings with the kids, less air travel, and more time closer to home.

Source: *International Herald Tribune*, May 23, 2008

- a. List and explain the elasticities of demand that are implicitly referred to in the news clip.
- b. Why, according to the news clip, is the demand for gasoline inelastic?

More Elasticities of Demand

Use this information to work Problems 17 and 18.

Economy Forces Many to Shorten Holiday Plans

This year Americans are taking fewer exotic holidays by air and instead are visiting local scenic places by car. The global financial crisis has encouraged many Americans to cut their holiday budgets.

Source: *USA Today*, May 22, 2009

17. Given the prices of the two holidays, is the income elasticity of demand for exotic holidays positive or negative? Are exotic holidays a normal good or an inferior good? Are local holidays a normal good or an inferior good?
18. Are exotic holidays and local holidays substitutes? Explain your answer.
19. When Alex's income was \$3,000, he bought 4 bagels and 12 donuts a month. Now his income is \$5,000 and he buys 8 bagels and 6 donuts a month. Calculate Alex's income elasticity of demand for (a) bagels and (b) donuts.

20. Walmart's Recession-Time Pet Project

During the recession, Walmart moved its pet food and supplies to the front with its other fast-growing business, baby products. Retail experts point out that kids and pets tend to be fairly recession-resistant businesses—even in a recession, dogs will be fed and kids will get their toys.

Source: CNN, May 13, 2008

- What does this news clip imply about the income elasticity of demand for pet food and baby products?
- Would the income elasticity of demand be greater or less than 1? Explain.

21. If a 5 percent fall in the price of chocolate sauce increases the quantity demanded of chocolate sauce by 10 percent and increases the quantity of ice cream demanded by 15 percent, calculate the:
- Price elasticity of demand for chocolate sauce.
 - Cross elasticity of demand for ice cream with respect to the price of chocolate sauce.

22. To Love, Honour, and Save Money

In a survey of caterers and event planners, nearly half of them said that they were seeing declines in wedding spending in response to the economic slowdown; 12% even reported wedding cancellations because of financial concerns.

Source: *Time*, June 2, 2008

- Based upon this news clip, are wedding events a normal good or an inferior good? Explain.
- Are wedding events more a necessity or a luxury? Would the income elasticity of demand be greater than 1, less than 1, or equal to 1? Explain.

Elasticity of Supply

23. The table sets out the supply schedule of long-distance phone calls.

Price (cents per minute)	Quantity supplied (millions of minutes per day)
10	200
20	400
30	600
40	800

Calculate the elasticity of supply when:

- The price falls from 40¢ to 30¢ a minute.
- The average price is 20¢ a minute.

24. Weak Coal Prices Hit China's Third-Largest Coal Miner

The chairman of Yanzhou Coal Mining reported that the recession had decreased the demand for coal, with its sales falling by 11.9 percent to 7.92 million tonnes from 8.99 million tonnes a year earlier, despite a 10.6 percent cut in the price.

Source: Dow Jones, April 27, 2009

Calculate the price elasticity of supply of coal. Is the supply of coal elastic or inelastic?

Economics in the News

25. After you have studied *Economics in the News* on pp. 98–99, answer the following questions.
- Looking at Fig. 1 on p. 99, explain what must have happened in 2014 to the supply of coffee.
 - Given the information in Fig. 1 and the estimated elasticity of demand for coffee, by what percentage did the quantity of coffee change in 2014 and in which direction?
 - The news article says that farmers' revenue shrank as the price of coffee fell. Explain why this fact tells us that the demand for coffee is inelastic.
 - How does the total revenue test work for a rise in the price? What do you predict happened to total revenue in 2014? Why?
 - Coffee isn't just coffee. It comes in different varieties, the main two being Arabica and Robusta. Would you expect the elasticity of demand for Arabica to be the same as the elasticity of demand for coffee? Explain why or why not.

26. Comcast Deal Won't Lead to Netflix Price Hike

Under the deal, Netflix will buy Internet service from Comcast, rather than connect directly for free with some smaller ISPs like Cablevision as it does now.

Source: CNN, April 24, 2014

- How will Netflix's decision to buy more expensive Internet service influence Netflix's supply of online movie viewing?
- Given your answer to part (a), explain why Netflix says it will not hike its price.
- What can you say about the price elasticity of demand for Netflix online movie viewing?



5

EFFICIENCY AND EQUITY

After studying this chapter,
you will be able to:

- ◆ Describe the alternative methods of allocating scarce resources
- ◆ Explain the connection between demand and marginal benefit and define consumer surplus; and explain the connection between supply and marginal cost and define producer surplus
- ◆ Explain the conditions under which markets are efficient and inefficient
- ◆ Explain the main ideas about fairness and evaluate claims that markets result in unfair outcomes

Every day, millions of people make self-interested choices to drive to work rather than take the bus or train. The outcome of these choices is gridlock and a lot of lost time. Are we using our highways and our time efficiently?

One way of eliminating traffic jams is to make people pay for road use—to make all the highways toll-roads. Rich people can easily pay a toll, but poor people can't afford to pay. Would tolls be fair?

We'll answer these questions about highway use in *Economics in the News* at the end of the chapter. But first, we examine the efficiency and fairness of alternative ways of allocating scarce resources.

Resource Allocation Methods

If resources were abundant, and not scarce, we would not need to allocate them among alternative uses. But resources *are* scarce: They must be allocated somehow. Our goal is to discover how resources might be allocated efficiently and fairly. So what are the alternative methods of allocating scarce resources?

Eight alternative methods that might be used are:

- Market price
- Command
- Majority rule
- Contest
- First-come, first-served
- Lottery
- Personal characteristics
- Force

Let's briefly examine each method.

Market Price

When a market price allocates a scarce resource, the people who are willing and able to pay that price get the resource. Two kinds of people decide not to pay the market price: those who can afford to pay but choose not to buy and those who are too poor and simply can't afford to buy.

For many goods and services, distinguishing between those who choose not to buy and those who can't afford to buy doesn't matter. But for a few items, it does matter. For example, poor people can't afford to pay school fees and doctors' fees. Because poor people can't afford items that most people consider to be essential, these items are usually allocated by one of the other methods.

Command

A **command system** allocates resources by the order (command) of someone in authority. In the Canadian economy, the command system is used extensively inside firms and government departments. For example, if you have a job, most likely someone tells you what to do. Your labour is allocated to specific tasks by a command.

A command system works well in organizations in which the lines of authority and responsibility are clear and it is easy to monitor the activities being

performed. But a command system works badly when the range of activities to be monitored is large and when it is easy for people to fool those in authority. North Korea uses a command system and it works so badly that it even fails to deliver an adequate supply of food.

Majority Rule

Majority rule allocates resources in the way that a majority of voters choose. Societies use majority rule to elect representative governments that make some of the biggest decisions. For example, majority rule decides the tax rates that end up allocating scarce resources between private use and public use. And majority rule decides how tax dollars are allocated among competing uses such as education and healthcare.

Majority rule works well when the decisions being made affect large numbers of people and self-interest must be suppressed to use resources most effectively.

Contest

A contest allocates resources to a winner (or a group of winners). Sporting events use this method. Milos Raonic competes with other tennis professionals, and the winner gets the biggest payoff. But contests are more general than those in a sports arena, though we don't normally call them contests. For example, Bill Gates won a contest to provide the world's personal computer operating system.

Contests do a good job when the efforts of the "players" are hard to monitor and reward directly. When a manager offers everyone in the company the opportunity to win a big prize, people are motivated to work hard and try to become the winner. Only a few people end up with a big prize, but many people work harder in the process of trying to win. The total output produced by the workers is much greater than it would be without the contest.

First-Come, First-Served

A first-come, first-served method allocates resources to those who are first in line. Many casual restaurants won't accept reservations. They use first-come, first-served to allocate their scarce tables. Highway space is allocated in this way too: The first to arrive at the on-ramp gets the road space. If too many

vehicles enter the highway, the speed slows and people wait in line for some space to become available.

First-come, first-served works best when, as in the above examples, a scarce resource can serve just one user at a time in a sequence. By serving the user who arrives first, this method minimizes the time spent waiting for the resource to become free.

Lottery

Lotteries allocate resources to those who pick the winning number, draw the lucky cards, or come up lucky on some other gaming system. State lotteries and casinos reallocate millions of dollars worth of goods and services every year.

But lotteries are more widespread than jackpots and roulette wheels in casinos. They are used to allocate landing slots to airlines at some airports, places in the New York and Boston marathons, and have been used to allocate fishing rights and the electromagnetic spectrum used by cellphones.

Lotteries work best when there is no effective way to distinguish among potential users of a scarce resource.

Personal Characteristics

When resources are allocated on the basis of personal characteristics, people with the “right” characteristics get the resources. Some of the resources that matter most to you are allocated in this way. For example, you will choose a marriage partner on the basis of personal characteristics. But this method can also be used in unacceptable ways. Allocating the best jobs to white, Anglo-Saxon males and discriminating against visible minorities and women is an example.

Force

Force plays a crucial role, for both good and ill, in allocating scarce resources. Let’s start with the ill.

War, the use of military force by one nation against another, has played an enormous role historically in allocating resources. The economic supremacy of European settlers in the Americas and Australia owes much to the use of this method.

Theft, the taking of the property of others without their consent, also plays a large role. Both large-scale organized crime and small-scale petty crime collectively allocate billions of dollars worth of resources annually.

But force plays a crucial positive role in allocating resources. It provides the state with an effective method of transferring wealth from the rich to the poor, and it provides the legal framework in which voluntary exchange in markets takes place.

A legal system is the foundation on which our market economy functions. Without courts to enforce contracts, it would not be possible to do business. But the courts could not enforce contracts without the ability to apply force if necessary. The state provides the ultimate force that enables the courts to do their work.

More broadly, the force of the state is essential to uphold the principle of the rule of law. This principle is the bedrock of civilized economic (and social and political) life. With the rule of law upheld, people can go about their daily economic lives with the assurance that their property will be protected—that they can sue for violations against their property (and be sued if they violate the property of others).

Free from the burden of protecting their property and confident in the knowledge that those with whom they trade will honour their agreements, people can get on with focusing on the activity in which they have a comparative advantage and trading for mutual gain.

REVIEW QUIZ

- 1 Why do we need methods of allocating scarce resources?
- 2 Describe the alternative methods of allocating scarce resources.
- 3 Provide an example of each allocation method that illustrates when it works well.
- 4 Provide an example of each allocation method that illustrates when it works badly.

Work these questions in Study Plan 5.1 and get instant feedback. Do a Key Terms Quiz. [MyEconLab](#)

In the next sections, we’re going to see how a market can achieve an efficient use of resources, examine the obstacles to efficiency, and see how sometimes an alternative method might improve on the market. After looking at efficiency, we’ll turn our attention to the more difficult issue of fairness.

Benefit, Cost, and Surplus

Resources are allocated efficiently and in the *social interest* when they are used in the ways that people value most highly. You saw in Chapter 2 that this outcome occurs when the quantities produced are at the point on the *PPF* at which marginal benefit equals marginal cost (see pp. 35–37). We're now going to see whether competitive markets produce the efficient quantities.

We begin on the demand side of a market.

Demand, Willingness to Pay, and Value

In everyday life, we talk about “getting value for money.” When we use this expression, we are distinguishing between *value* and *price*. Value is what we get, and price is what we pay.

The value of one more unit of a good or service is its marginal benefit. We measure marginal benefit by the maximum price that is willingly paid for another unit of the good or service. But willingness to pay determines demand. *A demand curve is a marginal benefit curve.*

In Fig. 5.1(a), Lisa is willing to pay \$1 for the 30th slice of pizza and \$1 is her marginal benefit from that slice. In Fig. 5.1(b), Nick is willing to pay \$1 for the 10th slice of pizza and \$1 is his marginal benefit from that slice. But at what quantity is the market willing to pay \$1 for the marginal slice? The answer is provided by the *market demand curve*.

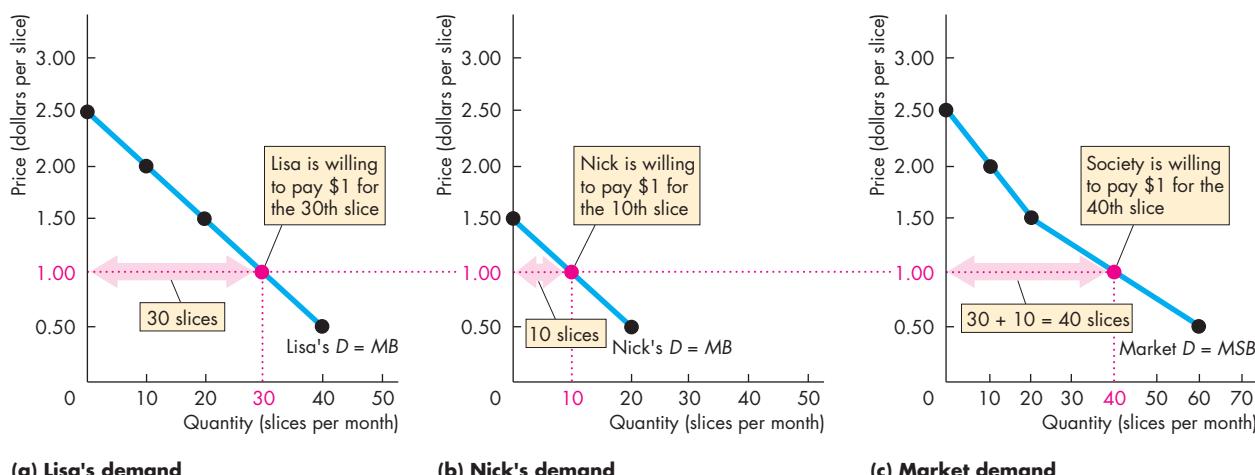
Individual Demand and Market Demand

The relationship between the price of a good and the quantity demanded by one person is called *individual demand*. And the relationship between the price of a good and the quantity demanded by all buyers is called *market demand*.

The market demand curve is the horizontal sum of the individual demand curves and is formed by adding the quantities demanded by all the individuals at each price.

Figure 5.1(c) illustrates the market demand for pizza if Lisa and Nick are the only people in the market. Lisa's demand curve in part (a) and Nick's demand curve in part (b) sum horizontally to the market demand curve in part (c).

FIGURE 5.1 Individual Demand, Market Demand, and Marginal Social Benefit



(a) Lisa's demand

At a price of \$1 a slice, the quantity demanded by Lisa is 30 slices and the quantity demanded by Nick is 10 slices, so the quantity demanded by the market is 40 slices. Lisa's demand

(b) Nick's demand

curve in part (a) and Nick's demand curve in part (b) sum horizontally to the market demand curve in part (c). The market demand curve is the marginal social benefit (MSB) curve.

MyEconLab Animation

At a price of \$1 a slice, Lisa demands 30 slices and Nick demands 10 slices, so the market quantity demanded at \$1 a slice is 40 slices.

For Lisa and Nick, their demand curves are their marginal benefit curves. For society, the market demand curve is the marginal benefit curve. We call the marginal benefit to the entire society *marginal social benefit*. So the market demand curve is also the *marginal social benefit (MSB) curve*.

Consumer Surplus

We don't always have to pay as much as we are willing to pay. We get a bargain. When people buy something for less than it is worth to them, they receive a consumer surplus. **Consumer surplus** is the excess of the benefit received from a good over the amount paid for it. We can calculate consumer surplus as the marginal benefit (or value) of a good minus its price, summed over the quantity bought.

Figure 5.2(a) shows Lisa's consumer surplus from pizza when the price is \$1 a slice. At this price, she buys 30 slices a month because the 30th slice is worth exactly \$1 to her. But Lisa is willing to pay \$2 for the 10th slice, so her marginal benefit from this slice is

\$1 more than she pays for it—she receives a surplus of \$1 on the 10th slice.

Lisa's consumer surplus is the sum of the surpluses on *all of the slices she buys*. This sum is the area of the green triangle—the area below the demand curve and above the market price line. The area of this triangle is equal to its base (30 slices) multiplied by its height (\$1.50) divided by 2, which is \$22.50. The area of the blue rectangle in Fig. 5.2(a) shows what Lisa pays for 30 slices of pizza.

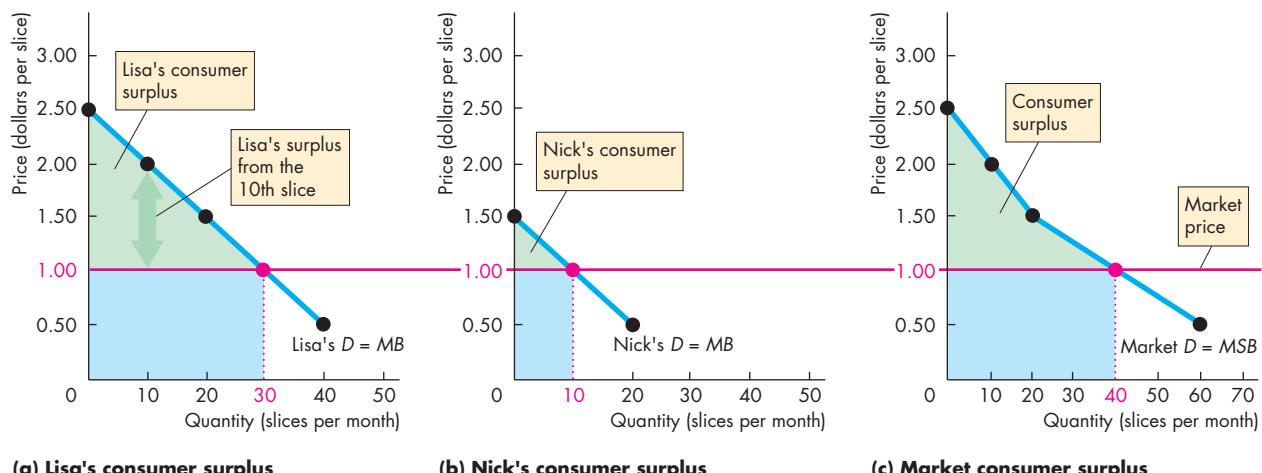
Figure 5.2(b) shows Nick's consumer surplus, and part (c) shows the consumer surplus for the market. The consumer surplus for the market is the sum of the consumer surpluses of Lisa and Nick.

All goods and services have decreasing marginal benefit, so people receive more benefit from their consumption than the amount they pay.

Supply and Marginal Cost

Your next task is to see how market supply reflects marginal cost. The connection between supply and cost closely parallels the related ideas about demand and benefit that you've just studied. Firms are in business to make a profit. To do so, they must sell

FIGURE 5.2 Demand and Consumer Surplus



Lisa is willing to pay \$2 for her 10th slice of pizza in part (a). At a market price of \$1 a slice, Lisa receives a surplus of \$1 on the 10th slice. The green triangle shows her consumer surplus on the 30 slices she buys at \$1 a slice. The

green triangle in part (b) shows Nick's consumer surplus on the 10 slices that he buys at \$1 a slice. The green area in part (c) shows the consumer surplus for the market. The blue rectangles show the amounts spent on pizza.

their output for a price that exceeds the cost of production. Let's investigate the relationship between cost and price.

Supply, Cost, and Minimum Supply-Price

Firms make a profit when they receive more from the sale of a good or service than the cost of producing it. Just as consumers distinguish between value and price, so producers distinguish between *cost* and *price*. Cost is what a firm gives up when it produces a good or service and price is what a firm receives when it sells the good or service.

The cost of producing one more unit of a good or service is its marginal cost. Marginal cost is the minimum price that producers must receive to induce them to offer one more unit of a good or service for sale. But the minimum supply-price determines supply. *A supply curve is a marginal cost curve.*

In Fig. 5.3(a), Maria is willing to produce the 100th pizza for \$15, her marginal cost of that pizza. In Fig. 5.3(b), Max is willing to produce the 50th pizza for \$15, his marginal cost.

What quantity is this market willing to produce for \$15 a pizza? The answer is provided by the *market supply curve*.

Individual Supply and Market Supply

The relationship between the price of a good and the quantity supplied by one producer is called *individual supply*. And the relationship between the price of a good and the quantity supplied by all producers is called *market supply*.

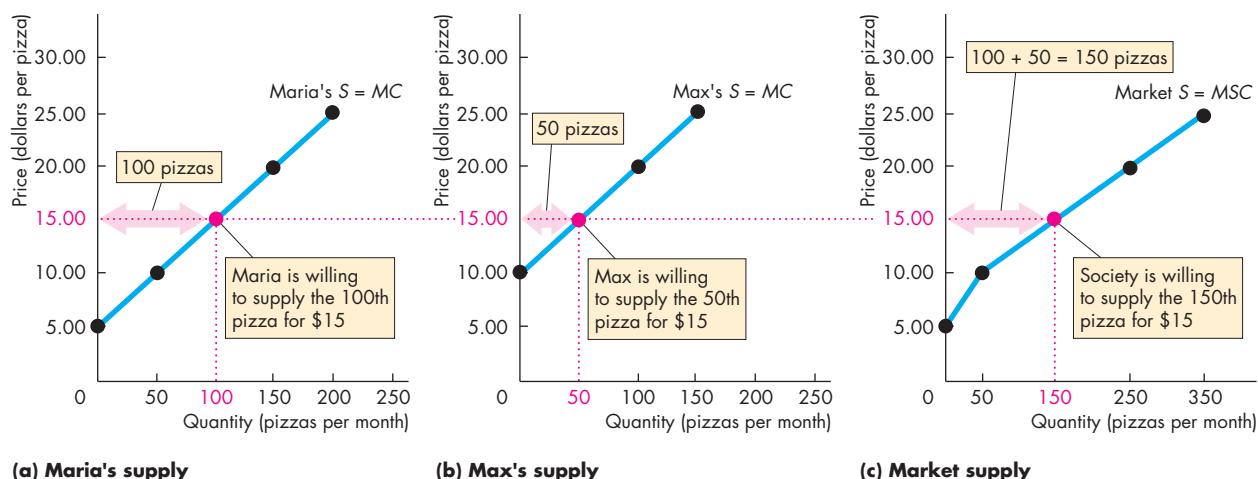
The market supply curve is the horizontal sum of the individual supply curves and is formed by adding the quantities supplied by all the producers at each price.

Figure 5.3(c) illustrates the market supply of pizzas if Maria and Max are the only producers. Maria's supply curve in part (a) and Max's supply curve in part (b) sum horizontally to the market supply curve in part (c).

At a price of \$15 a pizza, Maria supplies 100 pizzas and Max supplies 50 pizzas, so the quantity supplied by the market at \$15 a pizza is 150 pizzas.

For Maria and Max, their supply curves are their marginal cost curves. For society, the market supply curve is its marginal cost curve. We call the society's marginal cost *marginal social cost*. So the market supply curve is also the *marginal social cost (MSC) curve*.

FIGURE 5.3 Individual Supply, Market Supply, and Marginal Social Cost



At a price of \$15 a pizza, the quantity supplied by Maria is 100 pizzas and the quantity supplied by Max is 50 pizzas, so the quantity supplied by the market is 150 pizzas. Maria's

supply curve in part (a) and Max's supply curve in part (b) sum horizontally to the market supply curve in part (c). The market supply curve is the marginal social cost (MSC) curve.

Producer Surplus

When price exceeds marginal cost, the firm receives a producer surplus. **Producer surplus** is the excess of the amount received from the sale of a good or service over the cost of producing it. We calculate producer surplus as the price received minus the marginal cost (or minimum supply-price), summed over the quantity sold.

Figure 5.4(a) shows Maria's producer surplus from pizza when the price is \$15 a pizza. At this price, she sells 100 pizzas a month because the 100th pizza costs her \$15 to produce. But Maria is willing to produce the 50th pizza for her marginal cost, which is \$10, so she receives a surplus of \$5 on this pizza.

Maria's producer surplus is the sum of the surpluses on the pizzas she sells. This sum is the area of the blue triangle—the area below the market price and above the supply curve. The area of this triangle is equal to its base (100) multiplied by its height (\$10) divided by 2, which is \$500.

The red area below the supply curve in Fig. 5.4(a) shows what it costs Maria to produce 100 pizzas.

The area of the blue triangle in Fig. 5.4(b) shows Max's producer surplus and the blue area in Fig. 5.4(c) shows the producer surplus for the market.

The producer surplus for the market is the sum of the producer surpluses of Maria and Max.

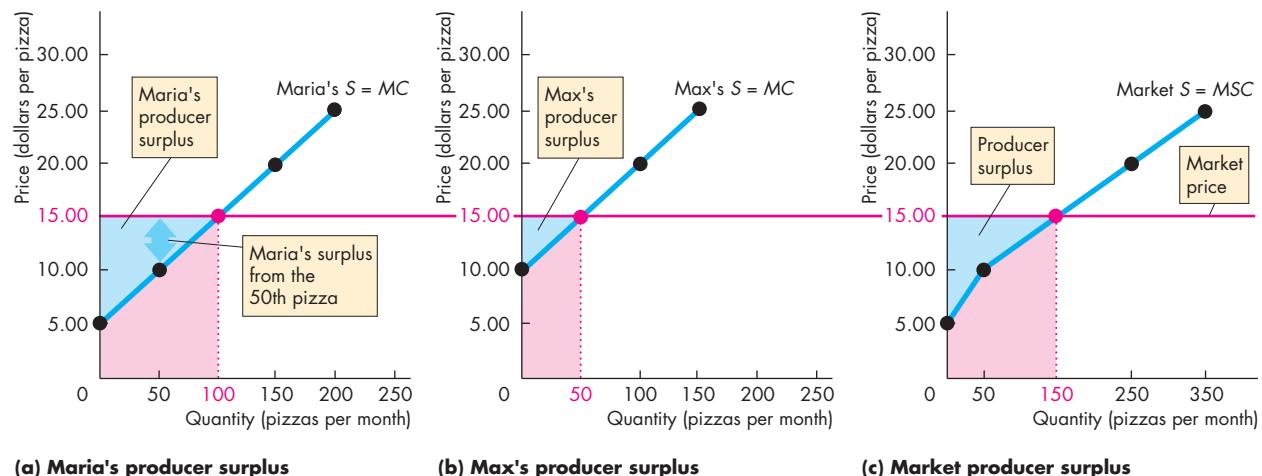
REVIEW QUIZ

- 1 What is the relationship between the marginal benefit, value, and demand?
- 2 What is the relationship between individual demand and market demand?
- 3 What is consumer surplus? How is it measured?
- 4 What is the relationship between the marginal cost, minimum supply-price, and supply?
- 5 What is the relationship between individual supply and market supply?
- 6 What is producer surplus? How is it measured?

Work these questions in Study Plan 5.2 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

Consumer surplus and producer surplus can be used to measure the efficiency of a market. Let's see how we can use these concepts to study the efficiency of a competitive market.

FIGURE 5.4 Supply and Producer Surplus



(a) Maria's producer surplus

(b) Max's producer surplus

(c) Market producer surplus

Maria is willing to produce the 50th pizza for \$10 in part (a). At a market price of \$15 a pizza, Maria gets a surplus of \$5 on the 50th pizza. The blue triangle shows her producer surplus on the 100 pizzas she sells at \$15 each.

The blue triangle in part (b) shows Max's producer surplus on the 50 pizzas that he sells at \$15 each. The blue area in part (c) shows producer surplus for the market. The red areas show the cost of producing the pizzas sold.

MyEconLab Animation and Draw Graph

Is the Competitive Market Efficient?

Figure 5.5(a) shows the market for pizza. The market forces that you studied in Chapter 3 (pp. 66–67) pull the pizza market to its equilibrium price of \$15 a pizza and equilibrium quantity of 10,000 pizzas a day. Buyers enjoy a consumer surplus (green area) and sellers enjoy a producer surplus (blue area), but is this competitive equilibrium efficient?

Efficiency of Competitive Equilibrium

You've seen that the market demand curve for a good or service tells us the marginal social benefit from it. You've also seen that the market supply curve of a good or service tells us the marginal social cost of producing it.

Equilibrium in a competitive market occurs when the quantity demanded equals the quantity supplied at the intersection of the demand curve and the supply curve. At this intersection point, marginal social benefit on the demand curve equals marginal social cost on the supply curve. This equality is the condition for allocative efficiency. So in equilibrium, a competitive market achieves allocative efficiency.

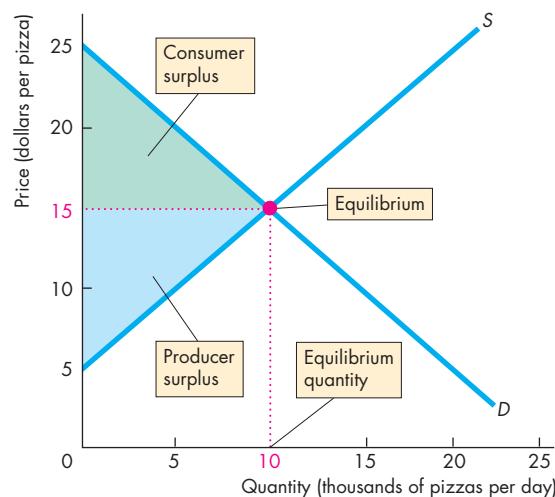
Figure 5.5 illustrates the efficiency of competitive equilibrium. The demand curve and the supply curve intersect in part (a) and marginal social benefit equals marginal social cost in part (b).

If production is less than 10,000 pizzas a day, the marginal pizza is valued more highly than it costs to produce. If production exceeds 10,000 pizzas a day, the marginal pizza costs more to produce than the value that consumers place on it. Only when 10,000 pizzas a day are produced is the marginal pizza worth exactly what it costs.

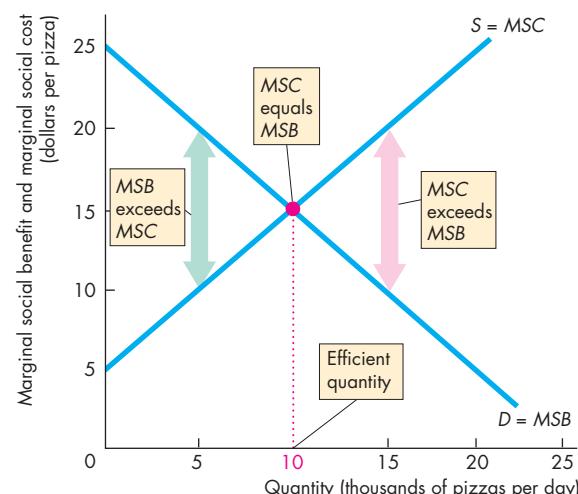
The competitive market pushes the quantity of pizzas produced to its efficient level of 10,000 a day. If production is less than 10,000 pizzas a day, a shortage raises the price, which increases production. If production exceeds 10,000 pizzas a day, a surplus of pizzas lowers the price, which decreases production. So a competitive pizza market is efficient.

Figure 5.5(a) also shows the consumer surplus and producer surplus. The sum of consumer surplus and producer surplus is called **total surplus**. When the efficient quantity is produced, total surplus is maximized. Buyers and sellers acting in their self-interest end up promoting the social interest.

FIGURE 5.5 An Efficient Market for Pizza



(a) Equilibrium and surpluses



(b) Efficiency

Competitive equilibrium in part (a) occurs when the quantity demanded equals the quantity supplied. Resources are used efficiently in part (b) when marginal social benefit, MSB , equals marginal social cost, MSC . Total surplus, which is the sum of consumer surplus (the green triangle) and producer surplus (the blue triangle), is maximized.

The efficient quantity in part (b) is the same as the equilibrium quantity in part (a). The competitive pizza market produces the efficient quantity of pizzas.

MyEconLab Animation and Draw Graph

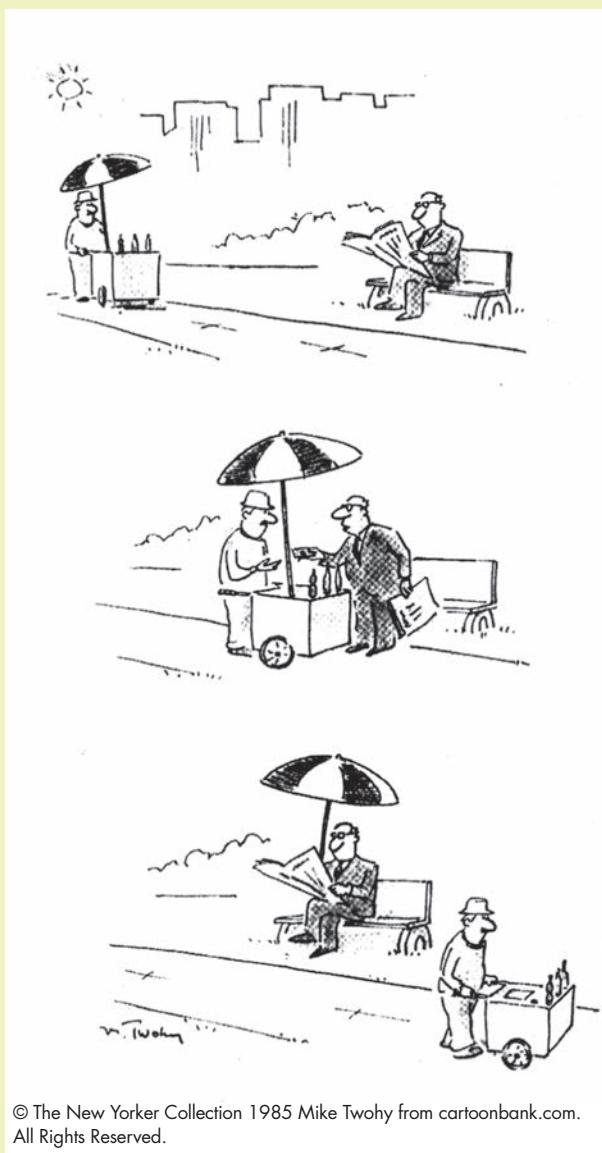
Economics in Action

Seeing the Invisible Hand

Adam Smith said that a seller in a competitive market is “led by *an invisible hand* to promote an end which was no part of his intention” (see p. 8). Smith believed that the invisible hand sends resources to the uses in which they have the highest value.

You can’t *see* the invisible hand, but you can imagine it, and you can see its consequences in the cartoon and in today’s world.

Umbrella for Sale The cold drinks vendor has cold drinks and shade and he has a marginal cost and a minimum supply-price of each. The reader on the park bench has a marginal benefit and willingness



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to pay for each. The reader’s marginal benefit from shade exceeds the vendor’s marginal cost; but the vendor’s marginal cost of a cold drink exceeds the reader’s marginal benefit. They trade the umbrella. The vendor gets a producer surplus from selling the shade for more than its marginal cost, and the reader gets a consumer surplus from buying the shade for less than its marginal benefit. Both are better off and the umbrella has moved to a higher-valued use.

The Invisible Hand at Work Today Many of the markets in which you trade work like that in the cartoon to achieve an efficient allocation of resources.

When you order a pizza for home delivery, you make a choice about how scarce resources will be used. You make your choice in your self-interest. The pizza cook and the person who delivers your pizza also make their choices in their self-interest.

The pizza market coordinates these choices. You buy the quantity of pizza that makes the price you pay equal to your marginal benefit. And the pizza producer sells the quantity at which the price equals his marginal cost. Total surplus is maximized in an efficient pizza market.



Market Failure

Markets are not always efficient, and when a market is inefficient, we call the outcome **market failure**. In a market failure, either too little (underproduction) or too much (overproduction) of an item is produced.

Underproduction In Fig. 5.6(a), the quantity of pizzas produced is 5,000 a day. At this quantity, consumers are willing to pay \$20 for a pizza that costs only \$10 to produce. The quantity produced is inefficient—there is underproduction—and total surplus is smaller than its maximum possible level.

We measure the scale of inefficiency by **deadweight loss**, which is the decrease in total surplus that results from an inefficient level of production. The grey triangle in Fig. 5.6(a) shows the deadweight loss.

Overproduction In Fig. 5.6(b), the quantity of pizzas produced is 15,000 a day. At this quantity, consumers are willing to pay only \$10 for a pizza that costs \$20 to produce. By producing the 15,000th pizza, \$10 of resources are wasted. Again, the grey triangle shows the deadweight loss, which reduces the total surplus to less than its maximum.

Inefficient production creates a deadweight loss that is borne by the entire society: It is a social loss.

Sources of Market Failure

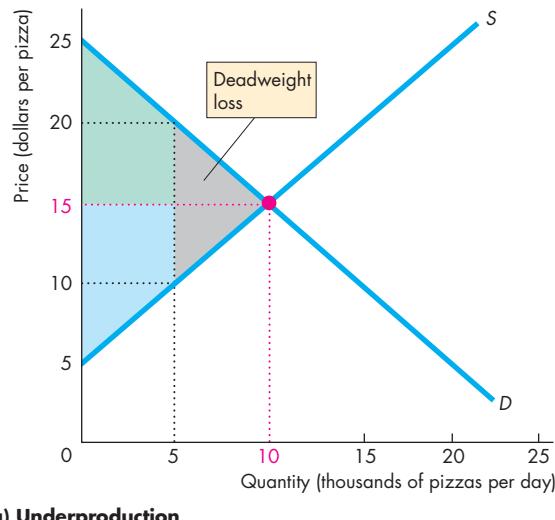
Obstacles to efficiency that bring market failure are:

- Price and quantity regulations
- Taxes and subsidies
- Externalities
- Public goods and common resources
- Monopoly
- High transactions costs

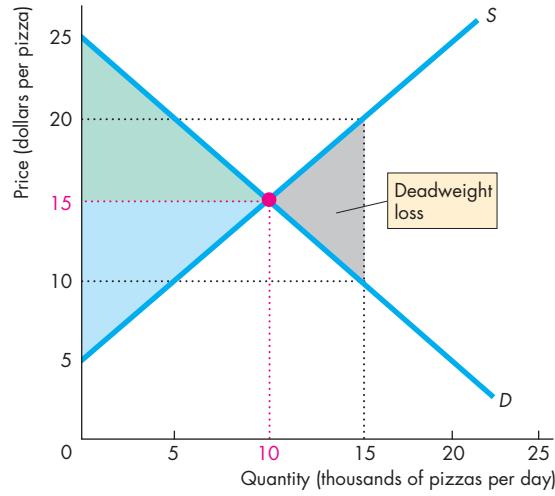
Price and Quantity Regulations A *price regulation*, either a price cap or a price floor, blocks the price adjustments that balance the quantity demanded and the quantity supplied and lead to underproduction. A *quantity regulation* that limits the amount that a farm is permitted to produce also leads to underproduction.

Taxes and Subsidies *Taxes* increase the prices paid by buyers, lower the prices received by sellers, and lead to underproduction. *Subsidies*, which are payments by the government to producers, decrease the prices paid by buyers, increase the prices received by sellers, and lead to overproduction.

FIGURE 5.6 Underproduction and Overproduction



(a) Underproduction



(b) Overproduction

If 5,000 pizzas a day are produced, in part (a), total surplus (the sum of the green and blue areas) is smaller than its maximum by the amount of the deadweight loss (the grey triangle). At all quantities below 10,000 pizzas a day, the benefit from one more pizza exceeds its cost.

If 15,000 pizzas a day are produced, in part (b), total surplus is also smaller than its maximum by the amount of the deadweight loss. At all quantities in excess of 10,000 pizzas a day, the cost of one more pizza exceeds its benefit.

MyEconLab Animation and Draw Graph

Externalities An *externality* is a cost or a benefit that affects someone other than the seller or the buyer. An *external cost* arises when an electric utility burns coal and emits carbon dioxide. The utility doesn't consider the cost of climate change when it decides how much power to produce. The result is overproduction. An *external benefit* arises when an apartment owner installs a smoke detector and decreases her neighbour's fire risk. She doesn't consider the benefit to her neighbour when she decides how many detectors to install. The result is underproduction.

Public Goods and Common Resources A *public good* is a good or service from which everyone benefits and no one can be excluded. National defence is an example. A competitive market would underproduce national defence because everyone would try to free ride on everyone else.

A *common resource* is owned by no one but is available to be used by everyone. Atlantic salmon is an example. It is in everyone's self-interest to ignore the costs they impose on others when they decide how much of a common resource to use: It is overused.

Monopoly A *monopoly* is a firm that is the sole provider of a good or service. Local water supply and cable television are supplied by firms that are monopolies. The monopoly's self-interest is to maximize its profit, and because it has no competitors, it produces too little and charges too high a price: It underproduces.

High Transactions Costs When you buy your first house, you will also buy the services of an agent and a lawyer to do the transaction. Economists call the costs of the services that enable a market to bring buyers and sellers together **transactions costs**. It is costly to operate *any* market, but some markets are so costly to operate that they simply don't. For example, there's no market in time slots on a local tennis court. Instead, the court uses first-come, first-served: You hang around until the court becomes vacant and "pay" with your waiting time. When transactions costs are high, the market might underproduce.

You now know the conditions under which resource allocation is efficient. You've seen how a competitive market can be efficient, and you've seen some obstacles to efficiency. Can alternative allocation methods improve on the market?

Alternatives to the Market

When a market is inefficient, can one of the alternative nonmarket methods that we described at the beginning of this chapter do a better job? Sometimes it can.

Often, majority rule might be used in an attempt to improve the allocation of resources. But majority rule has its own shortcomings. A group that pursues the self-interest of its members can become the majority. For example, a price or quantity regulation that creates inefficiency is almost always the result of a self-interested group becoming the majority and imposing costs on the minority. Also, with majority rule, votes must be translated into actions by bureaucrats who have their own agendas based on their self-interest.

Managers in firms issue commands and avoid the transactions costs that they would incur if they went to a market every time they needed a job done.

First-come, first-served works best in some situations. Think about the scene at a busy ATM. Instead of waiting in line people might trade places at a "market" price. But someone would need to ensure that trades were honoured. At a busy ATM, first-come, first-served is the most efficient arrangement.

There is no one efficient mechanism that allocates all resources efficiently. But markets, when supplemented by other mechanisms such as majority rule, command systems, and first-come, first-served, do an amazingly good job.

REVIEW QUIZ

- 1 Do competitive markets use resources efficiently? Explain why or why not.
- 2 What is deadweight loss and under what conditions does it occur?
- 3 What are the obstacles to achieving an efficient allocation of resources in the market economy?

Work these questions in Study Plan 5.3 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

Is an efficient allocation of resources also a fair allocation? Does the competitive market provide people with fair incomes for their work? Do people always pay a fair price for the things they buy? Don't we need the government to step into some competitive markets to prevent the price from rising too high or falling too low? Let's now study these questions.



Is the Competitive Market Fair?

When a natural disaster strikes, such as a severe winter storm or a hurricane, the prices of many essential items jump. The reason prices jump is that the demand and willingness to pay for these items has increased, but the supply has not changed. So the higher prices achieve an efficient allocation of scarce resources. News reports of these price hikes almost never talk about efficiency. Instead, they talk about equity or fairness. The claim that is often made is that it is unfair for profit-seeking dealers to cheat the victims of natural disaster.

Similarly, when low-skilled people work for a wage that is below what most would regard as a “living wage,” the media and politicians talk of employers taking unfair advantage of their workers.

How do we decide whether something is fair or unfair? You know when you *think* something is unfair, but how do you *know*? What are the *principles* of fairness?

Philosophers have tried for centuries to answer this question. Economists have offered their answers too. But before we look at the proposed answers, you should know that there is no universally agreed upon answer.

Economists agree about efficiency. That is, they agree that it makes sense to make the economic pie as large as possible and to produce it at the lowest possible cost. But they do not agree about equity. That is, they do not agree about what are fair shares of the economic pie for all the people who make it. The reason is that ideas about fairness are not exclusively economic ideas. They touch on politics, ethics, and religion. Nevertheless, economists have thought about these issues and have a contribution to make. Let's examine the views of economists on this topic.

To think about fairness, think of economic life as a game—a serious game. All ideas about fairness can be divided into two broad groups. They are:

- It's not fair if the *result* isn't fair.
- It's not fair if the *rules* aren't fair.

It's Not Fair if the Result Isn't Fair

The earliest efforts to establish a principle of fairness were based on the view that the result is what matters. The general idea was that it is unfair if people's incomes are too unequal. For example, it is unfair

that a bank president earns millions of dollars a year while a bank teller earns only thousands of dollars. It is unfair that a store owner makes a larger profit and her customers pay higher prices in the aftermath of a winter storm.

During the nineteenth century, economists thought they had made an incredible discovery: Efficiency requires equality of incomes. To make the economic pie as large as possible, it must be cut into equal pieces, one for each person. This idea turns out to be wrong. But there is a lesson in the reason that it is wrong, so this idea is worth a closer look.

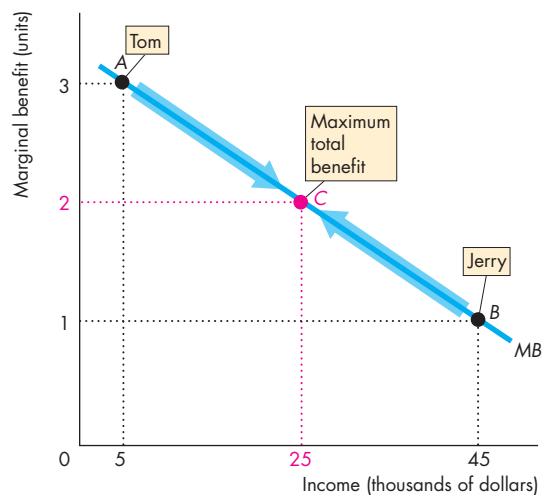
Utilitarianism The nineteenth-century idea that only equality brings efficiency is called *utilitarianism*.

Utilitarianism is a principle that states that we should strive to achieve “the greatest happiness for the greatest number.” The people who developed this idea were known as utilitarians. They included eminent thinkers such as Jeremy Bentham and John Stuart Mill.

Utilitarians argued that to achieve “the greatest happiness for the greatest number,” income must be transferred from the rich to the poor up to the point of complete equality—to the point at which there are no rich and no poor.

They reasoned in the following way: First, everyone has the same basic wants and a similar capacity to enjoy life. Second, the greater a person's income, the smaller is the marginal benefit of a dollar. The millionth dollar spent by a rich person brings a smaller marginal benefit to that person than the marginal benefit that the thousandth dollar spent brings to a poorer person. So by transferring a dollar from the millionaire to the poorer person, more is gained than is lost. The two people added together are better off.

Figure 5.7 illustrates this utilitarian idea. Tom and Jerry have the same marginal benefit curve, MB . (Marginal benefit is measured on the same scale of 1 to 3 for both Tom and Jerry.) Tom is at point *A*. He earns \$5,000 a year, and his marginal benefit from a dollar is 3 units. Jerry is at point *B*. He earns \$45,000 a year, and his marginal benefit from a dollar is 1 unit. If a dollar is transferred from Jerry to Tom, Jerry loses 1 unit of marginal benefit and Tom gains 3 units. So together, Tom and Jerry are better off—they are sharing the economic pie more efficiently. If a second dollar is transferred, the same thing happens: Tom gains more than Jerry loses. And the same is true for every dollar transferred until they both reach point *C*. At point *C*, Tom and Jerry have \$25,000

FIGURE 5.7 Utilitarian Fairness

Tom earns \$5,000 and has 3 units of marginal benefit at point A. Jerry earns \$45,000 and has 1 unit of marginal benefit at point B. If income is transferred from Jerry to Tom, Jerry's loss is less than Tom's gain. Only when each of them has \$25,000 and 2 units of marginal benefit (at point C) can the sum of their total benefit increase no further.

[MyEconLab Animation](#)

each and a marginal benefit of 2 units. Now they are sharing the economic pie in the most efficient way. It brings the greatest happiness to Tom and Jerry.

The Big Tradeoff One big problem with the utilitarian ideal of complete equality is that it ignores the costs of making income transfers. Recognizing the costs of making income transfers leads to what is called the **big tradeoff**, which is a tradeoff between efficiency and fairness.

The big tradeoff is based on the following facts. Income can be transferred from people with high incomes to people with low incomes only by taxing the high incomes. Taxing people's income from employment makes them work less. It results in the quantity of labour being less than the efficient quantity. Taxing people's income from capital makes them save less. It results in the quantity of capital being less than the efficient quantity. With smaller quantities of both labour and capital, the quantity of goods and services produced is less than the efficient quantity. The economic pie shrinks.

The tradeoff is between the size of the economic pie and the degree of equality with which it is shared. The greater the amount of income redistribution through income taxes, the greater is the inefficiency—the smaller is the economic pie.

There is a second source of inefficiency. A dollar taken from a rich person does not end up as a dollar in the hands of a poorer person. Some of the dollar is spent on administration of the tax and transfer system. The cost of the tax-collecting agency, Canada Revenue Agency (CRA), and the welfare-administering agencies, such as Employment and Social Development Canada, must be paid with some of the taxes collected. Also, taxpayers hire accountants, auditors, and lawyers to help them ensure that they pay the correct amount of taxes. These activities use skilled labour and capital resources that could otherwise be used to produce goods and services that people value.

When all these costs are taken into account, taking a dollar from a rich person does not give a dollar to a poor person. It is possible that with high taxes, people with low incomes might end up being worse off. Suppose, for example, that highly taxed entrepreneurs decide to work less hard and shut down some of their businesses. Low-income workers get fired and must seek other, perhaps even lower-paid, work.

Today, because of the big tradeoff, no one says that fairness requires complete equality of incomes.

Make the Poorest as Well Off as Possible A new solution to the big-tradeoff problem was proposed by philosopher John Rawls in a classic book entitled *A Theory of Justice*, published in 1971. Rawls says that, taking all the costs of income transfers into account, the fair distribution of the economic pie is the one that makes the poorest person as well off as possible. The incomes of rich people should be taxed, and after paying the costs of administering the tax and transfer system, what is left should be transferred to the poor. But the taxes must not be so high that they make the economic pie shrink to the point at which the poorest person ends up with a smaller piece. A bigger share of a smaller pie can be less than a smaller share of a bigger pie. The goal is to make the piece enjoyed by the poorest person as big as possible. Most likely, this piece will not be an equal share.

The “fair results” idea requires a change in the results after the game is over. Some economists say that these changes are themselves unfair and propose a different way of thinking about fairness.

It's Not Fair if the Rules Aren't Fair

The idea that it's not fair if the rules aren't fair is based on a fundamental principle that seems to be hardwired into the human brain: the symmetry principle. The **symmetry principle** is the requirement that people in similar situations be treated similarly. It is the moral principle that lies at the centre of all the big religions and that says, in some form or other, "Behave toward other people in the way you expect them to behave toward you."

In economic life, this principle translates into *equality of opportunity*. But equality of opportunity to do what? This question is answered by the philosopher Robert Nozick in a book entitled *Anarchy, State, and Utopia*, published in 1974.

Nozick argues that the idea of fairness as an outcome or result cannot work and that fairness must be based on the fairness of the rules. He suggests that fairness obeys two rules:

1. The state must enforce laws that establish and protect private property.
2. Private property may be transferred from one person to another only by voluntary exchange.

The first rule says that everything that is valuable must be owned by individuals and that the state must ensure that theft is prevented. The second rule says that the only legitimate way a person can acquire property is to buy it in exchange for something else that the person owns. If these rules, which are the only fair rules, are followed, then the result is fair. It doesn't matter how unequally the economic pie is shared, provided that the pie is made by people, each one of whom voluntarily provides services in exchange for the share of the pie offered in compensation.

These rules satisfy the symmetry principle. If these rules are not followed, the symmetry principle is broken. You can see these facts by imagining a world in which the laws are not followed.

First, suppose that some resources or goods are not owned. They are common property. Then everyone is free to participate in a grab to use them. The strongest will prevail. But when the strongest prevails, the strongest effectively *owns* the resources or goods in question and prevents others from enjoying them.

Second, suppose that we do not insist on voluntary exchange for transferring ownership of resources from one person to another. The alternative is *involuntary transfer*. In simple language, the alternative is theft.

Both of these situations violate the symmetry principle. Only the strong acquire what they want. The weak end up with only the resources and goods that the strong don't want.

In a majority-rule political system, the strong are those in the majority or those with enough resources to influence opinion and achieve a majority.

In contrast, if the two rules of fairness are followed, everyone, strong and weak, is treated in a similar way. All individuals are free to use their resources and human skills to create things that are valued by themselves and others and to exchange the fruits of their efforts with all others. This set of arrangements is the only one that obeys the symmetry principle.

Fair Rules and Efficiency If private property rights are enforced and if voluntary exchange takes place in a competitive market with none of the obstacles described above (p. 114), resources will be allocated efficiently.

According to the Nozick fair-rules view, no matter how unequal is the resulting distribution of income and wealth, it will be fair.

It would be better if everyone were as well off as those with the highest incomes, but scarcity prevents that outcome and the best attainable outcome is the efficient one.

Case Study: A Generator Shortage in a Natural Disaster

Hurricane Katrina shut down electricity supplies over a wide area and increased the demand for portable generators. What is the fair way to allocate the available generators?

If the market price is used, the outcome is efficient. Sellers and buyers are better off and no one is worse off. But people who own generators make a larger profit and the generators go to those who want them most and can afford them. Is that fair?

On the Nozick rules view, the outcome is fair. On the fair outcome view, the outcome might be considered unfair. But what are the alternatives? They are command; majority rule; contest; first-come, first-served; lottery; personal characteristics; and force. Except by chance, none of these methods delivers an allocation of generators that is either fair or efficient. It is unfair in the rules view because the distribution involves involuntary transfers of resources among citizens. It is unfair in the results view because the poorest don't end up being made as well off as possible.

AT ISSUE

Price Gouging

Price gouging is the practice of offering an essential item for sale following a natural disaster at a price much higher than its normal price.

When floods wiped out the Calgary Stampede and inundated the city in the summer of 2013, bags of ice, bottled water, and fruit were all in short supply. Stores with items for sale were getting exceptionally high prices. One store offered ice for \$20 a bag. Another sold bottled water but not at the normal price. Angry shoppers took to social media to denounce price gougers and call for boycotts of their stores.

In Favour of a Law Against Price Gouging

Supporters of laws against price gouging say:

- It unfairly exploits vulnerable needy buyers.
- It unfairly rewards unscrupulous sellers.
- In situations of extraordinary shortage, prices should be regulated to prevent these abuses and scarce resources should be allocated by one of the nonmarket mechanisms such as majority vote or equal shares for all.

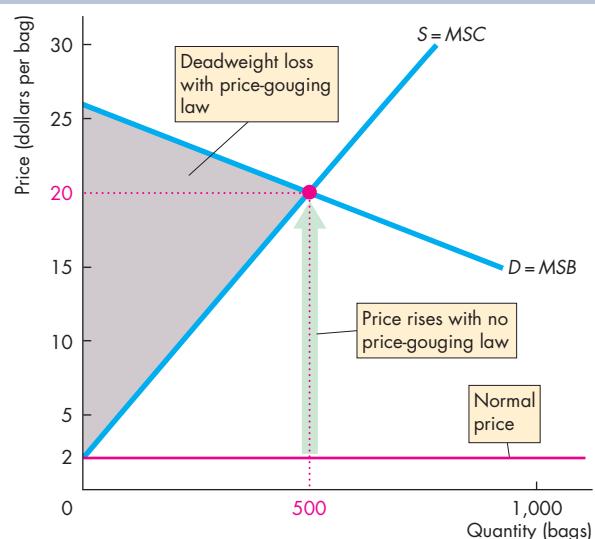


Should the price that a seller of ice may charge be regulated?

The Economist's Response

Economists say that preventing a voluntary market transaction leads to inefficiency—it makes some people worse off without making anyone better off.

- In the figure below, when the supply of ice is much less than normal, the equilibrium price rises from \$2 to \$20 per bag.
- Calling the price rise “gouging” and blocking it with a law prevents additional units from being made available and creates a deadweight loss.



The Effects of a Price-Gouging Law

REVIEW QUIZ

- 1 What are the two big approaches to thinking about fairness?
- 2 What is the utilitarian idea of fairness and what is wrong with it?
- 3 Explain the big tradeoff. What idea of fairness has been developed to deal with it?
- 4 What is the idea of fairness based on fair rules?

Work these questions in Study Plan 5.4 and get instant feedback. Do a Key Terms Quiz.

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◆ You've now studied efficiency and equity (fairness), the two biggest issues that run through the whole of economics. *Economics in the News* on pp. 120–121 looks at an example of an *inefficiency* in our economy today. At many points throughout this book—and in your life—you will return to and use the ideas you've learned in this chapter. We start to apply these ideas in the next chapter where we study some sources of *inefficiency* and *unfairness*.



Making Traffic Flow Efficiently

A Fundamental Law of Road Congestion

American Economic Review

October 2011

It is not an everyday occurrence for economic research to make the news. But an article in the *American Economic Review* by Gilles Duranton and Matthew A. Turner of the University of Toronto entitled “The Fundamental Law of Road Congestion: Evidence from U.S. Cities,” caught the attention of several newspapers and magazines for its eye-popping findings and implicit recommendation.

Noting that an average American household spends almost 3 hours a day in a passenger vehicle achieving an average speed of less than 50 kilometres per hour, Professors Duranton and Turner wanted to find out how it might be possible to end the rush-hour crawl, ease traffic congestion, and make the nation’s highways more productive.

To get the answers, they studied traffic flows and highways in all the major U.S. cities in 1983, 1993, and 2003 to determine the effect of adding highway capacity on traffic volumes and flows.

Their startling discovery is that on interstate highways, increasing highway capacity increases the vehicle-kilometres travelled by the same percentage. Residents and businesses drive more, and better highways attract inward migration.

Duranton and Turner also found that increasing the capacity of one type of road diverts little traffic from other types of roads.

And they found that increasing the provision of public transportation does not lower congestion.

They concluded that the only candidate for improving traffic flow is to use a congestion pricing system.

Source of information: “The Fundamental Law of Road Congestion: Evidence from U.S. Cities,” *American Economic Review*, 101(6): 2616–52.

ESSENCE OF THE STORY

- Researchers say that adding a lane to a highway eases congestion only temporarily.
- Highway use increases in proportion to the available roadways.
- Increasing the capacity of one road does not reduce congestion on others.
- Widening highways does not reduce congestion on city streets.
- Congestion pricing has successfully reduced congestion in some cities, one of which is London.
- Congestion pricing works by encouraging people to drive less or to find alternative ways to get to their destinations.

MyEconLab More Economics in the News

ECONOMIC ANALYSIS

- The discovery that adding a highway does not ease congestion points to congestion pricing as a solution. Let's see how a congestion price works.
- A highway has the marginal social cost curve MSC in the figures. The highway can carry only 10,000 vehicles per hour with no congestion.
- At off-peak times, the demand curve and marginal benefit curve is $D_o = MSB_o$; and the peak time demand curve and marginal benefit curve is $D_p = MSB_p$.
- Figure 1 illustrates inefficient road use. At off-peak, the outcome is efficient but at the peak demand time, at a zero price, 40,000 vehicles per hour enter the road. The marginal social cost is \$6 and there is a deadweight loss (of time and gasoline) shown by the grey triangle.
- Figure 2 illustrates efficient road use at the peak period. Imposing a congestion charge of \$3 per vehicle hour brings an equilibrium at 25,000 vehicles per hour, which is the efficient quantity. Total surplus, the sum of consumer surplus (green) and producer surplus (blue), is maximized.
- Congestion charges would be paid by all road users, regardless of whether they are rich or poor, but they don't have to leave the poor worse off.
- Revenue raised from congestion charges can be redistributed to low-income households if there is a fairness problem.
- So long as road users pay the marginal social cost of their decision, road use is efficient.



While traffic grinds to a halt on North American highways, Electronic Road Pricing (ERP) keeps vehicles moving in Singapore.

- London has a simple system of congestion pricing that imposes a charge when a vehicle enters a central congestion zone.
- Singapore has the world's most sophisticated congestion pricing with the price displayed on gantries (see photo), and the price rises as congestion increases and falls as congestion eases.
- Advances in technology make congestion pricing an attractive alternative to congestion.

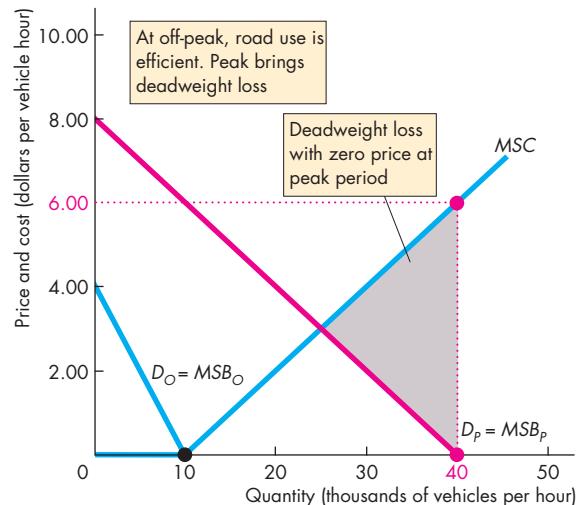


Figure 1 Inefficient Rush-Hour Road Use

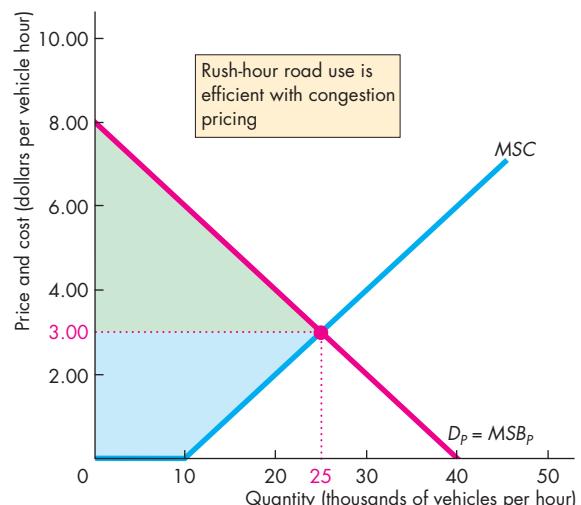


Figure 2 Efficient Rush-Hour Road Use



SUMMARY

Key Points

Resource Allocation Methods (pp. 106–107)

- Because resources are scarce, some mechanism must allocate them.
- The alternative allocation methods are market price; command; majority rule; contest; first-come, first-served; lottery; personal characteristics; and force.

Working Study Plan Problem 1 will give you a better understanding of resource allocation methods.

Benefit, Cost, and Surplus (pp. 108–111)

- The maximum price willingly paid is marginal benefit, so a demand curve is also a marginal benefit curve.
- The market demand curve is the horizontal sum of the individual demand curves and is the marginal social benefit curve.
- Value is what people are *willing to pay*; price is what people *must pay*.
- Consumer surplus is the excess of the benefit received from a good or service over the amount paid for it.
- The minimum supply-price is marginal cost, so a supply curve is also a marginal cost curve.
- The market supply curve is the horizontal sum of the individual supply curves and is the marginal social cost curve.
- Cost is what producers pay; price is what producers receive.

- Producer surplus is the excess of the amount received from the sale of a good or service over the cost of producing it.

Working Study Plan Problems 2 to 7 will give you a better understanding of benefit, cost, and surplus.

Is the Competitive Market Efficient? (pp. 112–115)

- In a competitive equilibrium, marginal social benefit equals marginal social cost and resource allocation is efficient.
- Buyers and sellers acting in their self-interest end up promoting the social interest.
- Total surplus, consumer surplus plus producer surplus, is maximized.
- Producing less than or more than the efficient quantity creates deadweight loss.
- Price and quantity regulations; taxes and subsidies; externalities; public goods and common resources; monopoly; and high transactions costs can lead to market failure.

Working Study Plan Problem 8 will give you a better understanding of the efficiency of competitive markets.

Is the Competitive Market Fair? (pp. 116–119)

- Ideas about fairness can be divided into two groups: fair *results* and fair *rules*.
- Fair-results ideas require income transfers from the rich to the poor.
- Fair-rules ideas require property rights and voluntary exchange.

Working Study Plan Problems 9 and 10 will give you a better understanding of the fairness of competitive markets.

Key Terms

- Big tradeoff, 117
- Command system, 106
- Consumer surplus, 109
- Deadweight loss, 114

- Market failure, 114
- Producer surplus, 111
- Symmetry principle, 118
- Total surplus, 112

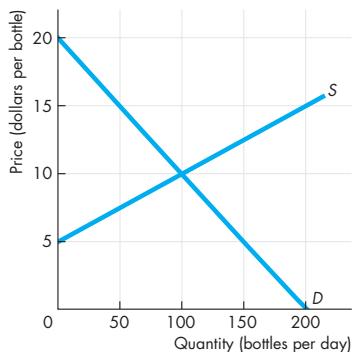
MyEconLab Key Terms Quiz

- Transactions costs, 115
- Utilitarianism, 116

WORKED PROBLEM

MyEconLab You can work this problem in Chapter 5 Study Plan.

The figure illustrates the market for sunscreen.

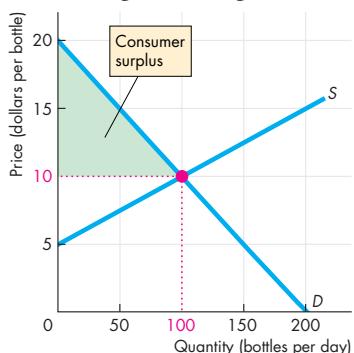


Questions

- At the market equilibrium, calculate:
 - consumer surplus and (b) producer surplus.
- Is the market for sunscreen efficient? Why?
- What is deadweight loss? Calculate it if factories produce only 50 bottles of sunscreen.

Solutions

- a. Consumer surplus is the excess of the benefit received over the amount buyers paid for it. The demand curve tells us the benefit, so consumer surplus equals the area under the demand curve above the market price, summed over the quantity bought. The price paid is \$10 a bottle, the quantity bought is 100 bottles, so consumer surplus equals the area of the green triangle in the figure below.



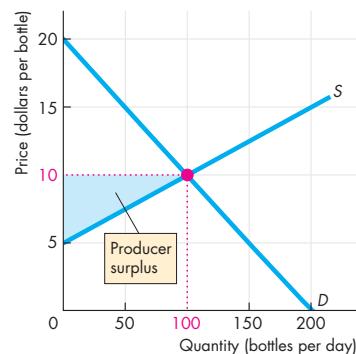
Area of the triangle = $(\text{Base} \times \text{Height}) \div 2$. The base is the quantity bought (100 bottles) and the height is the maximum price (\$20 a bottle) minus the market price (\$10 a bottle). Consumer surplus equals $100 \times (\$20 - \$10) \div 2$, which is \$500.

Key Point: Consumer surplus equals the area under the demand curve above the market price.

- b. Producer surplus is the excess of the amount received by sellers over the cost of production.

The supply curve tells us the cost of producing the good, so producer surplus is equal to the area under the market price above the supply curve, summed over the quantity sold.

Producer surplus is equal to the area of the blue triangle in the following figure.



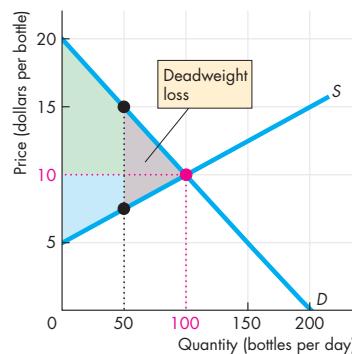
In this triangle, the base is the quantity sold (100 bottles) and the height is the market price (\$10 a bottle) minus the minimum cost (\$5 a bottle), so producer surplus equals $100 \times (\$10 - \$5) \div 2$, or \$250.

Key Point: Producer surplus equals the area under the market price above the supply curve.

- Total surplus (consumer surplus plus producer surplus) is a maximum, so the market is efficient.

Key Point: A competitive market is always efficient.

- When factories produce less than the efficient quantity (100 bottles), some total surplus is lost. This loss is called the deadweight loss and it is equal to the area of the grey triangle in the following figure.



MyEconLab Interactive Animation

The base is the benefit of the 50th bottle minus the cost of producing it (\$7.50), the height is the quantity not produced (50 bottles), so deadweight loss equals $(\$15 - \$7.50) \times 50 \div 2$, which is \$187.50.

Key Point: Underproduction creates a deadweight loss.



STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab You can work Problems 1 to 10 in Chapter 5 Study Plan and get instant feedback.

Resource Allocation Methods (Study Plan 5.1)

- At West, a restaurant in Vancouver, reservations are essential. At Cibo, a restaurant in downtown Vancouver, reservations are recommended. At Vij's, a restaurant near the University of British Columbia, reservations are not accepted. Describe the method of allocating scarce table resources at these three restaurants. Why do you think restaurants don't use the market price to allocate their tables?

Benefit, Cost, and Surplus (Study Plan 5.2)

Use the following table to work Problems 2 to 4. The table gives the demand schedules for train travel for the only buyers in the market, Ann, Beth, and Cy.

Price (dollars per kilometre)	Quantity demanded (kilometres)		
	Ann	Beth	Cy
3	30	25	20
4	25	20	15
5	20	15	10
6	15	10	5
7	10	5	0
8	5	0	0
9	0	0	0

- a. Construct the market demand schedule.
- b. What is the maximum price that each traveller is willing to pay to travel 20 kilometres? Why?
- a. What is the marginal social benefit when the total distance travelled is 60 kilometres?
- b. When the total distance travelled is 60 kilometres, how many kilometres does each travel and what is their marginal private benefit?
- What is each traveller's consumer surplus when the price is \$4 a kilometre? What is the market consumer surplus when the price is \$4 a kilometre?

Use the following table to work Problems 5 to 7.

The table in the next column gives the supply schedules of the only sellers of hot air balloon rides: Xavier, Yasmin, and Zack.

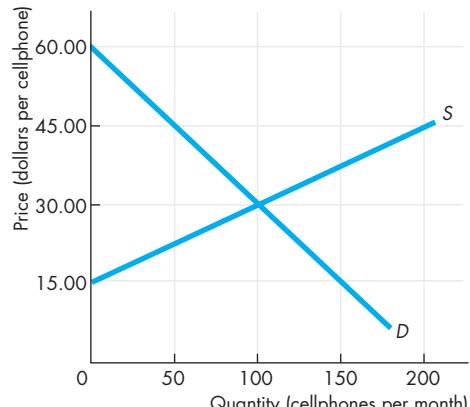
- a. Construct the market supply schedule.
- b. What are the minimum prices that Xavier, Yasmin, and Zack are willing to accept to supply 20 rides? Why?

Price (dollars per ride)	Quantity supplied (rides per week)		
	Xavier	Yasmin	Zack
100	30	25	20
90	25	20	15
80	20	15	10
70	15	10	5
60	10	5	0
50	5	0	0
40	0	0	0

- a. What is the marginal social cost when the total number of rides is 30?
- b. What is the marginal cost for each supplier when the total number of rides is 30 and how many rides does each seller supply?
- When the price is \$70 a ride, what is each seller's producer surplus? What is the market producer surplus?

Is the Competitive Market Efficient? (Study Plan 5.3)

- The figure shows the competitive market for cellphones.



- a. What is the market equilibrium?
- b. Shade in the consumer surplus and label it.
- c. Shade in the producer surplus and label it.
- d. Calculate total surplus.
- e. Is the market for cellphones efficient?

Is the Competitive Market Fair? (Study Plan 5.4)

- Explain why the allocation method used by each restaurant in Problem 1 is fair or not fair.
- In the Worked Problem (p. 123), how can the 50 bottles available be allocated to beach-goers? Would the possible methods be fair or unfair?



ADDITIONAL PROBLEMS AND APPLICATIONS

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

Resource Allocation Methods

11. At the Stratford Festival Theatre no reservations are accepted on the day of the performance; at matinees reservations are accepted; at opening night performances reservations are essential. Describe the method of allocating seats in these three performances. Why do you think the Stratford Festival Theatre has different reservations policies?

Benefit, Cost, and Surplus

Use the following table to work Problems 12 to 15. The table gives the supply schedules for jet-ski rides by the only suppliers: Rick, Sam, and Tom.

Price (dollars per ride)	Quantity supplied (rides per day)		
	Rick	Sam	Tom
10.00	0	0	0
12.50	5	0	0
15.00	10	5	0
17.50	15	10	5
20.00	20	15	10

12. What is each owner's minimum supply-price of 10 rides a day?
 13. Which owner has the largest producer surplus when the price of a ride is \$17.50? Explain.
 14. What is the marginal social cost of 45 rides a day?
 15. Construct the market supply schedule of rides.
 16. The table gives the demand and supply schedules for sandwiches.

Price (dollars per sandwich)	Quantity demanded	Quantity supplied
	(sandwiches per hour)	
0	300	0
1	250	50
2	200	100
3	150	150
4	100	200
5	50	250
6	0	300

- a. What is the maximum price that a consumer is willing to pay for the 200th sandwich?
 b. What is the minimum price that a producer is willing to accept for the 200th sandwich?
 c. If 200 sandwiches a day are available, what is the total surplus?

17. Home Heating Bills Surge Amid Record Cold

If there's one thing that can set home heating costs soaring, it's a long, frigid blast from one of the coldest winters in 20 years, and people are going to use 10 to 12 percent more natural gas this year than they have normally.

Source: CBC News, March 3, 2014

- How is the price of natural gas determined?
- When demand increases, explain the process by which the market adjusts.
- On a graph, show the effect of the increase in demand on consumer surplus and producer surplus.

Is the Competitive Market Efficient?

18. Use the data in the table in Problem 16.

- If the sandwich market is efficient, what is the consumer surplus, what is the producer surplus, and what is the total surplus?
- If the demand for sandwiches increases and sandwich makers produce the efficient quantity, what happens to producer surplus and deadweight loss?

Use the following news clip to work Problems 19 to 21.

The Right Price for Digital Music

Apple's \$1.29-for-the-latest-songs model isn't perfect and isn't it too much to pay for music that appeals to just a few people? What we need is a system that will be profitable but fair to music lovers. The solution: Price song downloads according to demand. The more people who download a particular song, the higher will be the price of that song; the fewer people who buy a particular song, the lower will be the price of that song. That is a free-market solution—the market would determine the price.

Source: *Slate*, December 5, 2005

Assume that the marginal social cost of downloading a song from the iTunes Store is zero. (This assumption means that the cost of operating the iTunes Store doesn't change if people download more songs.)

19. a. Draw a graph of the market for downloadable music with a price of \$1.29 for all the latest songs. On your graph, show consumer surplus and producer surplus.

- b. With a price of \$1.29 for all the latest songs, is the market efficient or inefficient? If it is inefficient, show the deadweight loss on your graph.
20. If the pricing scheme described in the news clip were adopted, how would consumer surplus, producer surplus, and the deadweight loss change?
21. a. If the pricing scheme described in the news clip were adopted, would the market be efficient or inefficient? Explain.
 b. Is the pricing scheme described in the news clip a “free-market solution”? Explain.
22. Only 1 percent of the world supply of water is fit for human consumption. Some places have more water than they can use; some could use much more than they have. The 1 percent available would be sufficient if only it were in the right place.
 a. What is the major problem in achieving an efficient use of the world’s water?
 b. If there were a global market in water, like there is in oil, how do you think the market would be organized?
 c. Would a free world market in water achieve an efficient use of the world’s water resources? Explain why or why not.

Is the Competitive Market Fair?

23. Use the information in Problem 22. Would a free world market in water achieve a fair use of the world’s water resources? Explain why or why not and be clear about the concept of fairness that you are using.
24. The winner of the men’s and women’s tennis singles at the Canadian Open is paid twice as much as the runner-up, but it takes two players to have a singles final. Is the compensation arrangement fair?
25. **The Scandal of Phone Call Price Gouging by Prisons**

In most U.S. states, the phone company guarantees the prison a commission of a percentage on every call. The average commission is 42% of the cost of the call, but in some states it is 60%. So 60% of what families pay to receive a collect call from their imprisoned relative has nothing to do with the cost of the phone service. Also, the phone company that offers the highest commission is often the company to get the prison contract.

Source: *The Guardian*, May 23, 2012

- a. Who is practising price gouging: the prison, the phone company, or both? Explain.
 b. Evaluate the “fairness” of the prison’s commission.

Economics in the News

26. After you have studied *Economics in the News* on pp. 120–121, answer the following questions.
- What is the method used to allocate highway space in Canada and what is the method used in Singapore?
 - Who benefits from the Canadian method of highway resource allocation? Explain your answer using the ideas of marginal social benefit, marginal social cost, consumer surplus, and producer surplus.
 - Who benefits from the Singaporean method of highway resource allocation? Explain your answer using the ideas of marginal social benefit, marginal social cost, consumer surplus, and producer surplus.
 - If road use were rationed by limiting drivers with even-date birthdays to drive only on even days (and odd-date birthdays to drive only on odd days), would highway use be more efficient? Explain your answer.
27. **Fight over Water Rates; Escondido Farmers Say Increase Would Put Them Out of Business**
 Agricultural users of water pay less than residential and business users. Since 1993, water rates have increased by more than 90 percent for residential customers and by only 50 percent for agricultural users.

Source: *The San Diego Union-Tribune*, June 14, 2006

- Do you think that the allocation of water between agricultural and residential users is likely to be efficient? Explain your answer.
- If agricultural users paid a higher price, would the allocation of resources be more efficient?
- If agricultural users paid a higher price, what would happen to consumer surplus and producer surplus from water?
- Is the difference in price paid by agricultural and residential users fair?



6

GOVERNMENT ACTIONS IN MARKETS

After studying this chapter,
you will be able to:

- ◆ Explain how a rent ceiling creates a housing shortage
- ◆ Explain how a minimum wage law creates unemployment
- ◆ Explain the effects of a tax
- ◆ Explain the effects of production quotas and subsidies
- ◆ Explain how markets for illegal goods work

In Toronto, where food servers and grocery clerks earn the minimum wage of \$11 an hour, a budget one-bedroom apartment rents for \$1,000 a month. For the lowest paid, that leaves \$500 a month for food, clothing, and other necessities. What can governments do to help these people?

This chapter explains the effects of minimum wage laws and rent ceilings, and *Economics in the News* at the end of the chapter looks at some recent changes in the Ontario minimum wage. The chapter also explains the effects of taxes, production quotas and subsidies, and laws that make trading in some things illegal.



A Housing Market with a Rent Ceiling

We spend more of our income on housing than on any other good or service, so it isn't surprising that rents can be a political issue. When rents are high, or when they jump by a large amount, renters might lobby the government for limits on rents.

A government regulation that makes it illegal to charge a price higher than a specified level is called a **price ceiling** or **price cap**.

The effects of a price ceiling on a market depend crucially on whether the ceiling is imposed at a level that is above or below the equilibrium price.

A price ceiling set *above the equilibrium price* has no effect. The reason is that the price ceiling does not constrain the market forces. The force of the law and the market forces are not in conflict. But a price ceiling *below the equilibrium price* has powerful effects on a market. The reason is that the price ceiling attempts to prevent the price from regulating the quantities demanded and supplied. The force of the law and the market forces are in conflict.

When a price ceiling is applied to a housing market, it is called a **rent ceiling**. A rent ceiling set below the equilibrium rent creates:

- A housing shortage
- Increased search activity
- A black market

A Housing Shortage

At the equilibrium price, the quantity demanded equals the quantity supplied. In a housing market, when the rent is at the equilibrium level, the quantity of housing supplied equals the quantity of housing demanded and there is neither a shortage nor a surplus of housing.

But at a rent set below the equilibrium rent, the quantity of housing demanded exceeds the quantity of housing supplied—there is a shortage. So if a rent ceiling is set below the equilibrium rent, there will be a shortage of housing.

When there is a shortage, the quantity available is the quantity supplied, and somehow this quantity must be allocated among the frustrated demanders. One way in which this allocation occurs is through increased search activity.

Increased Search Activity

The time spent looking for someone with whom to do business is called **search activity**. We spend some time in search activity almost every time we make a purchase. When you're shopping for the latest hot new cellphone, and you know four stores that stock it, how do you find which store has the best deal? You spend a few minutes on the Internet, checking out the various prices. In some markets, such as the housing market, people spend a lot of time checking the alternatives available before making a choice.

When a price is regulated and there is a shortage, search activity increases. In the case of a rent-controlled housing market, frustrated would-be renters scan the newspapers, not only for housing ads but also for death notices! Any information about newly available housing is useful, and apartment seekers race to be first on the scene when news of a possible supplier breaks.

The **opportunity cost** of a good is equal not only to its price but also to the value of the search time spent finding the good. So the opportunity cost of housing is equal to the rent (a regulated price) plus the time and other resources spent searching for the restricted quantity available. Search activity is costly. It uses time and other resources, such as phone calls, automobiles, and gasoline that could have been used in other productive ways.

A rent ceiling controls only the rent portion of the cost of housing. The cost of increased search activity might end up making the full cost of housing *higher* than it would be without a rent ceiling.

A Black Market

A rent ceiling also encourages illegal trading in a **black market**, an illegal market in which the equilibrium price exceeds the price ceiling. Black markets occur in rent-controlled housing and many other markets. For example, scalpers run black markets in tickets for big sporting events and rock concerts.

When a rent ceiling is in force, frustrated renters and landlords constantly seek ways of increasing rents. One common way is for a new tenant to pay a high price for worthless fittings, such as charging \$2,000 for threadbare drapes. Another is for the tenant to pay an exorbitant price for new locks and keys—called “key money.”

The level of a black market rent depends on how tightly the rent ceiling is enforced. With loose

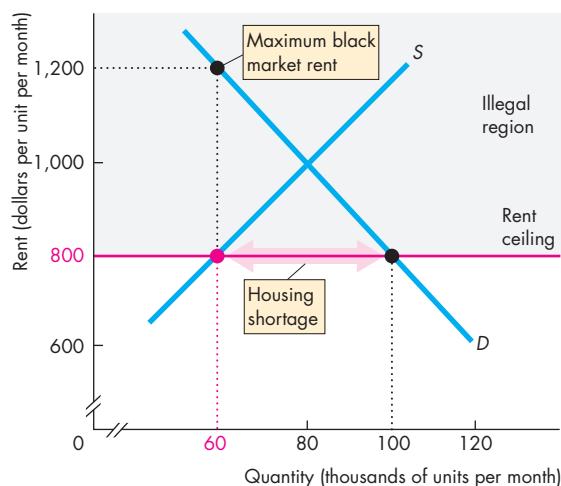
enforcement, the black market rent is close to the unregulated rent. But with strict enforcement, the black market rent is equal to the maximum price that a renter is willing to pay.

Figure 6.1 illustrates the effects of a rent ceiling. The demand curve for housing is D and the supply curve is S . A rent ceiling is imposed at \$800 a month. Rents that exceed \$800 a month are in the grey-shaded illegal region in the figure. You can see that the equilibrium rent, where the demand and supply curves intersect, is in the illegal region.

At a rent of \$800 a month, the quantity of housing supplied is 60,000 units and the quantity demanded is 100,000 units. So with a rent of \$800 a month, there is a shortage of 40,000 units of housing.

To rent the 60,000th unit, someone is willing to pay \$1,200 a month. They might pay this amount by incurring search costs that bring the total cost of housing to \$1,200 a month, or they might pay a black market price of \$1,200 a month. Either way, they end up incurring a cost that exceeds what the equilibrium rent would be in an unregulated market.

FIGURE 6.1 A Rent Ceiling



A rent above the rent ceiling of \$800 a month is illegal (in the grey-shaded illegal region). At a rent of \$800 a month, the quantity of housing supplied is 60,000 units. Frustrated renters spend time searching for housing and they make deals with landlords in a black market. Someone is willing to pay \$1,200 a month for the 60,000th unit.

MyEconLab Animation and Draw Graph

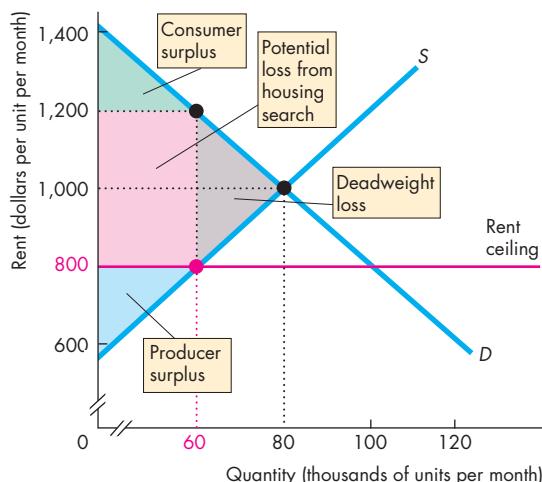
Inefficiency of a Rent Ceiling

A rent ceiling set below the equilibrium rent results in an inefficient underproduction of housing services. The *marginal social benefit* of housing exceeds its *marginal social cost* and a deadweight loss shrinks the producer surplus and consumer surplus (Chapter 5, pp. 112–114).

Figure 6.2 shows this inefficiency. The rent ceiling (\$800 per month) is below the equilibrium rent (\$1,000 per month) and the quantity of housing supplied (60,000 units) is less than the efficient quantity (80,000 units).

Because the quantity of housing supplied (the quantity available) is less than the efficient quantity, there is a deadweight loss, shown by the grey triangle. Producer surplus shrinks to the blue triangle and consumer surplus shrinks to the green triangle. The red rectangle represents the potential loss from increased search activity. This loss is borne by consumers, and the full loss from the rent ceiling is the sum of the deadweight loss and the increased cost of search.

FIGURE 6.2 The Inefficiency of a Rent Ceiling



Without a rent ceiling, the market produces an efficient 80,000 units of housing at a rent of \$1,000 a month. A rent ceiling of \$800 a month decreases the quantity of housing supplied to 60,000 units. Producer surplus and consumer surplus shrink and a deadweight loss arises. The red rectangle represents the cost of resources used in increased search activity. The full loss from the rent ceiling equals the sum of the red rectangle and grey triangle.

MyEconLab Animation and Draw Graph

Are Rent Ceilings Fair?

Rent ceilings might be inefficient, but don't they achieve a fairer allocation of scarce housing? Let's explore this question.

Chapter 5 (pp. 116–118) reviews two key ideas about fairness. According to the *fair-rules* view, anything that blocks voluntary exchange is unfair, so rent ceilings are unfair. But according to the *fair-result* view, a fair outcome is one that benefits the less well off. So according to this view, the fairest outcome is the one that allocates scarce housing to the poorest. To see whether rent ceilings help to achieve a fairer outcome in this sense, we need to consider how the market allocates scarce housing resources in the face of a rent ceiling.

Blocking rent adjustments doesn't eliminate scarcity. Rather, because it decreases the quantity of housing available, it creates an even bigger challenge for the housing market. Somehow, the market must ration a smaller quantity of housing and allocate that housing among the people who demand it.

When the rent is not permitted to allocate scarce housing, what other mechanisms are available, and are *they* fair? Some possible mechanisms are:

- A lottery
- First-come, first-served
- Discrimination

A lottery allocates housing to those who are lucky, not to those who are poor. First-come, first-served (a method used to allocate housing in England after World War II) allocates housing to those who have the greatest foresight and who get their names on a list first, not to the poorest. Discrimination allocates scarce housing based on the views and self-interest of the owner of the housing. In the case of public housing, what counts is the self-interest of the bureaucracy that administers the allocation.

In principle, self-interested owners and bureaucrats could allocate housing to satisfy some criterion of fairness, but they are not likely to do so. Discrimination based on friendship, family ties, and criteria such as race, ethnicity, or sex is more likely to enter the equation. We might make such discrimination illegal, but we cannot prevent it from occurring.

It is hard, then, to make a case for rent ceilings on the basis of fairness. When rent adjustments are blocked, other methods of allocating scarce housing resources operate that do not produce a fair outcome.

Economics in Action

Rent Control Winners: The Rich and Famous

New York, San Francisco, London, and Paris, four of the world's great cities, have rent ceilings in some part of their housing markets. Winnipeg has rent ceilings, and Toronto had them until the late 1990s. Other Canadian cities, including Calgary, Edmonton, and Vancouver, do not have rent ceilings.

To see the effects of rent ceilings in practice we can compare the housing markets in cities with ceilings with those without ceilings. We learn two main lessons from such a comparison.

First, rent ceilings definitely create a housing shortage. Second, they do lower the rents for some but raise them for others.

A survey* conducted in the United States in 1997 showed that the rents of housing units *actually available for rent* were 2.5 times the average of all rents in New York but equal to the average rent in Philadelphia. The winners from rent ceilings are the families that have lived in a city for a long time. In New York, these families include some rich and famous ones. The voting power of the winners keeps the rent ceilings in place. Mobile newcomers are the losers in a city with rent ceilings.

The bottom line is that, in principle and in practice, rent ceilings are inefficient and unfair.

* William Tucker, "How Rent Control Drives Out Affordable Housing," Cato Policy Analysis No. 274, May 21, 1997, Cato Institute.

REVIEW QUIZ

- 1 What is a rent ceiling and what are its effects if it is set above the equilibrium rent?
- 2 What are the effects of a rent ceiling that is set below the equilibrium rent?
- 3 How are scarce housing resources allocated when a rent ceiling is in place?
- 4 Why does a rent ceiling create an inefficient and unfair outcome in the housing market?

Work these questions in Study Plan 6.1 and get instant feedback. Do a Key Terms Quiz. **MyEconLab**

You now know how a price ceiling (rent ceiling) works. Next, we'll learn about the effects of a price floor by studying a minimum wage in a labour market.

A Labour Market with a Minimum Wage

For each one of us, the labour market is the market that influences the jobs we get and the wages we earn. Firms decide how much labour to demand, and the lower the wage rate, the greater is the quantity of labour demanded. Households decide how much labour to supply, and the higher the wage rate, the greater is the quantity of labour supplied. The wage rate adjusts to make the quantity of labour demanded equal to the quantity supplied.

When wage rates are low, or when they fail to keep up with rising prices, labour unions might turn to governments and lobby for a higher wage rate.

A government regulation that makes it illegal to charge a price lower than a specified level is called a **price floor**.

The effects of a price floor on a market depend crucially on whether the floor is imposed at a level that is above or below the equilibrium price.

A price floor set *below the equilibrium price* has no effect. The reason is that the price floor does not constrain the market forces. The force of the law and the market forces are not in conflict. But a price floor set *above the equilibrium price* has powerful effects on a market. The reason is that the price floor attempts to prevent the price from regulating the quantities demanded and supplied. The force of the law and the market forces are in conflict.

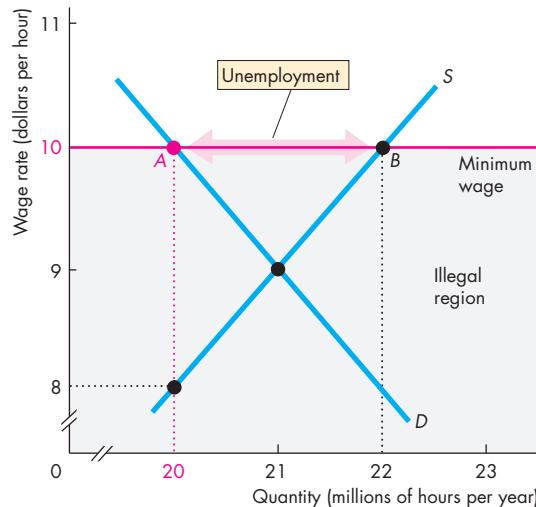
When a price floor is applied to a labour market, it is called a **minimum wage**. A minimum wage imposed at a level that is above the equilibrium wage creates unemployment. Let's look at the effects of a minimum wage.

Minimum Wage Brings Unemployment

At the equilibrium price, the quantity demanded equals the quantity supplied. In a labour market, when the wage rate is at the equilibrium level, the quantity of labour supplied equals the quantity of labour demanded: There is neither a shortage of labour nor a surplus of labour.

But at a wage rate above the equilibrium wage, the quantity of labour supplied exceeds the quantity of labour demanded—there is a surplus of labour. So when a minimum wage is set above the equilibrium wage, there is a surplus of labour. The demand for labour determines the level of employment, and the surplus of labour is unemployed.

FIGURE 6.3 Minimum Wage and Unemployment



The minimum wage rate is set at \$10 an hour. Any wage rate below \$10 an hour is illegal (in the grey-shaded illegal region). At the minimum wage of \$10 an hour, 20 million hours are hired but 22 million hours are available. Unemployment—AB—of 2 million hours a year is created. With only 20 million hours demanded, someone is willing to supply the 20 millionth hour for \$8.

MyEconLab Animation and Draw Graph

Figure 6.3 illustrates the effect of the minimum wage on unemployment. The demand for labour curve is D and the supply of labour curve is S . The horizontal red line shows the minimum wage set at \$10 an hour. A wage rate below this level is illegal, in the grey-shaded illegal region of the figure. At the minimum wage rate, 20 million hours of labour are demanded (point A) and 22 million hours of labour are supplied (point B), so 2 million hours of available labour are unemployed.

With only 20 million hours demanded, someone is willing to supply that 20 millionth hour for \$8. Frustrated unemployed workers spend time and other resources searching for hard-to-find jobs.

Is the Minimum Wage Fair?

The minimum wage is unfair on both views of fairness: It delivers an unfair *result* and imposes an unfair *rule*.

The *result* is unfair because only those people who have jobs and keep them benefit from the minimum

wage. The unemployed end up worse off than they would be with no minimum wage. Some of those who search for jobs and find them end up worse off because of the increased cost of job search they incur. Also, those who search and find jobs aren't always the least well off. When the wage rate doesn't allocate labour, other mechanisms determine who finds a job. One such mechanism is discrimination, which is yet another source of unfairness.

The minimum wage imposes an unfair *rule* because it blocks voluntary exchange. Firms are willing to hire more labour and people are willing to work more, but they are not permitted by the minimum wage law to do so.

Inefficiency of a Minimum Wage

In the labour market, the supply curve measures the marginal social cost of labour to workers. This cost is leisure forgone. The demand curve measures the marginal social benefit from labour. This benefit is the value of the goods and services produced. An unregulated labour market allocates the economy's scarce

labour resources to the jobs in which they are valued most highly. The market is efficient.

The minimum wage frustrates the market mechanism and results in unemployment and increased job search. At the quantity of labour employed, the marginal social benefit of labour exceeds its marginal social cost and a deadweight loss shrinks the firms' surplus and the workers' surplus.

Figure 6.4 shows this inefficiency. The minimum wage (\$10 an hour) is above the equilibrium wage (\$9 an hour) and the quantity of labour demanded and employed (20 million hours) is less than the efficient quantity (21 million hours).

Because the quantity of labour employed is less than the efficient quantity, there is a deadweight loss, shown by the grey triangle. The firms' surplus shrinks to the blue triangle and the workers' surplus shrinks to the green triangle. The red rectangle shows the potential loss from increased job search, which is borne by workers. The full loss from the minimum wage is the sum of the deadweight loss and the increased cost of job search.

AT ISSUE

Does the Minimum Wage Cause Unemployment?

Minimum wage rates in Canada are set by the provincial governments, and in January 2014 they ranged from a low of \$9.95 an hour in Alberta to a high of \$11.00 an hour in Nunavut.

Does the minimum wage result in unemployment, and if so, how much unemployment does it create?

No, It Doesn't

David Card of the University of California at Berkeley (see p. 512) and Alan Krueger of Princeton University say:

- An increase in the minimum wage *increases* teenage employment and *decreases* unemployment.
- Their study of minimum wages in California, New Jersey, and Texas found that the employment rate of low-income workers increased following an increase in the minimum wage.
- A higher wage *increases* employment by making workers more conscientious and productive as well as less likely to quit, which lowers unproductive labour turnover.
- A higher wage rate also encourages managers to seek ways to increase labour productivity.

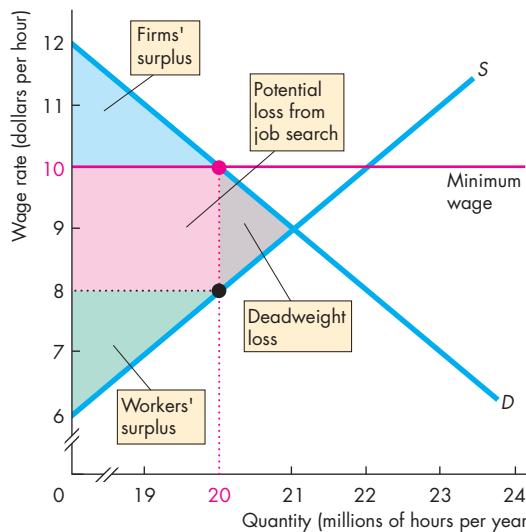
Yes, It Does

Michele Campolieti and Morley Gunderson of the University of Toronto and Tony Fang of the University of Northern British Columbia* say:

- A 10 percent rise in the minimum wage decreases employment by between 3 percent and 5 percent.
- They studied employment data for thousands of individuals whose wage rates were higher than the old minimum but lower than the new minimum.
- They observed how employment changed when the minimum wage changed compared to a control group in the same wage range but in provinces where the minimum wage didn't change.
- Dozens of other studies for 20 countries agree that the minimum wage kills jobs.

*Michele Campolieti, Tony Fang, and Morley Gunderson, "Minimum Wage Impacts on Youth Employment Transitions, 1993–1999," *Canadian Journal of Economics*, Vol. 38, No. 1, February 2005, pp. 81–104.

FIGURE 6.4 The Inefficiency of a Minimum Wage



A minimum wage decreases employment. Firms' surplus (blue area) and workers' surplus (green area) shrink and a dead-weight loss (grey area) arises. Job search increases and the red area shows the loss from this activity.

[MyEconLab Animation](#)

REVIEW QUIZ

- 1 What is a minimum wage and what are its effects if it is set above the equilibrium wage?
- 2 What are the effects of a minimum wage set below the equilibrium wage?
- 3 Explain how scarce jobs are allocated when a minimum wage is in place.
- 4 Explain why a minimum wage creates an inefficient allocation of labour resources.
- 5 Explain why a minimum wage is unfair.

Work these questions in Study Plan 6.2 and get instant feedback. Do a Key Terms Quiz.

[MyEconLab](#)

Next we're going to study a more widespread government action in markets: taxes. We'll see how taxes change prices and quantities. You will discover the surprising fact that while the government can impose a tax, it can't decide who will pay the tax! You will also see that a tax creates a deadweight loss.

Taxes

Everything you earn and almost everything you buy is taxed. Income taxes and social security taxes are deducted from your earnings, and sales taxes such as the GST and HST are added to the bill when you buy something. Employers also pay social security taxes such as the Employment Insurance tax for their workers, and producers of tobacco products, alcoholic drinks, and gasoline pay a tax every time they sell something.

Who *really* pays these taxes? Because the income tax and social security taxes are deducted from your pay, and the sales tax is added to the prices that you pay, isn't it obvious that *you* pay these taxes? And isn't it equally obvious that your employer pays the employer's contribution to the Employment Insurance tax and that tobacco producers pay the tax on cigarettes?

You're going to discover that it isn't obvious who *really* pays a tax and that lawmakers don't make that decision. We begin with a definition of tax incidence.

Tax Incidence

Tax incidence is the division of the burden of a tax between buyers and sellers. When the government imposes a tax on the sale of a good,* the price paid by buyers might rise by the full amount of the tax, by a lesser amount, or not at all. If the price paid by buyers rises by the full amount of the tax, then the burden of the tax falls entirely on buyers—the buyers pay the tax. If the price paid by buyers rises by a lesser amount than the tax, then the burden of the tax falls partly on buyers and partly on sellers. And if the price paid by buyers doesn't change at all, then the burden of the tax falls entirely on sellers.

Tax incidence does not depend on the tax law. The law might impose a tax on sellers or on buyers, but the outcome is the same in either case. To see why, let's look at the tax on cigarettes in Ontario.

A Tax on Sellers

On February 1, 2006, Ontario upped the tax on the sale of cigarettes to \$3.09 a pack of 25. To work out the effects of this tax (rounded to \$3) on the sellers of cigarettes, we begin by examining the effects on demand and supply in the market for cigarettes.

*These outcomes also apply to services and factors of production (land, labour, and capital).

In Fig. 6.5, the demand curve is D and the supply curve is S . With no tax, the equilibrium price is \$6 per pack and 350 million packs a year are bought and sold.

A tax on sellers is like an increase in cost, so it decreases supply. To determine the position of the new supply curve, we add the tax to the minimum price that sellers are willing to accept for each quantity sold. You can see that without the tax, sellers are willing to offer 350 million packs a year for \$6 a pack. So with a \$3 tax, they will offer 350 million packs a year only if the price is \$9 a pack. The supply curve shifts to the red curve labelled $S + \text{tax on sellers}$.

Equilibrium occurs where the new supply curve intersects the demand curve at 325 million packs a year. The price paid by buyers rises by \$2 to \$8 a pack. And the price received by sellers falls by \$1 to \$5 a pack. So buyers pay \$2 of the tax on a pack and sellers pay the other \$1.

A Tax on Buyers

Suppose that instead of taxing sellers, Ontario taxes cigarette buyers \$3 a pack.

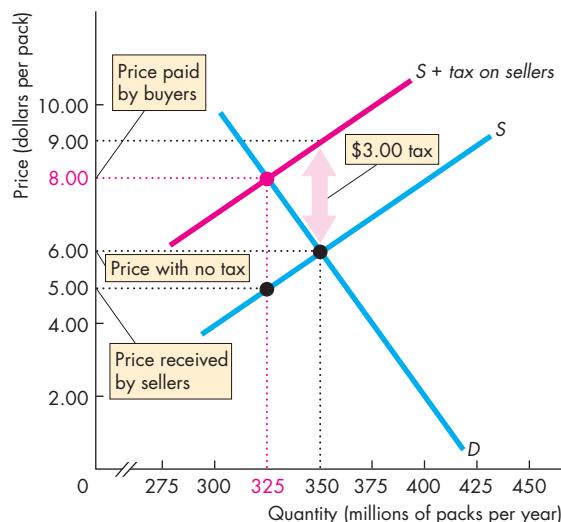
A tax on buyers lowers the amount they are willing to pay sellers, so it decreases demand and shifts the demand curve leftward. To determine the position of this new demand curve, we subtract the tax from the maximum price that buyers are willing to pay for each quantity bought. You can see, in Fig. 6.6, that without the tax, buyers are willing to buy 350 million packs a year for \$6 a pack. So with a \$3 tax, they are willing to buy 350 million packs a year only if the price including the tax is \$6 a pack, which means that they're willing to pay sellers only \$3 a pack. The demand curve shifts to become the red curve labelled $D - \text{tax on buyers}$.

Equilibrium occurs where the new demand curve intersects the supply curve at a quantity of 325 million packs a year. The price received by sellers is \$5 a pack, and the price paid by buyers is \$8 a pack.

Equivalence of Tax on Buyers and Sellers

You can see that the tax on buyers in Fig. 6.6 has the same effects as the tax on sellers in Fig. 6.5. In both cases, the equilibrium quantity decreases to 325 million packs a year, the price paid by buyers rises to \$8 a pack, and the price received by sellers falls to \$5 a pack. Buyers pay \$2 of the \$3 tax, and sellers pay the other \$1 of the tax on a pack.

FIGURE 6.5 A Tax on Sellers



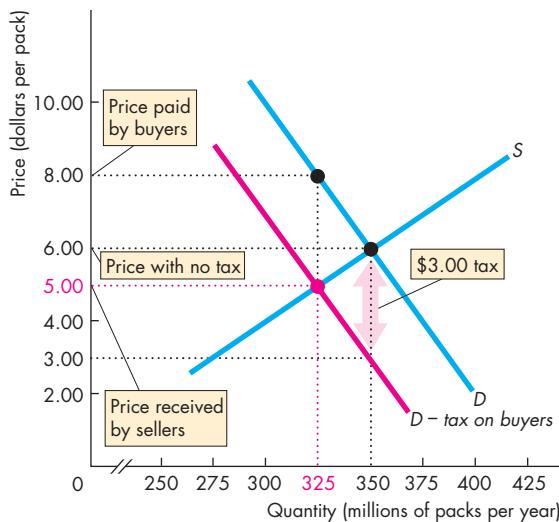
With no tax, 350 million packs a year are bought and sold at \$6 a pack. A tax on sellers of \$3 a pack shifts the supply curve from S to $S + \text{tax on sellers}$. The equilibrium quantity decreases to 325 million packs a year, the price paid by buyers rises to \$8 a pack, and the price received by sellers falls to \$5 a pack. The tax raises the price paid by buyers by less than the tax and lowers the price received by sellers, so buyers and sellers share the burden of the tax.

[MyEconLab Animation and Draw Graph](#)

Can We Share the Burden Equally? Suppose that Ontario wants the burden of the cigarette tax to fall equally on buyers and sellers and declares that a \$1.50 tax be imposed on each. Is the burden of the tax then shared equally?

You can see that it is not. The tax is still \$3 a pack. You've seen that the tax has the same effect regardless of whether it is imposed on sellers or buyers. So imposing half the tax on sellers and half on buyers is like an average of the two cases you've just examined. (Draw the demand-supply graph and work out what happens in this case. The demand curve shifts downward by \$1.50 and the supply curve shifts upward by \$1.50. The new equilibrium quantity is still 325 million packs a year. Buyers pay \$8 a pack, of which \$1.50 is tax. Sellers receive \$6.50 from buyers, but pay a \$1.50 tax, so sellers net \$5 a pack.)

When a transaction is taxed, there are two prices: the price paid by buyers, which includes the tax; and the price received by sellers, which excludes the tax.

FIGURE 6.6 A Tax on Buyers

With no tax, 350 million packs a year are bought and sold at \$6 a pack. A tax on buyers of \$3 a pack shifts the demand curve from D to $D - \text{tax on buyers}$. The equilibrium quantity decreases to 325 million packs a year, the price paid by buyers rises to \$8 a pack, and the price received by sellers falls to \$5 a pack. The tax raises the price paid by buyers by less than the tax and lowers the price received by sellers, so buyers and sellers share the burden of the tax.

[MyEconLab Animation](#)

Buyers respond to the price that *includes* the tax and sellers respond to the price that *excludes* the tax.

A tax is like a wedge between the price buyers pay and the price sellers receive. The size of the wedge determines the effects of the tax, not the side of the market on which the government imposes the tax.

The Employment Insurance Tax The Employment Insurance tax is an example of a tax that the federal government imposes on *both* workers (buyers) and firms (sellers). But the principles you've just learned apply to this tax too. The market for labour, *not* the federal government, decides how the burden of the Employment Insurance tax is divided between firms and workers.

In the Ontario cigarette tax example, buyers bear twice the burden of the tax borne by sellers. In special cases, either buyers or sellers bear the entire burden. The division of the burden of a tax between buyers and sellers depends on the elasticities of demand and supply, as you will now see.

Tax Incidence and Elasticity of Demand

The division of the tax between buyers and sellers depends in part on the elasticity of demand. There are two extreme cases:

- Perfectly inelastic demand—buyers pay.
- Perfectly elastic demand—sellers pay.

Perfectly Inelastic Demand Figure 6.7 shows the market for insulin, a vital daily medication for those with diabetes. Demand is perfectly inelastic at 100,000 doses a day, regardless of the price, as shown by the vertical demand curve D . That is, a diabetic would sacrifice all other goods and services rather than not consume the insulin dose that provides good health. The supply curve of insulin is S . With no tax, the price is \$2 a dose and the quantity is 100,000 doses a day.

If insulin is taxed at 20¢ a dose, we must add the tax to the minimum price at which drug companies are willing to sell insulin. The result is the new supply curve $S + \text{tax}$. The price rises to \$2.20 a dose, but the quantity does not change. Buyers pay the entire tax of 20¢ a dose.

FIGURE 6.7 Tax with Perfectly Inelastic Demand

In this market for insulin, demand is perfectly inelastic. With no tax, the price is \$2 a dose and the quantity is 100,000 doses a day. A tax of 20¢ a dose shifts the supply curve to $S + \text{tax}$. The price rises to \$2.20 a dose, but the quantity bought does not change. Buyers pay the entire tax.

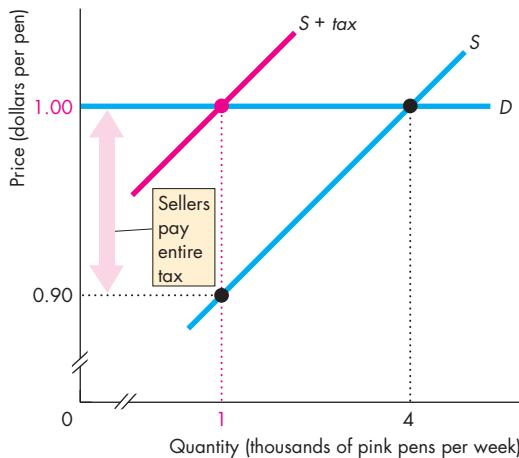
[MyEconLab Animation](#)

Perfectly Elastic Demand Figure 6.8 shows the market for pink marker pens. Demand is perfectly elastic at \$1 a pen, as shown by the horizontal demand curve D . If pink pens are less expensive than the other colours, everyone uses pink. If pink pens are more expensive than other colours, no one uses pink. The supply curve is S . With no tax, the price of a pink pen is \$1 and the quantity is 4,000 pens a week.

Suppose that the government imposes a tax of 10¢ a pen on pink marker pens but not on other colours. The new supply curve is $S + \text{tax}$. The price remains at \$1 a pen, and the quantity decreases to 1,000 pink pens a week. The 10¢ tax leaves the price paid by buyers unchanged but lowers the amount received by sellers by the full amount of the tax. Sellers pay the entire tax of 10¢ a pink pen.

We've seen that when demand is perfectly inelastic, buyers pay the entire tax, and when demand is perfectly elastic, sellers pay the entire tax. In the usual case, demand is neither perfectly inelastic nor perfectly elastic and the tax is split between buyers and sellers. But the division depends on the elasticity of demand: The more inelastic the demand, the larger is the amount of the tax paid by buyers.

FIGURE 6.8 Tax with Perfectly Elastic Demand



In this market for pink pens, demand is perfectly elastic. With no tax, the price of a pen is \$1 and the quantity is 4,000 pens a week. A tax of 10¢ a pink pen shifts the supply curve to $S + \text{tax}$. The price remains at \$1 a pen, and the quantity of pink pens sold decreases to 1,000 a week. Sellers pay the entire tax.

MyEconLab Animation

Tax Incidence and Elasticity of Supply

The division of the tax between buyers and sellers also depends, in part, on the elasticity of supply. Again, there are two extreme cases:

- Perfectly inelastic supply—sellers pay.
- Perfectly elastic supply—buyers pay.

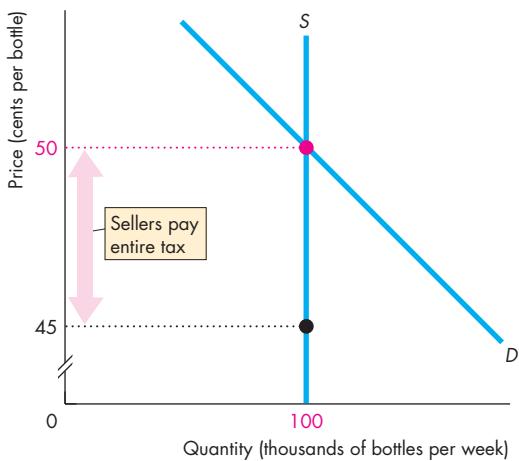
Perfectly Inelastic Supply Figure 6.9(a) shows the market for water from a mineral spring that flows at a constant rate that can't be controlled. Supply is perfectly inelastic at 100,000 bottles a week, as shown by the supply curve S . The demand curve for the water from this spring is D . With no tax, the price is 50¢ a bottle and the quantity is 100,000 bottles.

Suppose this spring water is taxed at 5¢ a bottle. The supply curve does not change because the spring owners still produce 100,000 bottles a week, even though the price they receive falls. But buyers are willing to buy the 100,000 bottles only if the price is 55¢ a bottle, so the price remains at 55¢ a bottle. The tax reduces the price received by sellers to 50¢ a bottle, and sellers pay the entire tax.

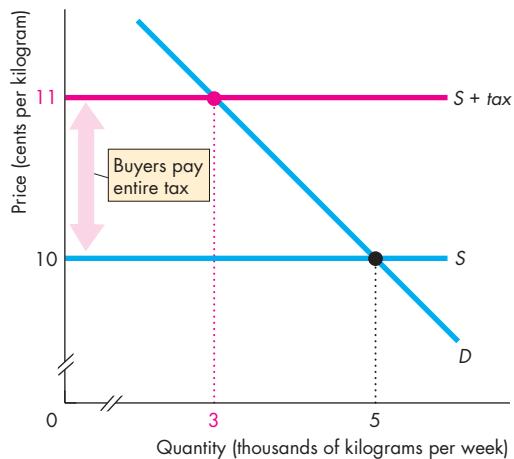
Perfectly Elastic Supply Figure 6.9(b) shows the market for sand from which computer-chip makers extract silicon. Supply of this sand is perfectly elastic at a price of 10¢ a kilogram, as shown by the supply curve S . The demand curve for sand is D . With no tax, the price is 10¢ a kilogram and 5,000 kilograms a week are bought.

If this sand is taxed at 1¢ a kilogram, we must add the tax to the minimum supply-price. Sellers are now willing to offer any quantity at 11¢ a kilogram along the curve $S + \text{tax}$. A new equilibrium is determined where the new supply curve intersects the demand curve: at a price of 11¢ a kilogram and a quantity of 3,000 kilograms a week. The tax has increased the price buyers pay by the full amount of the tax—1¢ a kilogram—and has decreased the quantity sold. Buyers pay the entire tax.

We've seen that when supply is perfectly inelastic, sellers pay the entire tax, and when supply is perfectly elastic, buyers pay the entire tax. In the usual case, supply is neither perfectly inelastic nor perfectly elastic and the tax is split between buyers and sellers. But how the tax is split depends on the elasticity of supply: The more elastic the supply, the larger is the amount of the tax paid by buyers.

FIGURE 6.9 Tax and the Elasticity of Supply

(a) Perfectly inelastic supply



(b) Perfectly elastic supply

Part (a) shows the market for water from a mineral spring. Supply is perfectly inelastic. With no tax, the price is 50¢ a bottle. With a tax of 5¢ a bottle, the price remains at 50¢ a bottle. The number of bottles bought remains the same, but the price received by sellers decreases to 45¢ a bottle. Sellers pay the entire tax.

Part (b) shows the market for sand. Supply is perfectly elastic. With no tax, the price is 10¢ a kilogram. A tax of 1¢ a kilogram increases the minimum supply-price to 11¢ a kilogram. The supply curve shifts to $S + \text{tax}$. The price increases to 11¢ a kilogram. Buyers pay the entire tax.

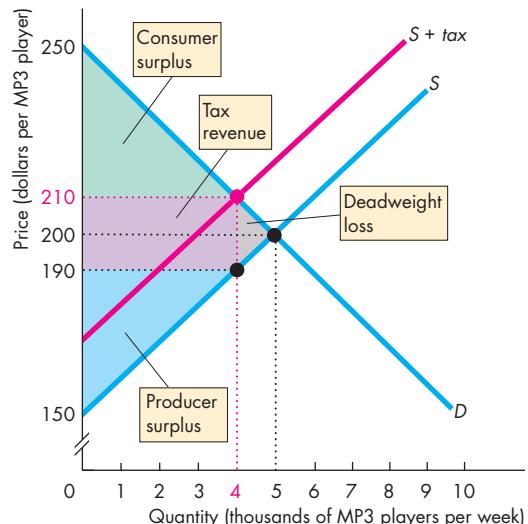
Taxes and Efficiency

A tax drives a wedge between the buying price and the selling price and results in inefficient underproduction. The price buyers pay is also the buyers' willingness to pay, which measures *marginal social benefit*. The price sellers receive is also the sellers' minimum supply-price, which equals *marginal social cost*.

A tax makes marginal social benefit exceed marginal social cost, shrinks the producer surplus and consumer surplus, and creates a deadweight loss.

Figure 6.10 shows the inefficiency of a tax on MP3 players. The demand curve, D , shows marginal social benefit, and the supply curve, S , shows marginal social cost. Without a tax, the market produces the efficient quantity (5,000 players a week).

With a tax, the sellers' minimum supply-price rises by the amount of the tax and the supply curve shifts to $S + \text{tax}$. This supply curve does not show marginal social cost. The tax component isn't a *social*

FIGURE 6.10 Taxes and Efficiency

With no tax, 5,000 players a week are produced. With a \$20 tax, the buyers' price rises to \$210, the sellers' price falls to \$190, and the quantity decreases to 4,000 players a week. Consumer surplus shrinks to the green area, and the producer surplus shrinks to the blue area. Part of the loss of consumer surplus and producer surplus goes to the government as tax revenue (the purple area) and part becomes a deadweight loss (the grey area).

cost of production. It is a transfer of resources to the government. At the new equilibrium quantity (4,000 players a week), both consumer surplus and producer surplus shrink. Part of each surplus goes to the government in tax revenue—the purple area; part becomes a deadweight loss—the grey area.

Only in the extreme cases of perfectly inelastic demand and perfectly inelastic supply does a tax not change the quantity bought and sold so that no dead-weight loss arises.

Taxes and Fairness

We've examined the incidence and the efficiency of taxes. But when political leaders debate tax issues, it is fairness, not incidence and efficiency, that gets the most attention. The NDP complain that tax cuts are unfair because they give the benefits of lower taxes to the rich. Conservatives counter that it is fair that the rich get most of the tax cuts because they pay most of the taxes. No easy answers are available to the questions about the fairness of taxes.

Economists have proposed two conflicting principles of fairness to apply to a tax system:

- The benefits principle
- The ability-to-pay principle

The Benefits Principle The *benefits principle* is the proposition that people should pay taxes equal to the benefits they receive from the services provided by government. This arrangement is fair because it means that those who benefit most pay the most taxes. It makes tax payments and the consumption of government-provided services similar to private consumption expenditures.

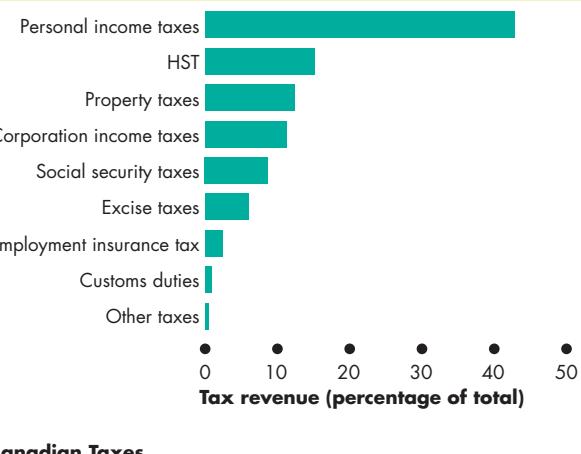
The benefits principle can justify high fuel taxes to pay for highways, high taxes on alcoholic beverages and tobacco products to pay for public health-care services, and high rates of income tax on high incomes to pay for the benefits from law and order and from living in a secure environment, from which the rich might benefit more than the poor.

The Ability-to-Pay Principle The *ability-to-pay principle* is the proposition that people should pay taxes according to how easily they can bear the burden of the tax. A rich person can more easily bear the burden than a poor person can, so the ability-to-pay principle can reinforce the benefits principle to justify high rates of income tax on high incomes.

Economics in Action

Workers and Consumers Pay the Most Tax

Because the elasticity of the supply of labour is low and the elasticity of demand for labour is high, workers pay most of the personal income taxes and most of the social security taxes. Because the elasticities of demand for alcohol, tobacco, and gasoline are low and the elasticities of supply are high, the burden of these taxes (excise taxes) falls more heavily on buyers than on sellers.



Canadian Taxes

Source of data: Statistics Canada, CANSIM Table 385-0001.

REVIEW QUIZ

- 1 How does the elasticity of demand influence the incidence of a tax, the tax revenue, and the deadweight loss?
- 2 How does the elasticity of supply influence the incidence of a tax, the quantity bought, the tax revenue, and the deadweight loss?
- 3 Why is a tax inefficient?
- 4 When would a tax be efficient?
- 5 What are the two principles of fairness that are applied to tax systems?

Work these questions in Study Plan 6.3 and get instant feedback. Do a Key Terms Quiz.

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Your next task is to study production quotas and subsidies, tools that are used to influence the markets for farm products.

Production Quotas and Subsidies

An early or late frost, a hot dry summer, and a wet spring present just a few of the challenges that fill the lives of farmers with uncertainty and sometimes with economic hardship. Fluctuations in the weather bring fluctuations in farm output and prices and sometimes leave farmers with low incomes. To help farmers avoid low prices and low incomes, governments intervene in the markets for farm products.

Price floors that work a bit like the minimum wage that you've already studied might be used. But as you've seen, this type of government action creates a surplus and is inefficient. These same conclusions apply to the effects of a price floor for farm products.

Governments often use two other methods of intervention in the markets for farm products:

- Production quotas
- Subsidies

Production Quotas

In the markets for milk, eggs, and poultry (among others), governments have, from time to time, imposed production quotas. A **production quota** is an upper limit to the quantity of a good that may be produced in a specified period. To discover the effects of a production quota, let's look at what a production quota does to the market for milk.

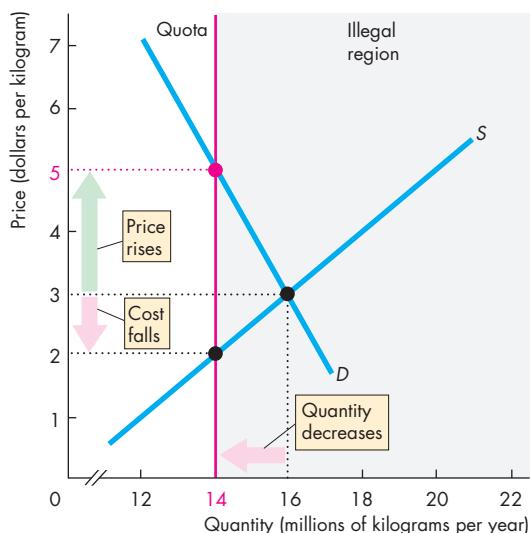
Suppose that the dairy farmers want to limit total production of milk to get a higher price. They persuade the government to introduce a production quota on milk.

The effect of the production quota depends on whether it is set below or above the equilibrium quantity. If the government introduced a production quota above the equilibrium quantity, nothing would change because dairy farmers would already be producing less than the quota. But a production quota set *below the equilibrium quantity* has big effects, which are:

- A decrease in supply
- A rise in price
- A decrease in marginal cost
- Inefficient underproduction
- An incentive to cheat and overproduce

Figure 6.11 illustrates these effects.

FIGURE 6.11 The Effects of a Production Quota



With no quota, farmers produce 16 million kilograms of milk (powder) a year and the price is \$3 a kilogram. A production quota of 14 million kilograms a year restricts total production to that amount. The quantity produced decreases to 14 million kilograms a year, the price rises to \$5 a kilogram, and the farmers' marginal cost falls to \$2 a kilogram. Because marginal social cost (on the supply curve) is less than marginal social benefit (on the demand curve), a dead-weight loss arises from the underproduction.

MyEconLab Animation

A Decrease in Supply A production quota on milk decreases the supply of milk. Each grower is assigned a production limit that is less than the amount that would be produced—and supplied—without the quota. The total of the growers' limits equals the quota, and any production in excess of the quota is illegal.

The quantity supplied becomes the amount permitted by the production quota, and this quantity is fixed. The supply of milk becomes perfectly inelastic at the quantity permitted under the quota.

In Fig. 6.11, with no quota, growers would produce 16 million kilograms of milk (powder) a year—the market equilibrium quantity. With a production quota set at 14 million kilograms a year, the grey-shaded area shows the illegal region. As in the case of price ceilings and price floors, market forces and political forces are in conflict in this illegal region.

The vertical red line labelled "Quota" becomes the supply curve of milk at prices above \$2 a kilogram.

A Rise in Price The production quota raises the price of milk. When the government sets a production quota, it leaves market forces free to determine the price. Because the quota decreases the supply of milk, it raises the price. In Fig. 6.11, with no quota, the price is \$3 a kilogram. With a quota of 14 million kilograms, the price rises to \$5 a kilogram.

A Decrease in Marginal Cost The production quota lowers the marginal cost of producing milk. Marginal cost decreases because farmers produce less and stop using the resources with the highest marginal cost. Dairy farmers slide down their supply (and marginal cost) curves. In Fig. 6.11, marginal cost decreases to \$2 a kilogram.

Inefficiency The production quota results in inefficient underproduction. Marginal social benefit at the quantity produced is equal to the market price, which has increased. Marginal social cost at the quantity produced has decreased and is less than the market price. So marginal social benefit exceeds marginal social cost and a deadweight loss arises.

An Incentive to Cheat and Overproduce The production quota creates an incentive for farmers to cheat and produce more than their individual production limit. With the quota, the price exceeds marginal cost, so the farmer can get a larger profit by producing one more unit. Of course, if all farmers produce more than their assigned limit, the production quota becomes ineffective, and the price falls to the equilibrium (no quota) price.

To make the production quota effective, farmers must set up a monitoring system to ensure that no one cheats and overproduces. But it is costly to set up and operate a monitoring system and it is difficult to detect and punish producers who violate their quotas.

Because of the difficulty of operating a quota, producers often lobby governments to establish a quota and provide the monitoring and punishment systems that make it work.

Subsidies

In Canada, the European Union, and the United States, the producers of many farm products, including grain, meat, milk, and eggs, receive government subsidies. A **subsidy** is a payment made by the government to a producer.

The effects of a subsidy are similar to the effects of a tax but they go in the opposite direction. These effects are:

- An increase in supply
- A fall in price and increase in quantity produced
- An increase in marginal cost
- Payments by government to farmers
- Inefficient overproduction

Figure 6.12 illustrates the effects of a subsidy to grain farmers.

An Increase in Supply In Fig. 6.12, with no subsidy, the demand curve D and the supply curve S determine the price of grain at \$40 a tonne and the quantity of grain at 40 million tonnes a year.

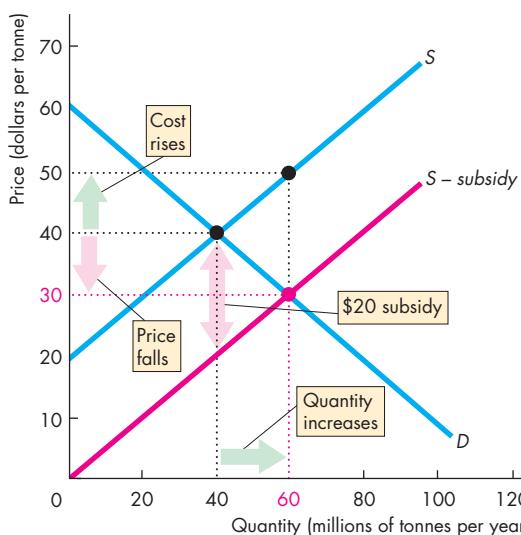
Suppose that the government introduces a subsidy of \$20 a tonne to grain farmers. A subsidy is like a negative tax. A tax is equivalent to an increase in cost, so a subsidy is equivalent to a decrease in cost. The subsidy brings an increase in supply.

To determine the position of the new supply curve, we subtract the subsidy from the farmers' minimum supply-price. In Fig. 6.12, with no subsidy, farmers are willing to offer 40 million tonnes a year at a price of \$40 a tonne. With a subsidy of \$20 a tonne, they will offer 40 million tonnes a year if the price is as low as \$20 a tonne. The supply curve shifts to the red curve labelled $S - \text{subsidy}$.

A Fall in Price and Increase in Quantity Produced The subsidy lowers the price of grain and increases the quantity produced. In Fig. 6.12, equilibrium occurs where the new supply curve intersects the demand curve at a price of \$30 a tonne and a quantity of 60 million tonnes a year.

An Increase in Marginal Cost The subsidy lowers the price paid by consumers but increases the marginal cost of growing grain. Marginal cost increases because farmers grow more grain, which means that they must begin to use some resources that are less ideal for growing grain. Farmers slide up their supply (and marginal cost) curves. In Fig. 6.12, marginal cost increases to \$50 a tonne.

Payments by Government to Farmers The government pays a subsidy to farmers on each tonne of grain produced. In this example, farmers increase production to 60 million tonnes a year and receive a

FIGURE 6.12 The Effects of a Subsidy

With no subsidy, farmers produce 40 million tonnes a year at \$40 a tonne. A subsidy of \$20 a tonne shifts the supply curve rightward to $S - \text{subsidy}$. The equilibrium quantity increases to 60 million tonnes a year, the price falls to \$30 a tonne, and the price plus the subsidy received by farmers rises to \$50 a tonne. In the new equilibrium, marginal social cost (on the supply curve) exceeds marginal social benefit (on the demand curve) and the subsidy results in inefficient overproduction.

[MyEconLab Animation](#)

subsidy of \$20 a tonne. So farmers receive payments from the government that total \$1,200 million a year.

Inefficient Overproduction The subsidy results in inefficient overproduction. At the quantity produced with the subsidy, marginal social benefit is equal to the market price, which has fallen. Marginal social cost has increased and it exceeds the market price. Because marginal social cost exceeds marginal social benefit, the increased production brings inefficiency.

Subsidies spill over to the rest of the world. Because a subsidy lowers the domestic market price, subsidized farmers will offer some of their output for sale on the world market. The increase in supply on the world market lowers the price in the rest of the world. Faced with lower prices, farmers in other countries decrease production and receive smaller revenues.

Economics in Action

Rich High-Cost Farmers the Winners

Farm subsidies are a major obstacle to achieving an efficient use of resources in the global markets for farm products and are a source of tension between rich and developing nations.

Canada, the United States, and the European Union pay their farmers subsidies, which create inefficient overproduction of food in these rich economies.

One international study concluded that Canadians would be better off if they imported all their food rather than produce any themselves!

At the same time, Canadian, U.S., and European subsidies make it more difficult for farmers in the developing nations of Africa, Asia, and Central and South America to compete in global food markets. Farmers in these countries can often produce at a lower opportunity cost than Canadian, U.S., and European farmers.

Two rich countries, Australia and New Zealand, have stopped subsidizing farmers. The result has been an improvement in the efficiency of farming in these countries. New Zealand is so efficient at producing lamb and dairy products that it has been called the Saudi Arabia of milk (an analogy to Saudi Arabia's huge oil reserve and production).

International opposition to farm subsidies is strong. Opposition to farm subsidies inside Canada, the European Union, and the United States is growing, but it isn't as strong as the pro-farm lobby, so don't expect an early end to these subsidies.

REVIEW QUIZ

- 1 Summarize the effects of a production quota on the market price and the quantity produced.
- 2 Explain why a production quota is inefficient.
- 3 Explain why a voluntary production quota is difficult to operate.
- 4 Summarize the effects of a subsidy on the market price and the quantity produced.
- 5 Explain why a subsidy is inefficient.

Work these questions in Study Plan 6.4 and get instant feedback. Do a Key Terms Quiz.

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Governments intervene in some markets by making it illegal to trade in a good. Let's now see how these markets work.

Markets for Illegal Goods

The markets for many goods and services are regulated, and buying and selling some goods is illegal. The best-known examples of such goods are drugs such as marijuana, cocaine, ecstasy, and heroin.

Despite the fact that these drugs are illegal, trade in them is a multibillion-dollar business. This trade can be understood by using the same economic model and principles that explain trade in legal goods. To study the market for illegal goods, we're first going to examine the prices and quantities that would prevail if these goods were not illegal. Next, we'll see how prohibition works. Then we'll see how a tax might be used to limit the consumption of these goods.

A Free Market for a Drug

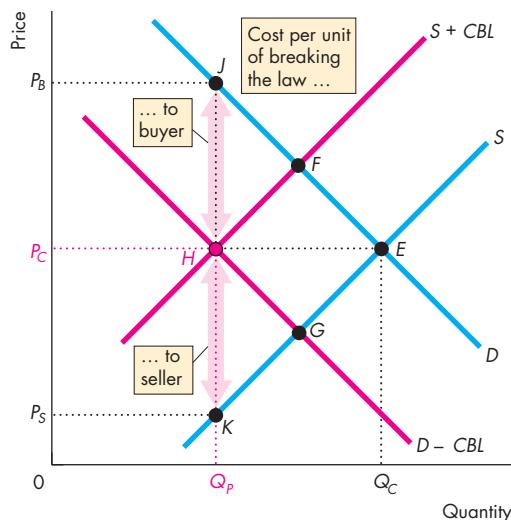
Figure 6.13 shows the market for a drug. The demand curve, D , shows that, other things remaining the same, the lower the price of the drug, the larger is the quantity of the drug demanded. The supply curve, S , shows that, other things remaining the same, the lower the price of the drug, the smaller is the quantity supplied. If the drug were not illegal, the quantity bought and sold would be Q_C and the price would be P_C .

A Market for an Illegal Drug

When a good is illegal, the cost of trading in the good increases. By how much the cost increases and who bears the cost depend on the penalties for violating the law and the degree to which the law is enforced. The larger the penalties and the better the policing, the higher are the costs. Penalties might be imposed on sellers, buyers, or both.

Penalties on Sellers Drug dealers in Canada face large penalties if their activities are detected. For example, a marijuana dealer caught with less than 3 kilograms could serve a 1-year prison term. A heroin dealer or marijuana dealer caught with 3 kilograms could be imprisoned for 2 years. These penalties are part of the cost of supplying illegal drugs, and they bring a decrease in supply—a leftward shift in the supply curve. To determine the new supply curve, we add the cost of breaking the law to the minimum price that drug dealers are willing to accept. In Fig. 6.13, the cost of breaking the law by selling drugs (CBL) is added to the minimum price that

FIGURE 6.13 Market for an Illegal Good



The demand curve for drugs is D , and the supply curve is S . If drugs are not illegal, the quantity bought and sold is Q_C at a price of P_C —point E . If selling drugs is illegal, the cost of breaking the law by selling drugs (CBL) is added to the minimum supply-price and supply decreases to $S + CBL$. The market moves to point F . If buying drugs is illegal, the cost of breaking the law is subtracted from the maximum price that buyers are willing to pay, and demand decreases to $D - CBL$. The market moves to point G . With both buying and selling illegal, the supply curve and the demand curve shift and the market moves to point H . The market price remains at P_C , but the market price plus the penalty for buying rises—point J —and the market price minus the penalty for selling falls—point K .

MyEconLab Animation

dealers will accept and the supply curve shifts leftward to $S + CBL$. If penalties were imposed only on sellers, the market equilibrium would move from point E to point F .

Penalties on Buyers In Canada, it is illegal to possess drugs such as marijuana, cocaine, ecstasy, and heroin. Possession of marijuana can bring a prison term of 6 months and a fine of \$1,000. Possession of heroin can bring a prison term of 7 years. Penalties fall on buyers, and the cost of breaking the law must be subtracted from the value of the good to determine the maximum price buyers are willing to pay for the drugs. Demand decreases, and the demand curve shifts leftward. In Fig. 6.13, the demand curve shifts

to $D - CBL$. If penalties were imposed only on buyers, the market equilibrium would move from point E to point G .

Penalties on Both Sellers and Buyers If penalties are imposed on both sellers *and* buyers, both supply and demand decrease and both the supply curve and the demand curve shift. In Fig. 6.13, the costs of breaking the law are the same for both buyers and sellers, so both curves shift leftward by the same amount. The market equilibrium moves to point H . The market price remains at the competitive market price P_C , but the quantity bought decreases to Q_P . Buyers pay P_C plus the cost of breaking the law, which equals P_B . Sellers receive P_C minus the cost of breaking the law, which equals P_S .

The larger the penalties and the greater the degree of law enforcement, the larger is the decrease in demand and/or supply. If the penalties are heavier on sellers, the supply curve shifts farther than the demand curve and the market price rises above P_C . If the penalties are heavier on buyers, the demand curve shifts farther than the supply curve and the market price falls below P_C . In the United States, the penalties on sellers are larger than those on buyers, so the quantity of drugs traded decreases and the market price increases compared with a free market.

With high enough penalties and effective law enforcement, it is possible to decrease demand and/or supply to the point at which the quantity bought is zero. But in reality, such an outcome is unusual. It does not happen in Canada in the case of illegal drugs. The key reason is the high cost of law enforcement and insufficient resources for the police to achieve effective enforcement. Because of this situation, some people suggest that drugs (and other illegal goods) should be legalized and sold openly but also taxed at a high rate in the same way that legal drugs such as alcohol are taxed. How would such an arrangement work?

Legalizing and Taxing Drugs

From your study of the effects of taxes, it is easy to see that the quantity bought of a drug could decrease if the drug were legalized and taxed. Imposing a sufficiently high tax could decrease the supply, raise the price, and achieve the same decrease in the quantity bought as does a prohibition on drugs. The government would collect a large tax revenue.

Illegal Trading to Evade the Tax It is likely that an extremely high tax rate would be needed to cut the quantity of drugs bought to the level prevailing with a prohibition. It is also likely that many drug dealers and consumers would try to cover up their activities to evade the tax. If they did act in this way, they would face the cost of breaking the law—the tax law. If the penalty for tax law violation is as severe and as effectively policed as drug-dealing laws, the analysis we've already conducted applies also to this case. The quantity of drugs bought would depend on the penalties for law breaking and on the way in which the penalties are assigned to buyers and sellers.

Taxes Versus Prohibition: Some Pros and Cons

Which is more effective: prohibition or taxes? In favour of taxes and against prohibition is the fact that the tax revenue can be used to make law enforcement more effective. It can also be used to run a more effective education campaign against illegal drug use. In favour of prohibition and against taxes is the fact that prohibition sends a signal that might influence preferences, decreasing the demand for illegal drugs. Also, some people intensely dislike the idea of the government profiting from trade in harmful substances.

REVIEW QUIZ

- How does the imposition of a penalty for selling an illegal drug influence demand, supply, price, and the quantity of the drug consumed?
- How does the imposition of a penalty for possessing an illegal drug influence demand, supply, price, and the quantity of the drug consumed?
- How does the imposition of a penalty for selling *or* possessing an illegal drug influence demand, supply, price, and the quantity of the drug consumed?
- Is there any case for legalizing drugs?

Work these questions in Study Plan 6.5 and get instant feedback.

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◆ You now know how to use the demand and supply model to predict prices, to study government actions in markets, and to study the sources and costs of inefficiency. In *Economics in the News* on pp. 144–145, you will see how to apply what you've learned by looking at the effects of the minimum wage rate in the market for low-skilled labour.

Push to Raise the Minimum Wage

Ontario's Minimum Wage to Rise to \$11 an Hour This June, an Increase of 75 Cents an Hour.

Financial Post

Canadian Press, January 30, 2014

Ontario's Liberal government is raising the minimum wage to \$11 an hour, promising annual increases will be tied to the rate of inflation.

Premier Kathleen Wynne announced the 75-cent-an-hour hike on Thursday — the first minimum wage increase in the province since 2010 — calling it a “fair adjustment” that reflects the rise in the Consumer Price Index.

“I think the vast majority of people in Ontario understand that it’s very difficult to make ends meet living on minimum wage, and that there needs to be a fair way of allowing minimum wage to keep up with the cost of living,” she said.

At \$11 an hour, Ontario will join Nunavut in having the highest minimum wage in Canada. ...

Anti-poverty activists and unions have been demanding an immediate increase to a \$14-an-hour minimum wage, but the government has said that would hurt businesses and end up reducing jobs. ...

However, the Canadian Restaurant and Foodservices Association warned the 75-cent hike will result in fewer jobs, especially among youth, calling it “unnecessary, tough for small business and counter-productive.” ...

The Progressive Conservatives warned the \$11 minimum wage amounted to a seven per cent increase in business costs, and predicted it would result in reduced hours for workers or even job losses.

“If labour costs go up seven per cent, they’ve got to lay people off, putting them on unemployment,” [said] PC critic Jane McKenna. “What’s stopping a 40-hour week from becoming a 37-hour week?”

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ESSENCE OF THE STORY

- The Ontario government is raising the minimum wage by 75¢ to \$11 an hour and plans to increase the rate in future years in line with the cost of living (measured by the Consumer Price Index).
- Ontario will join Nunavut with the highest minimum wage in Canada.
- Anti-poverty activists and unions want an increase to \$14 an hour.
- The government says that \$14 an hour would decrease the number of jobs.
- Employers and the Ontario Progressive Conservative opposition say that a rise to \$11 will lower employment.

ECONOMIC ANALYSIS

- The news article reports that the Ontario government is increasing the provincial minimum wage rate by 75¢ to \$11 per hour.
- The Ontario minimum wage was set at \$10.25 an hour in 2010.
- Other wage rates have risen and the cost of living has increased, and there was a widely held view that the minimum wage rate needed to rise.
- With the increase to \$11 per hour, Ontario's minimum wage will join Nunavut's as the highest in Canada.
- Supporters of the increases believed that employment would not be adversely affected, while opponents argued that the higher minimum wage would bring job losses.
- The figures illustrate these two opinions about the effect of a higher minimum wage rate.
- Figure 1 illustrates a market for low-skilled labour in which the equilibrium wage rate exceeds the minimum wage.
- The demand for labour is D_0 and the supply of labour is S_0 , so the equilibrium wage rate is \$11 an hour, which is also the minimum wage rate.

- Because the equilibrium wage rate equals the minimum wage rate, the quantity of labour demanded equals the quantity of labour supplied and the minimum wage rate has no effect on the market outcome.
- Figure 2 illustrates a market for low-skilled labour in which the equilibrium wage rate is lower than the minimum wage rate.
- The demand for labour is D_1 and the supply of labour is S_1 , so the equilibrium wage rate is \$10.25 an hour.
- The minimum wage rate is \$11 an hour, and the quantity of labour employed equals the quantity demanded at the minimum wage rate.
- The quantity of labour demanded and employed is 10 million (an assumed quantity).
- At the equilibrium wage rate, the quantity of labour supplied is 12 million (also an assumed quantity), so 2 million workers are unemployed.
- With the equilibrium wage rate less than the minimum wage rate, the quantity of labour demanded is less than the quantity of labour supplied and the minimum wage rate brings an increase in unemployment.

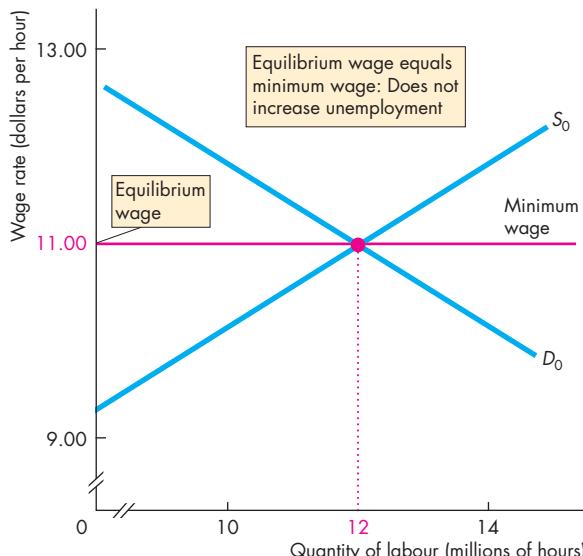


Figure 1 Government and Union View of Labour Market

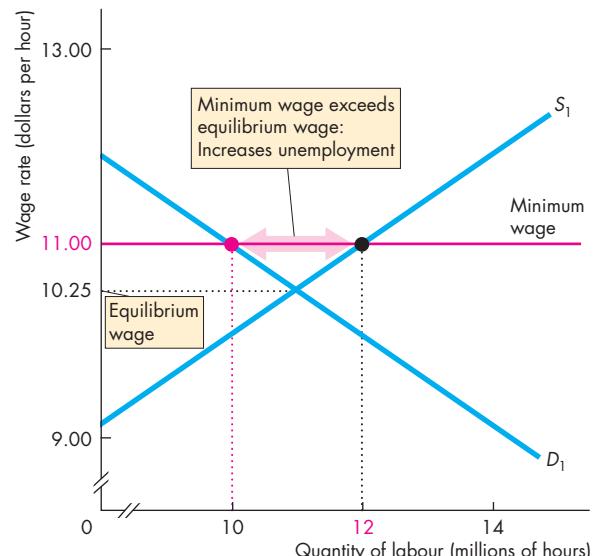


Figure 2 PC Opposition and Employer View of Labour Market

SUMMARY

Key Points

A Housing Market with a Rent Ceiling (pp. 128–130)

- A rent ceiling that is set above the equilibrium rent has no effect.
- A rent ceiling that is set below the equilibrium rent creates a housing shortage, increased search activity, and a black market.
- A rent ceiling that is set below the equilibrium rent is inefficient and unfair.

Working Problems 1 and 2 will give you a better understanding of a housing market with a rent ceiling.

A Labour Market with a Minimum Wage (pp. 131–133)

- A minimum wage set below the equilibrium wage rate has no effect.
- A minimum wage set above the equilibrium wage rate creates unemployment and increases the amount of time people spend searching for a job.
- A minimum wage set above the equilibrium wage rate is inefficient, unfair, and hits low-skilled young people hardest.

Working Problems 3 and 4 will give you a better understanding of a labour market with a minimum wage.

Taxes (pp. 133–138)

- A tax raises the price paid by buyers, but usually by less than the tax.
- The elasticity of demand and the elasticity of supply determine the share of a tax paid by buyers and sellers.

- The less elastic the demand or the more elastic the supply, the larger is the share of the tax paid by buyers.
- If demand is perfectly elastic or supply is perfectly inelastic, sellers pay the entire tax. And if demand is perfectly inelastic or supply is perfectly elastic, buyers pay the entire tax.

Working Problem 5 will give you a better understanding of taxes.

Production Quotas and Subsidies (pp. 139–141)

- A production quota leads to inefficient underproduction, which raises the price.
- A subsidy is like a negative tax. It lowers the price, increases the cost of production, and leads to inefficient overproduction.

Working Problems 6 and 7 will give you a better understanding of production quotas and subsidies.

Markets for Illegal Goods (pp. 142–143)

- Penalties on sellers increase the cost of selling the good and decrease the supply of the good.
- Penalties on buyers decrease their willingness to pay and decrease the demand for the good.
- Penalties on buyers and sellers decrease the quantity of the good, raise the price buyers pay, and lower the price sellers receive.
- Legalizing and taxing can achieve the same outcome as penalties on buyers and sellers.

Working Problem 8 will give you a better understanding of markets for illegal goods.

Key Terms

Black market, 128

Price floor, 131

MyEconLab Key Terms Quiz

Minimum wage, 131

Production quota, 139

Subsidy, 140

Price cap, 128

Rent ceiling, 128

Tax incidence, 133

Price ceiling, 128

Search activity, 128



WORKED PROBLEM

MyEconLab You can work this problems in Chapter 6 Study Plan.

The table gives the demand and supply schedules for tickets to a concert in the park.

Price (dollars per ticket)	Quantity demanded (tickets per concert)		Quantity supplied (tickets per concert)
5	600	200	
6	500	300	
7	400	400	
8	300	500	
9	200	600	
10	100	700	

Questions

- If there is no tax on concert tickets, what is the price of a ticket and how many tickets are bought?
- If a sales tax of \$2 a ticket is levied on sellers of concert tickets:

 - What is the price a concert-goer pays for a ticket and how many tickets are bought?
 - Who pays the tax and what is the government's tax revenue?
 - Is the market for concert tickets efficient? Explain.

Solutions

- With no sales tax on concert tickets, the price of a ticket is the market equilibrium price, which is \$7 a ticket. At \$7 a ticket, the quantity of tickets bought is 400 per concert.
- With a sales tax of \$2 a ticket levied on sellers of concert tickets, the supply of tickets will decrease. It decreases because at any ticket price paid by buyers, concert organizers will receive \$2 less per ticket.

For example, concert organizers are willing to supply 700 tickets per concert if they receive \$10 a ticket. But with a tax of \$2 a ticket, concert organizers will receive only \$8 a ticket after paying the government the \$2 tax per ticket. So concert organizers will not be willing to supply 700 tickets at the after-tax price of \$8 a ticket. The table above tells us that concert organizers are willing to supply only 500 tickets per concert when they receive \$8 a ticket.

We need to create the new supply schedule. We have already found one point on the new supply schedule: At a market price of \$10 a ticket, concert organizers are willing to supply 500 tickets.

The table in the next column shows the new supply schedule.

Price (dollars per ticket)	Quantity demanded (tickets per concert)	New quantity supplied (tickets per concert)	
6	500		
7	400	200	
8	300	300	
9	200	400	
10	100	500	

Check that you can explain why at a market price of \$7 a ticket, concert organizers are willing to supply 400 tickets when tickets are not taxed but only 200 tickets when tickets are taxed \$2 per ticket.

With the \$2 tax, concert-goers pay \$8 a ticket and buy 300 tickets.

Key Point: A sales tax raises the market price and the quantity bought decreases.

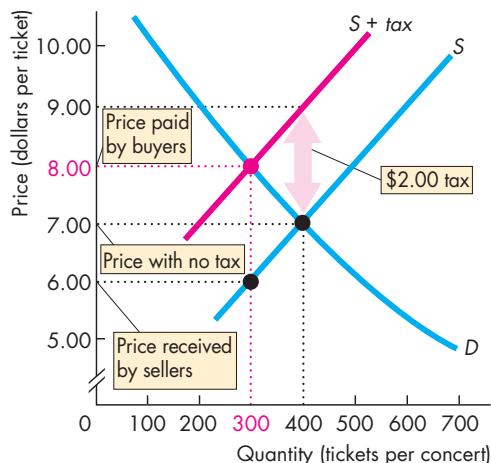
- If a sales tax of \$2 a ticket is levied on concert tickets, the price concert-goers pay rises from \$7 a ticket to \$8 a ticket. So concert-goers pay \$1 of the \$2 tax. The other \$1 of tax is paid by concert organizers. The government's tax revenue is \$2 × 300, or \$600.

Key Point: Some of the tax is paid by buyers and some by sellers.

- With no tax, 400 tickets per concert is efficient. With the tax, the ticket price rises and the quantity bought decreases to 300 per concert. The outcome is inefficient and a deadweight loss arises.

Key Point: A sales tax that decreases the quantity sold is inefficient and creates a deadweight loss.

Key Figure



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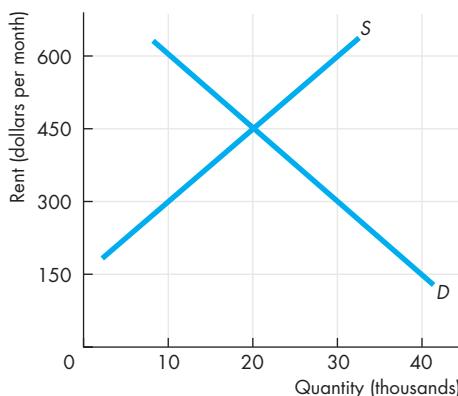


STUDY PLAN PROBLEMS AND APPLICATIONS

MyEconLab You can work Problems 1 to 8 in Chapter 6 Study Plan and get instant feedback.

A Housing Market with a Rent Ceiling (Study Plan 6.1)

Use the following graph of the market for rental housing in Townsville to work Problems 1 and 2.



1. a. What are the equilibrium rent and the quantity of housing rented?
b. If a rent ceiling is set at \$600 a month, what is the rent paid? What is the shortage of housing?
2. If the rent ceiling is \$300 a month, what is the quantity rented, the shortage of housing, and the maximum price that someone is willing to pay for the last unit of housing available?

A Labour Market with a Minimum Wage (Study Plan 6.2)

Use the following data on the demand and supply schedules of teenage labour to work Problems 3 and 4.

Wage rate (dollars per hour)	Quantity demanded		Quantity supplied	
	(hours per month)			
5	2,500		1,500	
6	2,000		2,000	
7	1,500		2,500	
8	1,000		3,000	

3. Calculate the equilibrium wage rate, the hours worked, and the quantity of unemployment.
4. The minimum wage for teenagers is \$7 an hour.
 - a. How many hours are unemployed?
 - b. If the demand for teenage labour increases by 500 hours a month, what is the wage rate and how many hours are unemployed?

Taxes (Study Plan 6.3)

5. The table in the next column sets out the demand and supply schedules for chocolate brownies.

Price (cents per brownie)	Quantity demanded		Quantity supplied (millions per day)
		(millions per day)	
50	5		3
60	4		4
70	3		5
80	2		6

- a. If sellers are taxed 20¢ a brownie, what is the price and who pays the tax?
- b. If buyers are taxed 20¢ a brownie, what is the price and who pays the tax?

Production Quotas and Subsidies (Study Plan 6.4)

Use the following data to work Problems 6 and 7. The demand and supply schedules for rice are:

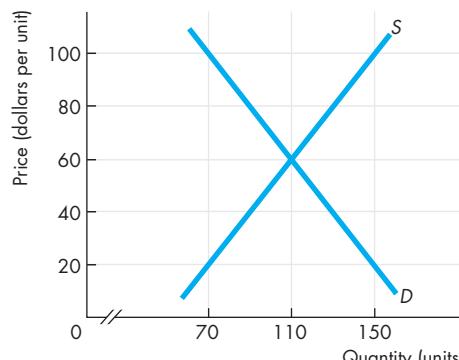
Price (dollars per box)	Quantity demanded		Quantity supplied	
	(boxes per week)			
1.20	3,000		1,500	
1.30	2,750		2,000	
1.40	2,500		2,500	
1.50	2,250		3,000	
1.60	2,000		3,500	

Calculate the price, the marginal cost of rice, and the quantity produced if the government:

6. Sets a production quota of 2,000 boxes a week.
7. Introduces a subsidy of \$0.30 a box.

Markets for Illegal Goods (Study Plan 6.5)

8. The figure shows the market for an illegal good.



Calculate the market price and the quantity bought if a penalty of \$20 a unit is imposed on:

- a. Sellers only or buyers only.
- b. Both sellers and buyers.



ADDITIONAL PROBLEMS AND APPLICATIONS

MyEconLab

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

A Housing Market with a Rent Ceiling

Use the following table to work Problems 9 and 10. The table sets out the demand and supply schedules for college meals:

Price (dollars per meal)	Quantity demanded	Quantity supplied
	(meals per week)	
4	3,000	1,500
5	2,750	2,000
6	2,500	2,500
7	2,250	3,000
8	2,000	3,500

9. a. What are the equilibrium meal price and equilibrium quantity of meals?
b. If the college put a price ceiling on meals at \$7 a meal, what is the price students pay for a meal? How many meals do they buy?
10. If the college put a price ceiling on meals at \$4 a meal, what is the quantity bought, the shortage of meals, and the maximum price that someone is willing to pay for the last meal available?

A Labour Market with a Minimum Wage

Use the following news clip to work Problems 11 and 12.

Malaysia Passes Its First Minimum Wage Law

About 3.2 million low-income workers across Malaysia are expected to benefit from the country's first minimum wage, which the government says will transform Malaysia into a high-income nation. Employer groups argue that paying the minimum wage, which is not based on productivity or performance, would raise their costs and reduce business profits.

Source: *The New York Times*, May 1, 2012

11. On a graph of the market for low-skilled labour, show the effect of the minimum wage on the quantity of labour employed.
12. Explain the effects of the minimum wage on the workers' surplus, the firms' surplus, and the efficiency of the market for low-skilled workers.

Taxes

13. Use the news clip in Problem 11.
 - a. If the Malaysian government cut the tax on business profits, would it offset the effect of the minimum wage on employment? Explain.

- b. Would a cut in the social security tax that small businesses pay offset the effect of the higher minimum wage on employment? Explain.

14. The demand and supply schedules for tulips are:

Price (dollars per bunch)	Quantity demanded	Quantity supplied
	(bundles per week)	
10	100	40
12	90	60
14	80	80
16	70	100
18	60	120

- a. If tulips are not taxed, what is the price and how many bunches are bought?
- b. If tulips are taxed \$6 a bunch, what are the price and quantity bought? Who pays the tax?

15. **Cigarette Taxes, Black Markets, and Crime: Lessons from New York's 50-Year Losing Battle**

New York City has the highest cigarette taxes in the United States. During the four months following the recent tax hike, sales of taxed cigarettes in the city fell by more than 50 percent as consumers turned to the city's bustling black market. The thriving illegal market for cigarettes has diverted billions of dollars from legitimate businesses and governments to criminals.

Source: Cato Institute, February 6, 2003

- a. How has the market for cigarettes in New York City responded to the high cigarette taxes?
- b. How does the emergence of a black market impact the elasticity of demand in a legal market?
- c. Why might an increase in the tax rate actually cause a decrease in the tax revenue?

Production Quotas and Subsidies

Use the following news clip to work Problems 16 to 18.

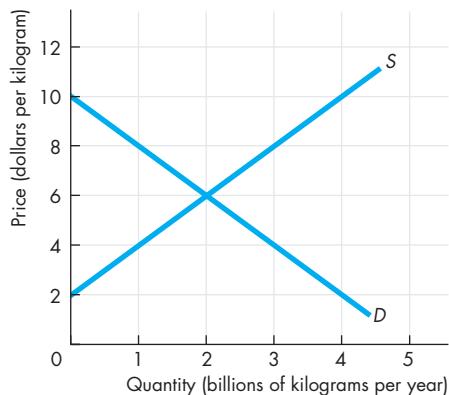
Crop Prices Erode Farm Subsidy Program

High corn and soybean prices mean farmers are making the most money in their lives. The reason: Grain prices are far too high to trigger payouts under the U.S. primary farm-subsidy program's "price support" formula. The market has done what Congress couldn't do and that is "slash farm subsidies."

Source: *The Wall Street Journal*, July 25, 2011

16. a. Why are U.S. soybean farmers subsidized?
 b. Explain how a subsidy paid to soybean farmers affects the price of soybean and the marginal cost of producing it.
17. Show in a graph how a subsidy paid to soybean farmers affects the consumer surplus and the producer surplus from soybeans. Does the subsidy make the soybean market more efficient or less efficient? Explain.
18. In the market for corn with a price support, explain why the corn price has risen and ended up being too high to “trigger payouts.”

Use the following figure, which shows the market for tomatoes, to work Problems 19 and 20.



19. If the government subsidizes growers at \$4 a kilogram, what is the quantity produced, the quantity demanded, and the subsidy paid to growers?
20. If the government subsidizes tomato growers at \$4 a kilogram, who gains and who loses from the subsidy? What is the deadweight loss? Could the subsidy be regarded as being fair?

Markets for Illegal Goods

21. The table gives the demand and supply schedules for an illegal drug.

Price (dollars per unit)	Quantity demanded	Quantity supplied
	(units per day)	
50	500	300
60	400	400
70	300	500
80	200	600
90	100	700

- a. What is the price and how many units are bought if there is no penalty on drugs?
 b. If the penalty on sellers is \$20 a unit, what are the price and quantity consumed?

- c. If the penalty on buyers is \$20 a unit, what are the price and quantity consumed?

Economics in the News

22. Study *Economics in the News* on pp. 144–145, and note that the minimum wage was last increased in 2010 and that since then other wage rates and the cost of most things that people buy have increased. Then answer the following questions.
- How would you expect the demand for and supply of low-skilled labour to have changed from 2010 to 2014?
 - How would you expect the equilibrium wage rate of low-skilled labour to have changed from 2010 to 2014?
 - Would you expect the minimum wage to have increased, decreased, or had no effect on the unemployment rate from 2010 to 2014?
 - Draw a graph to illustrate your answers to parts (a), (b), and (c).

23. **Hollywood: Organized Crime Hits the Movies**

The Mexican army seized 1,180 disc burners and 3.14 million copies of movies and TV shows from 23 warehouses in a move to fight piracy that costs Hollywood about \$590 million a year.

Source: Bloomberg *Businessweek*, April 7, 2011

Assume that the marginal cost of producing a DVD (legal or illegal) is a constant \$3 and that legal DVDs bear an additional marginal cost of \$5 each in royalty payments to film studios.

- Draw a graph of the market for counterfeit DVDs, assuming that there are no effective penalties on either buyers or sellers for breaking the law.
- How do the events reported in the news clip change the market outcome? Show the effects in your graph.
- With no penalty on buyers, if a penalty for breaking the law is imposed on sellers at more than \$5 a disc, how does the market work and what is the equilibrium price?
- With no penalty on sellers, if a penalty for breaking the law is imposed on buyers at more than \$5 a disc, how does the market work and what is the equilibrium price?
- What is the marginal benefit of an illegal DVD in the situations described in parts (c) and (d)?
- In light of your answer to part (e), why does law enforcement usually focus on sellers rather than buyers?



H

7

GLOBAL MARKETS IN ACTION

After studying this chapter,
you will be able to:

- ◆ Explain how markets work with international trade
- ◆ Identify the gains from international trade and its winners and losers
- ◆ Explain the effects of international trade barriers
- ◆ Explain and evaluate arguments used to justify restricting international trade

iPhones, Wii games, and Nike shoes are just three of the items that you might buy that are not produced in Canada. Why don't we produce phones, games, and shoes in Canada? Isn't the globalization of production killing good Canadian jobs?

You will find the answers in this chapter. And you will see why global trade is a win-win deal for buyers and sellers. You will also see why governments restrict trade, and in *Economics in the News* at the end of the chapter, why it is difficult for Canada to reach a free-trade deal with Japan and other Pacific nations.

But first, we study the gains from international trade.

How Global Markets Work

Because we trade with people in other countries, the goods and services that we can buy and consume are not limited by what we can produce. The goods and services that we buy from other countries are our **imports**, and the goods and services that we sell to people in other countries are our **exports**.

International Trade Today

Global trade today is enormous. In 2013, global exports and imports were \$23 trillion, which is one-third of the value of global production. The United States is the world's largest international trader and accounts for 10 percent of world exports and 12 percent of world imports. Germany and China, which rank 2 and 3 behind the United States, lag by a large margin.

In 2013, total Canadian exports were \$566 billion, which is 27 percent of the value of Canadian production. Total Canadian imports were \$486 billion, which is about 23 percent of total expenditure in Canada.

We trade both goods and services. In 2013, exports of services were about 15 percent of total exports and imports of services were about 19 percent of total imports.

What Drives International Trade?

Comparative advantage is the fundamental force that drives international trade. Comparative advantage (see Chapter 2, p. 40) is a situation in which a person can perform an activity or produce a good or service at a lower opportunity cost than anyone else. This same idea applies to nations. We can define *national comparative advantage* as a situation in which a nation can perform an activity or produce a good or service at a lower opportunity cost than any other nation.

The opportunity cost of producing a T-shirt is lower in China than in Canada, so China has a comparative advantage in producing T-shirts. The opportunity cost of producing a regional jet is lower in Canada than in China, so Canada has a comparative advantage in producing regional jets.

You saw in Chapter 2 how Liz and Joe reap gains from trade by specializing in the production of the good at which they have a comparative advantage and then trading with each other. Both are better off.

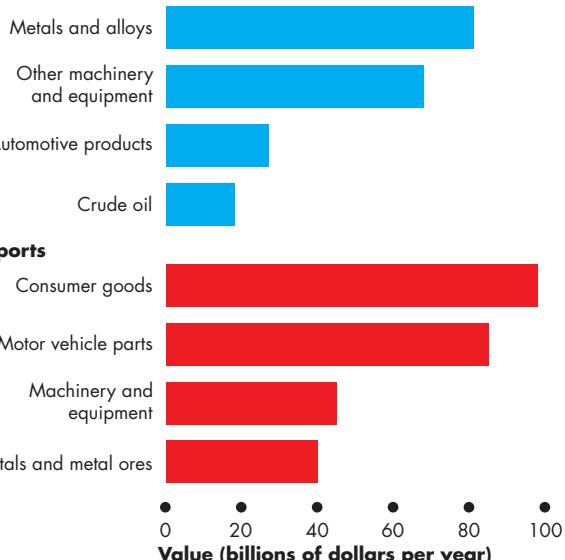
This same principle applies to trade among nations. Because China has a comparative advantage

Economics in Action

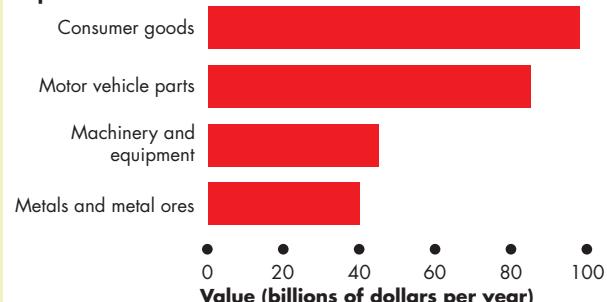
We Trade Metals for Consumer Goods

The figure shows Canada's four largest exports and imports by value. Metals and alloys and machinery and equipment are our biggest exports and consumer goods and motor vehicle parts are our biggest imports. Trade in automobiles—both exports and imports—has slipped from top spot in earlier years.

Exports



Imports



Canadian Exports and Imports in 2012

Source of data: Statistics Canada.

at producing T-shirts and Canada has a comparative advantage at producing regional jets, the people of both countries can gain from specialization and trade. China can buy regional jets from Canada at a lower opportunity cost than that at which Chinese firms can produce them. And Canadians can buy T-shirts from China for a lower opportunity cost than that at which Canadian firms can produce them. Also, through international trade, Chinese producers can get higher prices for their T-shirts and Canadian firms can sell regional jets for a higher price. Both countries gain from international trade.

Let's now illustrate the gains from trade that we've just described by studying demand and supply in the global markets for T-shirts and regional jets.

Why Canada Imports T-Shirts

Canada imports T-shirts because the rest of the world has a comparative advantage in producing T-shirts. Figure 7.1 illustrates how this comparative advantage generates international trade and how trade affects the price of a T-shirt and the quantities produced and bought.

The demand curve D_C and the supply curve S_C show the demand and supply in the Canadian domestic market only. The demand curve tells us the quantity of T-shirts that Canadians are willing to buy at various prices. The supply curve tells us the quantity of T-shirts that Canadian garment makers are willing to sell at various prices—that is, the quantity supplied at each price when all T-shirts sold in Canada are produced in Canada.

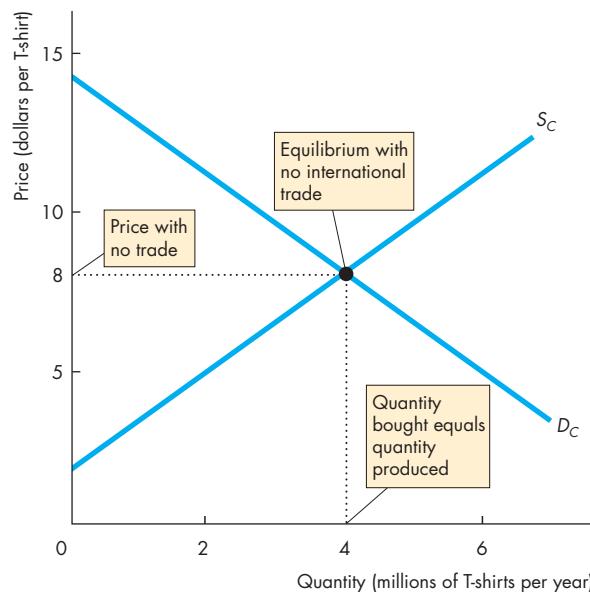
Figure 7.1(a) shows what the Canadian T-shirt market would be like with no international trade.

The price of a shirt would be \$8 and 4 million shirts a year would be produced by Canadian garment makers and bought by Canadian consumers.

Figure 7.1(b) shows the market for T-shirts with international trade. Now the price of a T-shirt is determined in the world market, not the Canadian domestic market. The world price of a T-shirt is less than \$8, which means that the rest of the world has a comparative advantage in producing T-shirts. The world price line shows the world price at \$5 a shirt.

The Canadian demand curve, D_C , tells us that at \$5 a shirt, Canadians buy 6 million shirts a year. The Canadian supply curve, S_C , tells us that at \$5 a shirt, Canadian garment makers produce 2 million T-shirts a year. To buy 6 million T-shirts when only 2 million are produced in Canada, we must import T-shirts from the rest of the world. The quantity of T-shirts imported is 4 million a year.

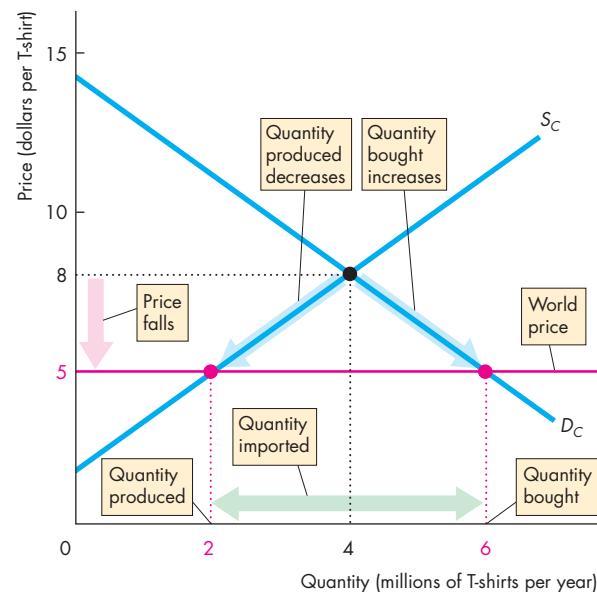
FIGURE 7.1 A Market with Imports



(a) Equilibrium with no international trade

Part (a) shows the Canadian market for T-shirts with no international trade. The Canadian domestic demand curve D_C and Canadian domestic supply curve S_C determine the price of a T-shirt at \$8 and the quantity of T-shirts produced and bought in Canada at 4 million a year.

Part (b) shows the Canadian market for T-shirts with international trade. World demand for and world supply of



(b) Equilibrium in a market with imports

T-shirts determine the world price of a T-shirt, which is \$5. The price in the Canadian market falls to \$5 a shirt. Canadian purchases of T-shirts increase to 6 million a year, and Canadian production of T-shirts decreases to 2 million a year. Canada imports 4 million T-shirts a year.

Why Canada Exports Regional Jets

Figure 7.2 illustrates international trade in regional jets. The demand curve D_C and the supply curve S_C show the demand and supply in the Canadian domestic market only. The demand curve tells us the quantity of regional jets that Canadian airlines are willing to buy at various prices. The supply curve tells us the quantity of regional jets that Canadian aircraft makers are willing to sell at various prices.

Figure 7.2(a) shows what the Canadian regional jet market would be like with no international trade. The price of a regional jet would be \$100 million and 40 airplanes a year would be produced by Bombardier and bought by Canadian airlines.

Figure 7.2(b) shows the Canadian airplane market with international trade. Now the price of a regional jet is determined in the world market and the world price of a regional jet is higher than \$100 million, which means that Canada has a comparative advantage

in producing regional jets. The world price line shows the world price at \$150 million.

The Canadian demand curve, D_C , tells us that at \$150 million each, Canadian airlines buy 20 regional jets a year. The Canadian supply curve, S_C , tells us that at \$150 million each, Bombardier produces 70 regional jets a year. The quantity produced in Canada (70 a year) minus the quantity purchased by Canadian airlines (20 a year) is the quantity exported, which is 50 regional jets a year.

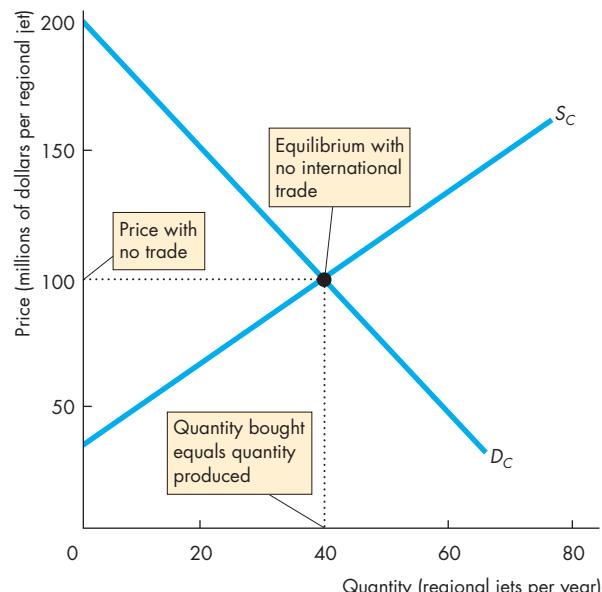
REVIEW QUIZ

- 1 Describe the situation in the market for a good or service that Canada imports.
- 2 Describe the situation in the market for a good or service that Canada exports.

Work these questions in Study Plan 7.1 and get instant feedback. Do a Key Terms Quiz.

MyEconLab

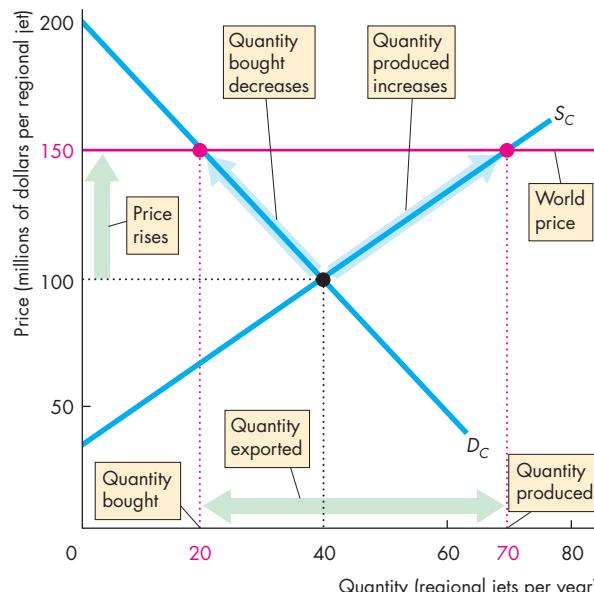
FIGURE 7.2 A Market with Exports



(a) Equilibrium without international trade

In part (a), the Canadian market with no international trade, the domestic demand curve D_C and the domestic supply curve S_C determine the price of a regional jet in Canada at \$100 million and 40 regional jets are produced and bought each year.

In part (b), the Canadian market with international trade, world demand and world supply determine the



(b) Equilibrium in a market with exports

world price of a regional jet at \$150 million. The price in Canada rises. Canadian production increases to 70 a year, Canadian purchases decrease to 20 a year, and Canada exports 50 regional jets a year.

MyEconLab Animation

Winners, Losers, and the Net Gain from Trade

In Chapter 1 (see p. 6), we asked whether globalization is in the self-interest of the low-wage worker in Malaysia who sews your new running shoes and the displaced shoemaker in Toronto. Is globalization in the social interest? We're now going to answer these questions. You will learn why producers complain about cheap foreign imports, but consumers of imports never complain.

Gains and Losses from Imports

We measure the gains and losses from imports by examining their effect on consumer surplus, producer surplus, and total surplus. In the importing country the winners are those whose surplus increases and the losers are those whose surplus decreases.

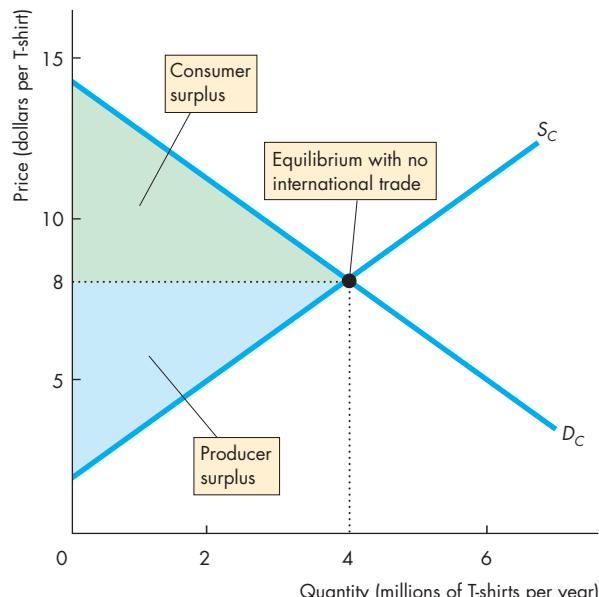
Figure 7.3(a) shows what consumer surplus and producer surplus would be with no international

trade in T-shirts. Domestic demand, D_C , and domestic supply, S_C , determine the price and quantity. The green area shows consumer surplus and the blue area shows producer surplus. Total surplus is the sum of consumer surplus and producer surplus.

Figure 7.3(b) shows how these surpluses change when the Canadian market opens to imports. The price in Canada falls to the world price. The quantity bought increases to the quantity demanded at the world price and consumer surplus expands from A to the larger green area $A + B + D$. The quantity produced in Canada decreases to the quantity supplied at the world price and producer surplus shrinks to the smaller blue area C .

Part of the gain in consumer surplus, the area B , is a loss of producer surplus—a redistribution of total surplus. But the other part of the increase in consumer surplus, the area D , is a net gain. This increase in total surplus results from the lower price and increased purchases and is the gain from imports.

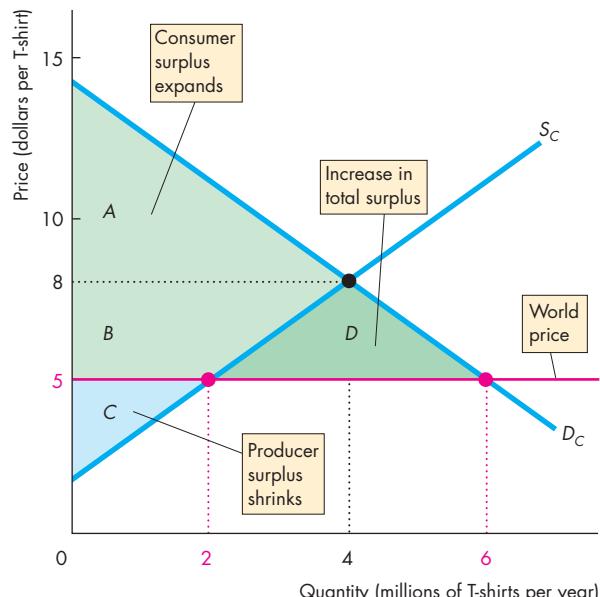
FIGURE 7.3 Gains and Losses in a Market with Imports



(a) Consumer surplus and producer surplus with no international trade

In part (a), with no international trade, the green area shows the consumer surplus and the blue area shows the producer surplus.

In part (b), with international trade, the price falls to the world price of \$5 a shirt. Consumer surplus expands from



(b) Gains and losses from imports

area A to the area $A + B + D$. Producer surplus shrinks to area C . Area B is a transfer of surplus from producers to consumers. Area D is an increase in total surplus—the gain from imports.

Gains and Losses from Exports

We measure the gains and losses from exports just like we measured those from imports, by their effect on consumer surplus, producer surplus, and total surplus.

Figure 7.4(a) shows the situation with no international trade. Domestic demand, D_C , and domestic supply, S_C , determine the price and quantity, the consumer surplus, and the producer surplus.

Figure 7.4(b) shows how the consumer surplus and producer surplus change when the good is exported. The price rises to the world price. The quantity bought decreases to the quantity demanded at the world price and the consumer surplus shrinks to the green area A . The quantity produced increases to the quantity supplied at the world price and the producer surplus expands to the blue area $B + C + D$.

Part of the gain in producer surplus, the area B , is a loss in consumer surplus—a redistribution of the total surplus. But the other part of the increase in producer surplus, the area D , is a net gain. This increase in total

surplus results from the higher price and increased production and is the gain from exports.

Gains for All

You've seen that both imports and exports bring gains. Because one country's exports are other countries' imports, international trade brings gain for all countries. International trade is a win-win game.

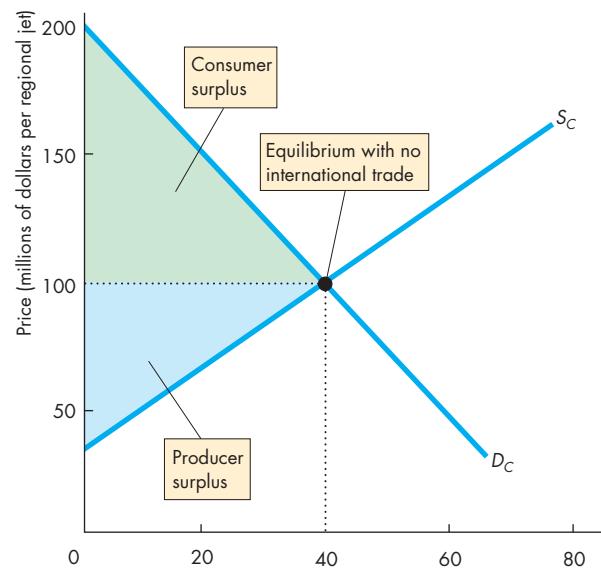
REVIEW QUIZ

- How is the gain from imports distributed between consumers and domestic producers?
- How is the gain from exports distributed between consumers and domestic producers?
- Why is the net gain from international trade positive?

Work these questions in Study Plan 7.2
and get instant feedback.

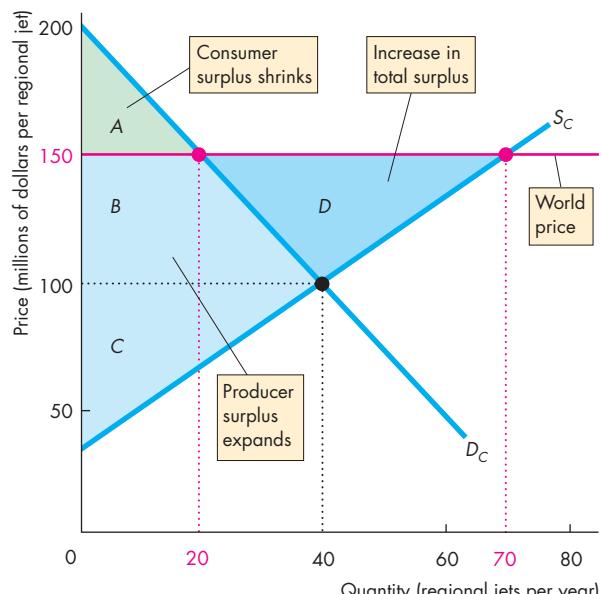
MyEconLab

FIGURE 7.4 Gains and Losses in a Market with Exports



(a) Consumer surplus and producer surplus with no international trade

In part (a), the Canadian market with no international trade, the green area shows the consumer surplus and the blue area shows the producer surplus. In part (b), the Canadian market with international trade, the price rises to the world



(b) Gains and losses from exports

price. Consumer surplus shrinks to area A . Producer surplus expands from area C to the area $B + C + D$. Area B is a transfer of surplus from consumers to producers. Area D is an increase in total surplus—the gain from exports.

MyEconLab Animation and Draw Graph

International Trade Restrictions

Governments use four sets of tools to influence international trade and protect domestic industries from foreign competition. They are:

- Tariffs
- Import quotas
- Other import barriers
- Export subsidies

Tariffs

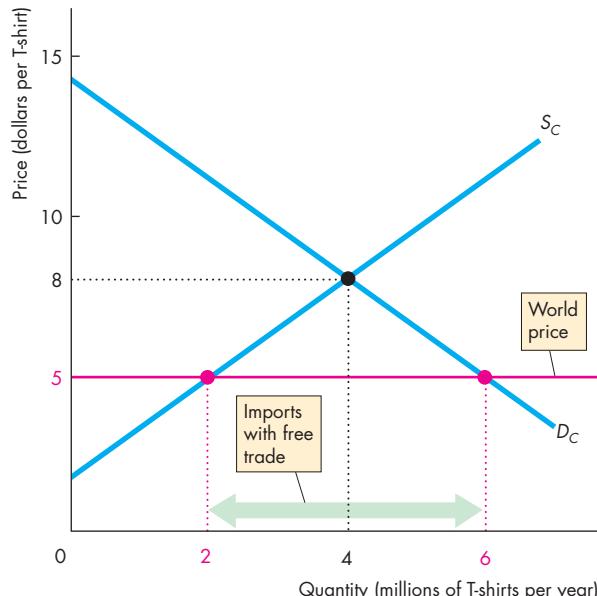
A **tariff** is a tax on a good that is imposed by the importing country when an imported good crosses its international boundary. For example, the government of India imposes a 100 percent tariff on wine imported from Ontario. So when an Indian imports a \$10 bottle of Ontario wine, he pays the Indian government a \$10 import duty.

Tariffs raise revenue for governments and serve the self-interest of people who earn their incomes in import-competing industries. But as you will see, restrictions on free international trade decrease the gains from trade and are not in the social interest.

The Effects of a Tariff To see the effects of a tariff, let's return to the example in which Canada imports T-shirts. With free trade, the T-shirts are imported and sold at the world price. Then, under pressure from Canadian garment makers, the government imposes a tariff on imported T-shirts. Buyers of T-shirts must now pay the world price plus the tariff. Several consequences follow and Fig. 7.5 illustrates them.

Figure 7.5(a) shows the situation with free international trade. Canada produces 2 million T-shirts a year and imports 4 million a year at the world price of \$5 a shirt. Figure 7.5(b) shows what happens when the Canadian government imposes a tariff of \$2 per T-shirt.

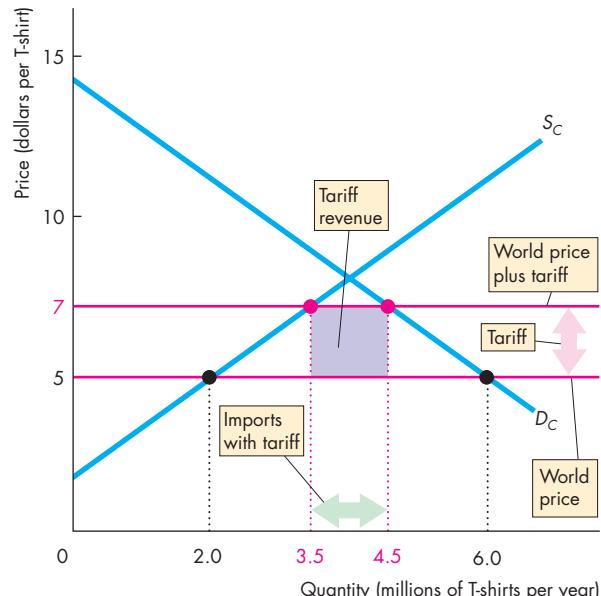
FIGURE 7.5 The Effects of a Tariff



(a) Free trade

The world price of a T-shirt is \$5. With free trade in part (a), Canadians buy 6 million T-shirts a year. Canadian garment makers produce 2 million T-shirts a year and Canada imports 4 million a year.

With a tariff of \$2 per T-shirt in part (b), the price in



(b) Market with tariff

the Canada rises to \$7 a T-shirt. Canadian production increases, Canadian purchases decrease, and the quantity imported decreases. The Canadian government collects a tariff revenue of \$2 on each T-shirt imported, which is shown by the purple rectangle.

The following changes occur in the market for T-shirts in Canada:

- The price of a T-shirt rises by \$2.
- The quantity of T-shirts bought decreases.
- The quantity of T-shirts produced in Canada increases.
- The quantity of T-shirts imported into Canada decreases.
- The Canadian government collects a tariff revenue.

Rise in Price of a T-Shirt To buy a T-shirt, Canadians must pay the world price plus the tariff, so the price of a T-shirt rises by the \$2 tariff to \$7. Figure 7.5(b) shows the new domestic price line, which lies \$2 above the world price line. The price rises by the full amount of the tariff. The buyer pays the entire tariff because supply from the rest of the world is perfectly elastic (see Chapter 6, pp. 136–137).

Decrease in Purchases The higher price of a T-shirt brings a decrease in the quantity demanded along the demand curve. Figure 7.5(b) shows the decrease from 6 million T-shirts a year at \$5 a shirt to 4.5 million a year at \$7 a shirt.

Increase in Domestic Production The higher price of a T-shirt stimulates domestic production, and Canadian garment makers increase the quantity supplied along the supply curve. Figure 7.5(b) shows the

increase from 2 million T-shirts at \$5 a shirt to 3.5 million a year at \$7 a shirt.

Decrease in Imports T-shirt imports decrease by 3 million, from 4 million to 1 million a year. Both the decrease in Canadian purchases and the increase in Canadian production contribute to this decrease in Canadian imports.

Tariff Revenue The government's tariff revenue is \$2 million—\$2 per shirt on 1 million imported shirts—shown by the purple rectangle.

Winners, Losers, and the Social Loss from a Tariff A tariff on an imported good creates winners and losers and a social loss. When the Canadian government imposes a tariff on an imported good:

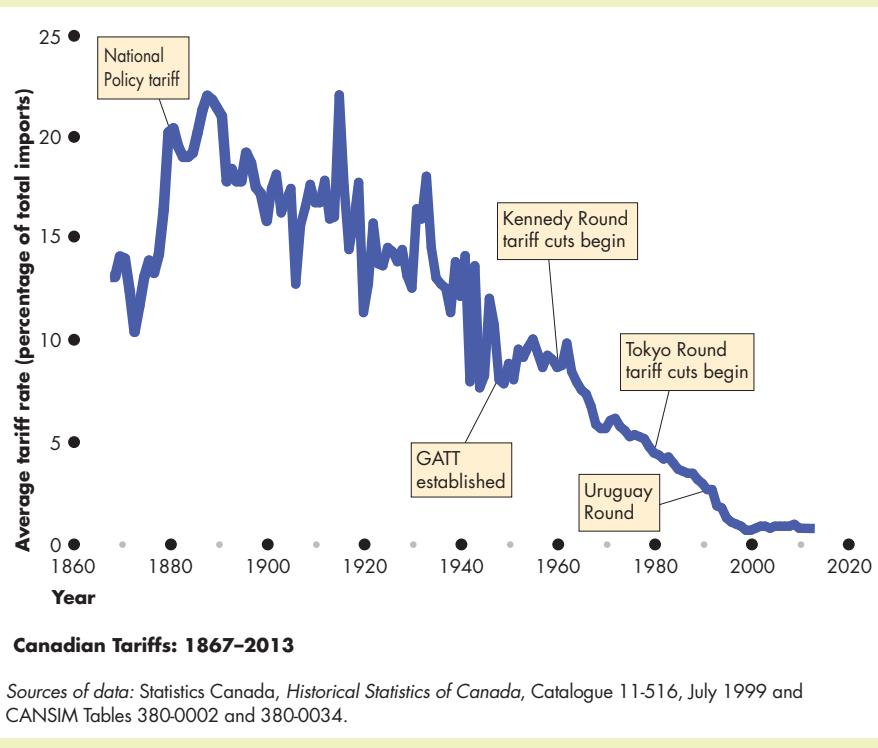
- Canadian consumers of the good lose.
- Canadian producers of the good gain.
- Canadian consumers lose more than Canadian producers gain.
- Society loses: a deadweight loss arises.

Canadian Consumers of the Good Lose Because the price of a T-shirt in Canada rises, the quantity of T-shirts demanded decreases. The combination of a higher price and smaller quantity bought decreases consumer surplus—the loss to Canadian consumers that arises from a tariff.

Economics in Action

Tariffs Almost Gone

Canadian tariffs were in place before Confederation. They increased sharply in the 1870s and remained high until the 1930s. In 1947, the **General Agreement on Tariffs and Trade (GATT)** was established to reduce international tariffs. Since then, tariffs have fallen in a series of negotiating rounds, the most significant of which are identified in the figure. Tariffs are now as low as they have ever been, but import quotas and other trade barriers persist.



Canadian Producers of the Good Gain Because the price of an imported T-shirt rises by the amount of the tariff, Canadian T-shirt producers are now able to sell their T-shirts for the world price plus the tariff, so the quantity of T-shirts supplied by Canadian producers increases. The combination of a higher price and larger quantity produced increases producer surplus—the gain to Canadian producers from the tariff.

Canadian Consumers Lose More Than Canadian Producers Gain

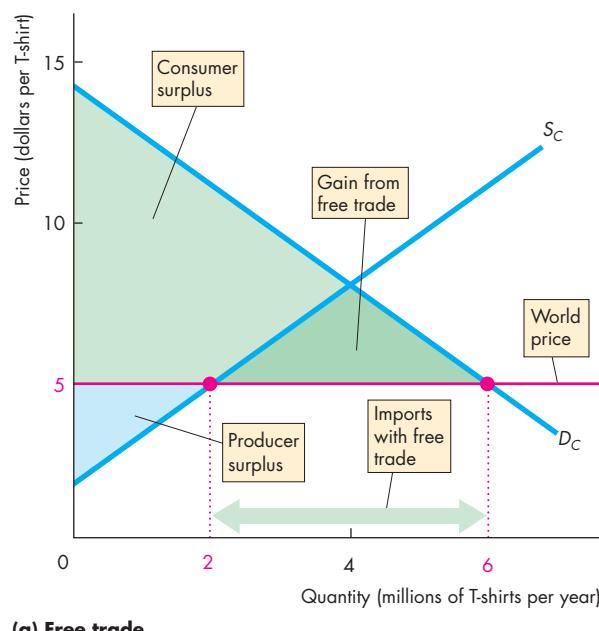
Consumer surplus decreases for four reasons: Some becomes producer surplus, some is lost in a higher cost of production (domestic producers have higher costs than foreign producers), some is lost because imports decrease, and some goes to the government as tariff revenue. Figure 7.6 shows these sources of lost consumer surplus.

Figure 7.6(a) shows the consumer surplus and producer surplus with free international trade in T-shirts. Figure 7.6(b) shows the consumer surplus and producer surplus with a \$2 tariff on imported T-shirts. By comparing Fig. 7.6(b) with Fig. 7.6(a), you can see how a tariff changes these surpluses.

Consumer surplus—the green area—shrinks for four reasons. First, the higher price transfers surplus from consumers to producers. The blue area *B* represents this loss (and gain of producer surplus). Second, domestic production costs more than imports. The supply curve S_C shows the higher cost of production, and the grey area *C* shows this loss of consumer surplus. Third, some of the consumer surplus is transferred to the government. The purple area *D* shows this loss (and gain of government revenue). Fourth, some of the consumer surplus is lost because imports decrease. The grey area *E* shows this loss.

Society Loses: A Deadweight Loss Arises Some of the loss of consumer surplus is transferred to producers and some is transferred to the government and spent on government programs that people value. But the increase in production cost and the loss from decreased imports is transferred to no one: It is a social loss—a deadweight loss. The grey areas labelled *C* and *E* represent this deadweight loss. Total surplus decreases by the area $C + E$.

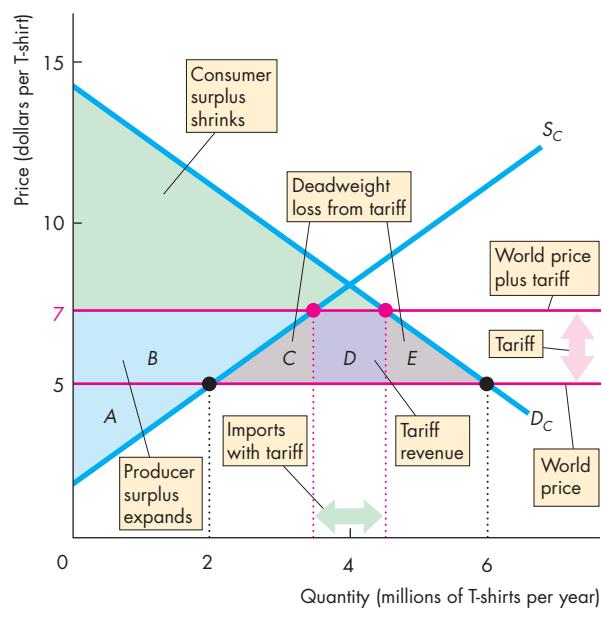
FIGURE 7.6 The Winners and Losers from a Tariff



(a) Free trade

The world price of a T-shirt is \$5. In part (a), with free trade, Canada imports 4 million T-shirts. Consumer surplus, producer surplus, and the gains from free trade are as large as possible.

In part (b), a tariff of \$2 per T-shirt raises the price of a T-shirt in Canada to \$7. The quantity imported decreases.



(b) Market with tariff

Consumer surplus shrinks by the area $B + C + D + E$. Producer surplus expands by area *B*. The government's tariff revenue is area *D*, and the tariff creates a deadweight loss equal to the area $C + E$.

Import Quotas

We now look at the second tool for restricting trade: import quotas. An **import quota** is a restriction that limits the quantity of a good that may be imported in a given period.

Most countries impose import quotas on a wide range of items. Canada imposes them on food products such as meat, eggs, and dairy and manufactured goods such as textiles and steel.

Import quotas enable the government to satisfy the self-interest of the people who earn their incomes in the import-competing industries. But you will discover that, like a tariff, an import quota decreases the gains from trade and is not in the social interest.

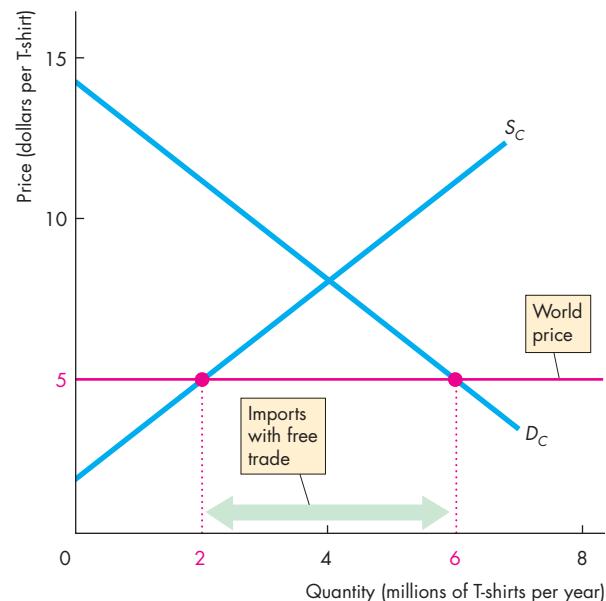
The Effects of an Import Quota The effects of an import quota are similar to those of a tariff. The price rises, the quantity bought decreases, and the quantity produced in Canada increases. Figure 7.7 illustrates the effects.

Figure 7.7(a) shows the situation with free international trade. Figure 7.7(b) shows what happens with an import quota of 1 million T-shirts a year. The Canadian supply curve of T-shirts becomes the domestic supply curve, S_C , plus the quantity that the import quota permits. So the supply curve becomes $S_C + \text{quota}$. The price of a T-shirt rises to \$7, the quantity of T-shirts bought in Canada decreases to 4.5 million a year, the quantity of T-shirts produced in Canada increases to 3.5 million a year, and the quantity of T-shirts imported decreases to the quota quantity of 1 million a year. All the effects of this quota are identical to the effects of a \$2 per shirt tariff, as you can check in Fig. 7.5(b).

Winners, Losers, and the Social Loss from an Import Quota

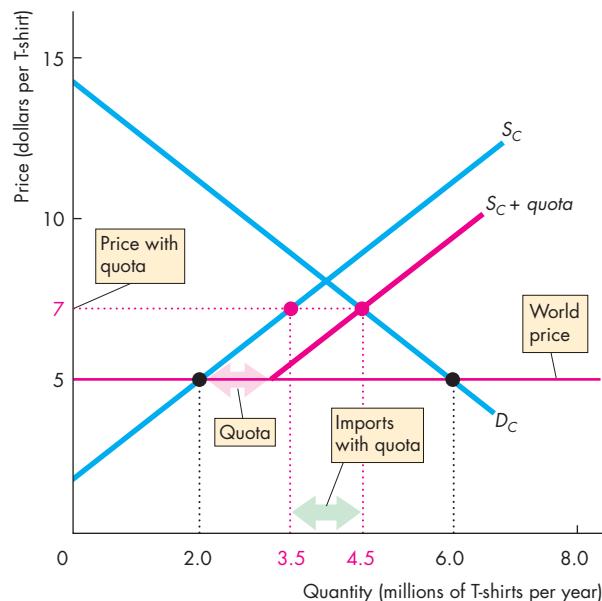
An import quota creates winners and losers that are similar to those of a tariff but with an interesting difference.

FIGURE 7.7 The Effects of an Import Quota



(a) Free trade

With free international trade, in part (a), Canadians buy 6 million T-shirts at the world price. Canada produces 2 million T-shirts and imports 4 million a year. With an import quota of 1 million T-shirts a year, in part (b), the supply of



(b) Market with import quota

T-shirts in Canada is shown by the curve $S_C + \text{quota}$. The price in Canada rises to \$7 a T-shirt. Canadian production increases, Canadian purchases decrease, and the quantity of T-shirts imported decreases.

When the government imposes an import quota:

- Canadian consumers of the good lose.
- Canadian producers of the good gain.
- Importers of the good gain.
- Society loses: a deadweight loss arises.

Figure 7.8 shows these gains and losses from a quota. By comparing Fig. 7.8(b) with a quota and Fig. 7.8(a) with free trade, you can see how an import quota of 1 million T-shirts a year changes the consumer and producer surpluses.

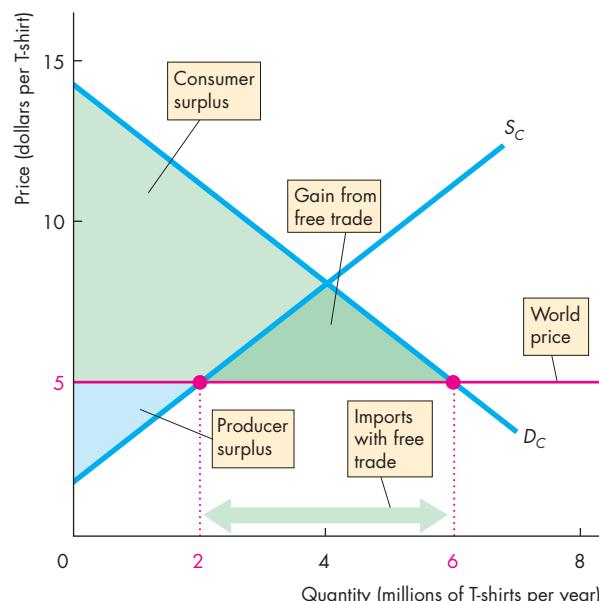
Consumer surplus—the green area—shrinks. This decrease is the loss to consumers from the import quota. The decrease in consumer surplus is made up of four parts. First, some of the consumer surplus is transferred to producers. The blue area *B* represents this loss of consumer surplus (and gain of producer surplus). Second, part of the consumer surplus is lost because the domestic cost of production is

higher than the world price. The grey area *C* represents this loss. Third, part of the consumer surplus is transferred to importers who buy T-shirts for \$5 (the world price) and sell them for \$7 (the Canadian domestic price). The two blue areas *D* represent this loss of consumer surplus and profit for importers. Fourth, part of the consumer surplus is lost because imports decrease. The grey area *E* represents this loss.

The loss of consumer surplus from the higher cost of production and the decrease in imports is a social loss—a deadweight loss. The grey areas labelled *C* and *E* represent this deadweight loss. Total surplus decreases by the area *C* + *E*.

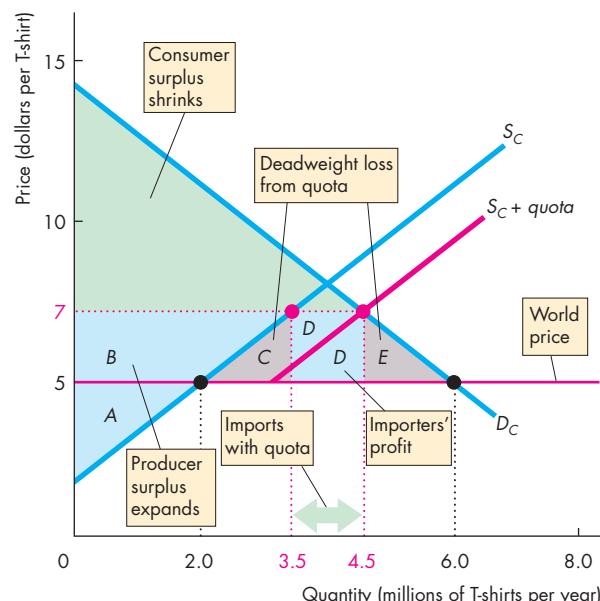
You can now see the one difference between a quota and a tariff. A tariff brings in revenue for the government while a quota brings a profit for the importers. All the other effects are the same, provided the quota is set at the same quantity of imports that results from the tariff.

FIGURE 7.8 The Winners and Losers from an Import Quota



(a) Free trade

The world price of a T-shirt is \$5. In part (a), with free trade, Canada produces 2 million T-shirts a year and imports 4 million T-shirts. Consumer surplus, producer surplus, and the gain from free international trade (darker green area) are as large as possible.



(b) Market with import quota

In part (b), the import quota raises the price of a T-shirt to \$7. The quantity imported decreases. Consumer surplus shrinks by the area *B* + *C* + *D* + *E*. Producer surplus expands by area *B*. Importers' profit is the two areas *D*, and the quota creates a deadweight loss equal to *C* + *E*.



ECONOMICS IN THE NEWS

The Changing Market for Coat Hangers

Your Dry Cleaning Bill Is About to Get Worse
 The price of wire hangers is a big deal for a dry cleaner, and that price will rise when the U.S. Commerce Department puts a 21 percent tariff on hangers made in Vietnam. The tariff is in response to a wire-hanger export subsidy paid to producers in Vietnam.

Source: CNN Money, June 4, 2012

SOME FACTS

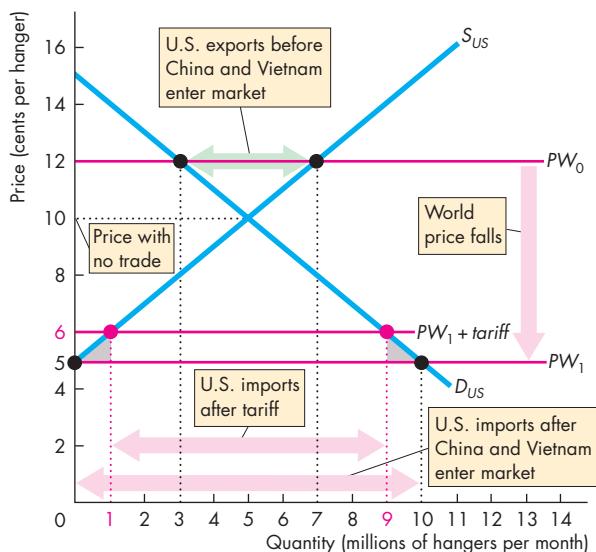
Albert J. Parkhouse invented the wire hanger in Jackson, Michigan, in 1903, and for almost 100 years the United States produced and exported wire hangers. During the past 20 years, China and Vietnam have become the major lowest-cost producers.

THE PROBLEM

Explain why the United States has switched from exporting to importing wire hangers. Also explain the effects of the 21 percent tariff. Does Vietnam's export subsidy make the tariff efficient? Illustrate your explanations with a graph.

THE SOLUTION

- Initially, the opportunity cost of producing a wire hanger was lower in the United States than in the rest of the world. The United States had a comparative advantage in producing wire hangers and exported them.
- Today, the opportunity cost of producing a wire hanger is lower in China and Vietnam than in the United States (and Canada). China and Vietnam have a comparative advantage in producing wire hangers, so the United States imports them.
- By imposing a 21 percent tariff on wire hangers, the price in the United States rises above the world price by this percentage.
- The higher price decreases the quantity of wire hangers demanded in the United States, increases the quantity that U.S. producers supply, and decreases U.S. imports of wire hangers.
- The figure illustrates the U.S. market for wire hangers. The demand curve D_{US} and the supply curve S_{US} are assumed not to change. The U.S. price with no international trade is 10 cents per hanger.



U.S. Market for Wire Hangers

- With a world price PW_0 of 12 cents a hanger, the United States had a comparative advantage in hangers, so it produced 7 million hangers a month, used 3 million, and exported 4 million. The figure shows the quantity of U.S. exports.
- When the world price falls to PW_1 at 5 cents a hanger, the United States stops producing hangers and imports 10 million a month.
- With a 21 percent tariff, the price in the United States rises to $PW_1 + \text{tariff}$. U.S. hanger production now becomes 1 million a month, the quantity used decreases to 9 million, and imports decrease to 8 million.
- The fact that the tariff is a response to Vietnam's export subsidy does not make the tariff efficient. It creates a deadweight loss shown by the two grey triangles.

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. ...

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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.

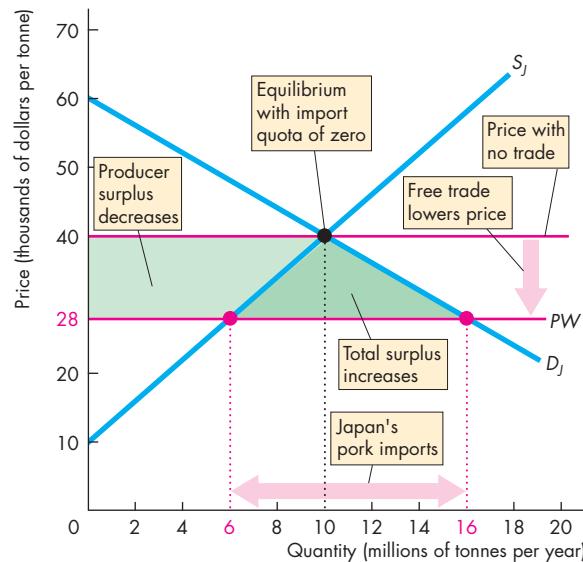


Figure 1 The Market for Pork in Japan

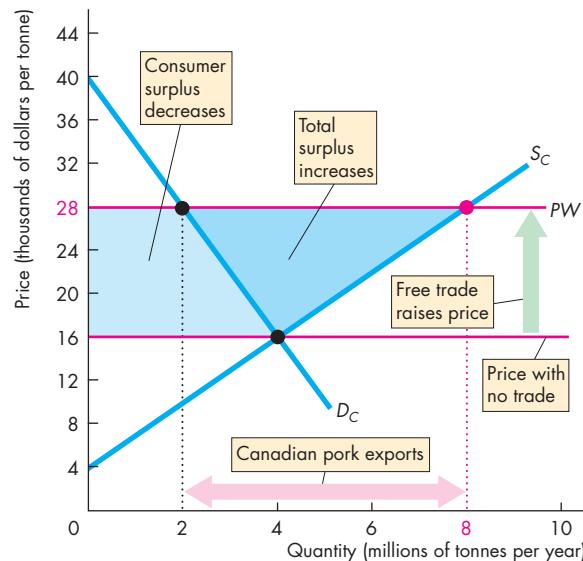


Figure 2 The Market for Pork in Canada



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.

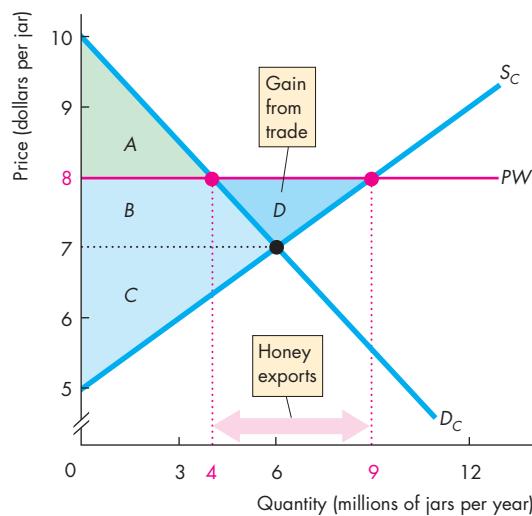
- With free international trade, Canada gains from exporting honey because the higher price and the larger quantity of honey produced increase Canada's total surplus from honey.

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

UNDERSTANDING HOW MARKETS WORK

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.

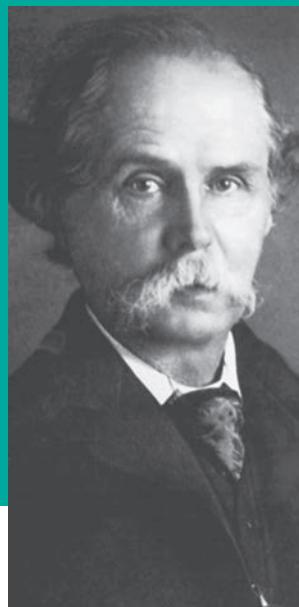
Everything and anything that can be exchanged is traded in markets to the benefit of both buyers and sellers.

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.

"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.

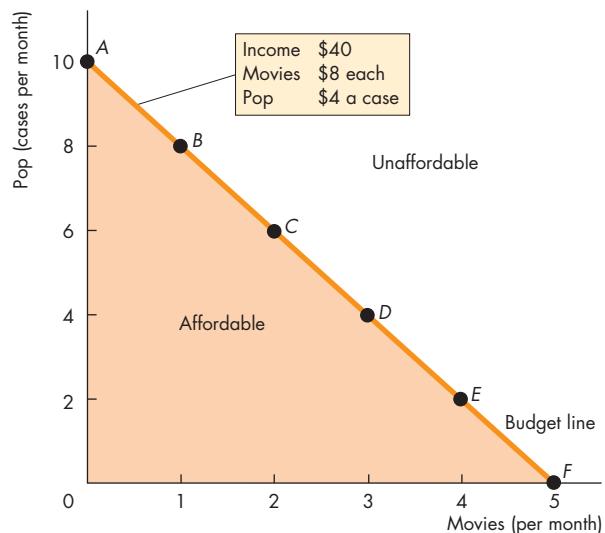
A Consumer's Budget Line Consumption possibilities are limited by income and by the prices of movies and pop. When Lisa spends all her income, she reaches the limits to her consumption possibilities. We describe this limit with a **budget line**, which marks the boundary between those combinations of 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 (\$dollars)	Cases	Expenditure (\$dollars)
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.

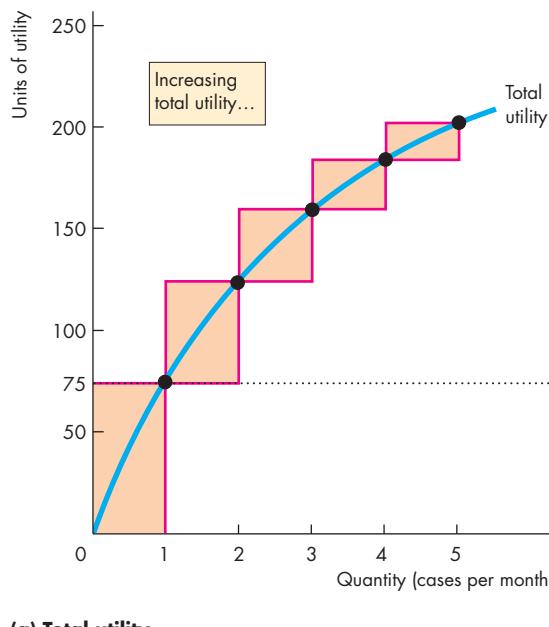
In Table 8.1, the columns headed “Marginal utility” show Lisa's marginal utility from movies and pop. You can see that if Lisa increases the pop she buys from 1 to 2 cases a month, her total utility from pop increases from 75 units to 123 units. For Lisa, the marginal utility from the second case each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

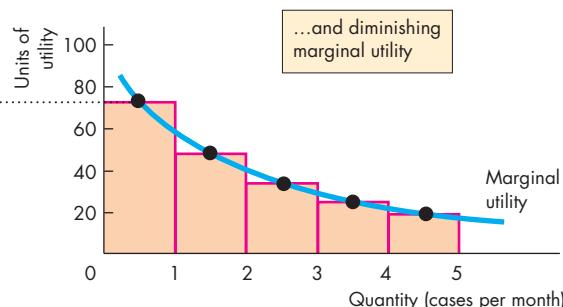
Positive Marginal Utility The things that people enjoy and want more of have a positive marginal utility. Some objects and activities can generate negative marginal utility and lower total utility. Two examples are hard labour and polluted air. But all the goods and services that people value and that 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,

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

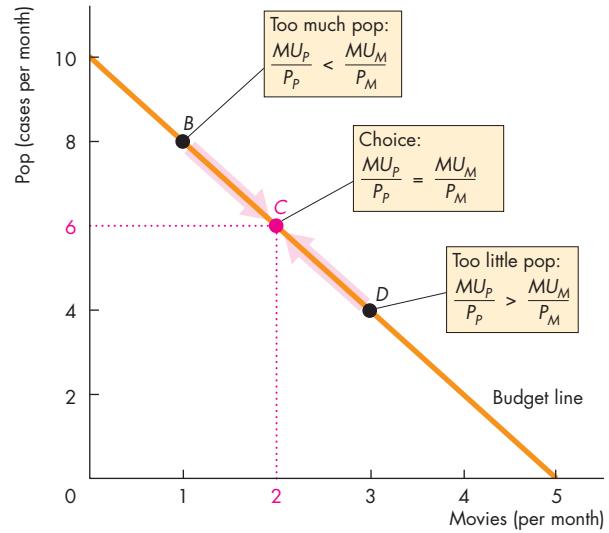
If Lisa spent an extra dollar on pop and a dollar less on movies, her total utility would increase. She would get 6 units from the extra dollar spent on pop and she would lose 4 units from the dollar less spent on movies. Her total utility would increase by 2 units ($6 - 4$).

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
B	1	50	6.25	8	10	2.50
C	2	40	5.00	6	20	5.00
D	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
A	0	0		10	5	1.25
	1	50	12.50	9	7	1.75
	2	40	10.00	8	10	2.50
B	3	32	8.00	7	13	3.25
	4	28	7.00	6	20	5.00
	5	26	6.50	5	22	5.50
C	6	24	6.00	4	24	6.00
	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.

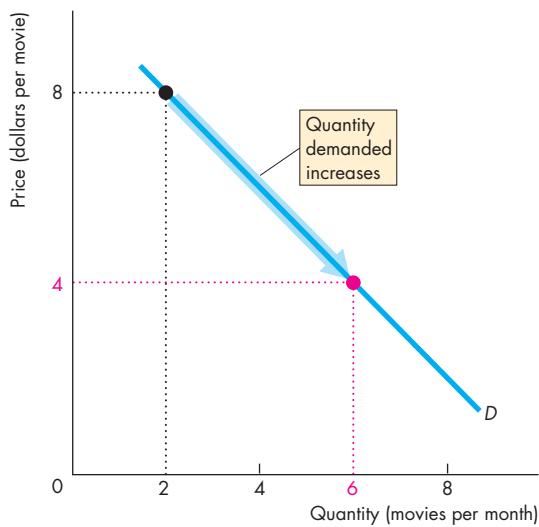
Figure 8.4(a) shows Lisa's demand curve for movies. When the price of a movie is \$8, Lisa sees 2 movies a month. When the price of a movie falls to \$4, she sees 6 movies a month. Lisa moves downward along her demand curve for movies.

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.

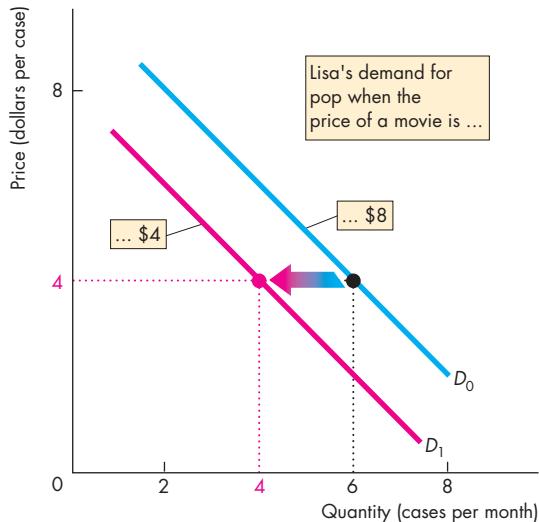
A Change in Demand The decrease in the quantity of pop that Lisa buys is the change in the quantity of pop that she plans to buy at a given price of pop when the price of a movie changes. It is a change in her demand for pop. We illustrate a change in demand by a shift of a demand curve.

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	

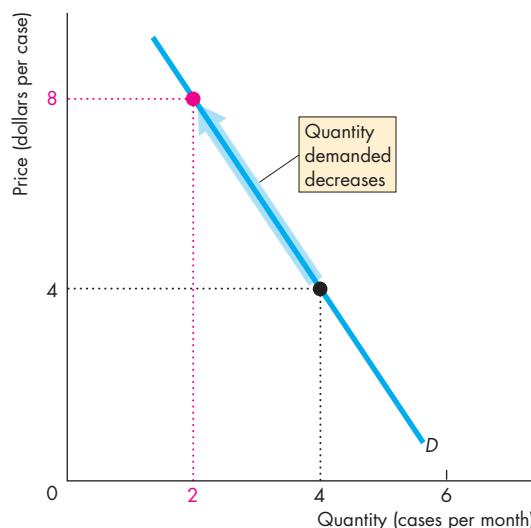
Lisa's Demand for Pop Now that we've calculated the effect of a change in the price of pop on Lisa's buying plans when income and the price of movies remain the same, we have found two points on her demand curve for pop: When the price of pop is \$4 a case, Lisa buys 4 cases a month; and when the price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

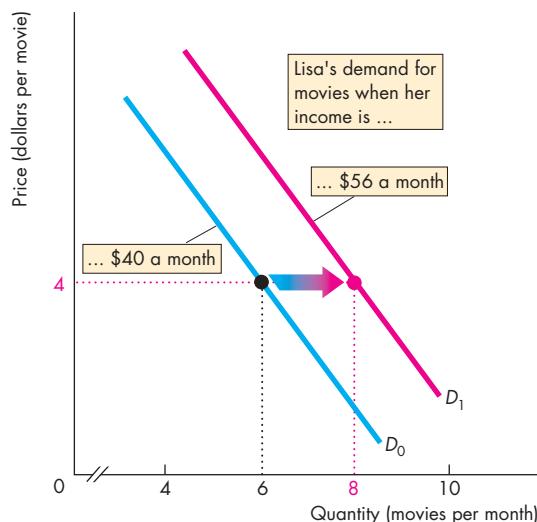
Figure 8.6 shows the effects of the rise in Lisa's income on her demand curves for movies and pop. The price of each good is \$4. When Lisa's income

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
A	4	28	7.00	10	5	1.25
	5	26	6.50	9	7	1.75
	6	24	6.00	8	10	2.50
	7	22	5.50	7	13	3.25
B	8	20	5.00	6	20	5.00
	9	17	4.25	5	22	5.50
C	10	16	4.00	4	24	6.00

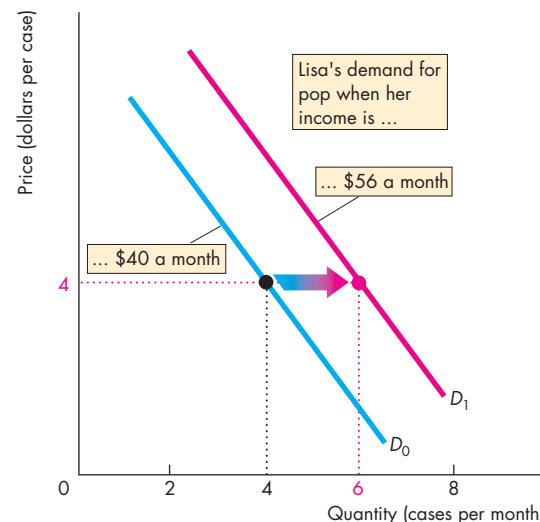
rises to \$56 a month, she sees 2 more movies and buys 2 more cases of pop. Her demand curves for both movies and pop shift rightward—her demand for both movies and pop increases. With a larger income, the consumer always buys more of a *normal* good. For Lisa, movies and pop are normal goods.

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.

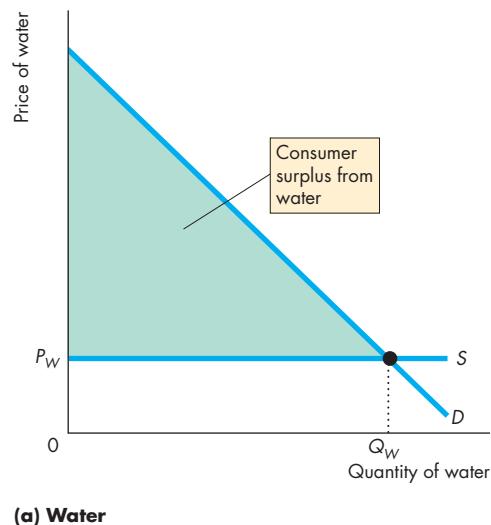
Diamonds, on the other hand, have a small total utility relative to water, but because we buy few diamonds, they have a high marginal utility.

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.

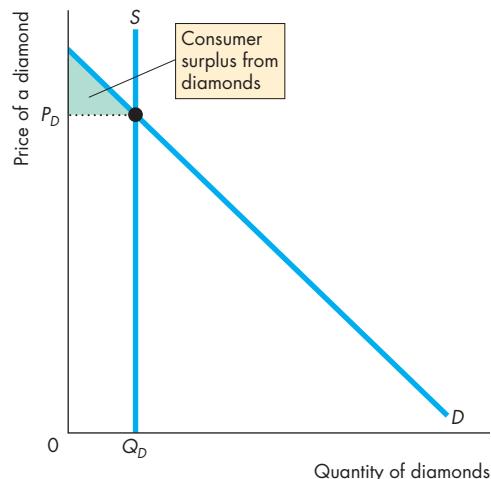
This equality of marginal utilities per dollar holds true for diamonds and water: Diamonds have a high price and a high marginal utility. Water has a low price and a low marginal utility. When the high marginal utility from diamonds is divided by the high price of a diamond, the result is a number that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

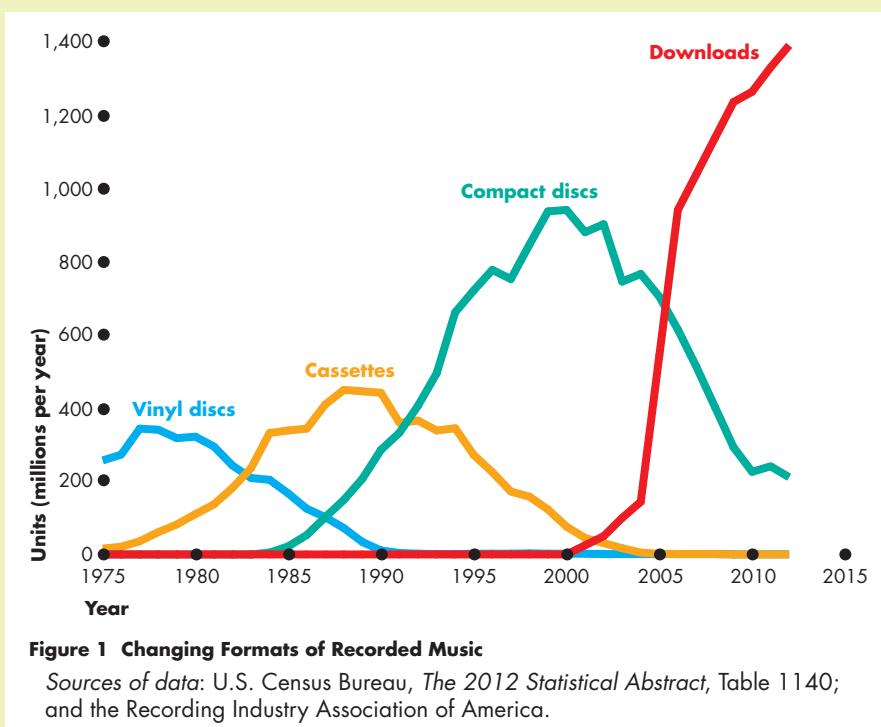
Most people buy all their music in digital form, but many still buy physical CDs and some people buy both downloads and CDs.

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.

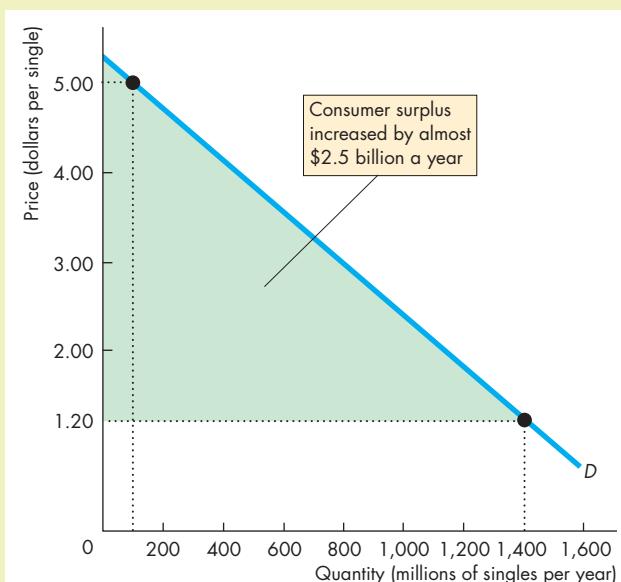
In the 1970s, recorded music came on vinyl discs. Cassettes gradually replaced vinyl, then compact discs (CDs) gradually replaced cassettes, and today, digital files downloaded to computers and mobile devices are replacing physical CDs.

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.

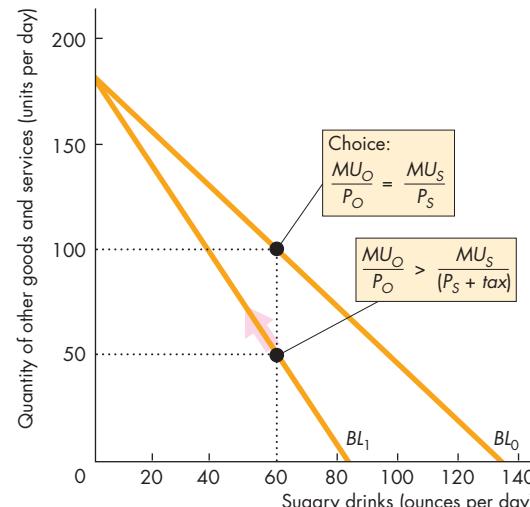


Figure 1 The Effect of a Tax

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-totallers in L.A. is Bling H₂O. 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 H₂O 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 H₂O 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.

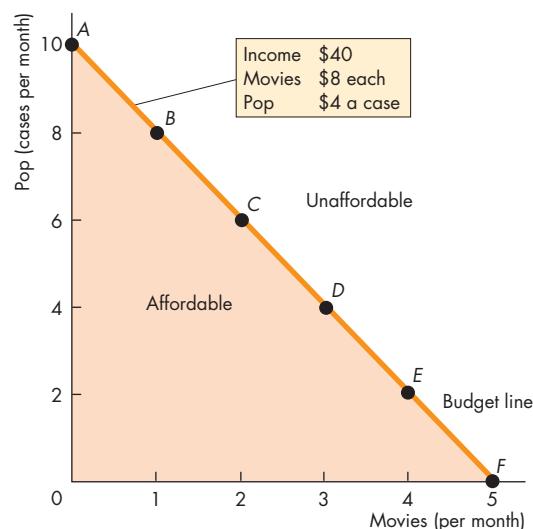
Figure 9.1 shows alternative combinations of movies and pop that Lisa can afford. In row *A*, she sees no movies and buys 10 cases of pop. In row *F*, she sees 5 movies and buys no pop. Both of these combinations of movies and pop exhaust the \$40 available. Check that the combination of movies and pop 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.

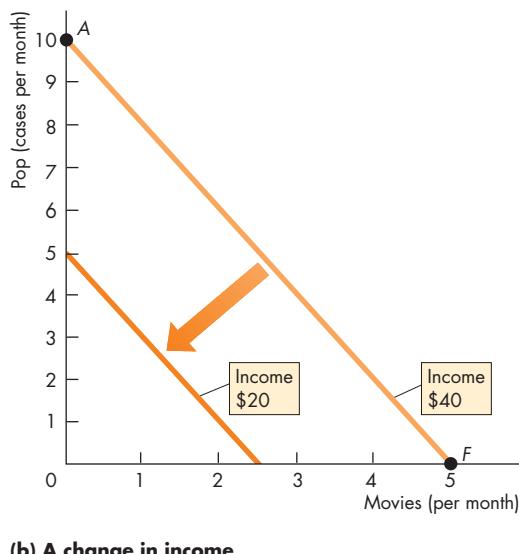
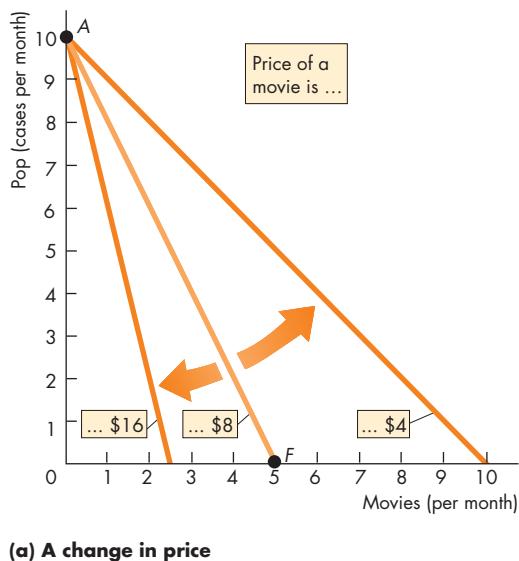
Real Income A household's **real income** is its income expressed as a quantity of goods that the household can afford to buy. Expressed in terms of pop, Lisa's real income is Y/P_P . This quantity is the maximum quantity of pop that she can buy. It is equal to her money income divided by the price of 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.

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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.

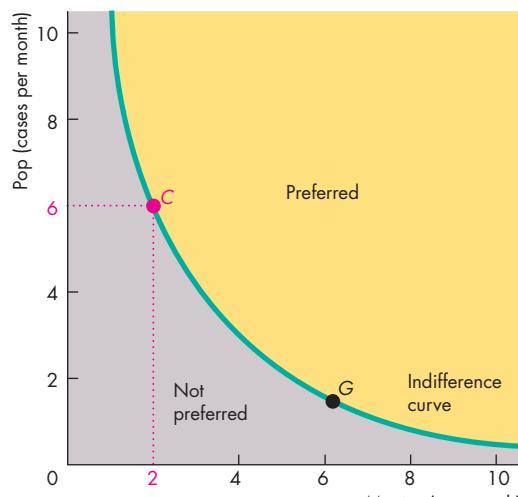
Lisa also says that she prefers all the combinations of movies and pop above the indifference curve in Fig. 9.3(a)—the yellow area—to those on the indifference curve. And she prefers any combination on the indifference curve to any combination in the grey area below the indifference curve.

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 .

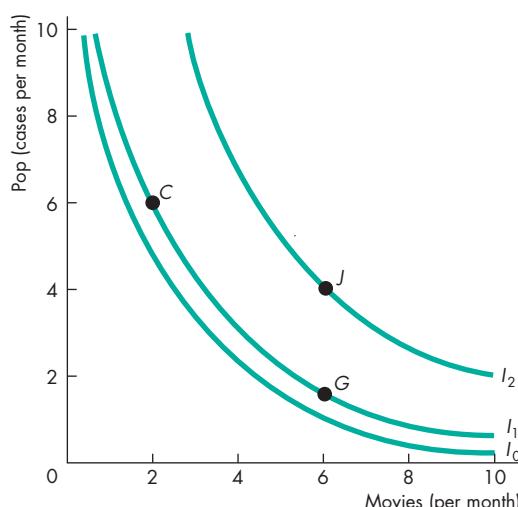
A preference map is a series of indifference curves that resemble the contour lines on a map. By looking at the shape of the contour lines on a map, we can draw conclusions about the terrain. Similarly, by looking at the shape of the indifference curves, we can draw conclusions about a person's preferences.

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.

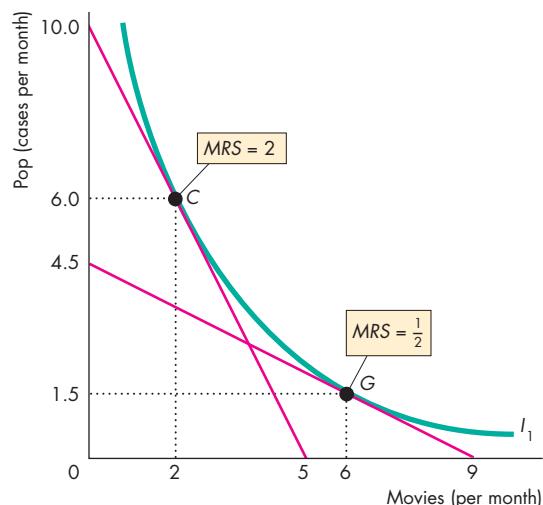
At point C on indifference curve I_1 , Lisa buys 6 cases of pop and sees 2 movies. Her marginal rate of substitution is the magnitude of the slope of the indifference curve at point C . To measure this magnitude, place a straight line against, or tangent to, the indifference curve at point C . Along 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).

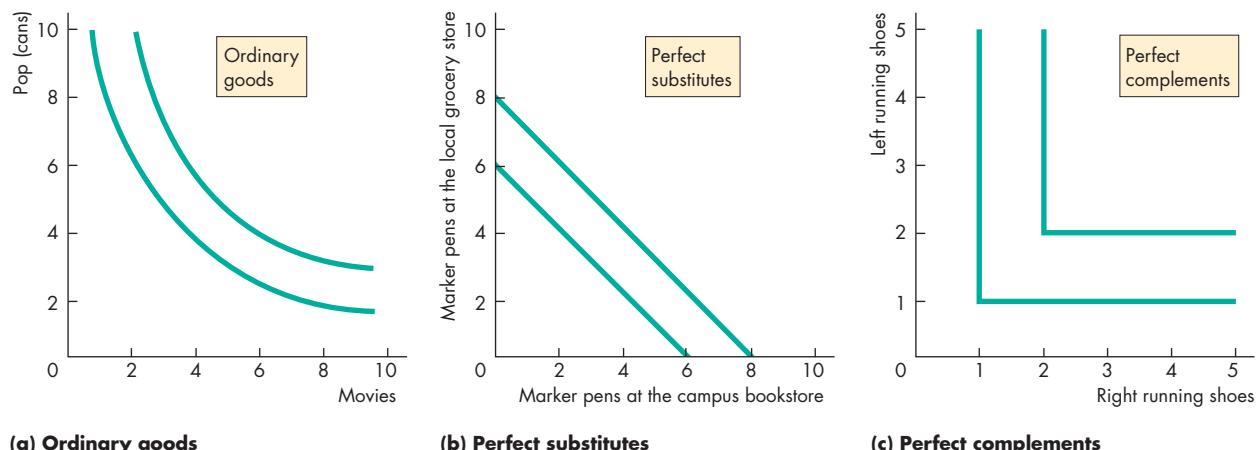
Close Substitutes Some goods substitute so easily for each other that most of us do not even notice which we are consuming. The different brands of marker pens and pencils are examples. Most people don't care which brand of these items they use or where they buy them. A marker pen from the campus bookstore 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.

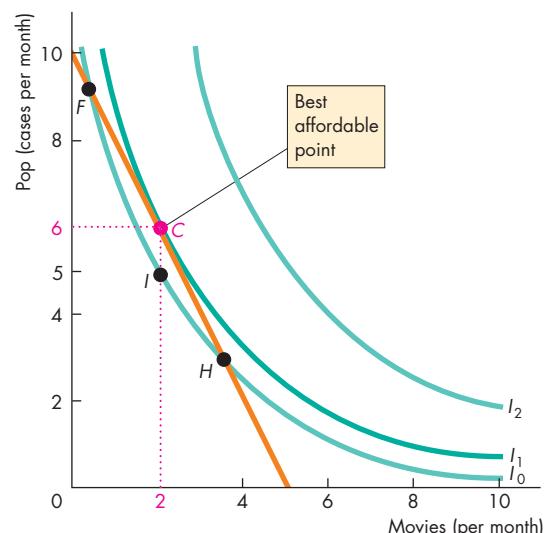
Predicting Consumer Choices

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).

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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.

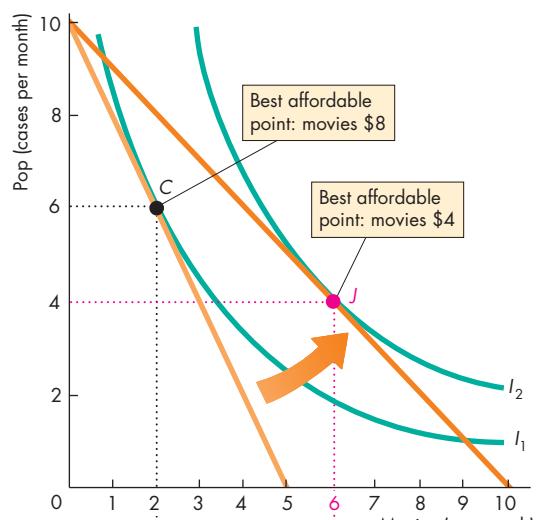
A Change in Price

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 .

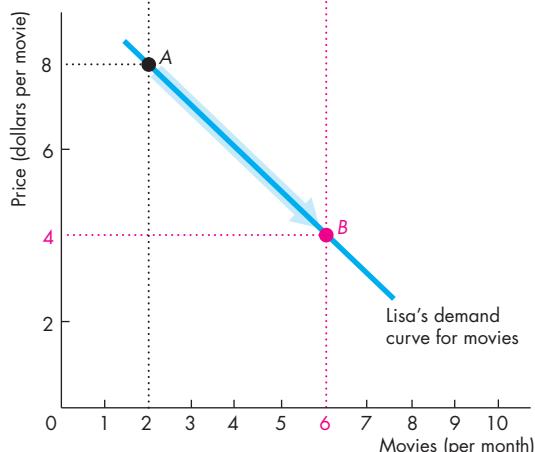
Now suppose that the price of a movie falls to \$4. With a lower price of a movie, the budget line rotates outward and becomes flatter. The new budget line is the darker orange one in Fig. 9.7(a). For a refresher on how a price change affects the budget line, check back to Fig. 9.2(a).

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.

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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.

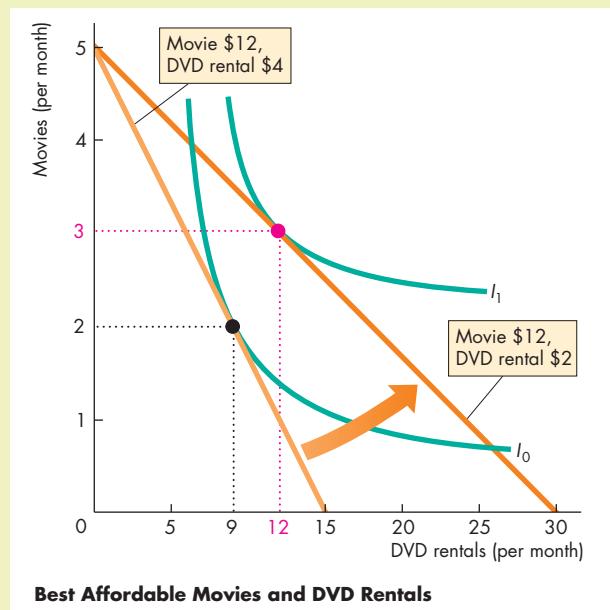
A student has a budget of \$60 a month to allocate to movies. To keep the story clear, we'll suppose that it cost \$12 to go to a movie in both 2005 and 2014. The price of a DVD rental in 2005 was \$4, so the student's budget line is the one that runs from 5 movies on the y -axis to 15 DVD rentals on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

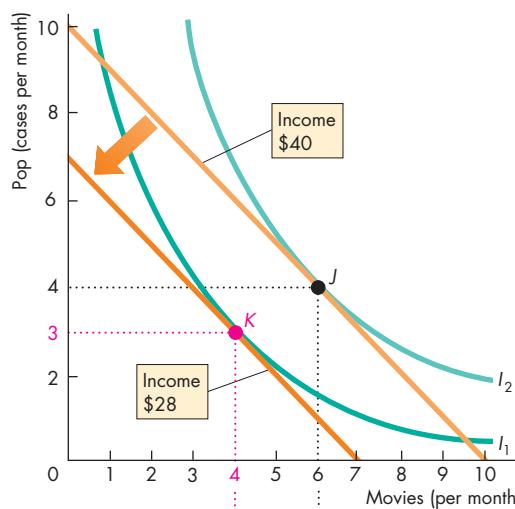
Next, let's see how Lisa changes her purchases of movies and pop when her income changes.

A Change in Income

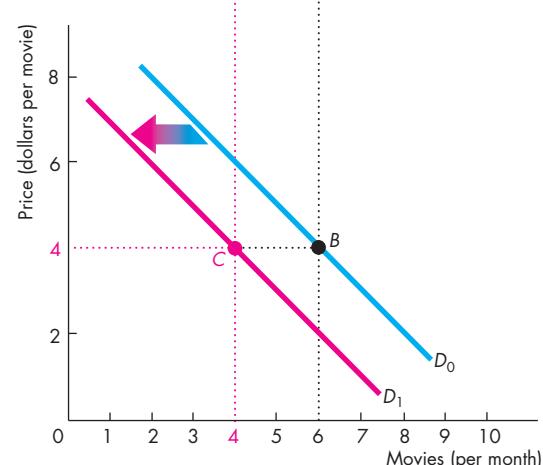
The effect of a change in income on buying plans is called the **income effect**. Let's work out the income effect by examining how buying plans change when income changes and prices remain constant. Figure 9.8 shows the income effect when Lisa's income falls. With an income of \$40, the price of a movie 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.

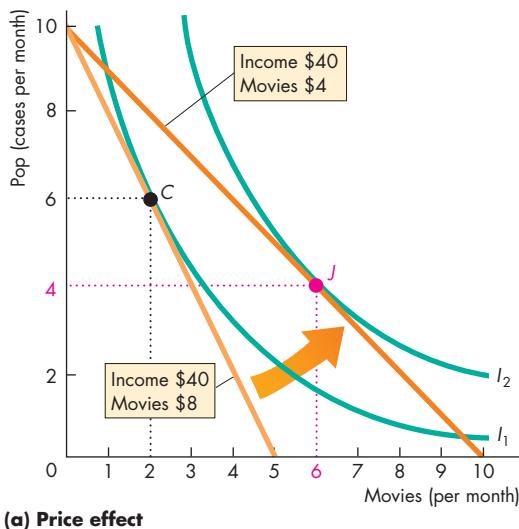
Substitution Effect The **substitution effect** is the effect of a change in price on the quantity bought when the consumer (hypothetically) remains indifferent between the original situation and the new one. To work out Lisa's substitution effect when the price of a movie falls, we must lower her income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

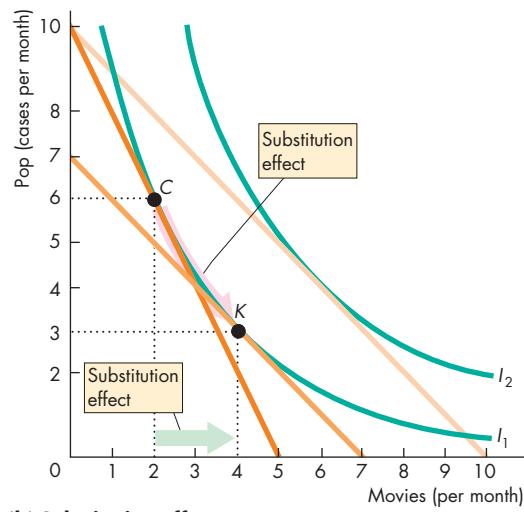
income that is just enough, at the new price of a movie, to keep Lisa's best affordable point on the same indifference curve (I_1) as her original point C . Lisa's budget line is now the medium orange line in Fig. 9.9(b). With the lower price of a movie and a smaller income, Lisa's best affordable point 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).



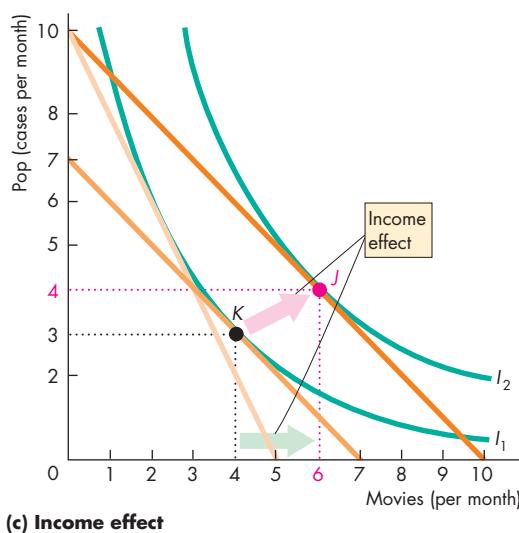
To isolate the substitution effect, we confront Lisa with the new price but keep her on her original indifference curve, I_1 . The substitution effect is the move from C to K along indifference curve I_1 —an increase from 2 to 4 movies a month.

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.

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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.

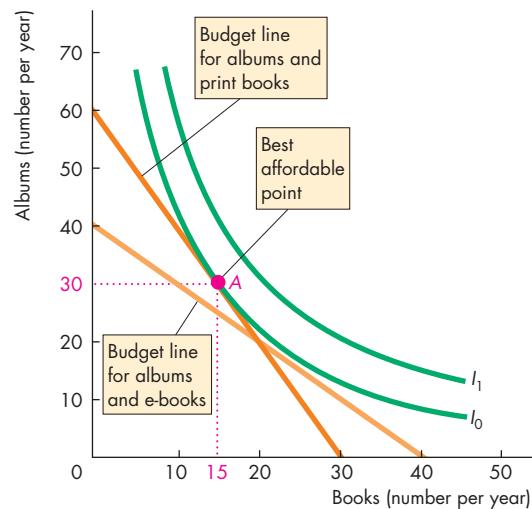


Figure 1 When the Price of a Reader Is \$200

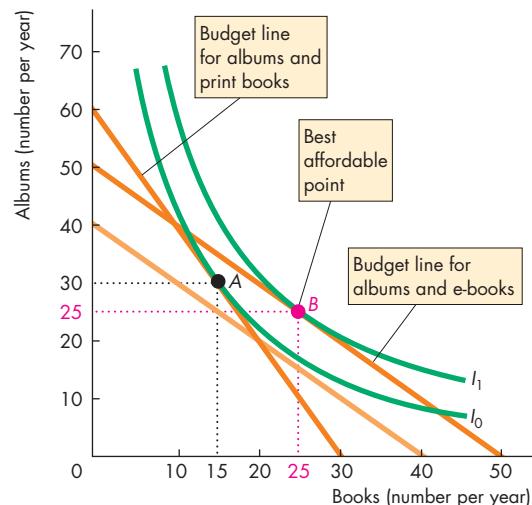


Figure 2 When the Price of a Reader Is \$100

- 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.

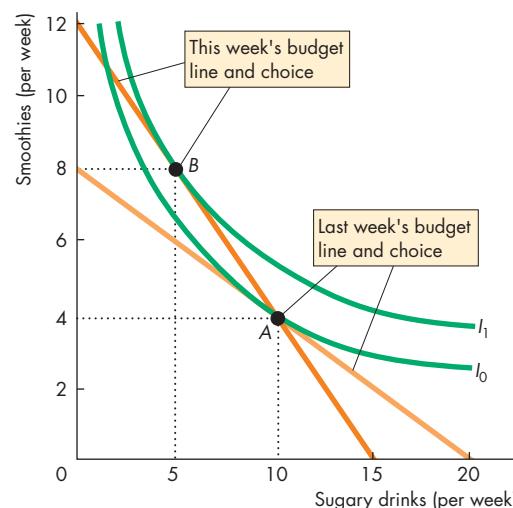
To increase her *MRS* from 0.4 to 0.8, Wendy buys fewer sugary drinks and more smoothies. We know how she changes her choice but not the new quantities she buys. To get the quantities, we would need to know Wendy's preferences as described by her indifference curves.

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:

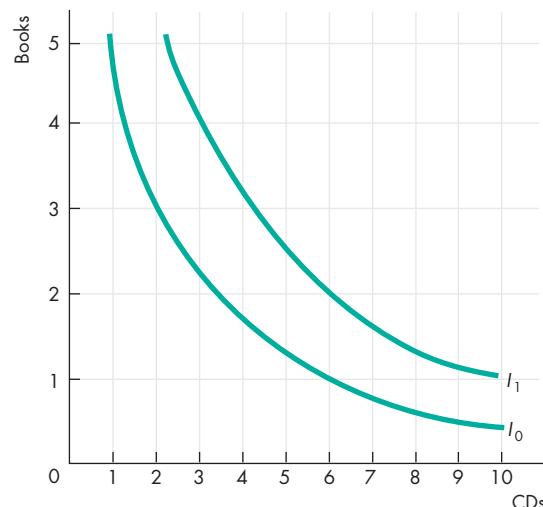
gasoline and restaurant meals. Identify the combinations of gasoline and restaurant meals that are affordable and those that are unaffordable.

- 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?

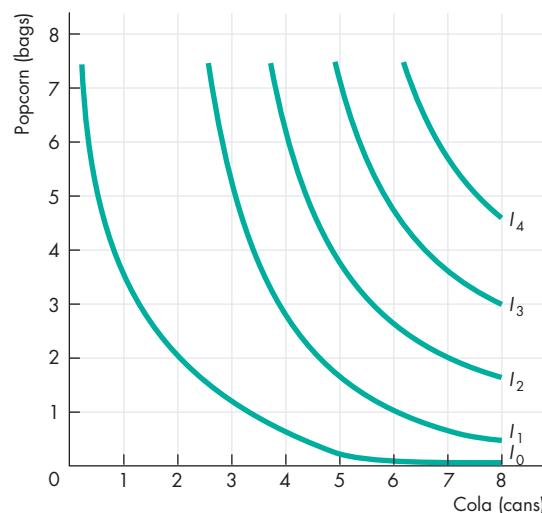
Predicting Consumer Choices

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

PART THREE

UNDERSTANDING HOUSEHOLDS' CHOICES

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.

“... 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
Total Revenue	\$400,000
<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>
Opportunity Cost of Production	
	\$370,000
Economic Profit	
	<u>\$30,000</u>

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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

Method	Quantities of inputs	
	Labour	Capital
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

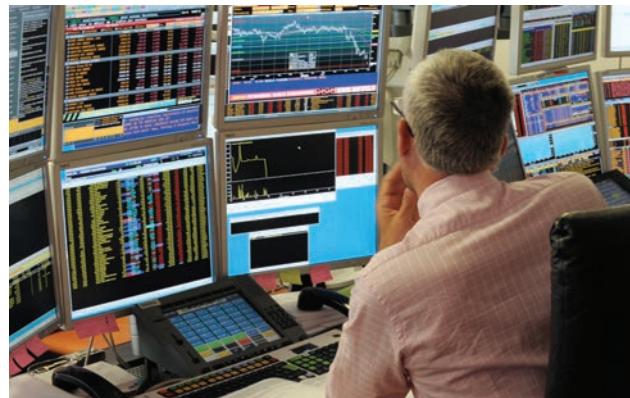


Figure 1 JPMorgan Share Price

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.

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

Economics in Action

The Size Distribution of Firms in Canada

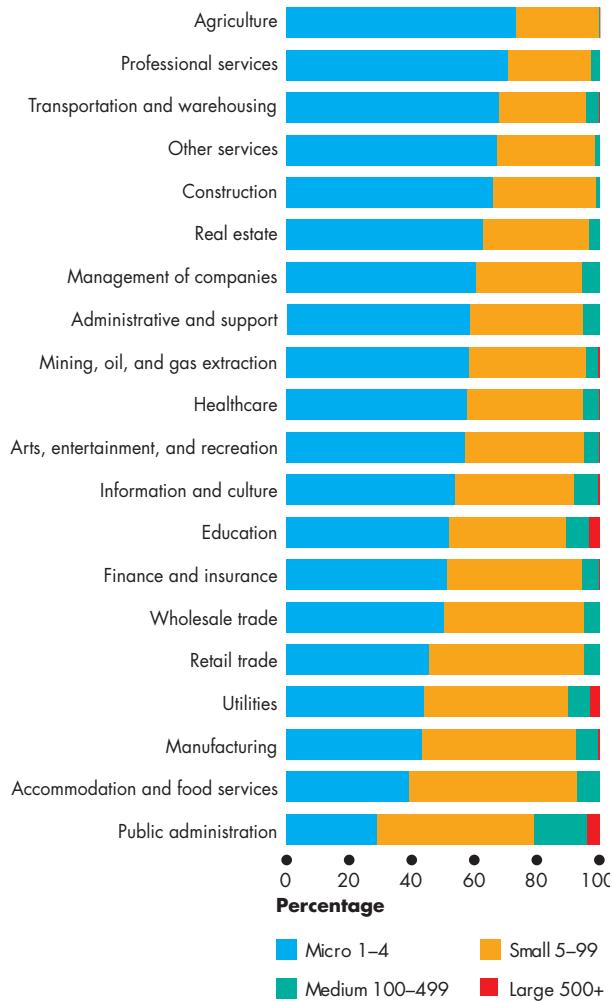
Industry Canada counts the number of establishments in the Canadian economy and classifies them by size measured by the number of employees. An establishment is not the same as a firm. Some firms operate several, or even many, establishments. For example, Loblaw Companies Limited operates 1,690 grocery 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.

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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.

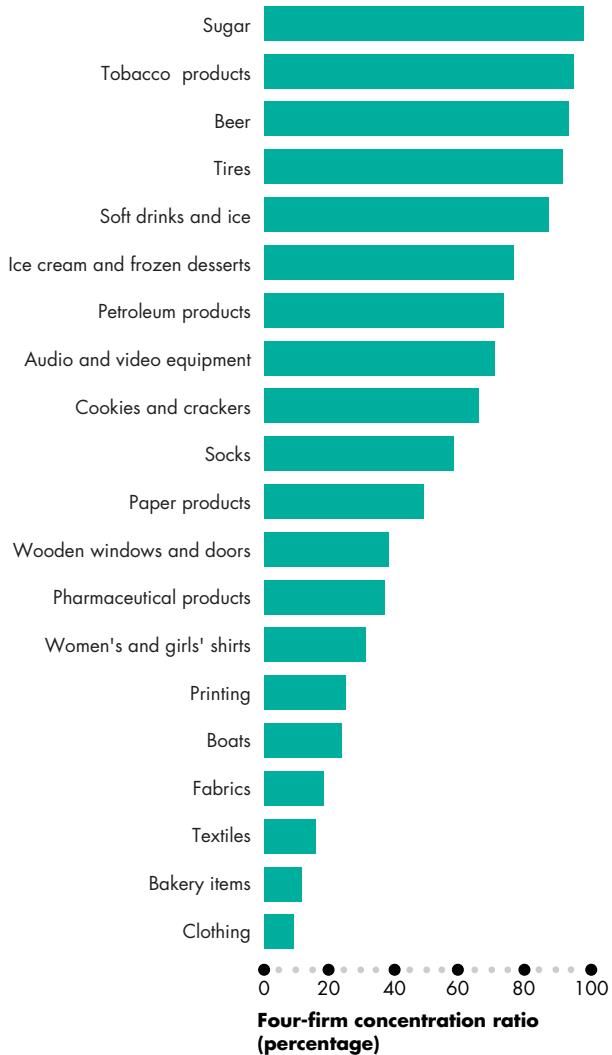
Newspapers and automobiles are examples of how the concentration measures give a misleading reading of the degree of competition.

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.

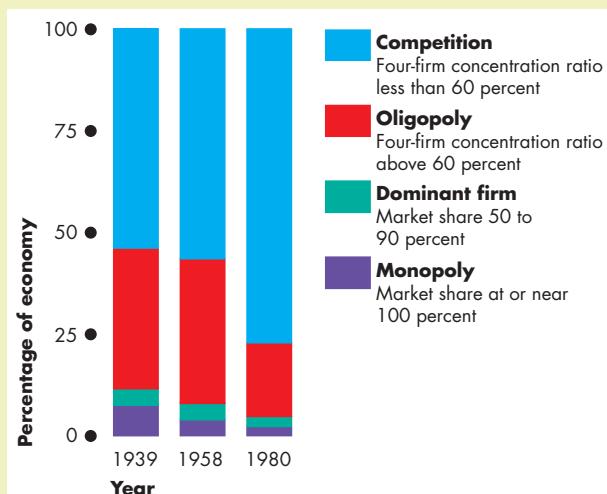
In 1939, three-quarters of the value of goods and services bought and sold in North America were traded in markets that are essentially competitive—markets that are almost perfect competition or monopolistic competition. Monopoly and the dominance of a single firm accounted for about 5 percent of sales. 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.

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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.

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◆ *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.

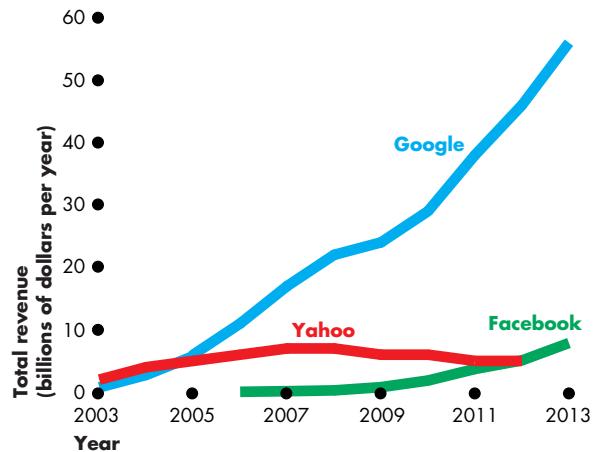


Figure 1 Total Revenue Comparison

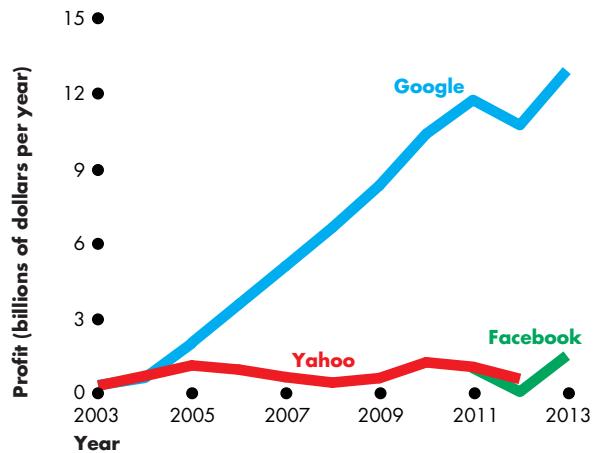


Figure 2 Profit Comparison

- 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.

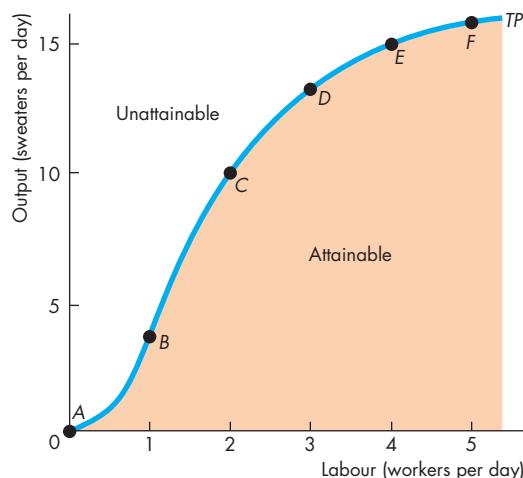
Total Product Curve

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 .

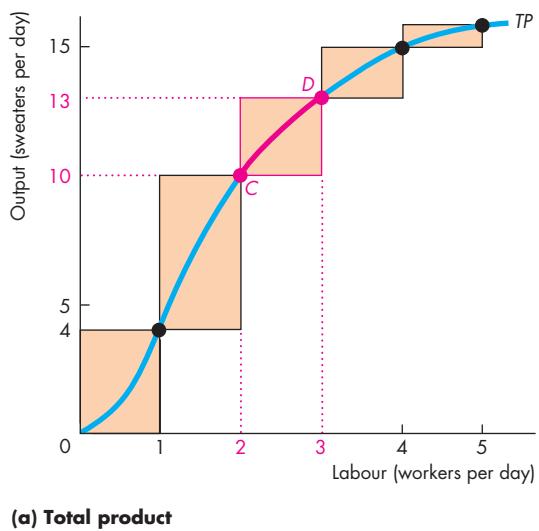
In part (a), the orange bars illustrate the marginal product of labour. The height of a bar measures marginal product. Marginal product is also measured by the slope of the total product curve. Recall that the slope of a curve is the change in the value of the variable measured on the y -axis—output—divided 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.

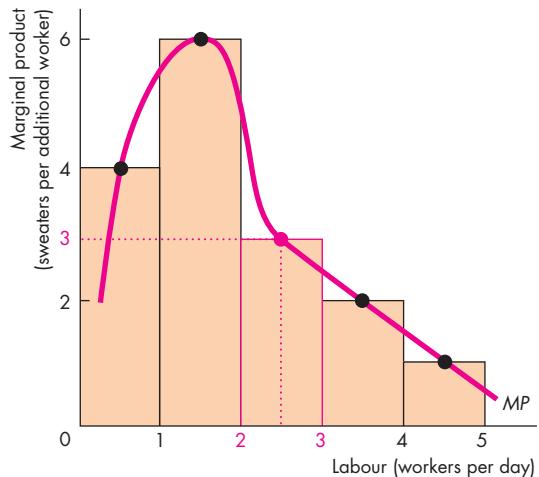
The total product and marginal product curves differ across firms and types of goods. GM's product curves are different from those of Hydro One's, whose curves in turn are different from those of Campus Sweaters. But the shapes of the product curves are similar because almost every production process 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.

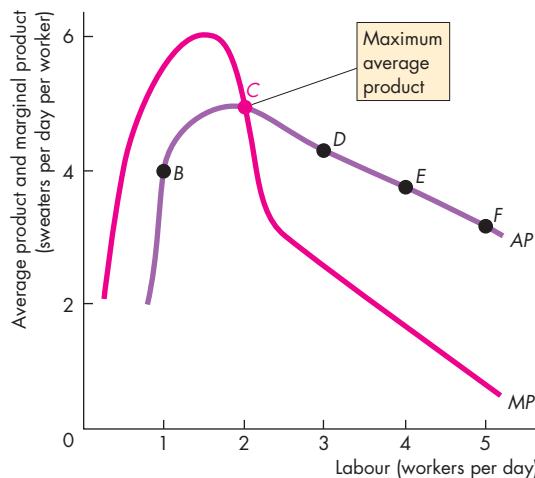
Average Product Curve

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.

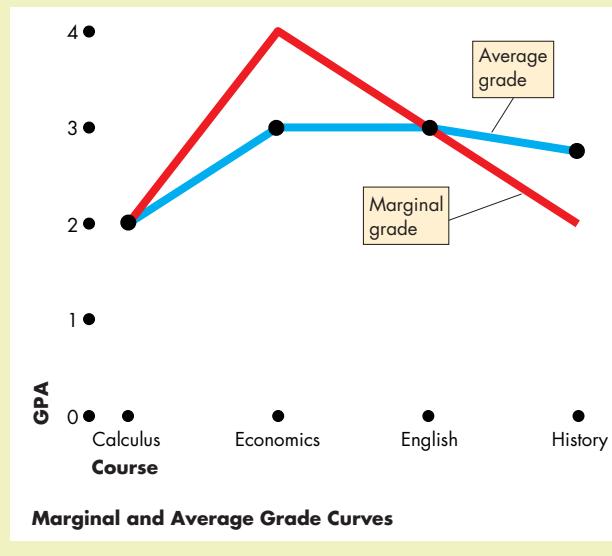
[MyEconLab Animation](#)

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.

[MyEconLab](#)

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,

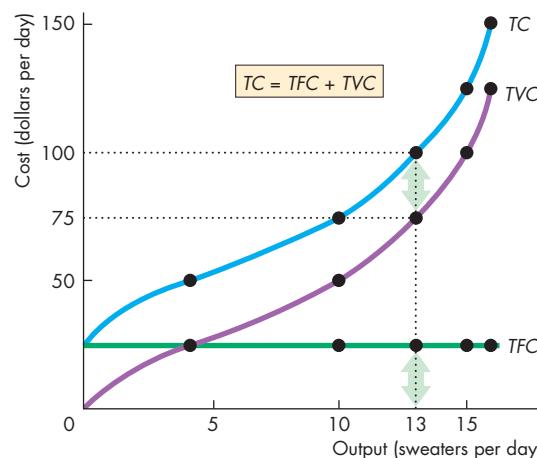
$$TC = TFC + TVC.$$

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).

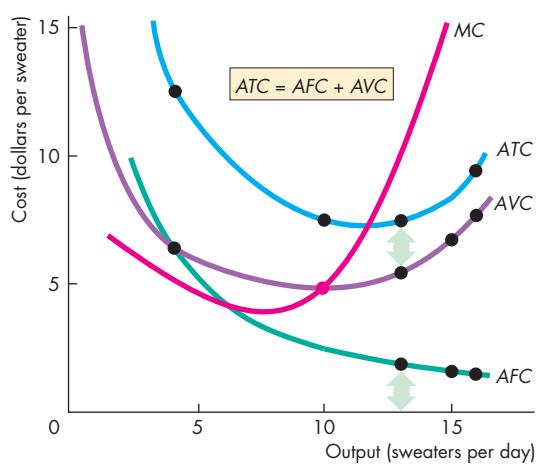
Figure 11.5 shows the average cost curves. The green average fixed cost curve (*AFC*) slopes downward. As output increases, the same constant total fixed cost is spread over a larger output. The blue average total cost curve (*ATC*) and the purple average variable cost curve (*AVC*) are U-shaped. The 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.

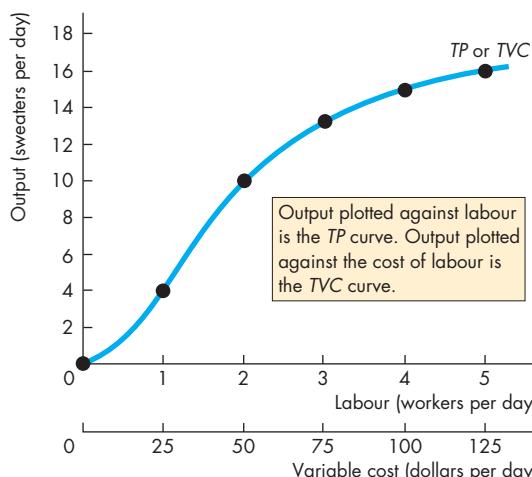
But as output increases further and diminishing returns set in, average variable cost starts to increase. With average fixed cost decreasing more quickly than average variable cost is increasing, the ATC curve continues to slope downward. Eventually, average variable cost starts to increase more quickly 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.

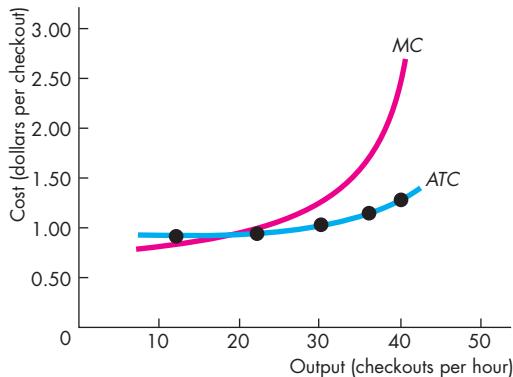


Figure 1 Operator Checkout

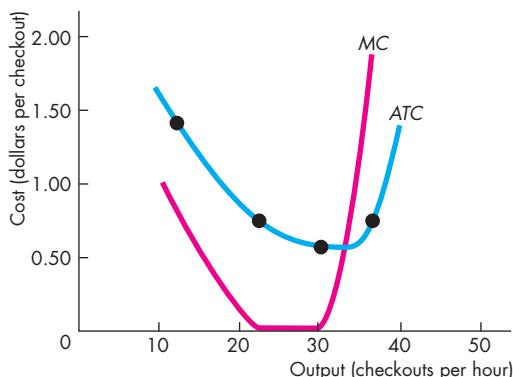


Figure 2 Self-Checkout

- 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.

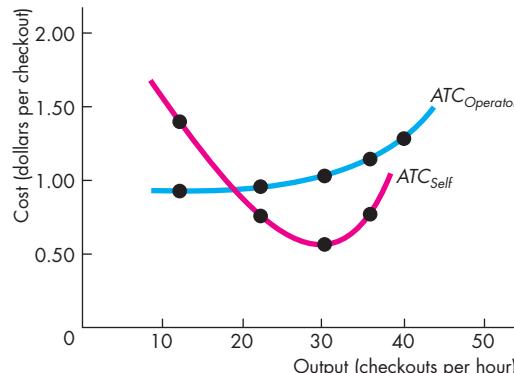


Figure 3 ATC Compared

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:

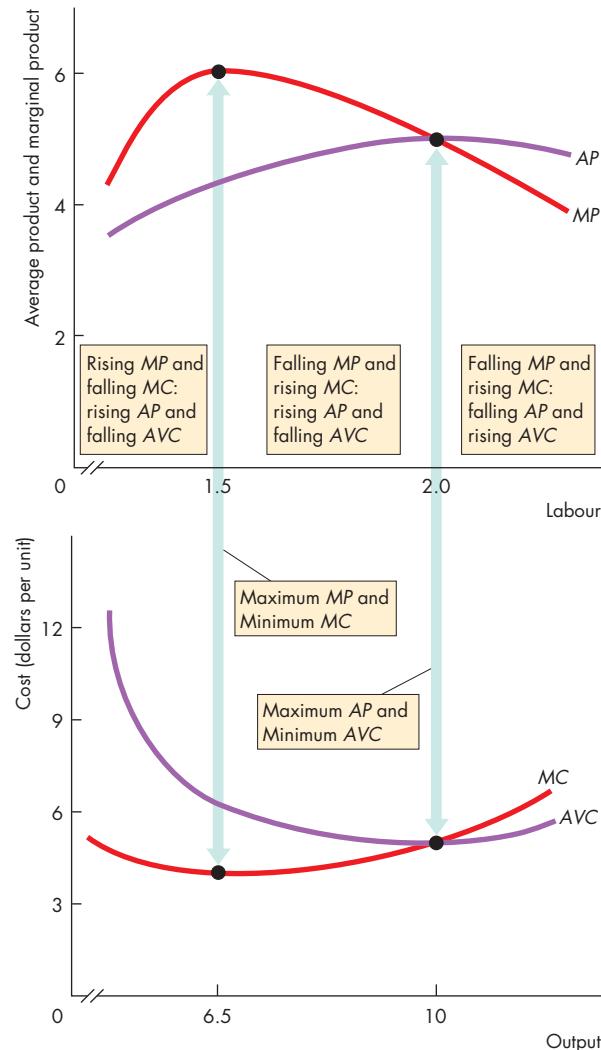
- Technology
- Prices of factors of production

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
Knitting machines (number)	1	2	3	4

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.

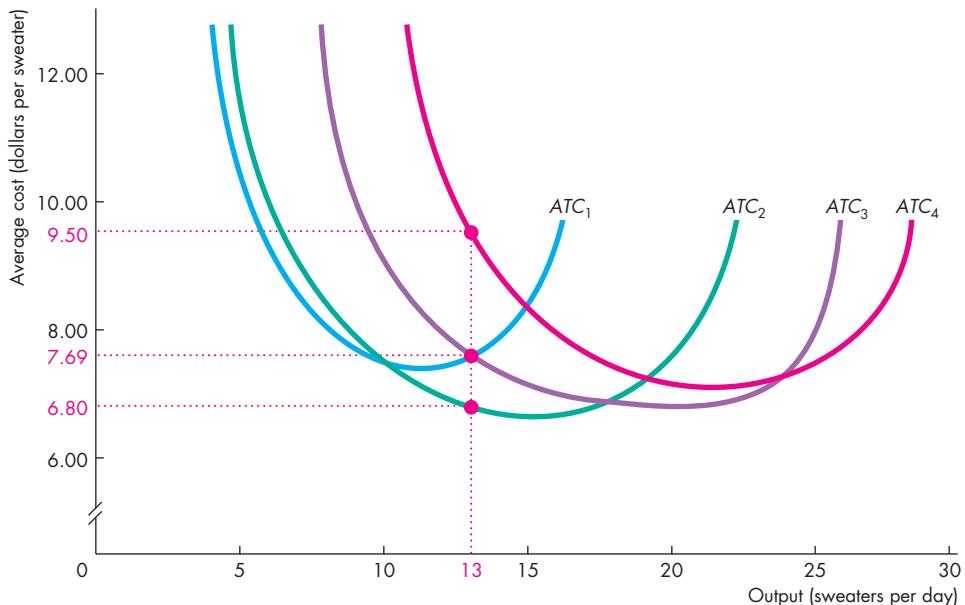
and increases the number of machines from 2 to 3, output increases from 18 to 22 sweaters a day. The marginal product of the third machine is 4 sweaters a day, down from 5 sweaters a day for the second machine.

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 .

[MyEconLab Animation](#)

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*₁. For outputs between 10 and 18 sweaters a day, average total cost is the lowest on *ATC*₂. For outputs between 18 and 24 sweaters a day, average total cost is the lowest on *ATC*₃. And for outputs in excess of 24 sweaters a day, average total cost is the lowest on *ATC*₄. 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.

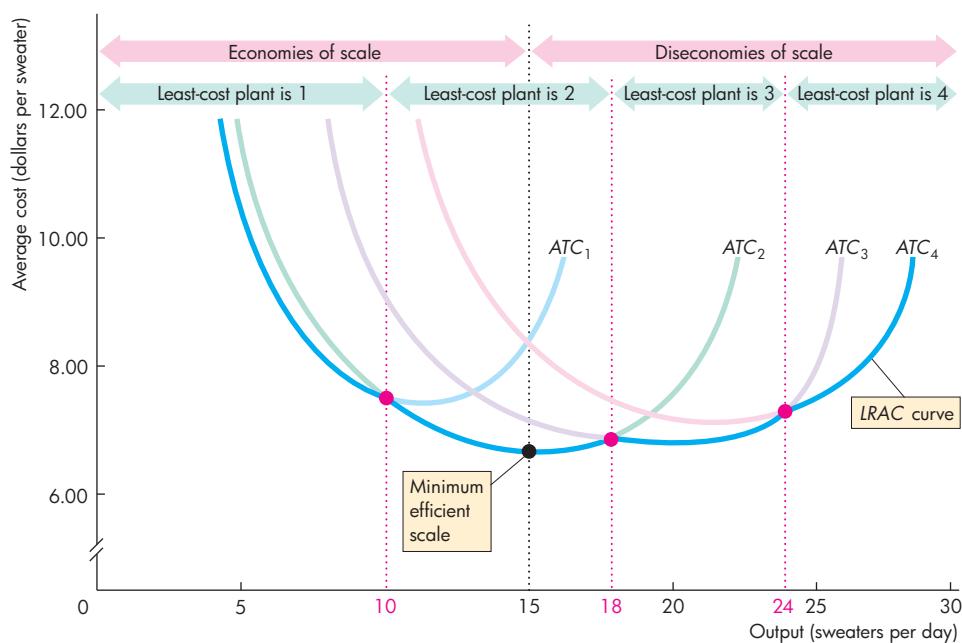
Diseconomies of scale are features of a firm's technology that make average total cost *rise* as output increases. When diseconomies of scale are present, the *LRAC* curve slopes upward. In Fig. 11.9, Campus Sweaters experiences diseconomies of scale at outputs greater than 15 sweaters a day.

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.

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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.

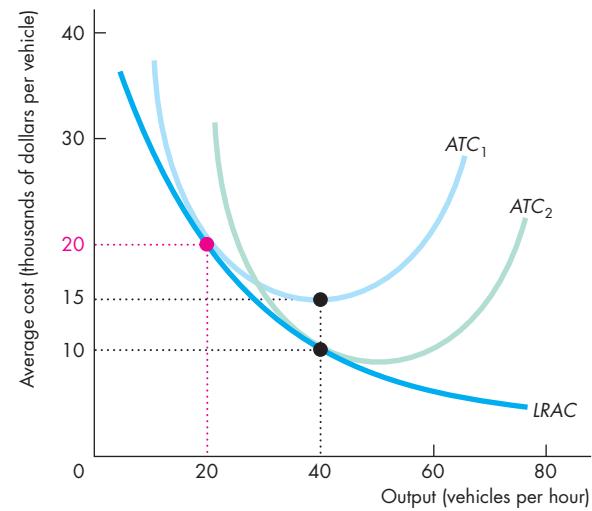
Producing 20 vehicles an hour doesn't use the plant at its lowest possible average total cost. If the firm could sell enough cars for it to produce 40 vehicles an hour, the firm could use its current plant and produce at an average cost of \$15,000 a vehicle.

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." ...

Written by Hollie Shaw. Copyright © 2013. Material reprinted by the express permission of *National Post*, a division of Postmedia Network Inc.

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.

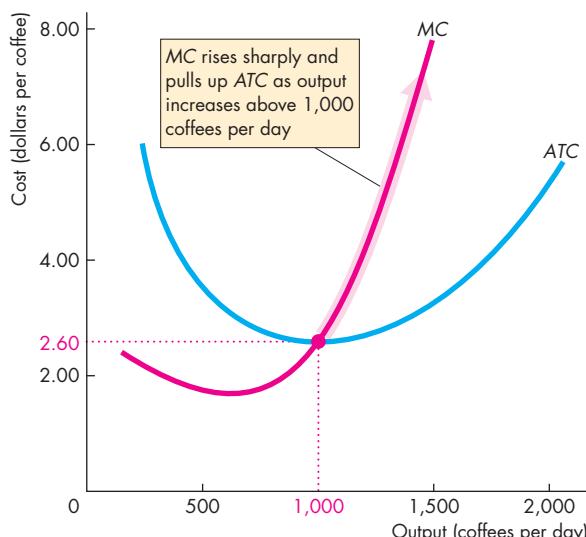


Figure 1 Starbucks' Short-Run Cost Curves

	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.

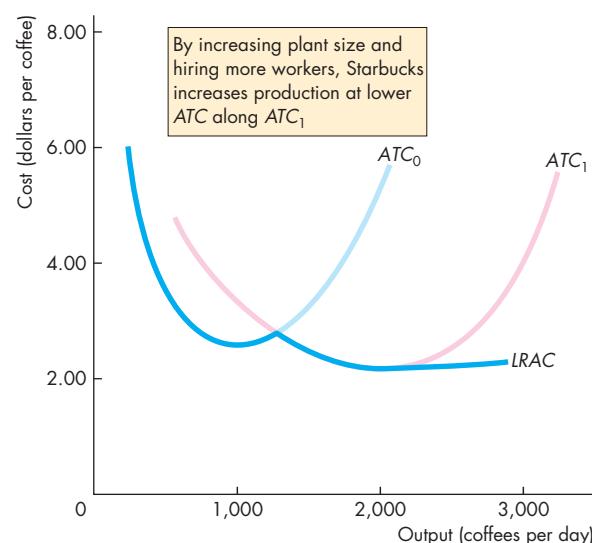


Figure 2 Starbucks' Long-Run Cost Curve



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		?	?	?	?	?

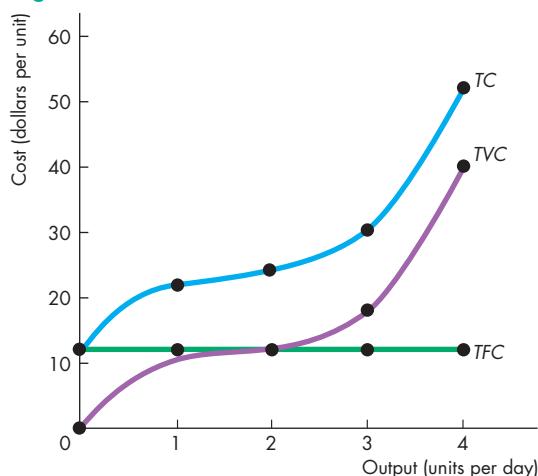
Questions

- 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 .

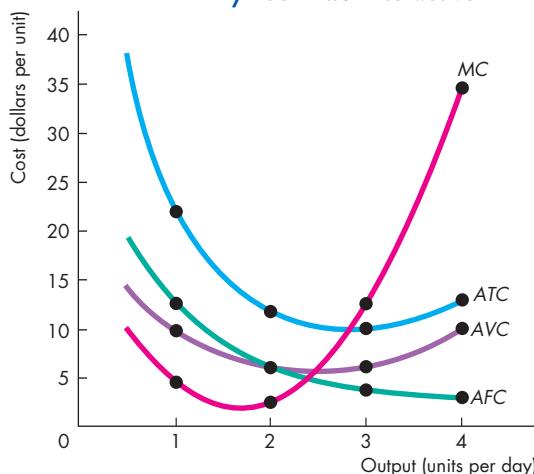
Output	MC	TC	TFC	TVC	ATC	AFC	AVC
0		\$12	\$12	\$0			
1	\$10	\$22	\$12	\$10	\$22	\$12	\$10
2	\$2	\$24	\$12	\$12	\$12	\$6	\$6
3	\$6	\$30	\$12	\$18	\$10	\$4	\$6
4	\$22	\$52	\$12	\$40	\$13	\$3	\$10

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	A	B	150	90
30	40	90	130	130
40	30	C	D	E
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.

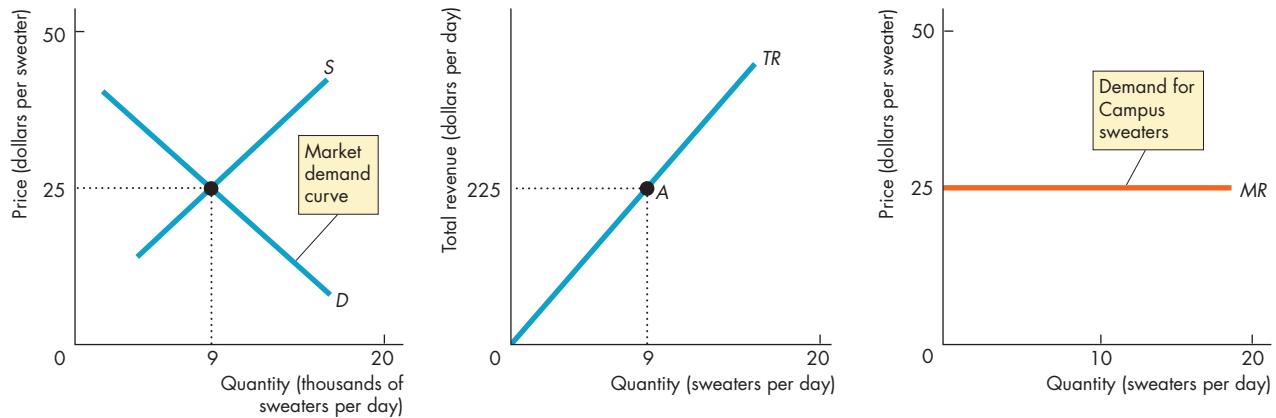
Total Revenue Total revenue is equal to the price multiplied by the quantity sold. In the table in Fig. 12.1, if Campus Sweaters sells 9 sweaters, its total revenue is \$225 ($9 \times \25).

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.

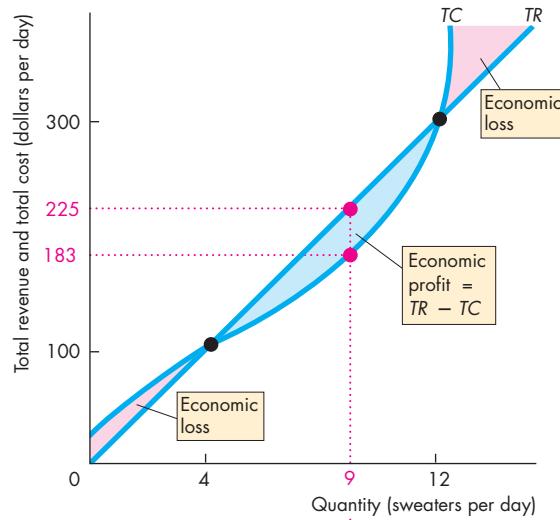
Figure 12.2 shows how to do this for Campus Sweaters. The table lists the firm's total revenue and total cost at different outputs, and part (a) of the figure shows the firm's total revenue curve, TR , and total cost curve, TC . These curves are graphs of numbers in the first three columns of the table.

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 .

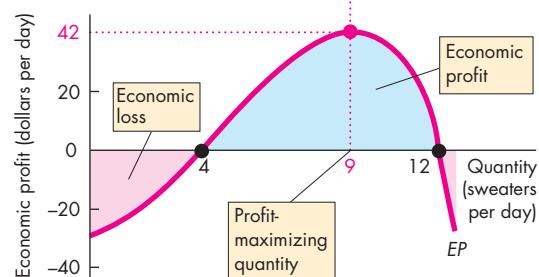
Campus Sweaters maximizes its economic profit by producing 9 sweaters a day: Total revenue is \$225, total cost is \$183, and economic profit is \$42. No other output rate achieves a larger profit.

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.

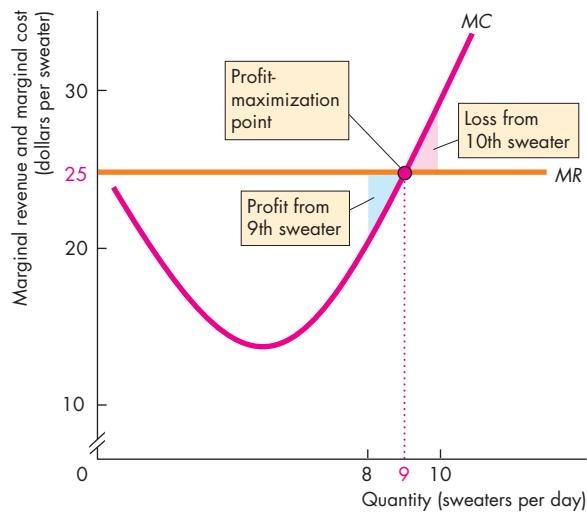
If Campus Sweaters increases its output from 9 sweaters to 10 sweaters a day, marginal revenue (\$25) is less than marginal cost (\$27), so by producing the 10th sweater, economic profit decreases. The last column of the table shows that economic profit decreases from \$42 to \$40 a day. The red area 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.

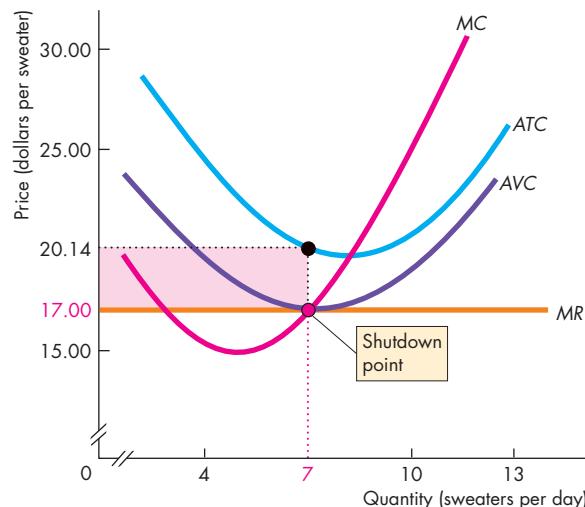
The Shutdown Point A firm's **shutdown point** is the price and quantity at which it is indifferent between producing and shutting down. The shutdown point occurs at the price and the quantity at which average variable cost is a minimum. At the shutdown point, the firm is minimizing its loss and its 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.



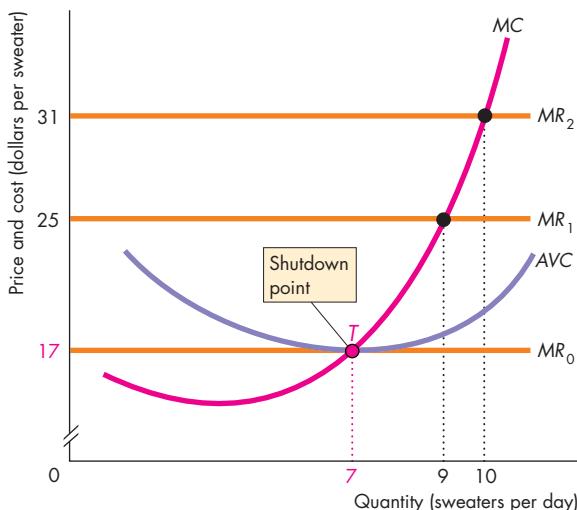
REVIEW QUIZ

- 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?

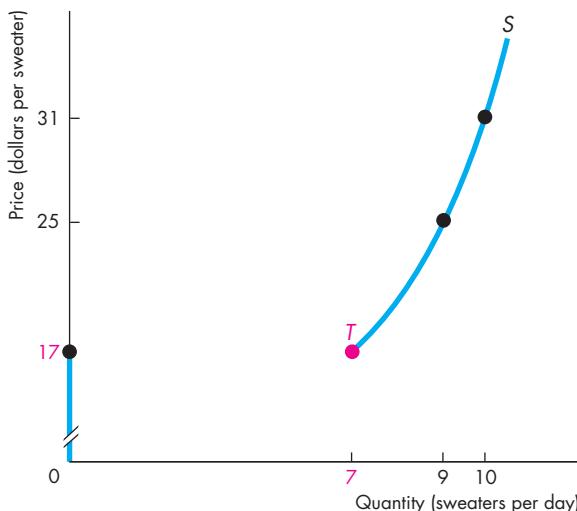
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So far, we've studied a single firm in isolation. We've seen that the firm's profit-maximizing decision depends on the market price, which it takes as given. How is the market price determined? Let's find out.

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.

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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.

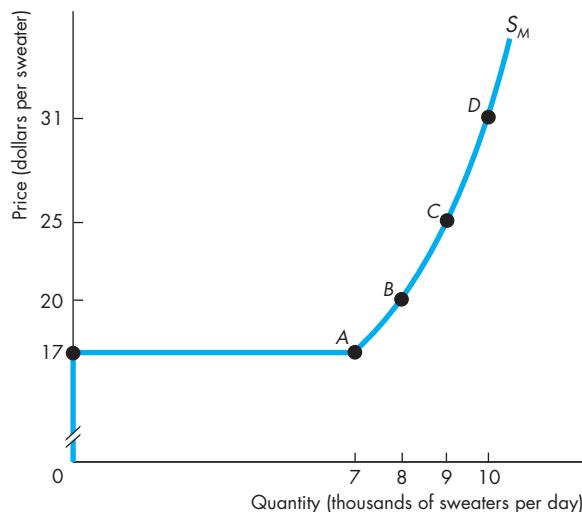
Figure 12.6 shows the supply curve for the competitive sweater market. In this example, the market consists of 1,000 firms exactly like Campus Sweaters. At each price, the quantity supplied by the market is 1,000 times the quantity supplied by a single firm.

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.

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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

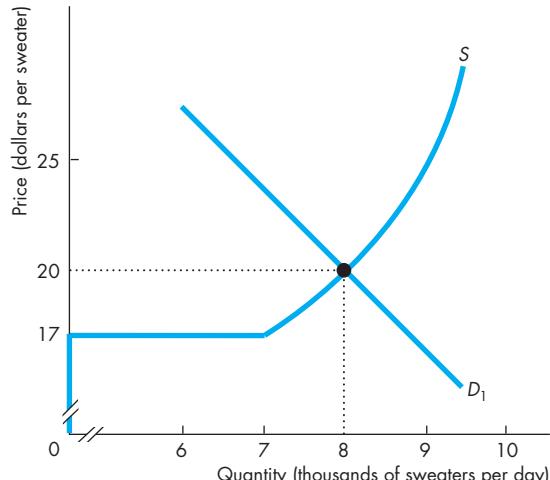
price, each firm maximizes profit by decreasing its output. If each firm produces 7 sweaters a day, the market output decreases to 7,000 sweaters a day.

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

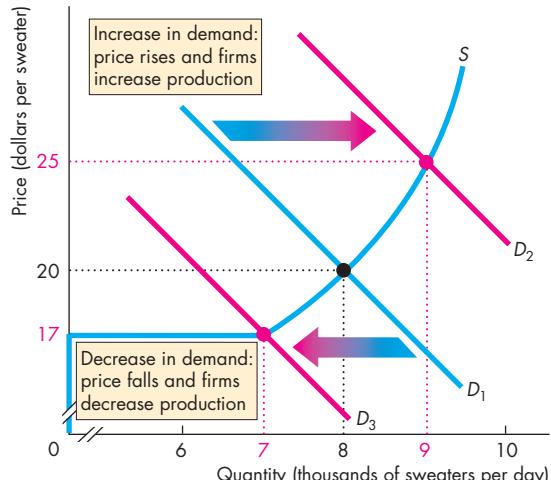
FIGURE 12.7 Short-Run Equilibrium



(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

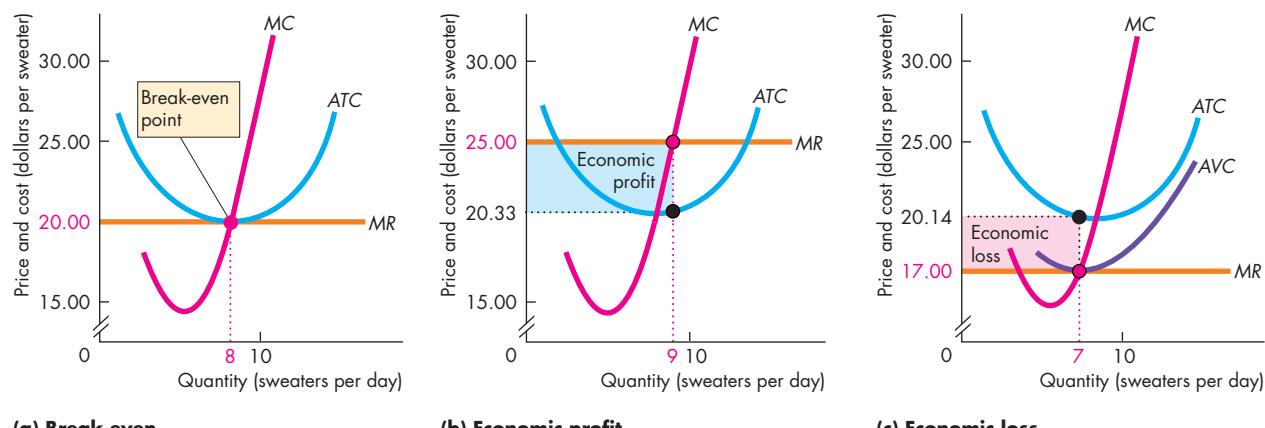
Figure 12.8(a) corresponds to the situation in Fig. 12.7(a) where the market demand is D_1 . The equilibrium price of a sweater is \$20 and the firm produces 8 sweaters a day. Average total cost is \$20 a sweater. Price equals average total cost (ATC), so the firm breaks even (makes zero economic profit).

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



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.

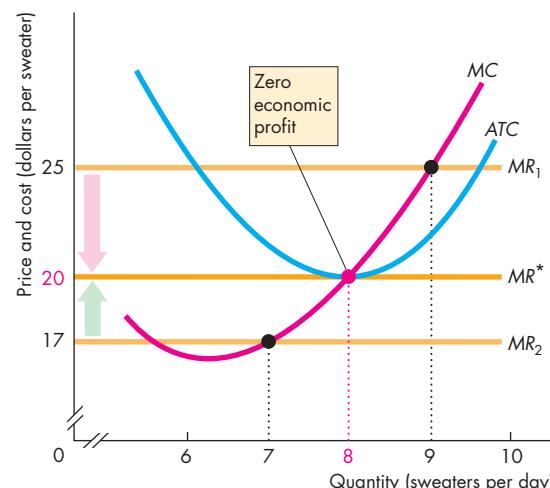
A Closer Look at Exit

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.

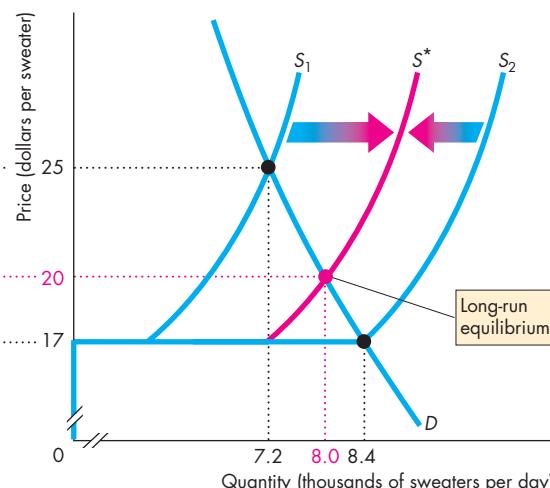
FIGURE 12.9 Entry, Exit, and Long-Run Equilibrium



(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

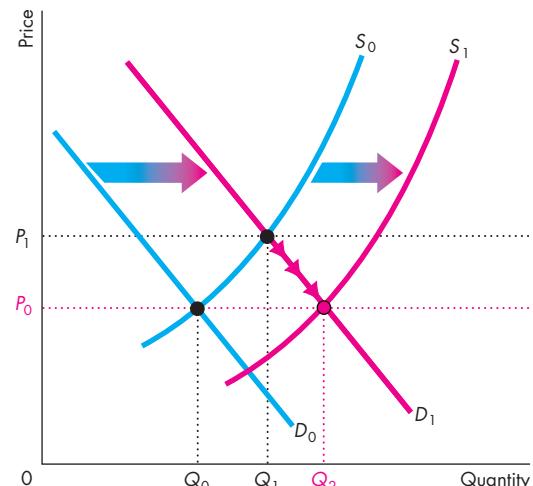
increases and the price stops rising and then begins to fall. Eventually, enough firms have entered for the supply and the increased demand to be in balance at a price that enables the firms in the market to return to zero economic profit—long-run equilibrium.

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

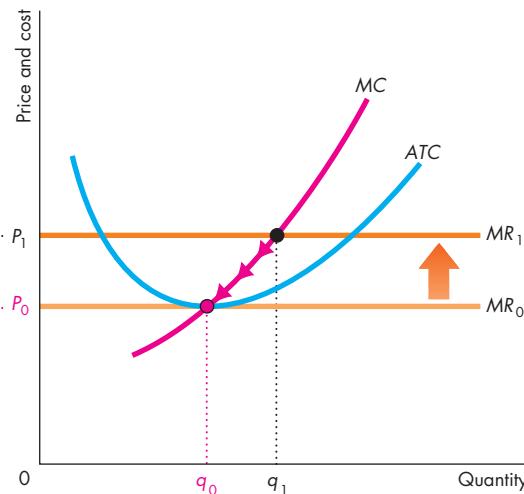
FIGURE 12.10 An Increase in Demand



(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

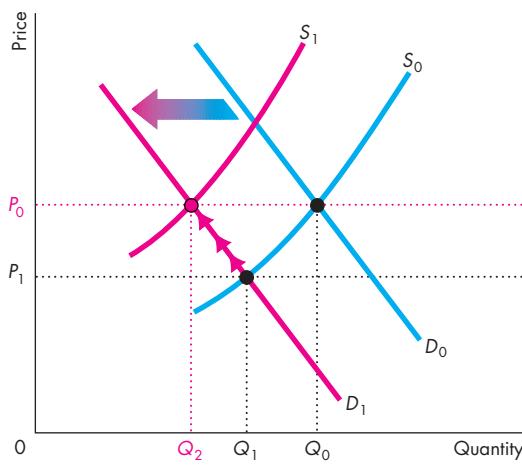
Provide a graphical analysis to explain why Sam the Record man exited the market and the effects of exit on the market for record store services.

THE SOLUTION

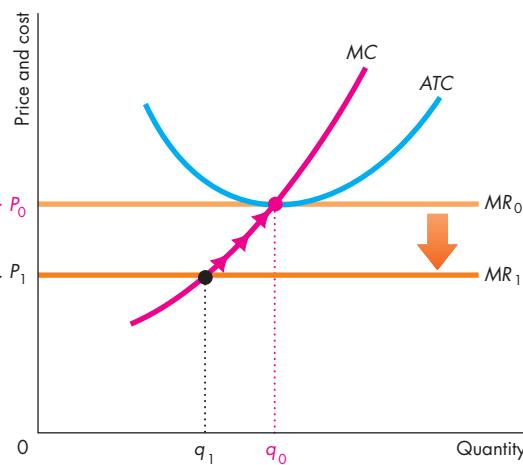
- With demand D_0 and supply S_0 , Q_0 customers are served at a price P_0 in part (a) of Fig. 1.
- With marginal revenue MR_0 and marginal cost MC , a record store serves q_0 customers in long-run equilibrium in part (b) of Fig. 1.



- 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.

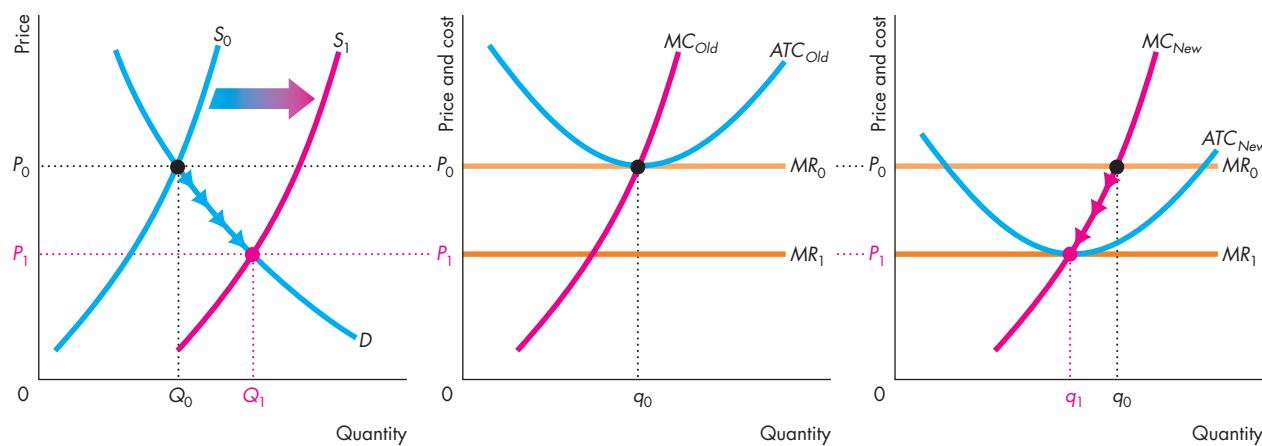
In part (a), the demand curve is D and initially the supply curve is S_0 , so the price is P_0 and the equilibrium quantity is Q_0 .

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_1 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.

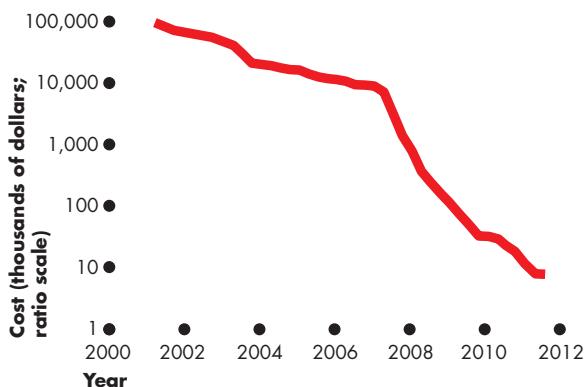


Figure 1 Cost per Genome

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.

MyEconLab

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.

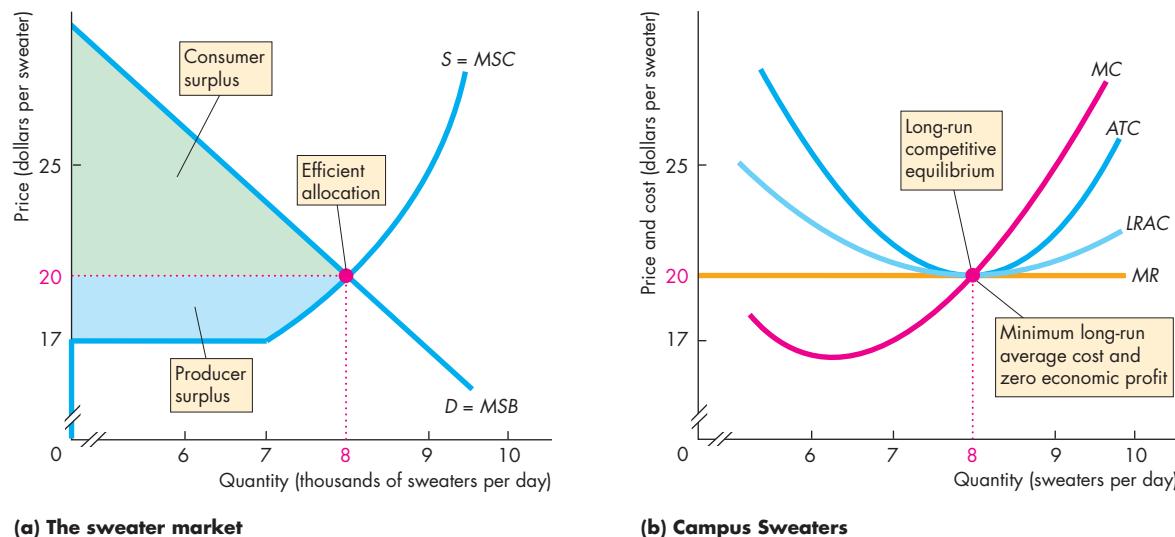
Equilibrium and Efficiency Resources are used efficiently when marginal social benefit equals marginal social cost. Competitive equilibrium achieves this efficient outcome because, with no externalities, price equals marginal social benefit for consumers, and price equals marginal social cost for producers.

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

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

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.

MyEconLab Animation and Draw Graph

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.

MyEconLab



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, July 11, 2013; and 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 .

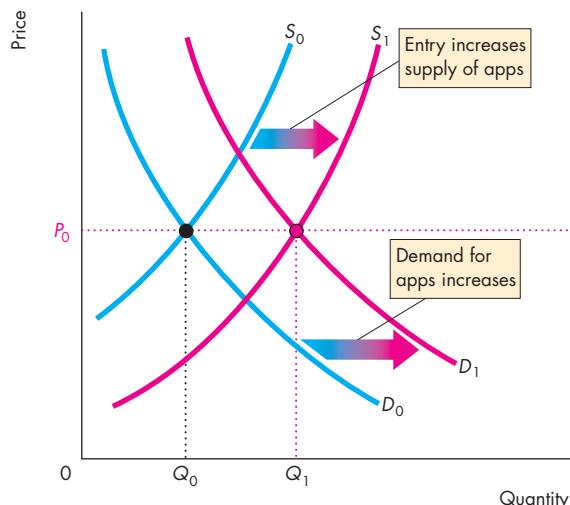


Figure 1 The Market for Apps

- 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.

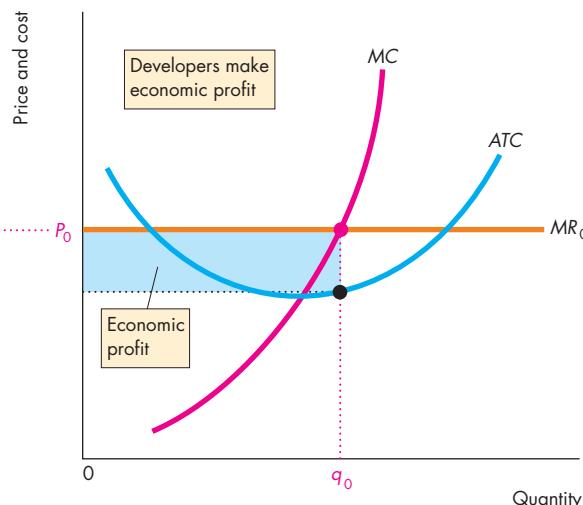


Figure 2 An Individual App Developer

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?

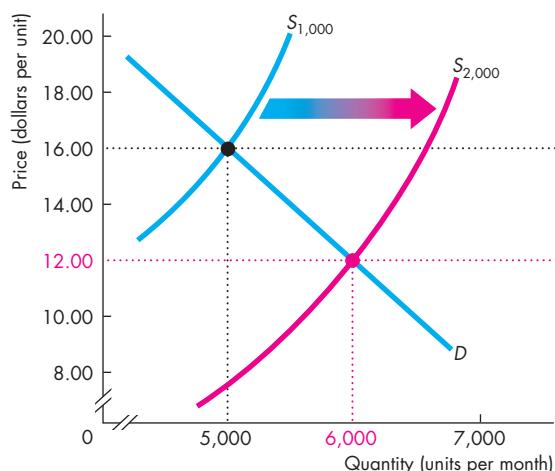
Solutions

- 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.

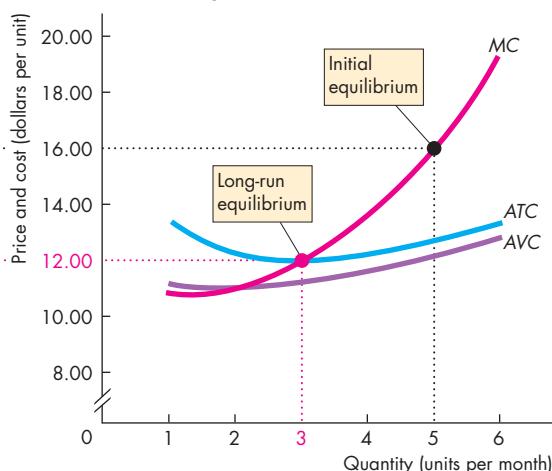
- Firms will enter if the price exceeds ATC and exit if the price is below ATC . In the equilibrium above, P is \$16 and ATC is \$12.70, so firms enter.

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)

(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

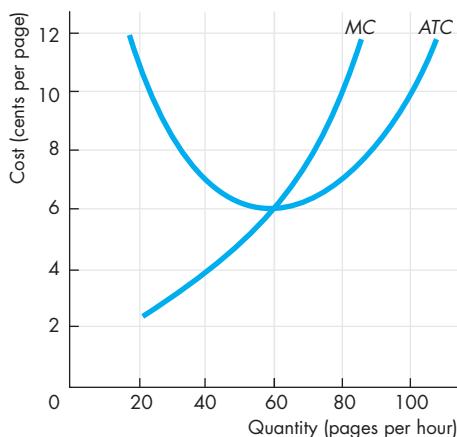
Two gas stations stand on opposite sides of the road: Rutter's Farm Store and Sheetz gas station. Rutter's doesn't even have to look across the highway to know when Sheetz changes its price for a gallon of gas. When Sheetz raises the price, Rutter's pumps are busy. When Sheetz lowers prices, there's 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)	
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:

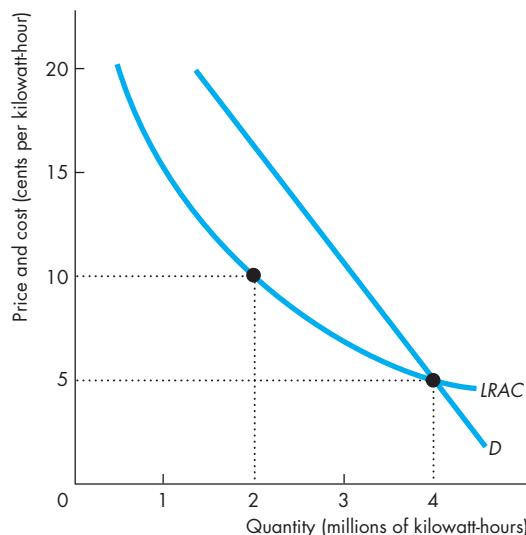
- Natural
- Ownership
- Legal

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.

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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.

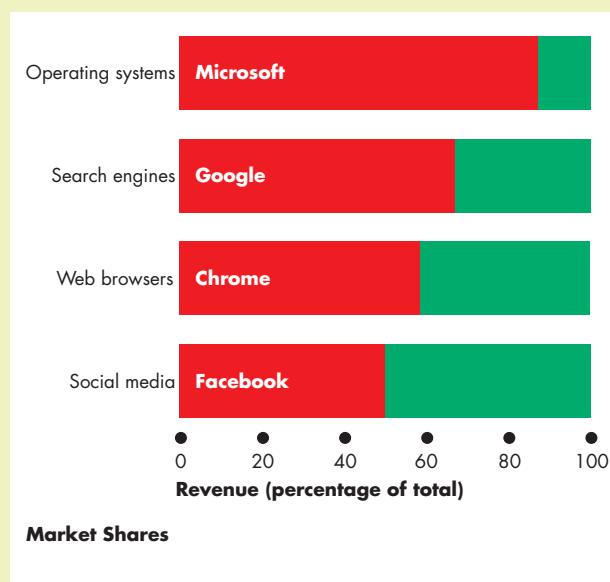
Economics in Action

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.

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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

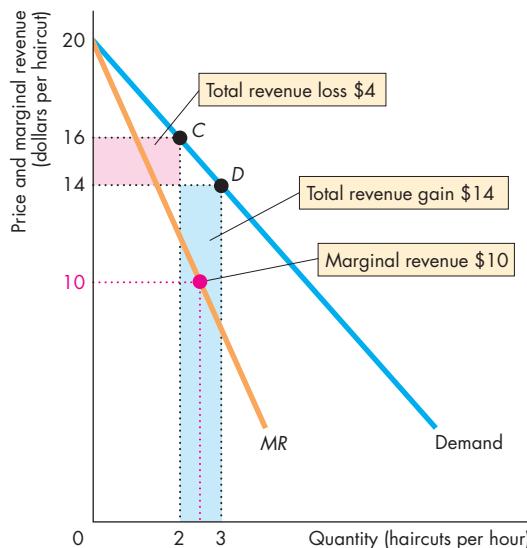
Because in a monopoly there is only one firm, the demand curve facing the firm is the market demand curve. Let's look at Bobbie's Barbershop, the sole supplier of haircuts in Trout River, Newfoundland. The table in Fig. 13.2 shows the market demand schedule. At a price of \$20, Bobbie sells no haircuts. 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 (ΔTR) 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 (<i>P</i>) (dollars per haircut)	Quantity demanded (<i>Q</i>) (haircuts per hour)	Total revenue (<i>TR</i> = <i>P</i> × <i>Q</i>) (dollars)	Marginal revenue (<i>MR</i> = $\Delta TR / \Delta Q$) (dollars per haircut)
A	20	0	0 18
B	18	1	18 14
C	16	2	32 10
D	14	3	42 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.

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Marginal Revenue and Elasticity

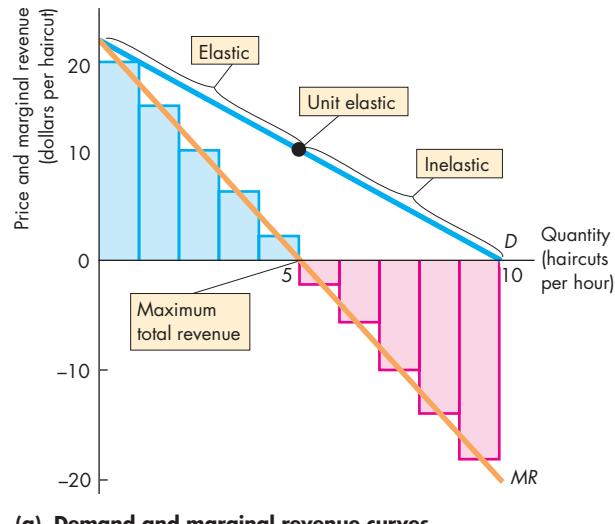
A single-price monopoly's marginal revenue is related to the *elasticity of demand* for its good. The demand for a good can be *elastic* (the elasticity is greater than 1), *inelastic* (the elasticity is less than 1), or *unit elastic* (the elasticity is equal to 1). Demand is *elastic* if a 1 percent 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.)

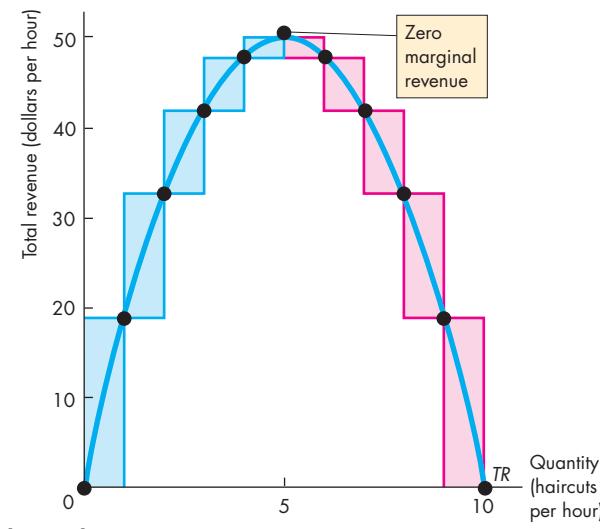
Figure 13.3 illustrates the relationship between marginal revenue, total revenue, and elasticity. As the price gradually falls from \$20 to \$10 a haircut, the quantity demanded increases from 0 to 5 haircuts an hour. Over this output range, marginal revenue is positive in part (a), total revenue increases 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.

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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.

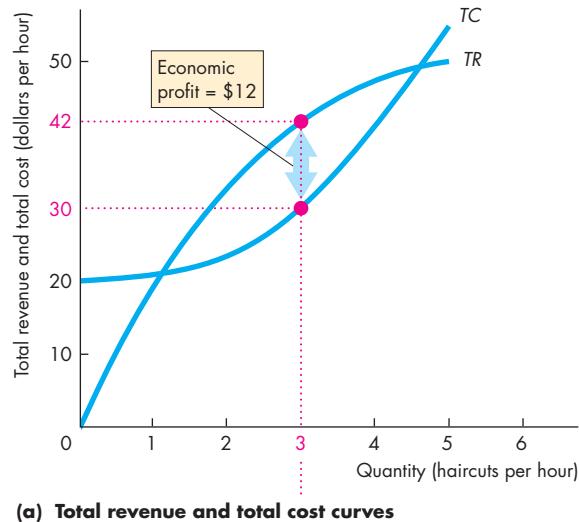
Maximum Price the Market Will Bear Unlike a firm in perfect competition, a monopoly influences the price of what it sells. But a monopoly doesn't set the price at the maximum *possible* price. At the maximum possible price, the firm would be able to sell only one unit of output, which in general is less 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

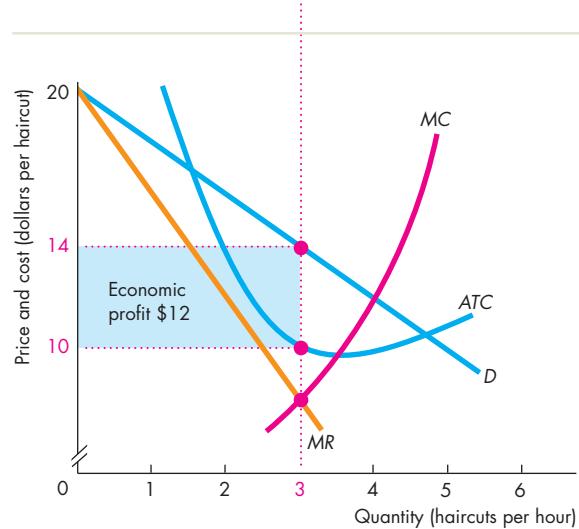
Price (P) (dollars per haircut)	Quantity demanded (Q) (haircuts per hour)	Total revenue ($TR = P \times Q$) (dollars)	Marginal revenue ($MR = \Delta TR / \Delta Q$) (dollars per haircut)	Total cost (TC) (dollars)	Marginal cost ($MC = \Delta TC / \Delta Q$) (dollars per haircut)	Profit ($TR - TC$) (dollars)
20	0	0 18	20 1	-20
18	1	18 14	21 3	-3
16	2	32 10	24 6	+8
14	3	42 6	30 10	+12
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

- 1 What is the relationship between marginal cost and marginal revenue when a single-price monopoly maximizes profit?
- 2 How does a single-price monopoly determine the price it will charge its customers?
- 3 What is the relationship between price, marginal revenue, and marginal cost when a single-price monopoly is maximizing profit?
- 4 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.

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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

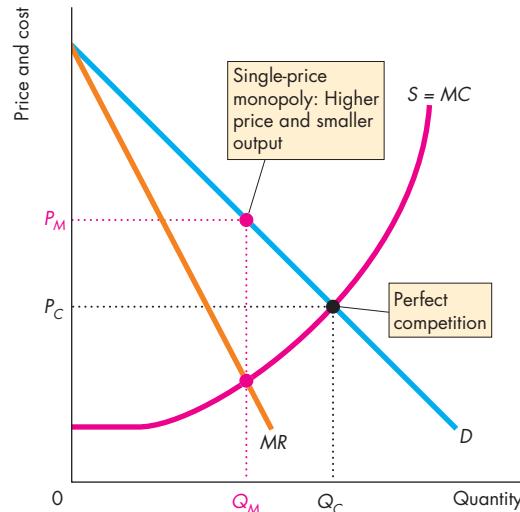
recall that in perfect competition, the market supply curve is the sum of the supply curves of the firms in the industry. Also recall that each firm's supply curve is its marginal cost curve (see Chapter 12, p. 277). So when the market is taken over by a single firm, the competitive market's supply curve 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.

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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.

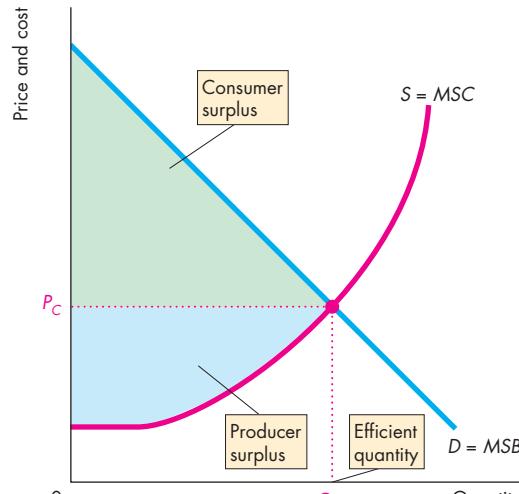
Figure 13.6(b) illustrates the inefficiency of monopoly and the sources of that inefficiency. A monopoly produces Q_M and sells its output for P_M . The smaller output and higher price drive a wedge between marginal social benefit and marginal social cost and create a *deadweight loss*. The grey triangle 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.

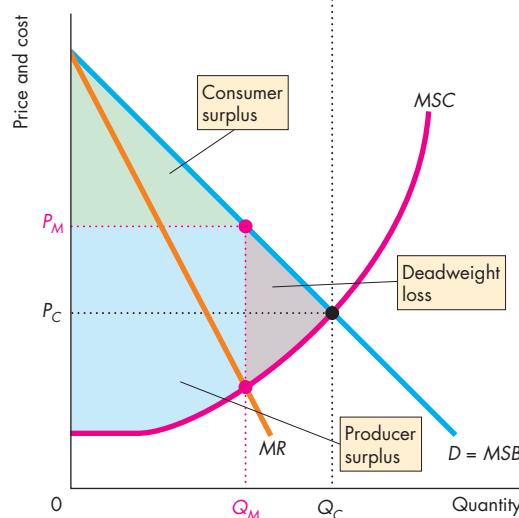
Although the monopoly gains from a higher price, it loses some producer surplus because it produces a smaller output. That loss is another part of the deadweight loss.

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.

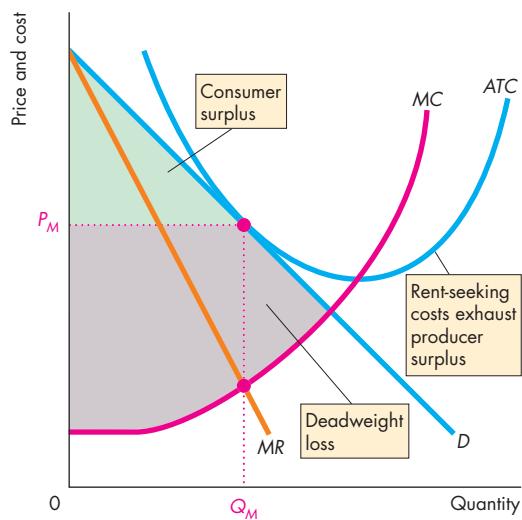
This type of rent seeking is a costly activity that uses up scarce resources. Taken together, firms spend billions of dollars lobbying MPs, MPPs, and bureaucrats in the pursuit of licences and laws that create barriers to entry and establish a monopoly.

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.

[MyEconLab](#)

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.

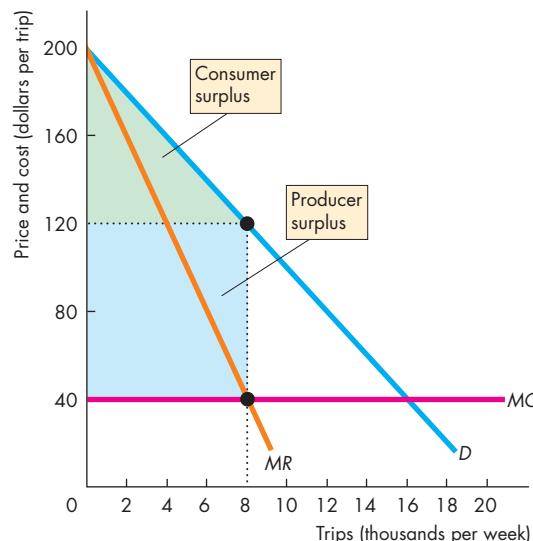
Let's now see how price discrimination works by looking at a price-discriminating airline.

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.

MyEconLab Animation

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?

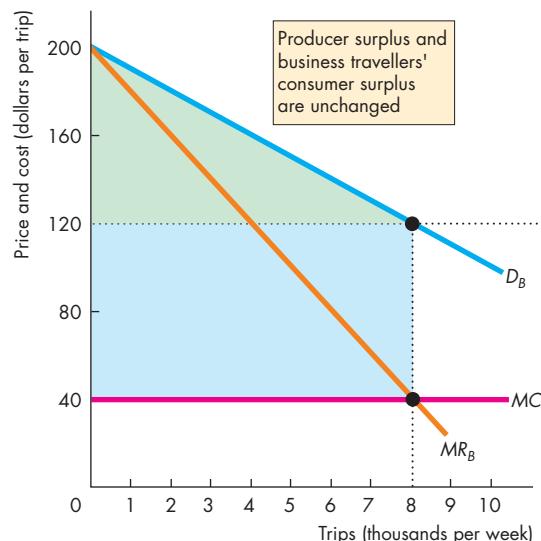
Inter-City digs more deeply into its survey results and discovers that its current customers always plan their travel less than two weeks before departure. In contrast, the people who travel by bus or car know their travel plans at least two weeks ahead of time.

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.

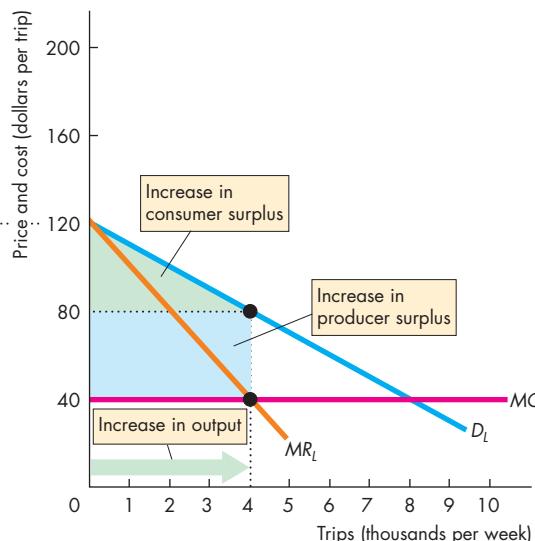
Inter-City announces its new fare schedule: no restrictions, \$120 and 14-day advance purchase, \$80. Inter-City increases its passenger count by 50 percent and increases its producer surplus by \$160,000.

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.

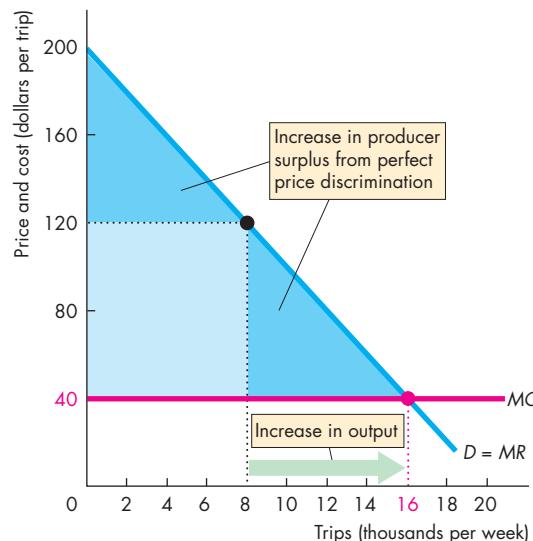
With marginal revenue equal to price, Inter-City can obtain even greater producer surplus by increasing output up to the point at which price (and marginal revenue) equals marginal cost.

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.

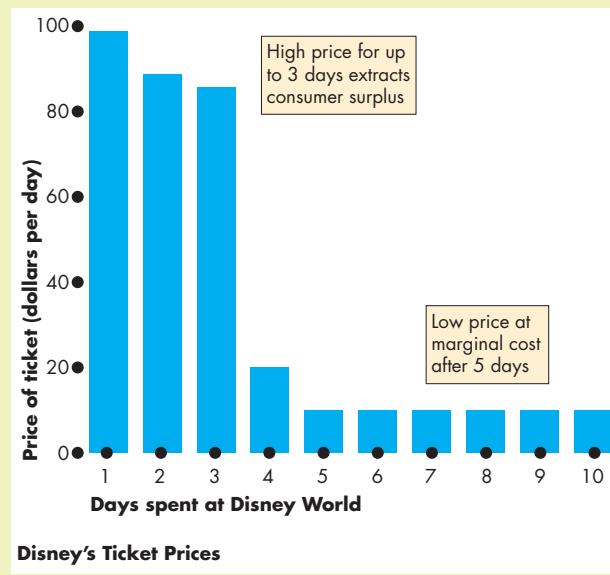
We next study some key monopoly policy issues.

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.

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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.

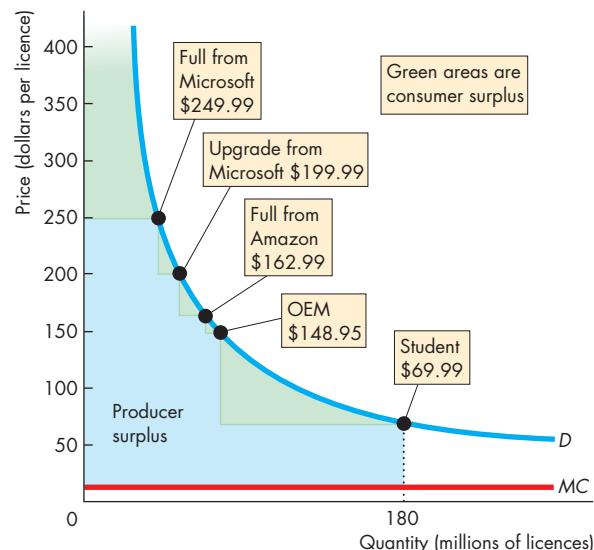
THE QUESTIONS

- 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.

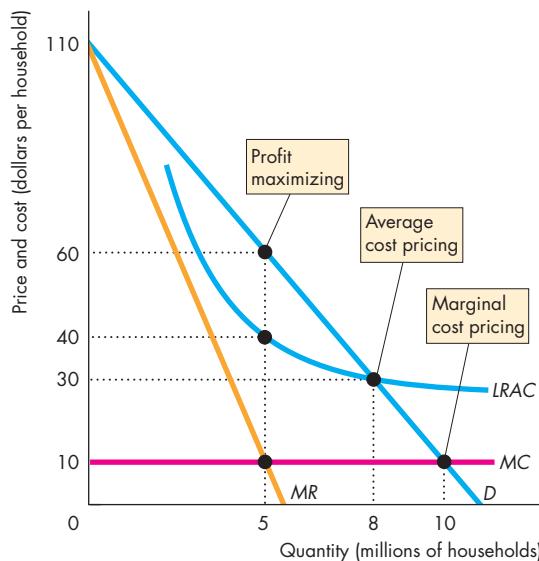
How can Shaw be regulated to produce the efficient quantity of cable TV service? The answer is by being regulated to set its price equal to marginal cost, known as the **marginal cost pricing rule**. The quantity demanded at a price equal to marginal cost is the efficient quantity—the quantity at which 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:

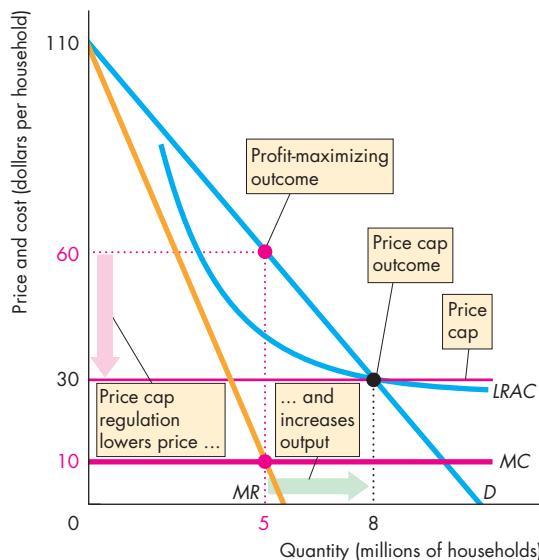
- Rate of return regulation
- Price cap regulation

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

- 1 What is the pricing rule that achieves an efficient outcome for a regulated monopoly? What is the problem with this rule?
- 2 What is the average cost pricing rule? Why is it not an efficient way of regulating monopoly?
- 3 What is a price cap? Why might it be a more effective way of regulating monopoly than rate of return regulation?
- 4 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.

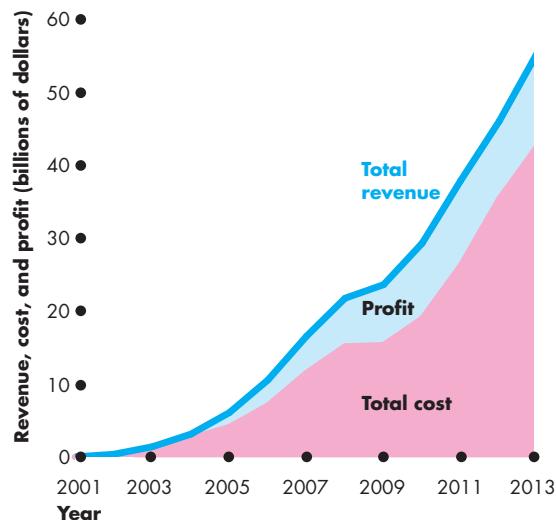


Figure 1 Google's Revenue, Cost, and Profit

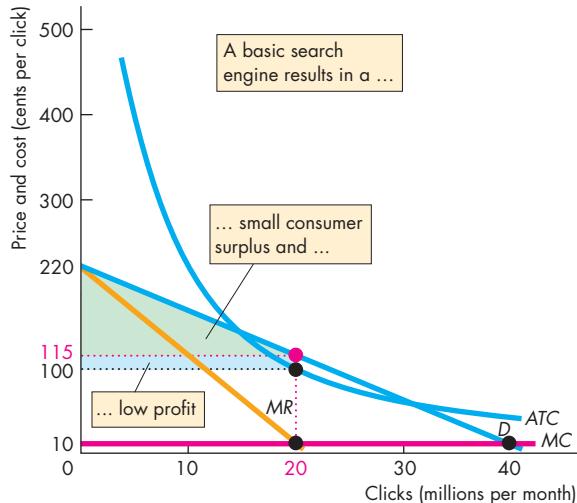


Figure 2 Basic Search Engine

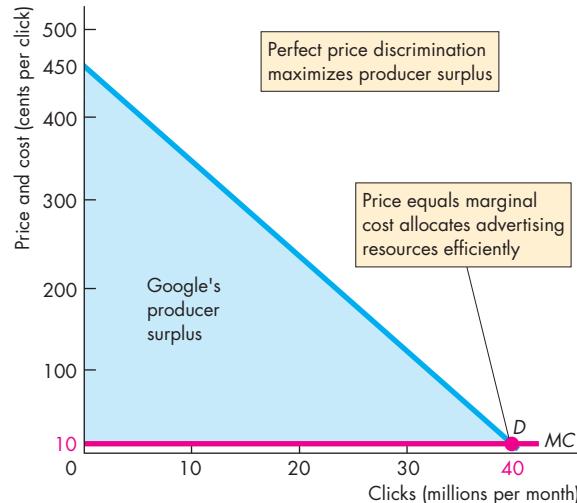


Figure 3 Google with AdWords and Other Features

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	

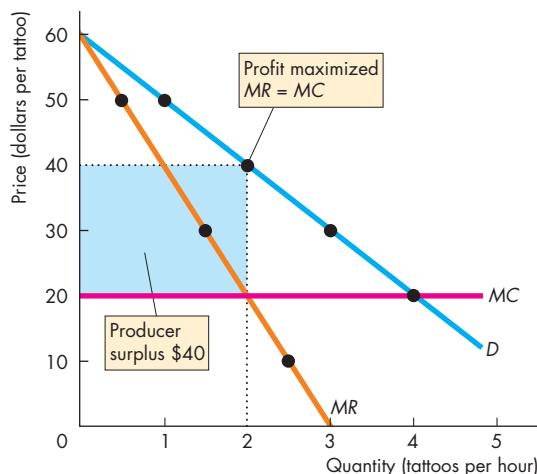
\$10). So this quantity maximizes profit. The highest price of a tattoo at which 2 tattoos per hour can be sold is \$40, so total revenue is \$80. Total cost is \$70, so economic profit is \$10. $TFC (TC \text{ at zero output}) = \30 , so $TVC = \$40$ and producer surplus = $TR - TVC = \$40$.

Key Point: Profit is maximized when marginal cost equals marginal revenue.

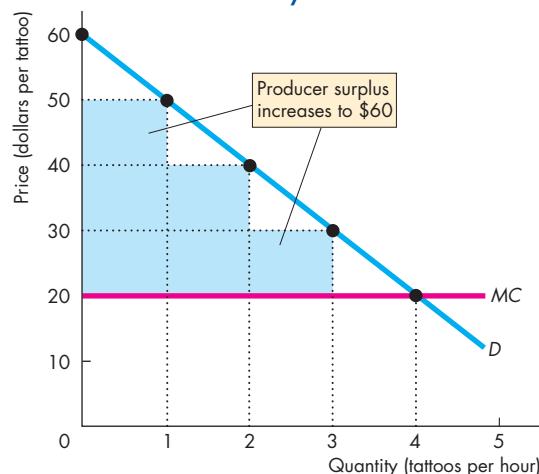
- If Tanya can perfectly price discriminate, she produces 4 tattoos per hour and sells one for \$50, one for \$40, one for \$30, and one for \$20. Total revenue is \$140 per hour. Total cost is \$110 per hour, so economic profit is \$30 per hour. Producer surplus = $TR - TVC$, which is $\$140 - \$80 = \$60$ 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.

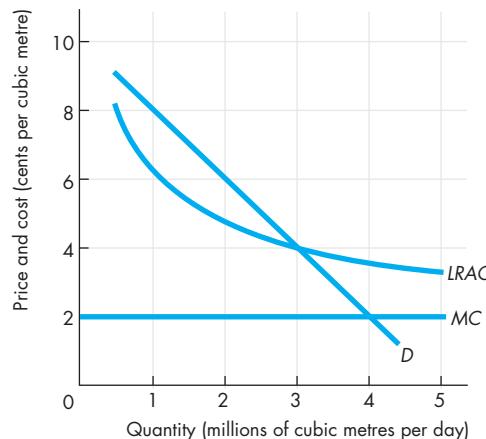
- Is Minnie's an efficient producer of water? Explain your answer.
- Suppose that new wells were discovered nearby to Minnie's and Minnie's faced competition from new producers. Explain what would happen to Minnie's output, price, and profit.

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

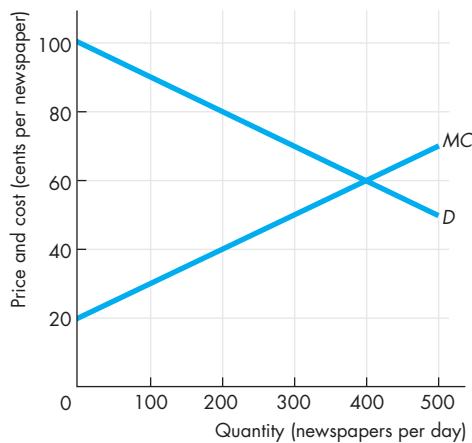
Use the following information to work Problems 12 to 16.

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, 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.

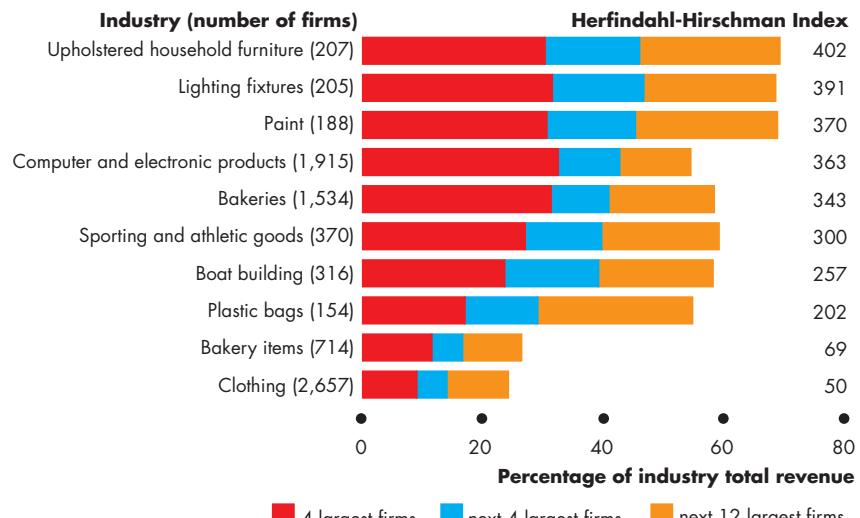
Price Because of product differentiation, a firm in monopolistic competition faces a downward-sloping demand curve. So, like a monopoly, the firm can set both its price and its output. But there is a tradeoff between the product's quality and price. A firm that makes a high-quality product can charge 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.

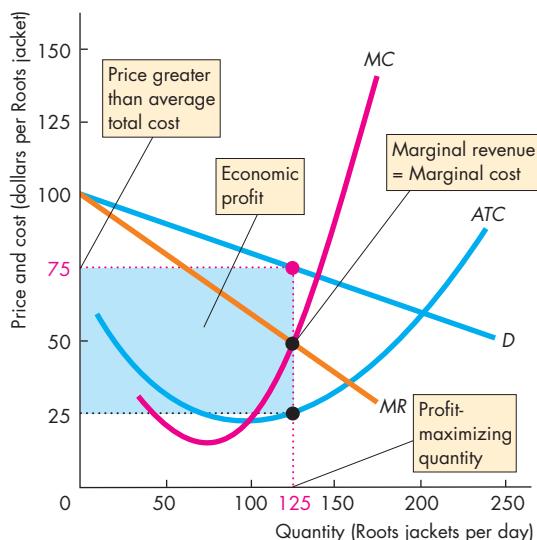
The demand curve for Roots jackets is D . This demand curve tells us the quantity of Roots jackets demanded at each price, given the prices of other jackets. It is not the demand curve for jackets in general.

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.

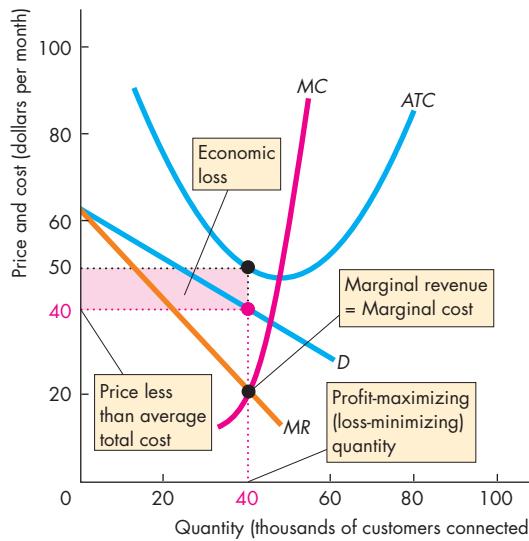
Profit Maximizing Might Be Loss Minimizing

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.

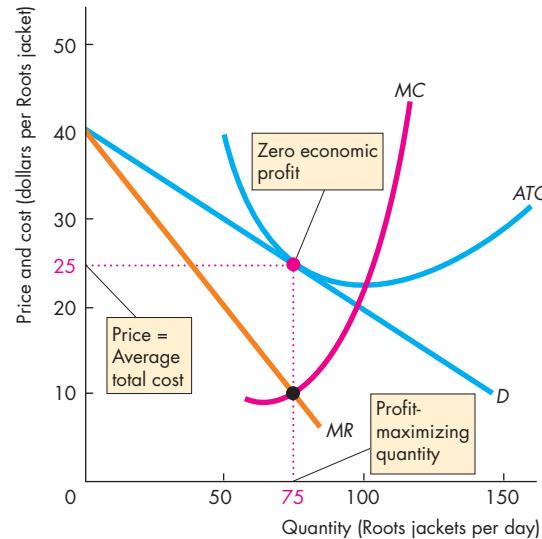
Long Run: Zero Economic Profit

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

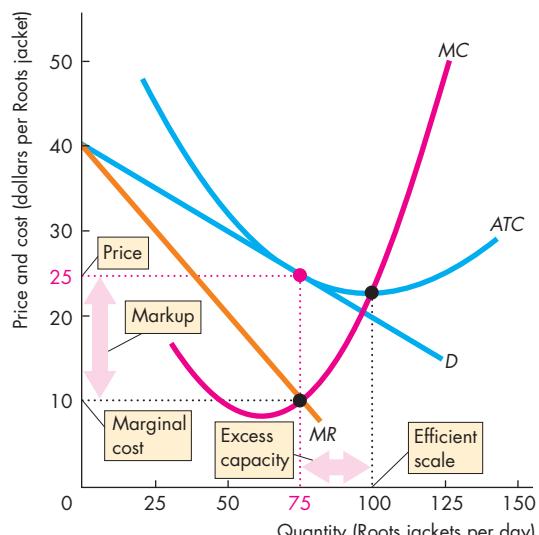
Figure 14.4 compares monopolistic competition and perfect competition and highlights two key differences between them:

- 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*.

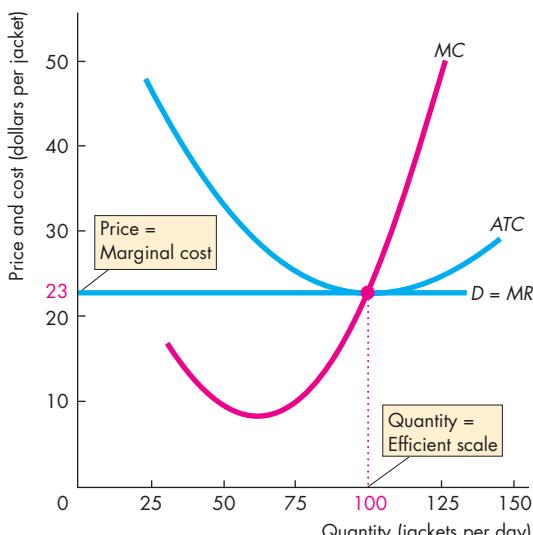
You can see the excess capacity in monopolistic competition all around you. Family restaurants (except for the truly outstanding ones) almost always have some empty tables. You can always get a pizza delivered in less than 30 minutes. It is rare that every pump at a gas station is in use with customers 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.

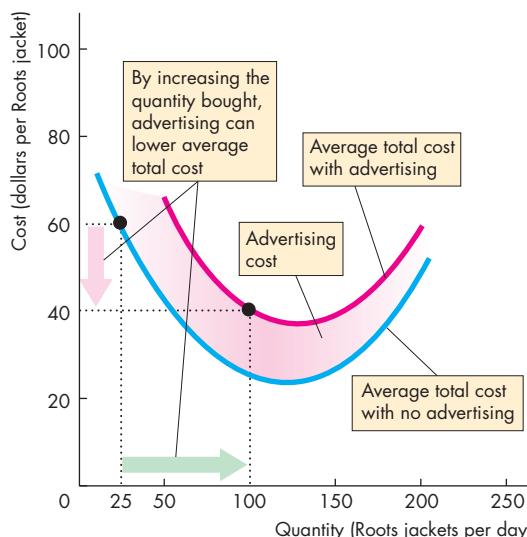


Selling Costs and Total Cost Selling costs are fixed costs and they increase the firm's total cost. So like the fixed cost of producing a good, advertising costs per unit decrease as the quantity produced increases.

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

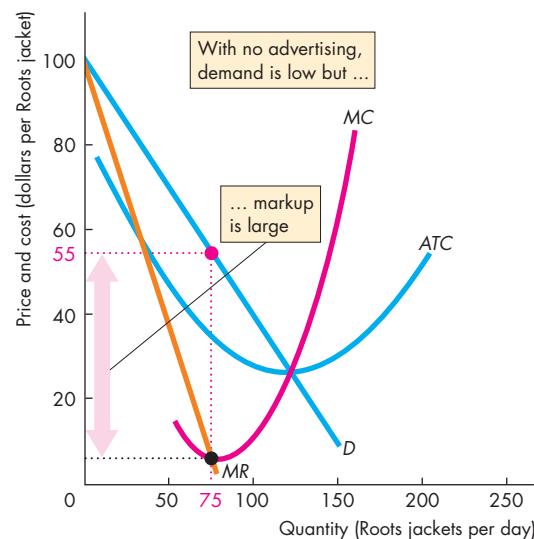
maximized at 75 jackets per day, and the markup is large. In part (b), advertising, which is a fixed cost, increases average total cost from ATC_0 to ATC_1 but leaves marginal cost unchanged at MC . Demand becomes much more elastic, the profit-maximizing quantity increases, and the markup shrinks.

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?

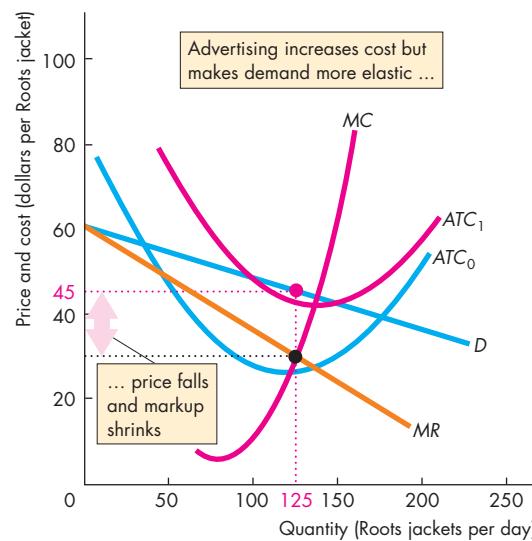
One answer is that advertising is a signal to the consumer of a high-quality product. A **signal** is an action taken by an informed person (or firm) to send a message to uninformed people. Think about two colas:

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.

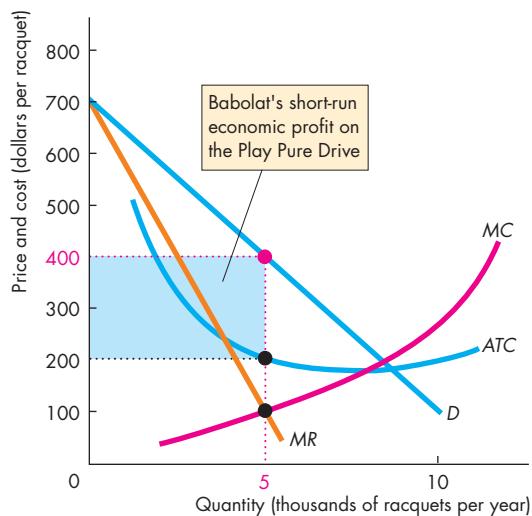


Figure 1 Economic Profit in the Short Run

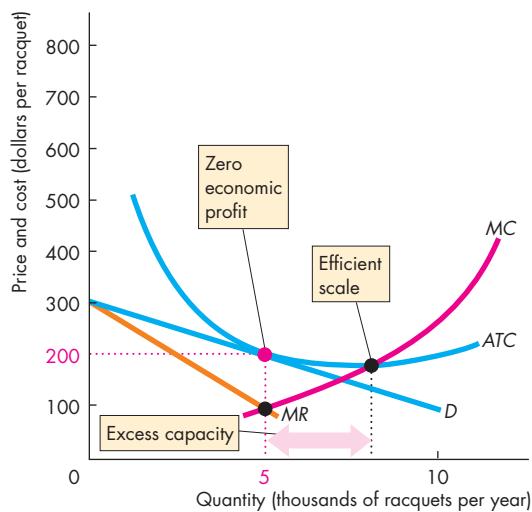


Figure 2 Zero Economic Profit in the Long Run

- 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.

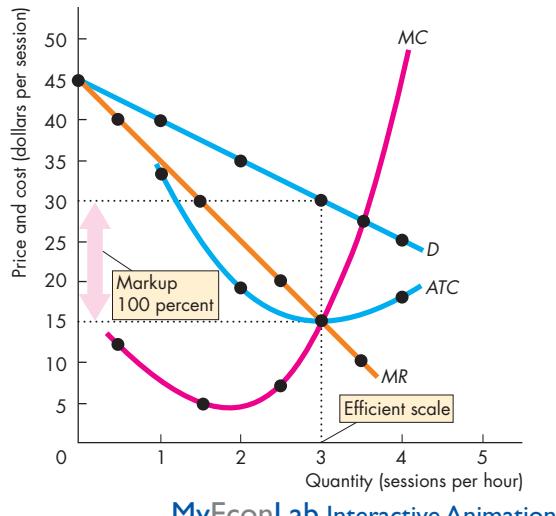
Key Point: Markup is the amount by which price exceeds marginal cost; and excess capacity is the gap between output and the efficient scale.

- 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)

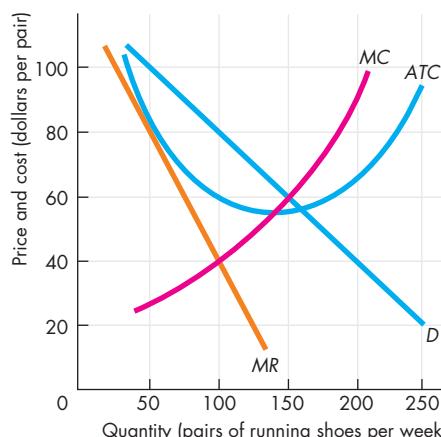
Use the following information to work Problems 3 and 4.

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.

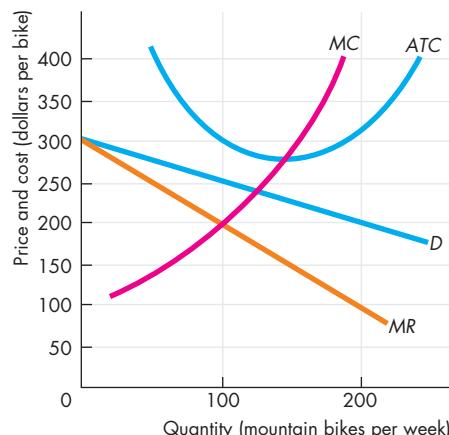
Lorie teaches singing. Her fixed costs are \$1,000 a month, and it costs her \$50 of labour to give one class. The table shows the demand schedule for Lorie's singing lessons.

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

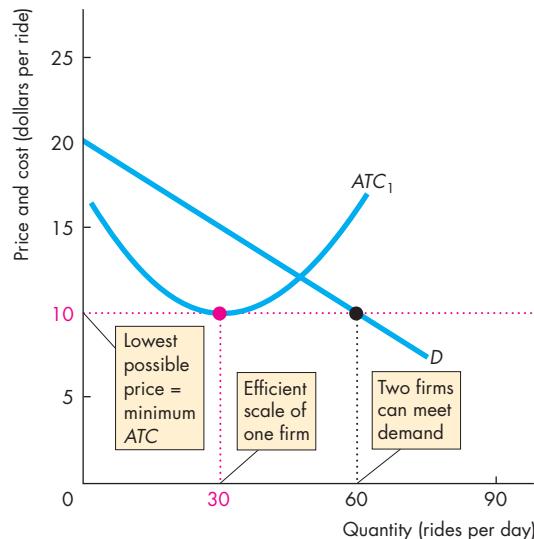
total cost curve of a taxi company is ATC_1 in part (a), the market is a natural **duopoly**—an oligopoly market with two firms. You can probably see some examples of duopoly where you live. Some cities have only two taxi companies, two car rental firms, two copy centres, or two college bookstores.

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.

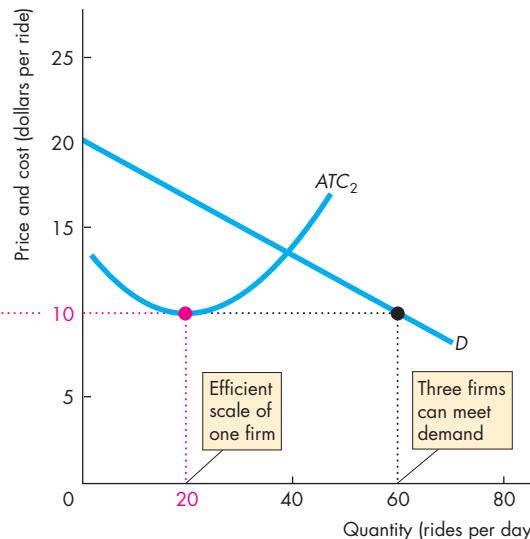
A legal oligopoly arises when a legal barrier to entry protects the small number of firms in a market. A city might license two taxi firms or two bus companies, for example, even though the combination of demand and economies of scale leaves room for more than two firms.

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.

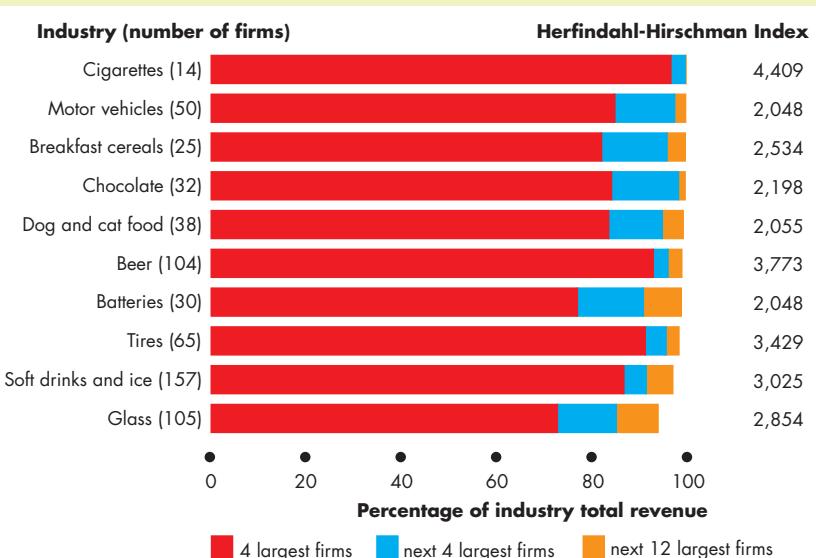
Economics in Action

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.

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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:

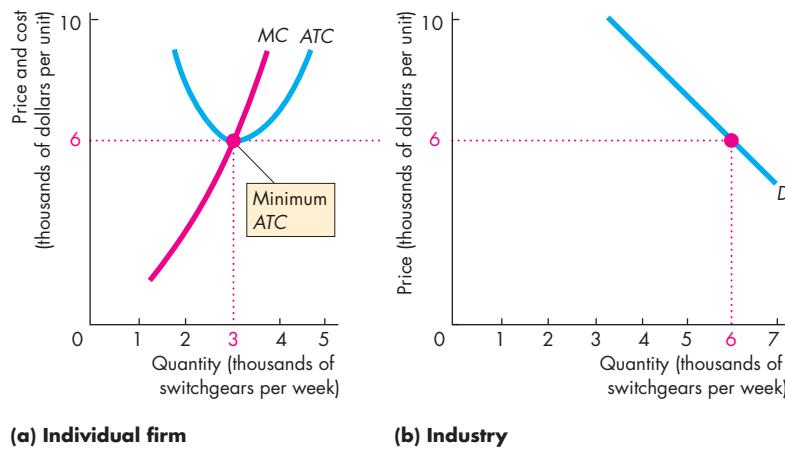
- Comply
- Cheat

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.

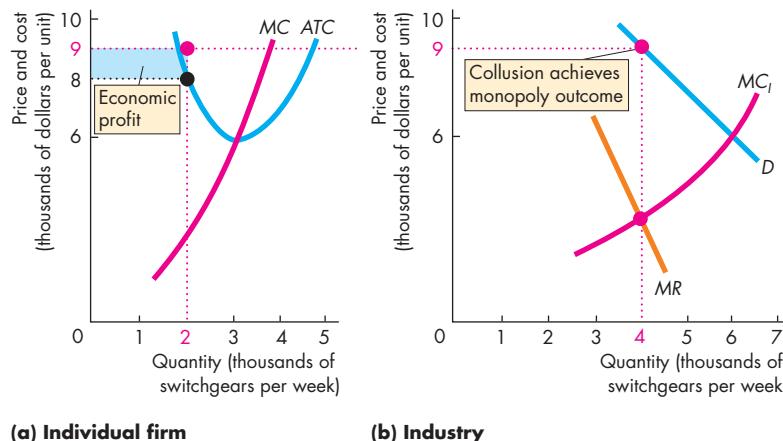
To hold the price at \$9,000 a unit, production must be 4,000 units a week. So Trick and Gear must agree on output rates for each of them that total 4,000 units a week. Let's suppose that they agree to split the market equally so that each firm produces 2,000 switchgears a week. Because the firms are 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

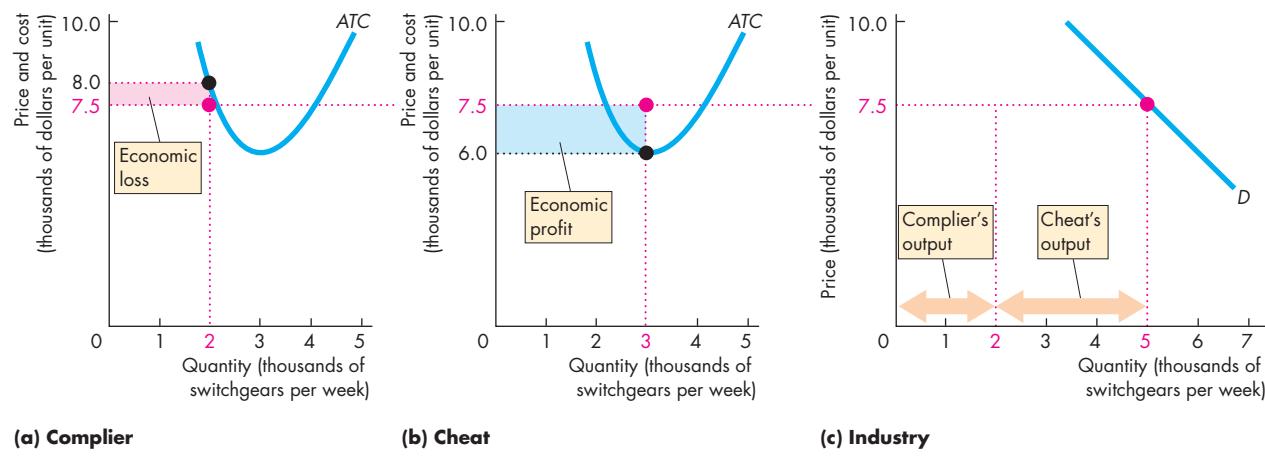
of \$7,500, Trick makes a profit of \$1,500 a unit and therefore an economic profit of \$4.5 million. This economic profit is the blue rectangle in part (b).

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.

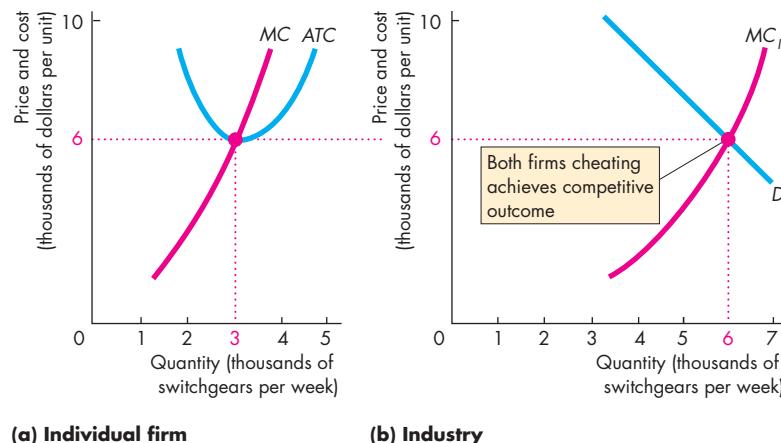
The Payoff Matrix Now that we have described the strategies and payoffs in the duopoly game, we can summarize the strategies and the payoffs in the form of the game's payoff matrix. Then we can find the Nash equilibrium.

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.

MyEconLab Animation

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

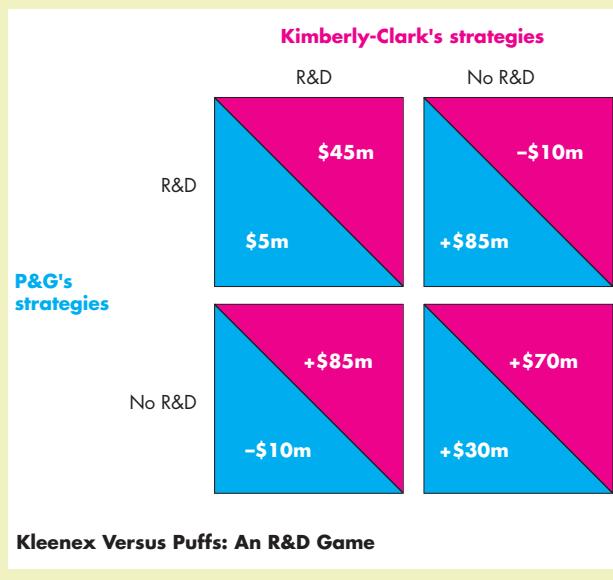
Anti-Viral Kleenex and Puffs Plus Lotion didn't get developed because Kimberly-Clark (Kleenex) and P&G (Puffs) were thinking about helping you cope with a miserable cold. These new-style tissues and other innovations in the quality of facial tissues are the product of a costly research and development (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.

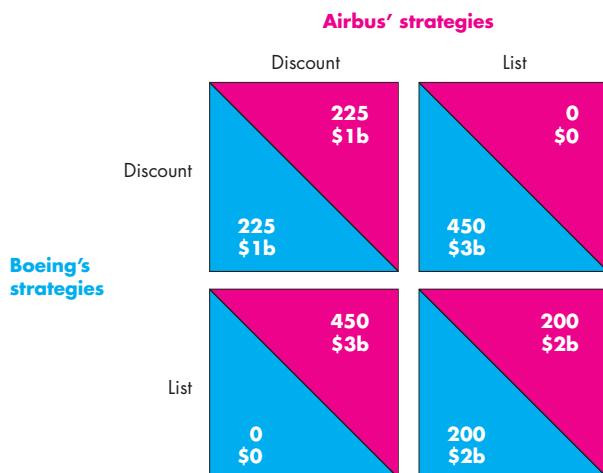
THE QUESTIONS

- 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.

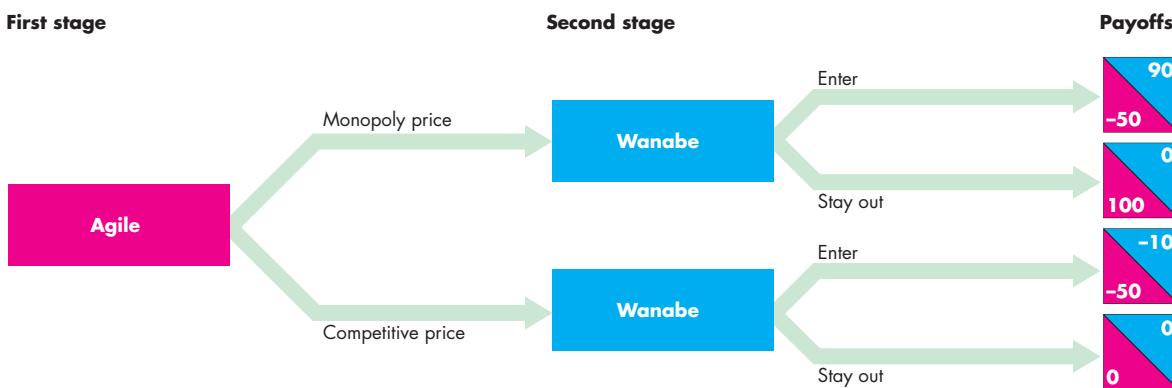
At the second stage, Wanabe must decide whether to enter or to stay out. Customers have no loyalty (there are no frequent-flyer programs) and they buy from the lowest-price firm. So if Wanabe enters, it sets a price just below Agile's and takes all the business.

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.

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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.

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

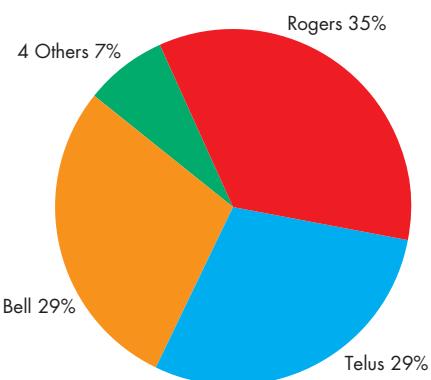


Figure 1 Market Shares in Cellphone Service

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, 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.

10. Construct a payoff matrix for the game that Bud and Wise must play.

11. 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	1
	Don't enter	10	5
		0	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.

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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 CO₂ and Temperature Trends

Figure 2 shows the global trends in carbon dioxide (CO₂) concentration and temperature.

Both trends are starkly upward. CO₂ 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 CO₂ trend. There is more uncertainty about the effect of the increase in CO₂ on global temperature, but the consensus is that the effect is significant.

Stopping the rising CO₂ 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.

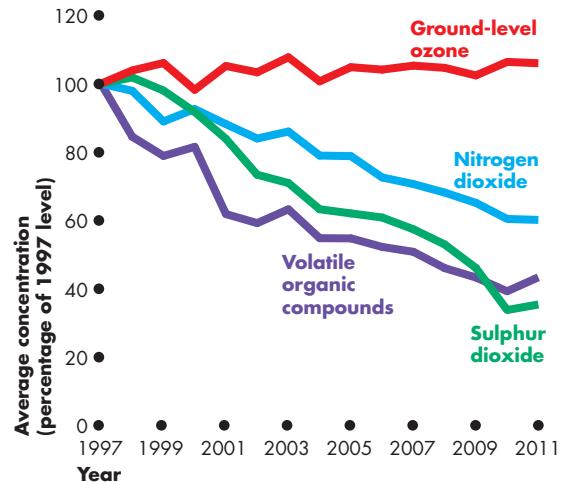


Figure 1 Canadian Air Pollution Trends

Source of data: Environment Canada.



Los Angeles still has a smoggy dawn on some days

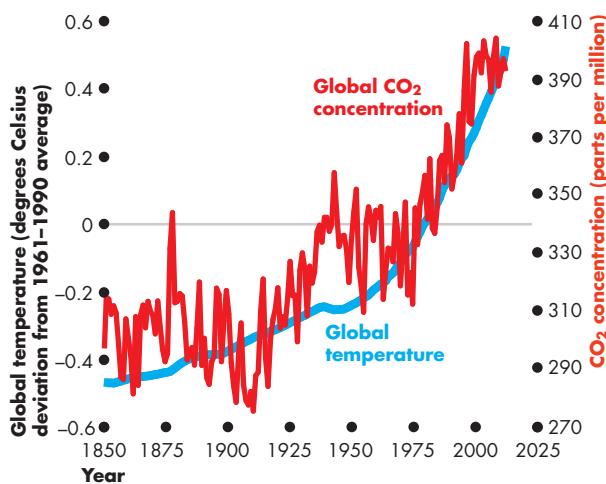


Figure 2 Global Warming Trends

Sources of data: Temperature: Met Office Hadley Centre (combined land and oceans); CO₂: 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,

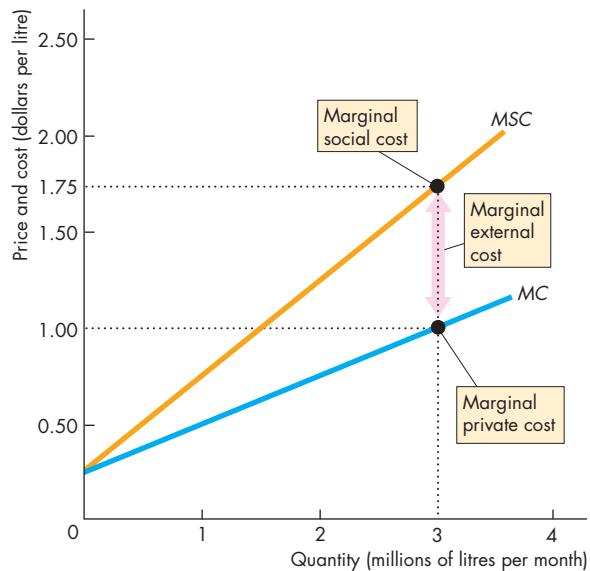
$$MSC = MC + \text{Marginal external cost}.$$

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.

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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.

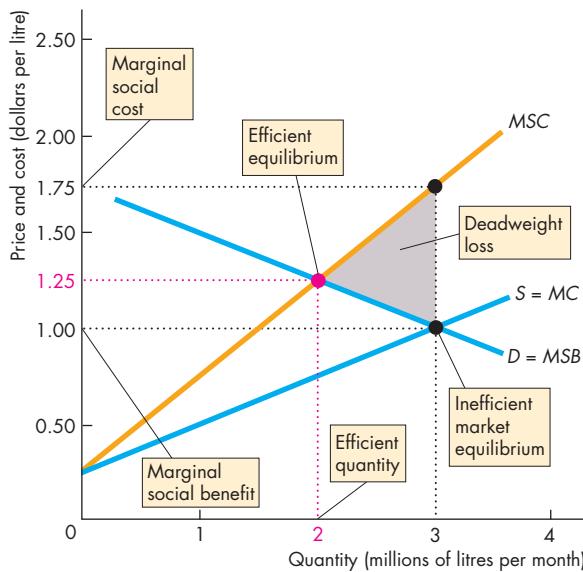
The marginal social cost curve, *MSC*, is found by adding marginal external cost to marginal private cost. So a point on the *MSC* curve shows the sum of the marginal private cost and marginal external cost at a given level of output.

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.

MyEconLab Animation and Draw Graph

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.

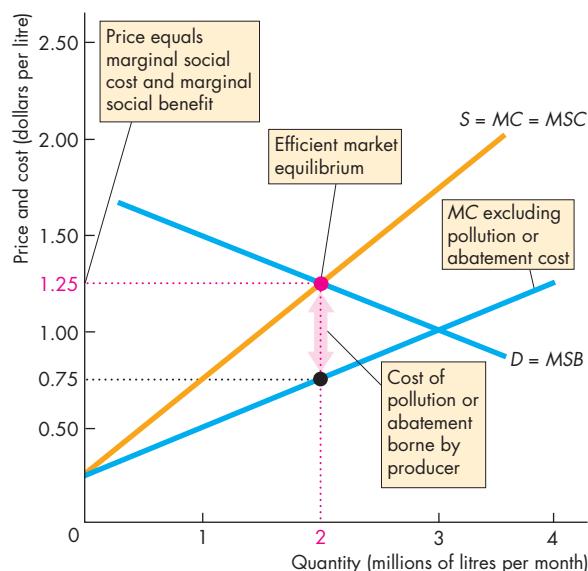
Produce Less and Pollute Less An alternative to incurring the cost of using an abatement technology is to use the polluting technology but cut production, reduce pollution, and get a higher income from renting homes by the river. The decision turns on cost: Firms will choose the least-cost alternative.

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.

MyEconLab Animation

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.

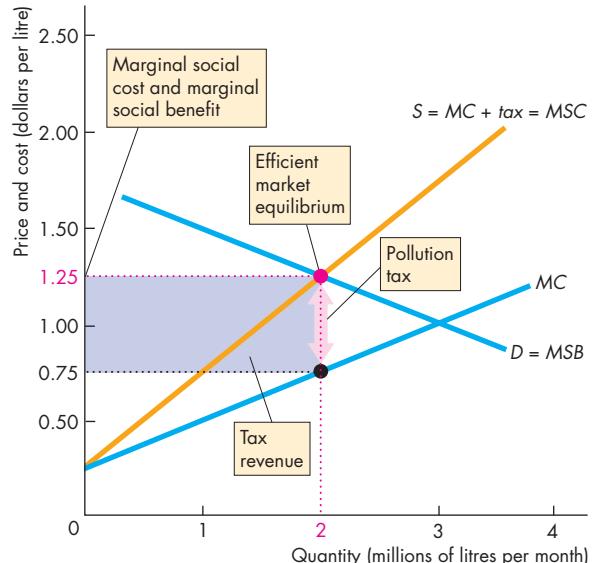
By setting the tax equal to the marginal external cost (or marginal abatement cost if it is lower), firms can be made to behave in the same way as they would if they bore the cost of the externality directly.

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.

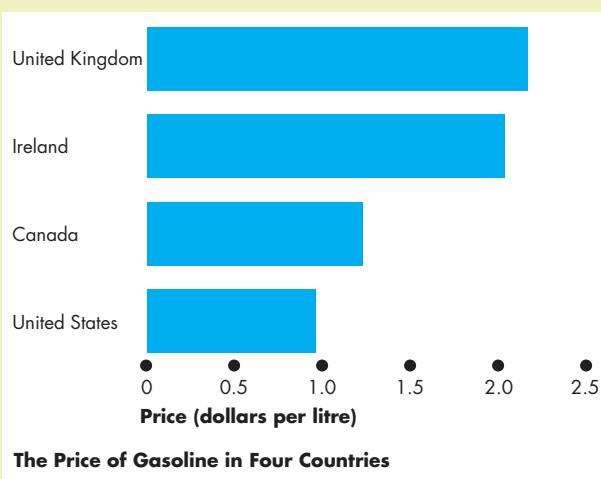
Ireland's Carbon Tax

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 CO₂ 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 CO₂ 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).

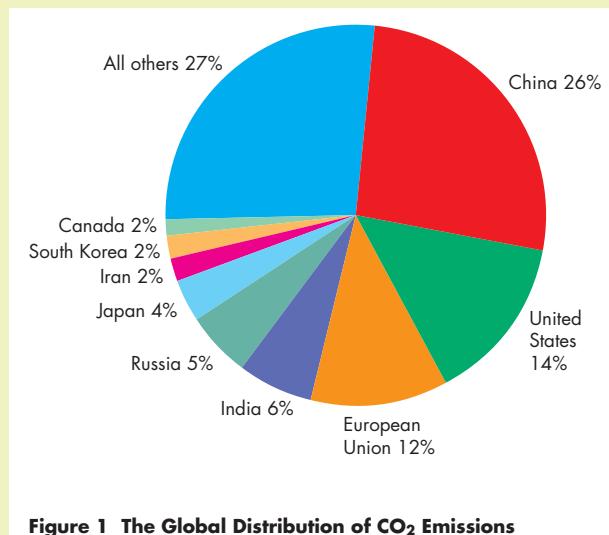


Figure 1 The Global Distribution of CO₂ Emissions

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 CO₂ 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.

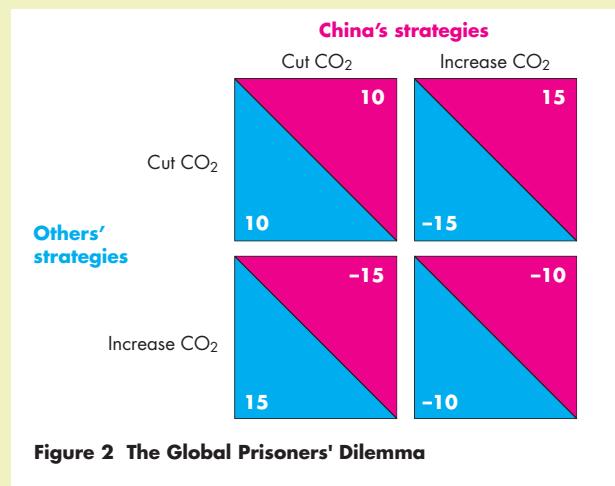


Figure 2 The Global Prisoners' Dilemma

REVIEW QUIZ

- What is the distinction between private cost and social cost?
- How do external costs prevent a competitive market from allocating resources efficiently?
- How can external costs be eliminated by assigning property rights?
- 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.

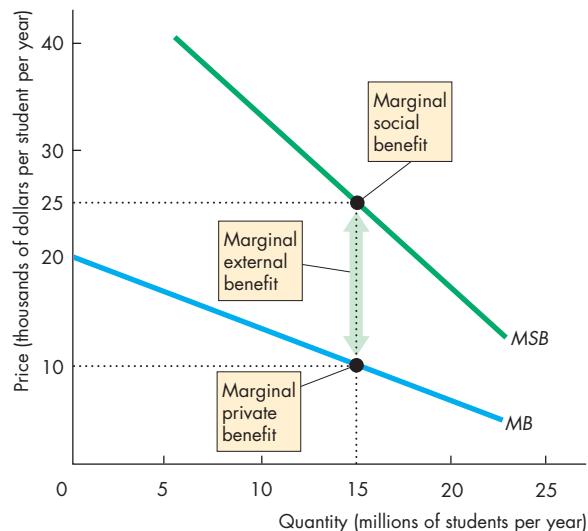
Marginal social benefit (MSB) is the marginal benefit enjoyed by society—by the consumer of a good or service (marginal private benefit) and by others (the marginal external benefit). That is,

$$MSB = MB + \text{Marginal external benefit.}$$

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



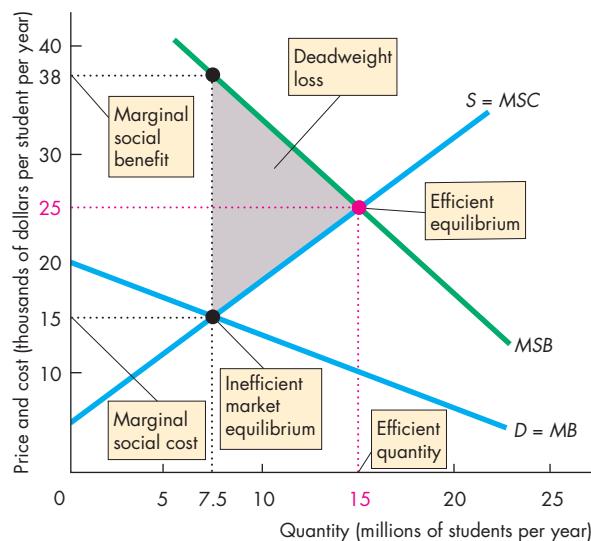
The MB curve shows the marginal private benefit enjoyed by the people who receive a university education. The MSB curve shows the sum of marginal private benefit and marginal external benefit. When 15 million students attend university, the marginal private benefit is \$10,000 per student, the marginal 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.

MyEconLab Animation and Draw Graph

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:

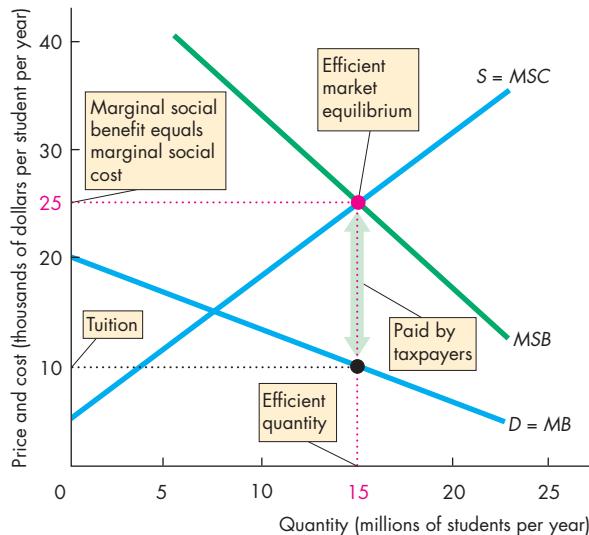
- Public production
- Private subsidies
- Vouchers
- Patents and copyrights

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.

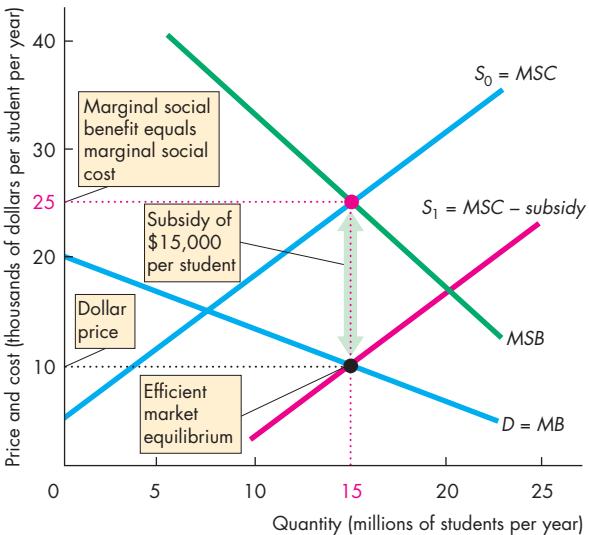
FIGURE 16.7 Public Production to Achieve an Efficient Outcome



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.

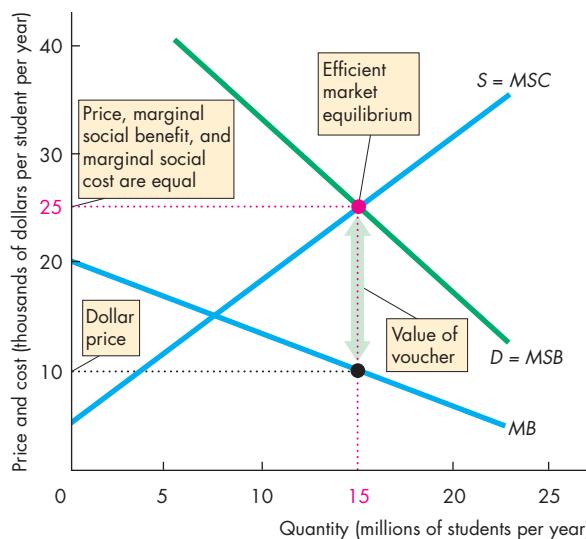
Figure 16.8 shows how a subsidy to private universities would work. In the absence of a subsidy, the market supply curve is $S_0 = MSC$. The demand curve is the marginal private benefit curve, $D = MB$. If the government provides a subsidy of \$15,000 per student per year, we must subtract the subsidy 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.

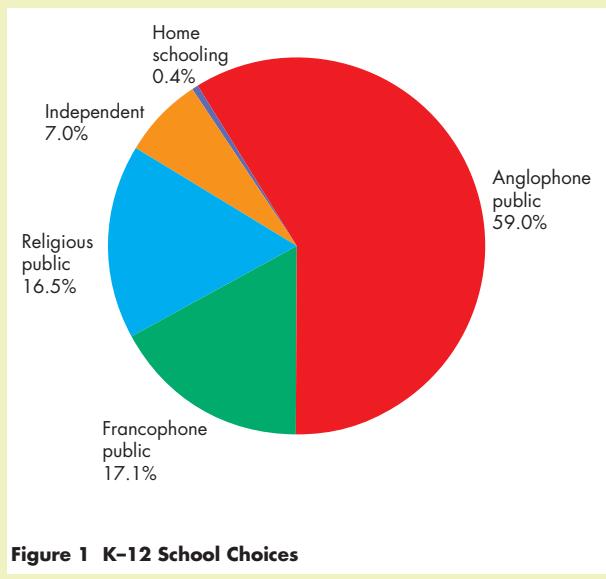
Today, around 4,000 charter schools in 40 U.S. states are teaching more than 1 million students. Are charter schools succeeding? Success has two dimensions: educational standards attained and cost per

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.

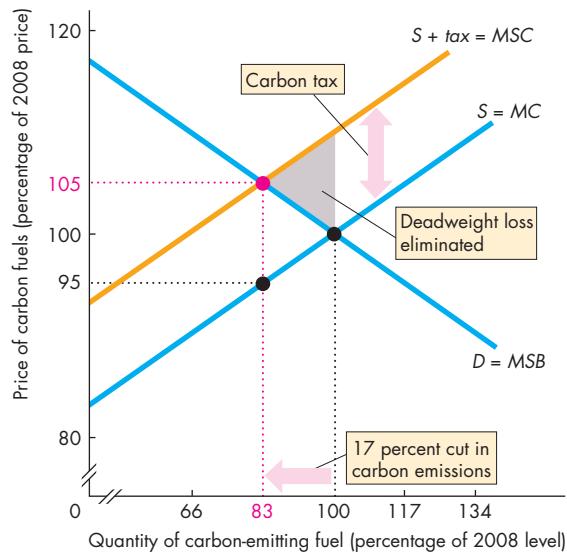


Figure 1 Carbon Tax Cuts Emissions

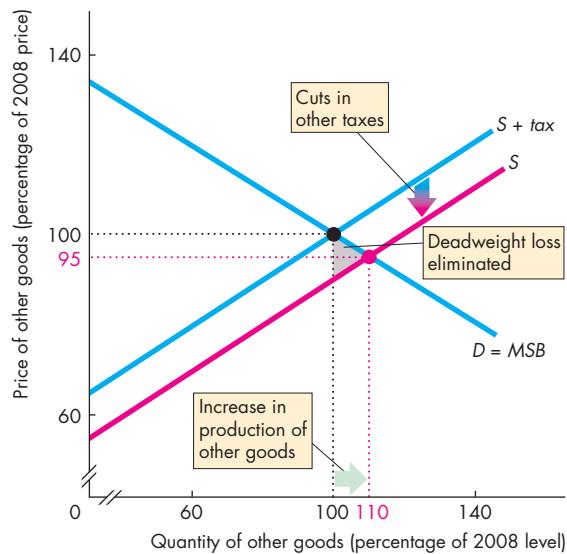


Figure 2 Cuts in Other Taxes Expand Production of Other Goods

- 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).

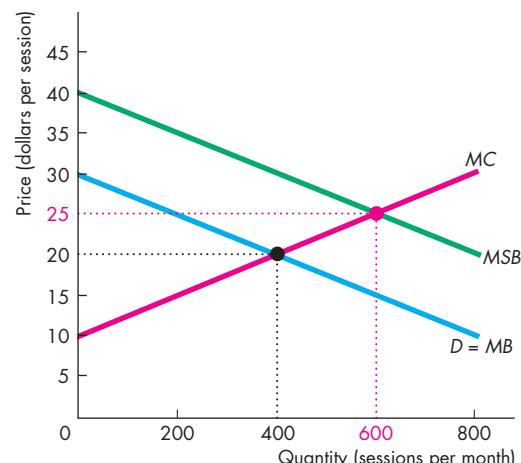
The table below combines the data from the other two tables.

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.

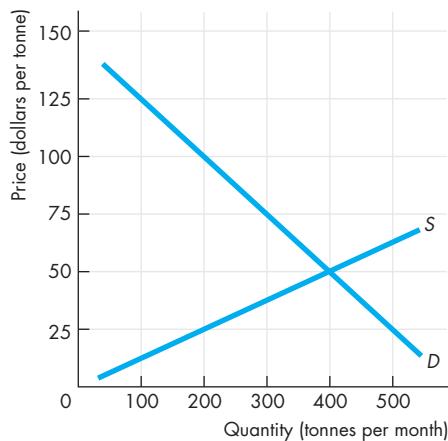
Externalities in Our Lives (Study Plan 16.1)

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

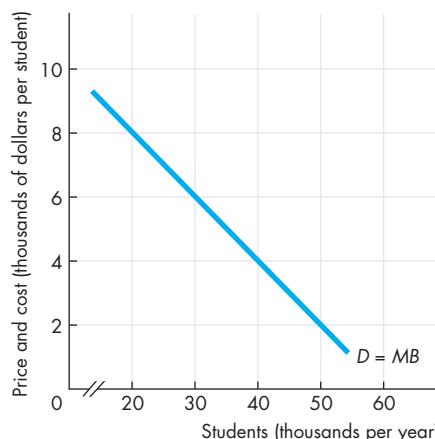
Gridlock costs Toronto \$6 billion a year, with average commutes of 80 minutes. By 2031, an additional 27 minutes will be added to the daily grind. Civic leaders are looking at road tolls, a regional gas tax, and parking levies.

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.

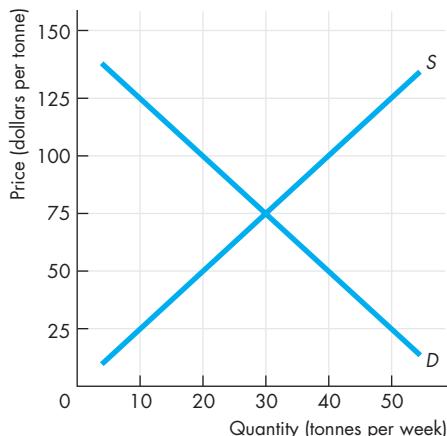
Externalities in Our Lives

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.

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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.

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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.

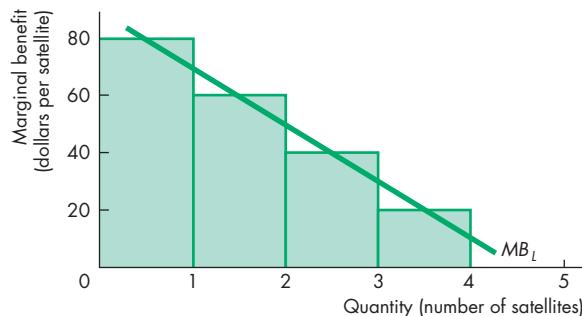
Marginal Social Benefit from a Public Good

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.

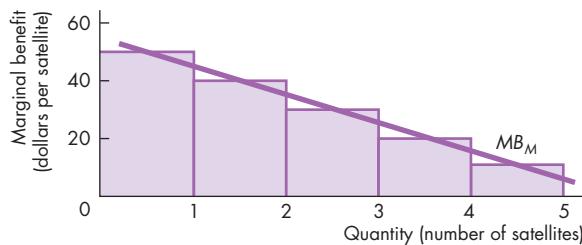
Figure 17.2(c) shows the marginal *social* benefit curve, MSB . Because everyone gets the same quantity of a public good, its marginal social benefit curve is the sum of the marginal benefits of all individuals at each quantity—it is the *vertical* sum of the individual MB curves. So the MSB curve in 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).

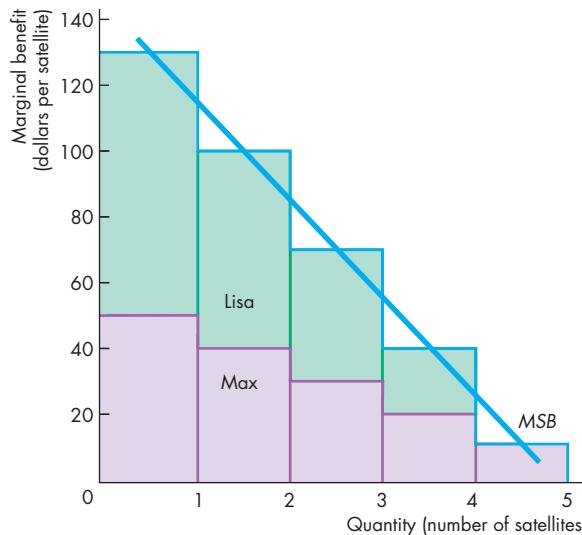
FIGURE 17.2 Benefits of a Public Good



(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 .

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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.)

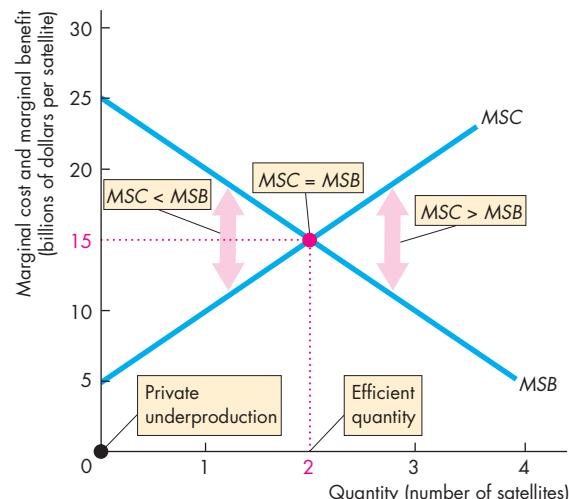
If marginal social benefit exceeds marginal social cost, as it does when fewer than 2 satellites are provided, resources can be used more efficiently by increasing the quantity. The extra benefit exceeds the extra cost. If marginal social cost exceeds marginal social benefit, as it does when more than 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.

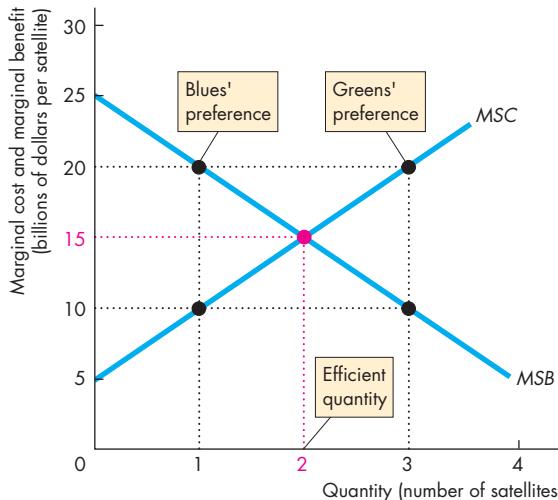
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Inc. has no revenue and so provides no satellites. Because the efficient level is 2 satellites, private provision is inefficient.

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.

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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.

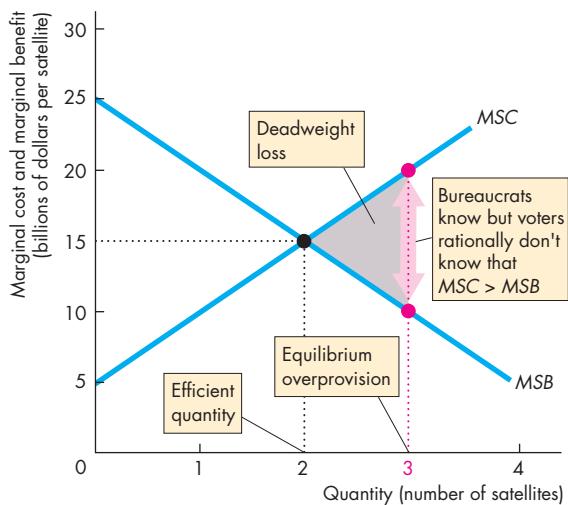
For the political process to deliver the efficient outcome that you've just seen, voters must be well informed, evaluate the alternatives, and vote in the election. Political parties must be well informed about voter preferences. As the next section shows, we can't expect to achieve this outcome.

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

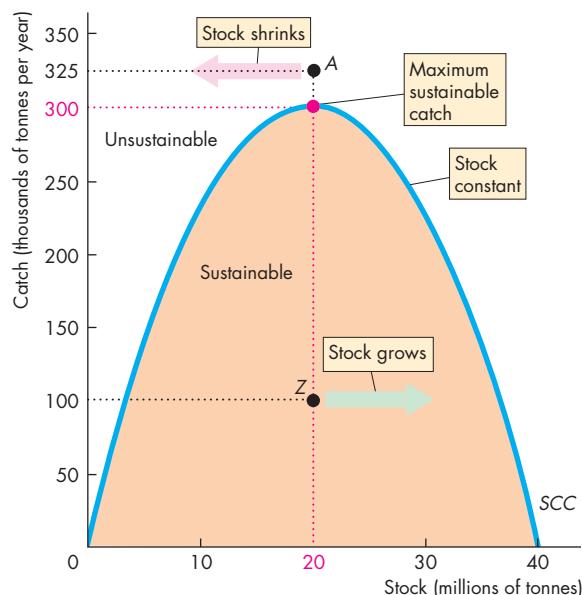
The Original Tragedy of the Commons

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.

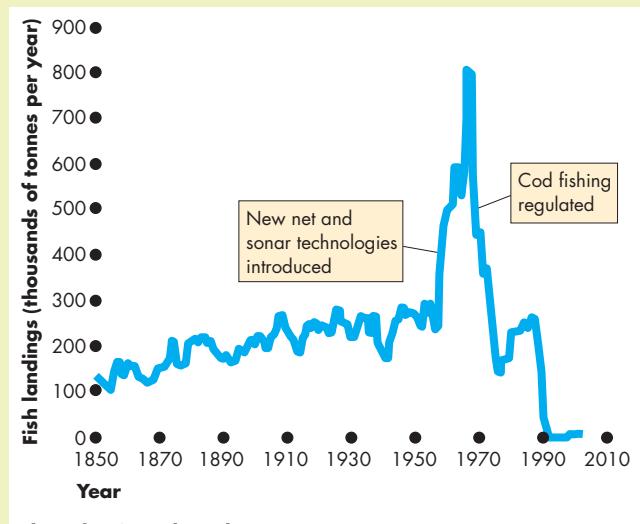
The situation changed dramatically during the 1960s with the introduction of high-efficiency nets (called trawls, seines, and gill nets), sonar technology to find fish concentrations, and large ships with efficient processing and storage facilities. These technological advances brought soaring cod harvests. 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.

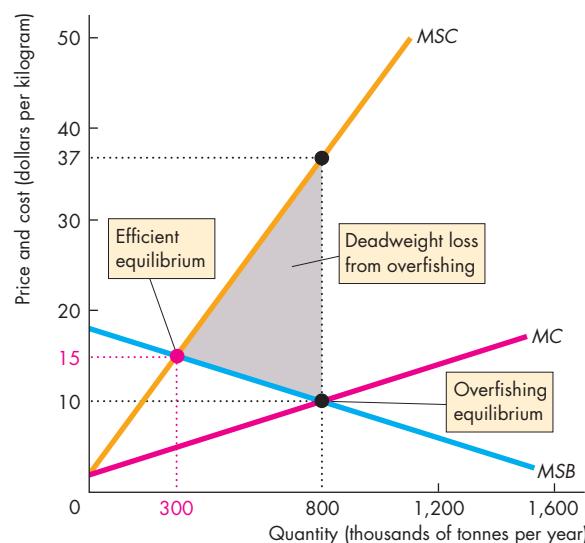
Marginal external cost also increases as the quantity of fish caught increases. If the quantity of fish caught is so large that it drives the species to near extinction, the marginal external cost becomes infinitely large.

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

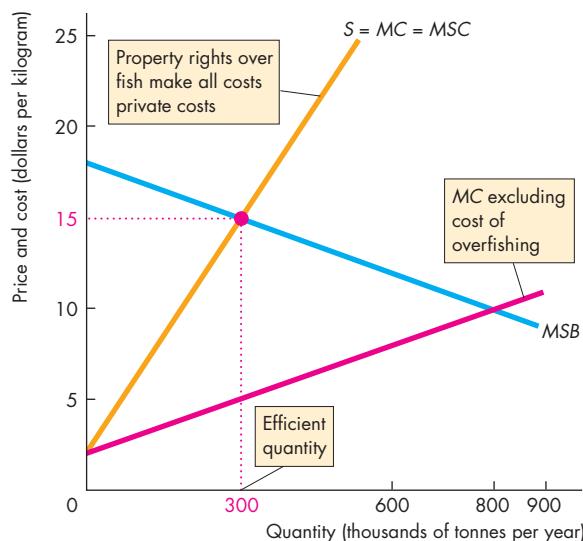
the same conditions as society faces. It doesn't matter who owns the resource.

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.

MyEconLab Animation

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.

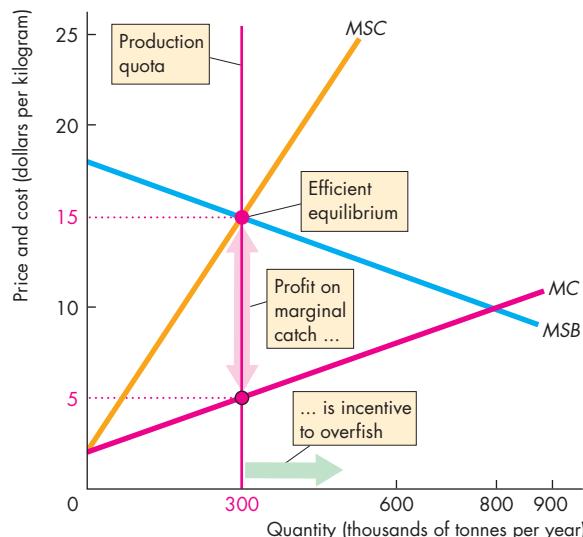
You studied the effects of a production quota in Chapter 6 (pp. 139–140) and learned that a quota can drive a wedge between marginal social benefit and marginal social cost and create deadweight loss. In that earlier example, the market was efficient without a quota. But in the case of common resources, 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.

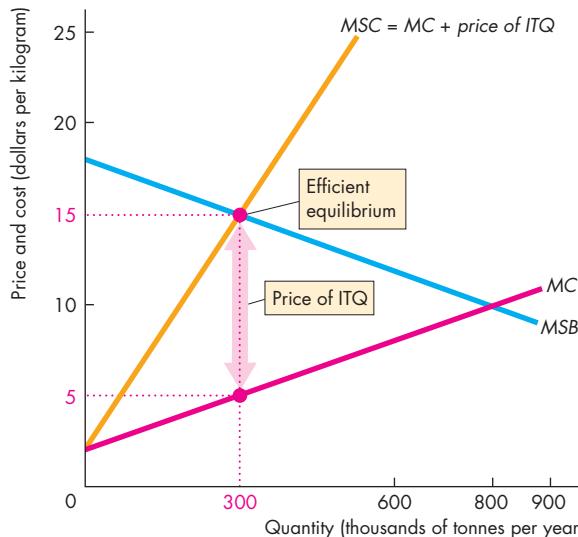
The market price of an ITQ is the highest price that someone is willing to pay for one. That price

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.

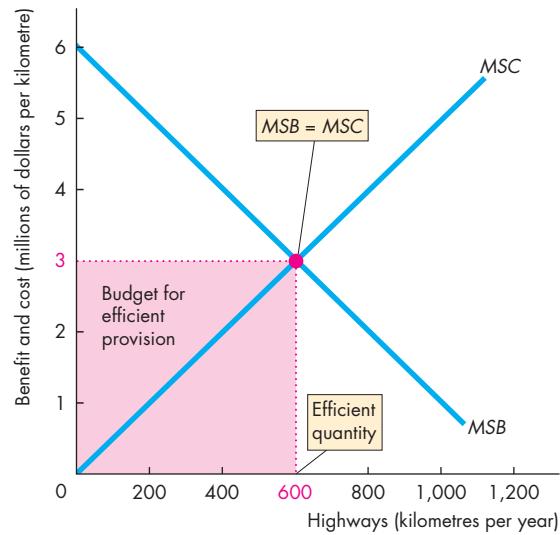


Figure 1 Efficient Provision of Highways

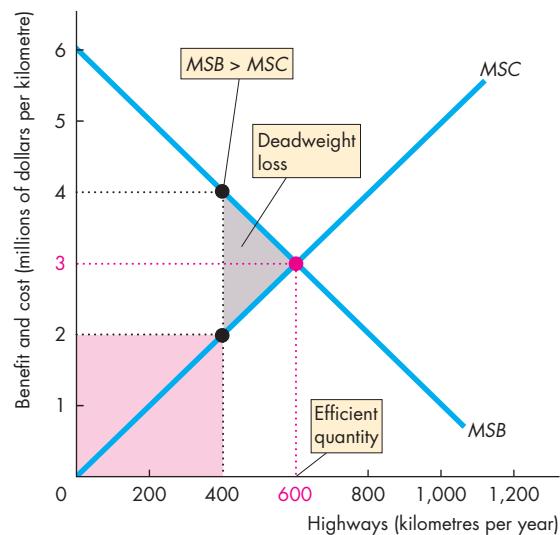


Figure 2 Inefficient Underprovision

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

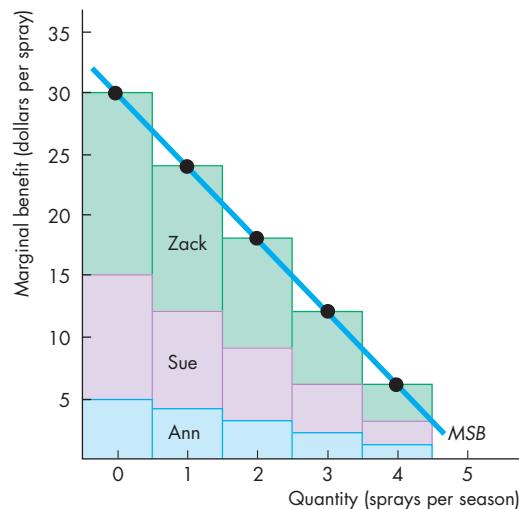


Figure 1 Marginal Social Benefit

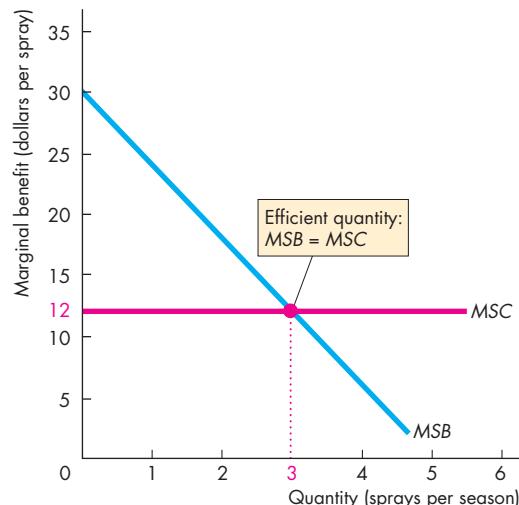


Figure 2 Efficient Quantity

◆ 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.

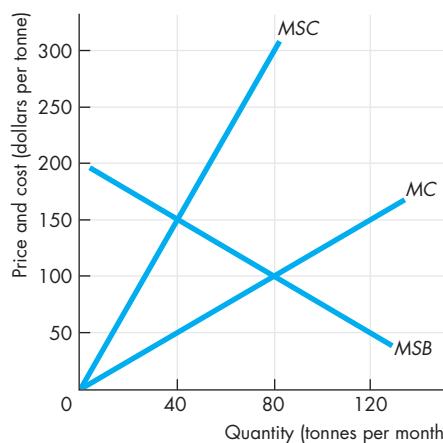
5. What quantity of spraying would a private firm provide? What is the efficient quantity of spraying? In a single-issue election on mosquito control, what quantity would the winner provide?

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.

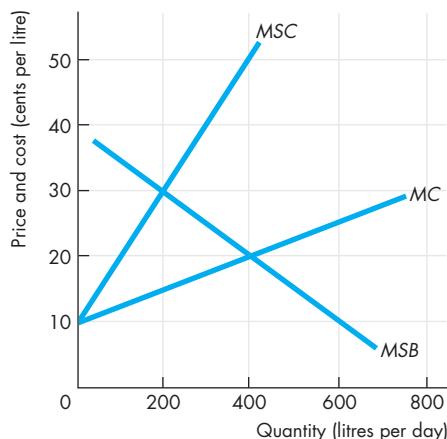
Source: *Fortune*, June 3, 2011

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.

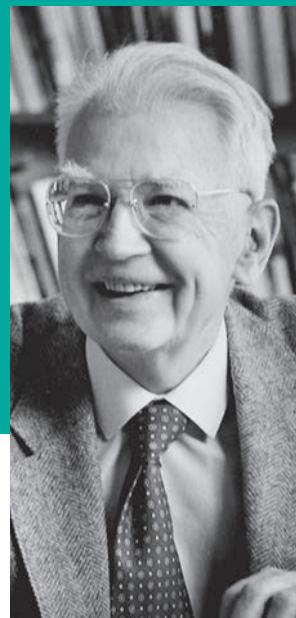
Ronald Coase (1910–2013), was born in England and educated at the London School of Economics, where he was deeply influenced by his teacher, Arnold Plant, and by the issues of his youth: communist central planning versus free markets.

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.

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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	12
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.

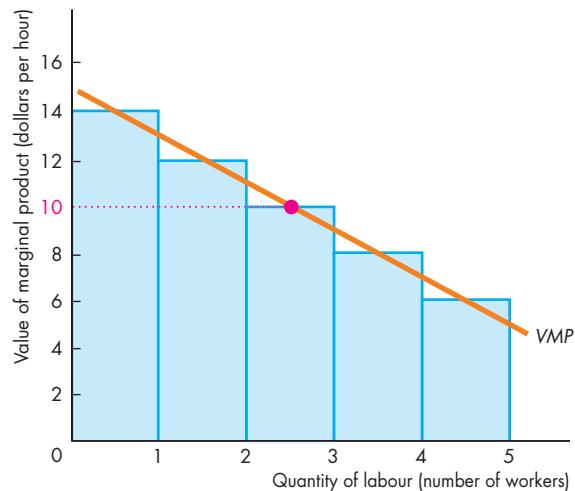
If Angelo hired 4 workers, his profit would fall. The fourth worker generates a value of marginal product of only \$8 an hour but costs \$10 an hour, so Angelo does not hire the fourth worker. When the wage rate is \$10 an hour, the quantity of labour demanded by Angelo is 3 workers.

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.

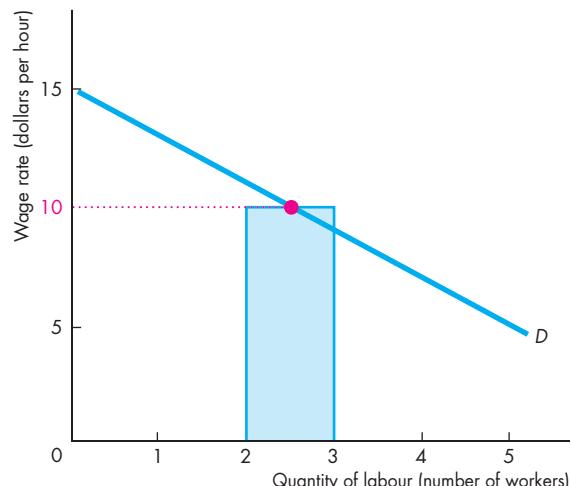
A change in the wage rate brings a change in the quantity of labour demanded and a movement along the demand for labour curve.

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.

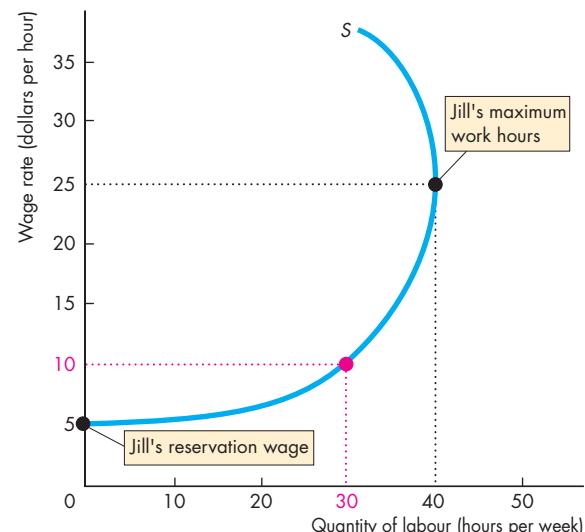
Think about the labour supply decision of Jill, one of the workers at Angelo's Bakery. Let's see how the wage rate influences the quantity of labour she is willing to supply.

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.

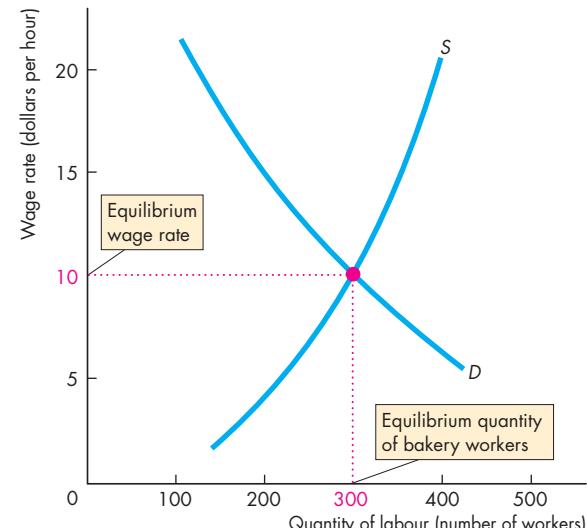
One reason why the market supply curve doesn't bend backward is that different households have different reservation wage rates and different wage rates at which their labour supply curves bend backward.

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

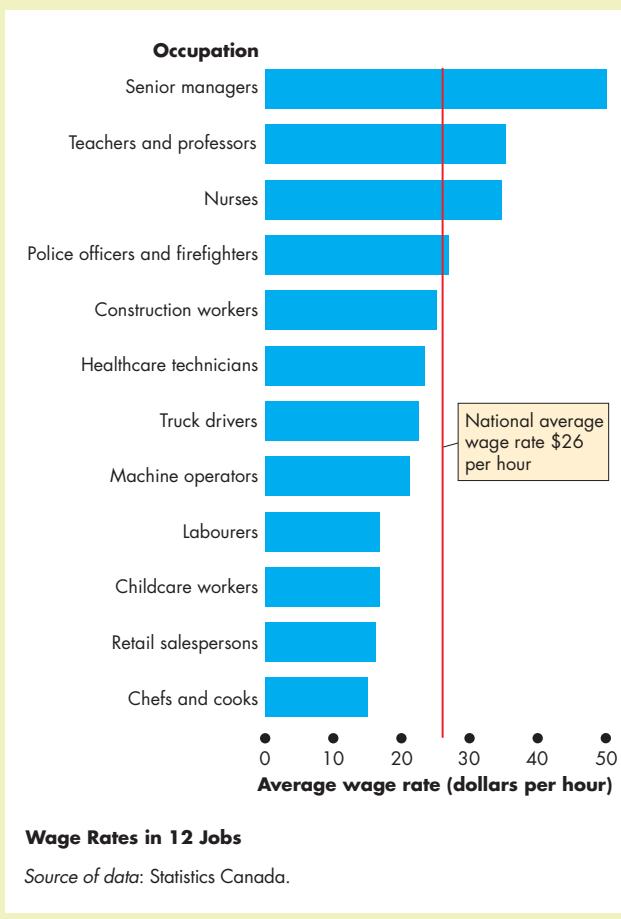
Wage Rates in Canada

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

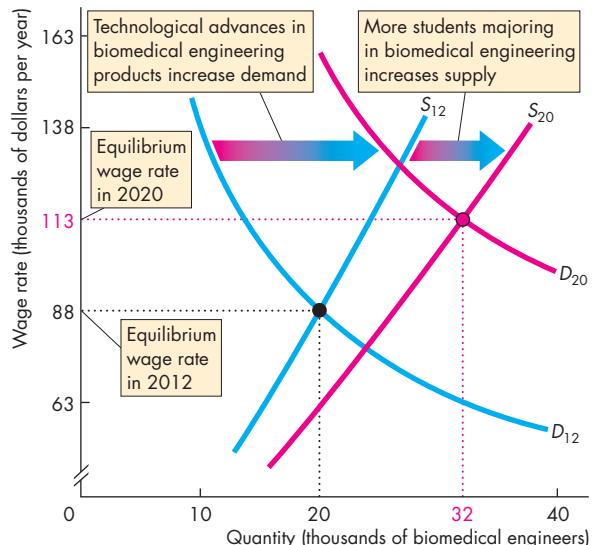
- Why is the number of jobs for biomedical engineering graduates increasing?
- What determines the demand for biomedical engineers and why might it be increasing?
- What determines the supply of biomedical engineers and why might it be increasing?
- What determines whether the wage rate of biomedical 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.

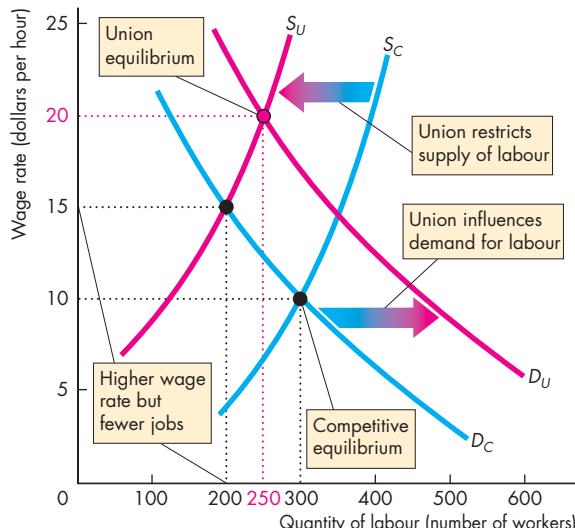
Influences on Labour Demand A union tries to increase the demand for the labour of its members in four main ways:

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.

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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).

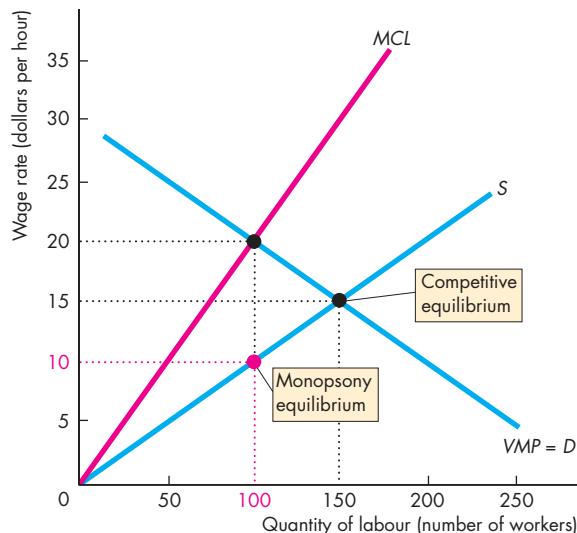
To find the profit-maximizing quantity of labour to hire, the monopsony sets the marginal cost of labour equal to the value of marginal product of labour. In Fig. 18.5, this outcome occurs when the firm employs 100 workers.

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.

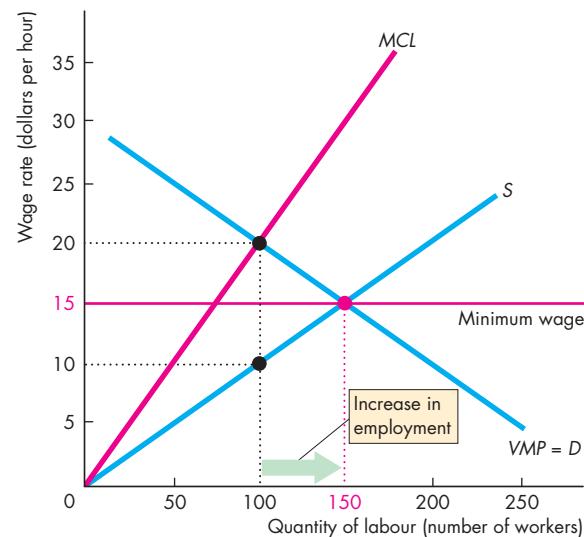
You've now seen that in a monopsony, a union can bargain for a higher wage rate without sacrificing jobs. A similar outcome can arise in a monopsony labour market when a minimum wage law is enforced. Let's look at the effect of a minimum wage.

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

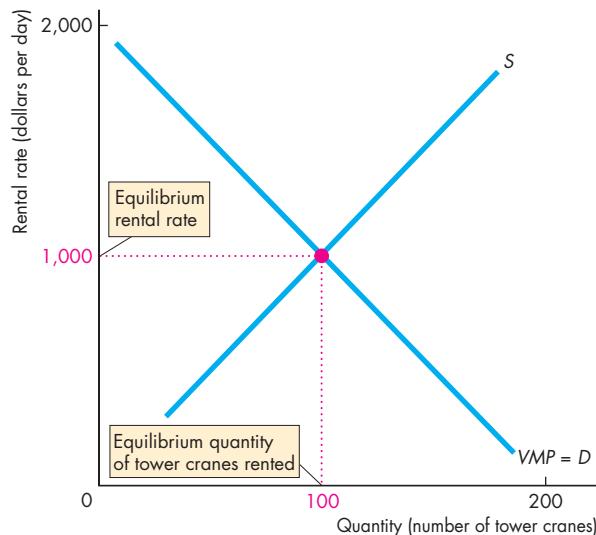
The demand for capital is derived from the *value of marginal product of capital*. Profit-maximizing firms hire the quantity of capital services that makes the value of marginal product of capital equal to the *rental rate of capital*. The *lower* the rental rate of capital, other things remaining the 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*.

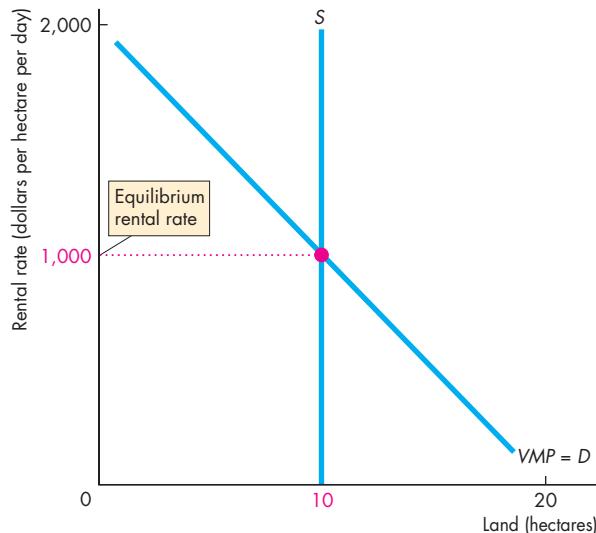
of land. The lower the rental rate, other things remaining the same, the greater is the quantity of land demanded.

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.

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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.

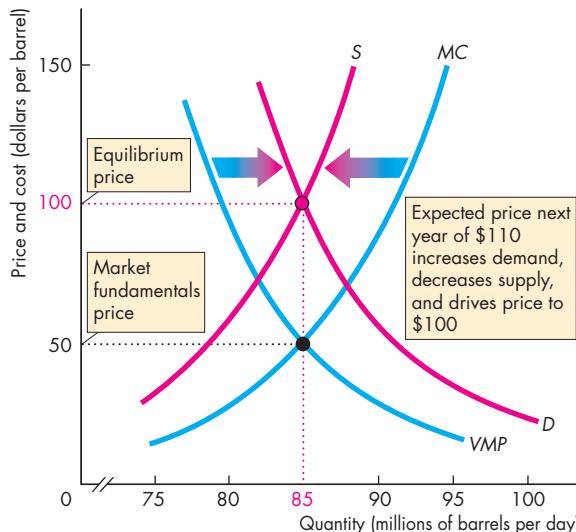
Speculative forces based on expectations about the future price also influence the supply of oil. The *higher* the expected future price of oil, the *smaller* is the present supply of oil. A trader with an oil inventory might plan to sell now or to hold and sell later. You've seen that interest forgone 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

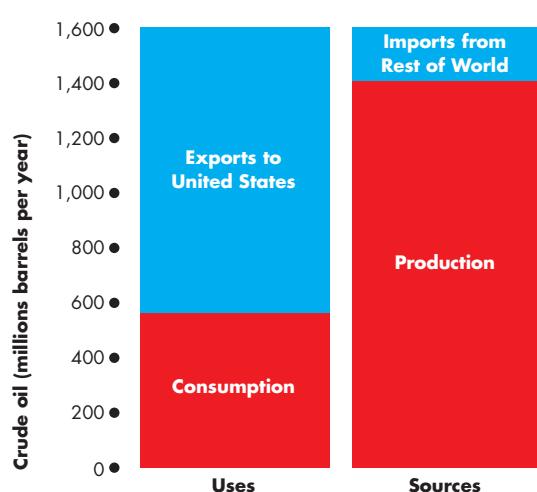


Figure 1 Canada's Uses and Sources of Oil

Source of data: Statistics Canada, Table 126-0001.

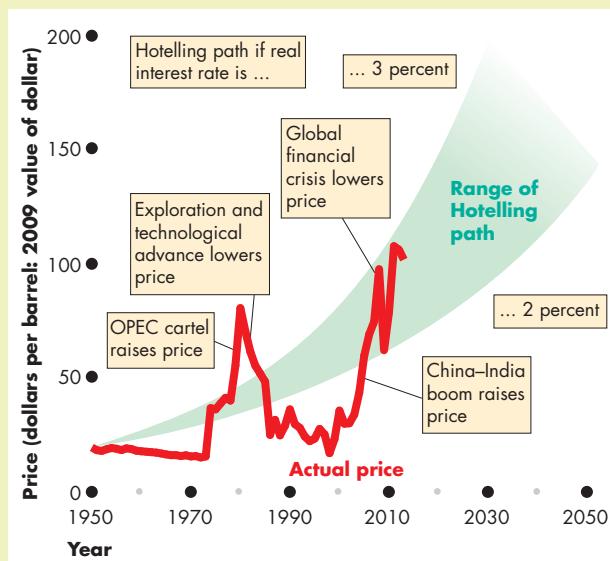


Figure 2 The Price of Oil and Its Hotelling Path

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. **MyEconLab**

◆ *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.

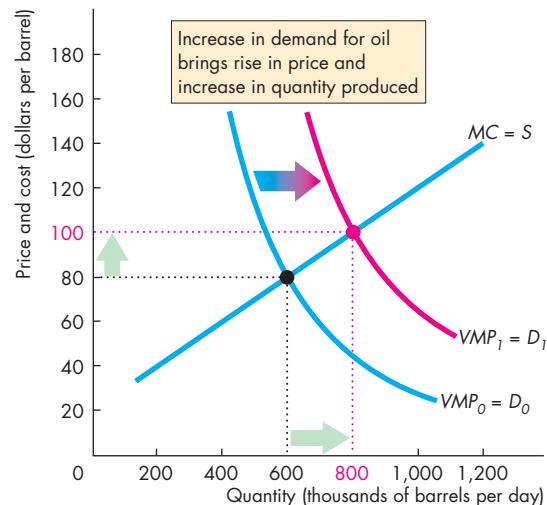


Figure 1 Alberta Oil Market

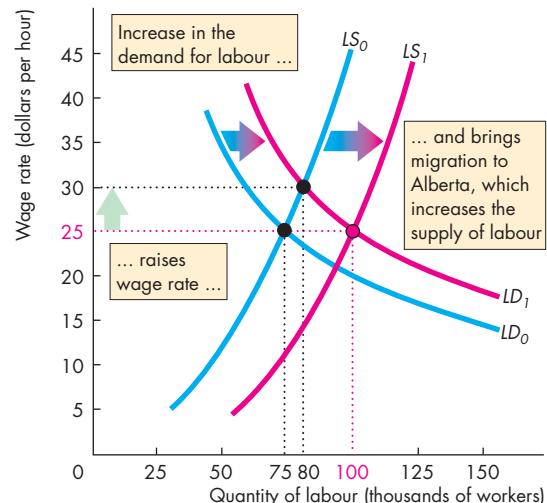


Figure 2 Alberta Labour Market

- 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		

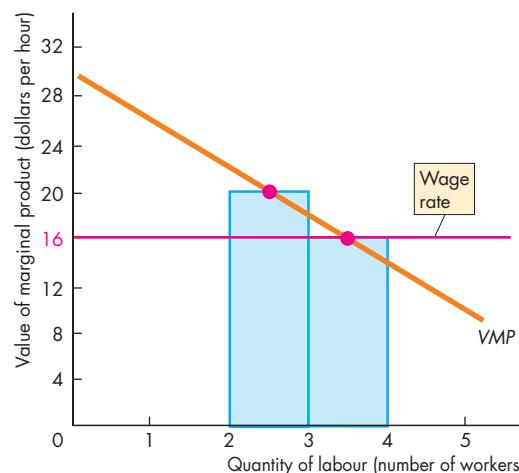
hires 4 workers who produce 44 boxes of tomatoes. Tom sells the tomatoes for \$88 and pays the wages of \$64, so his profit is \$24 an hour. The figure shows this equality.

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, 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.

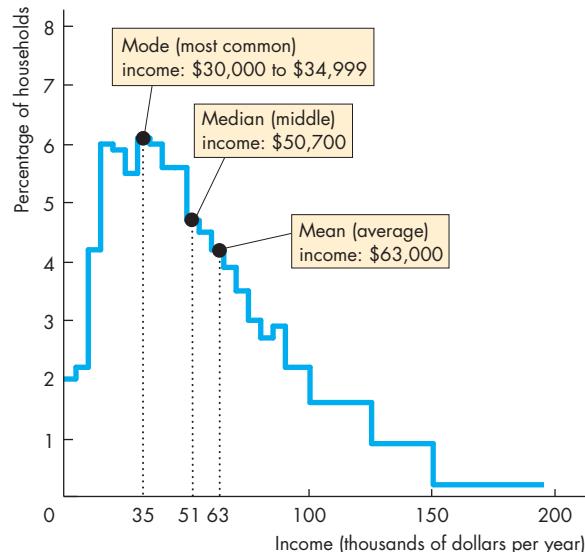
The *average* household money income in 2011, also called the *mean* income, was \$63,000. This number equals total household after-tax income divided by the 14 million households.

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.

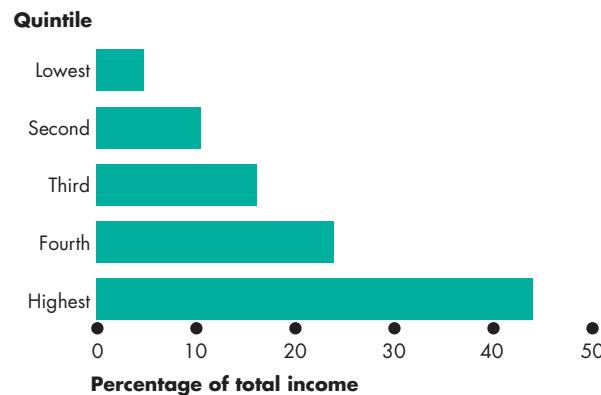
MyEconLab Animation

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.

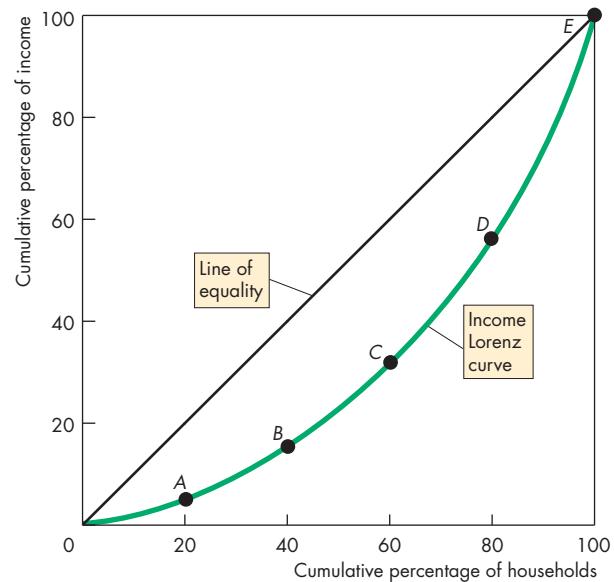
Source of data: See Fig. 19.1.

[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.

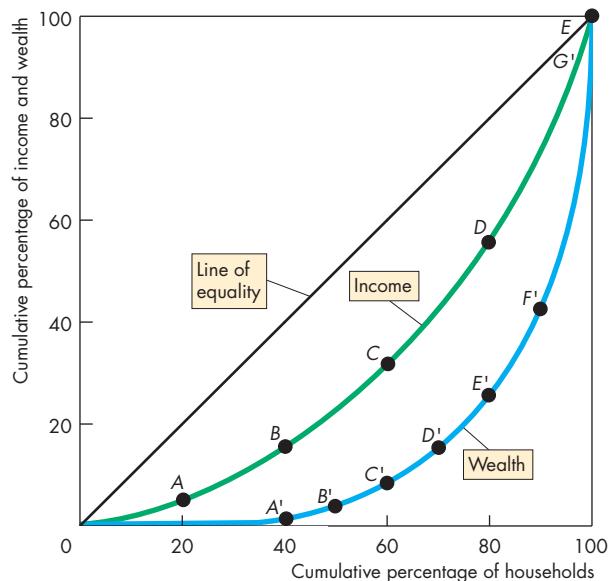
Wealth or Income?

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.

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.

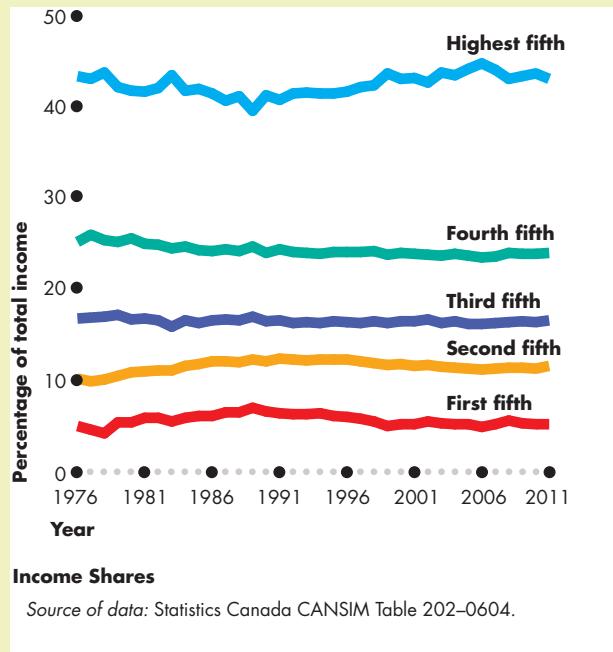
The national survey of wealth excludes human capital, so Peter looks more wealthy than Lee, although they have equal wealth. The bias in wealth measurement means that the income distribution is a more accurate measure of economic inequality than the wealth distribution.

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).

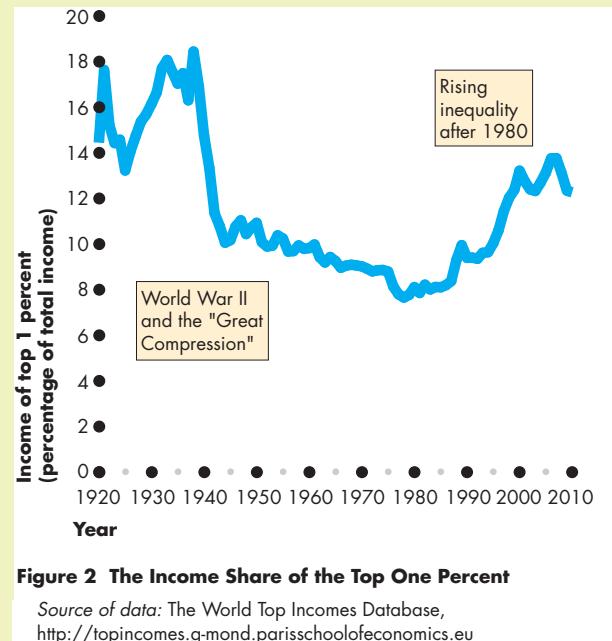


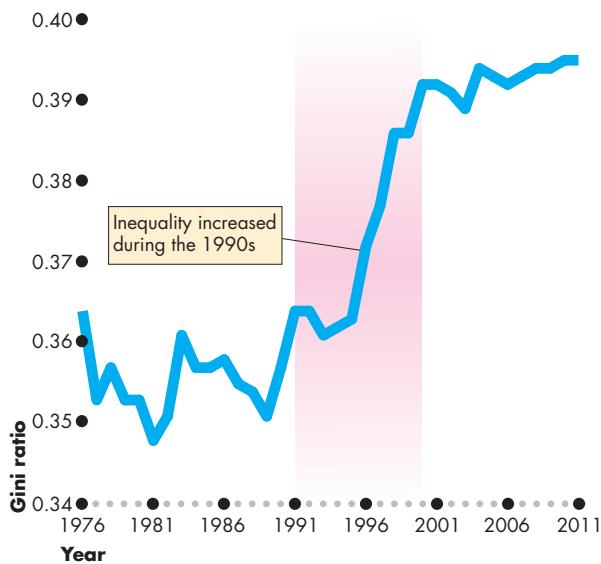
Figure 2 The Income Share of the Top One Percent

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.

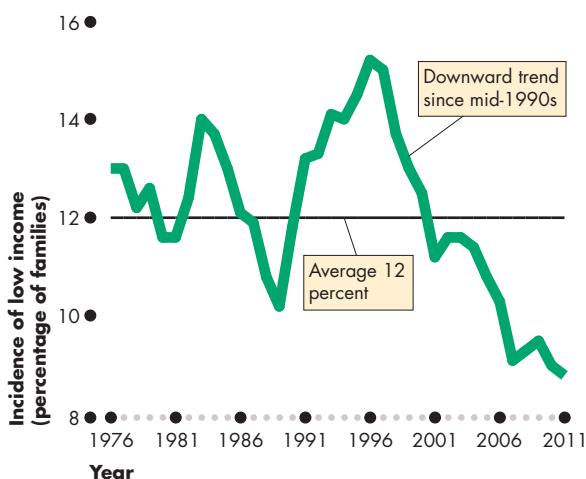
Poverty is both an absolute and a relative concept. Millions of people in Africa and Asia live, barely, in absolute poverty with incomes of less than \$400 a year.

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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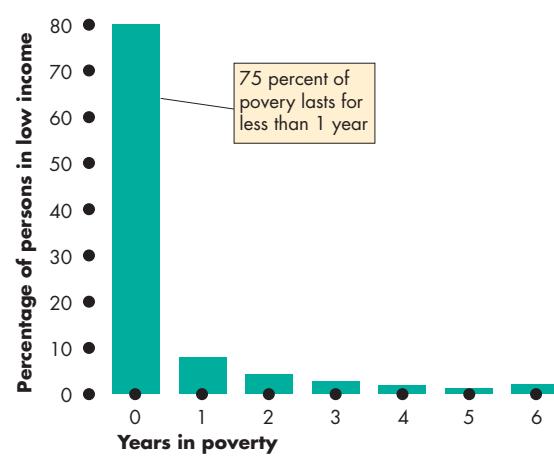
Economics in Action

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.



Source of data: Statistics Canada, CANSIM Table 202-0807.

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.

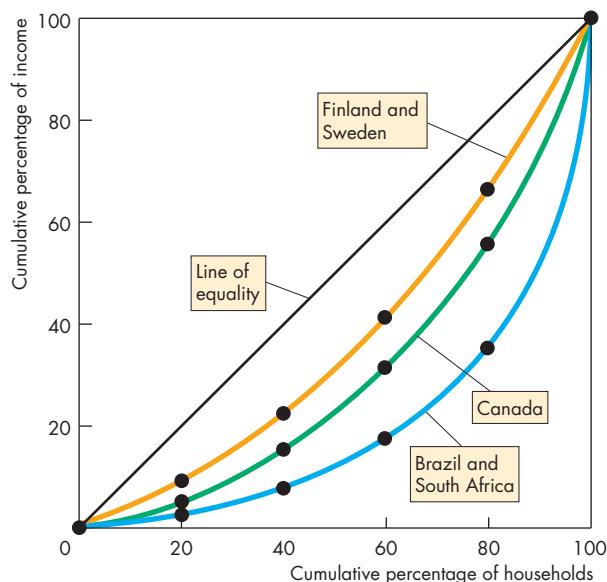
The numbers for Canada lie between these extremes, with an average person in the highest quintile receiving just under 9 times the income received by an average person in the lowest quintile.

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 ¹		
	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.

¹The 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.

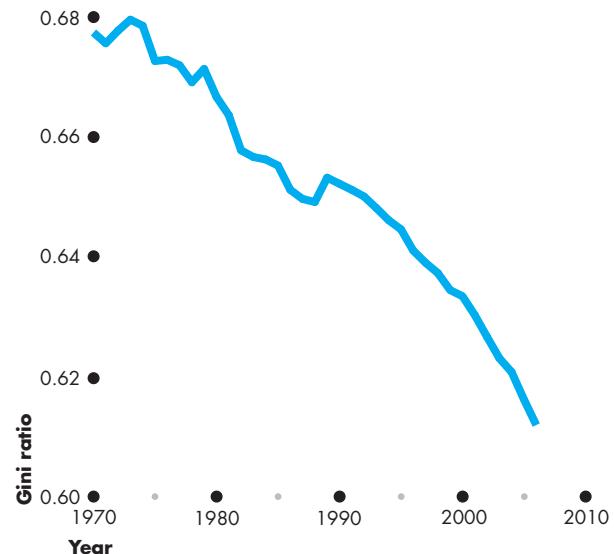
So the average Canadian earns 66 times the income of one of the world's 3 billion poorest people and more than 16.4 times the income of 80 percent of the people who live in developing economies. A Canadian with the lowest income in the highest income quintile earns 96 times that of the world's poorest 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>.

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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.

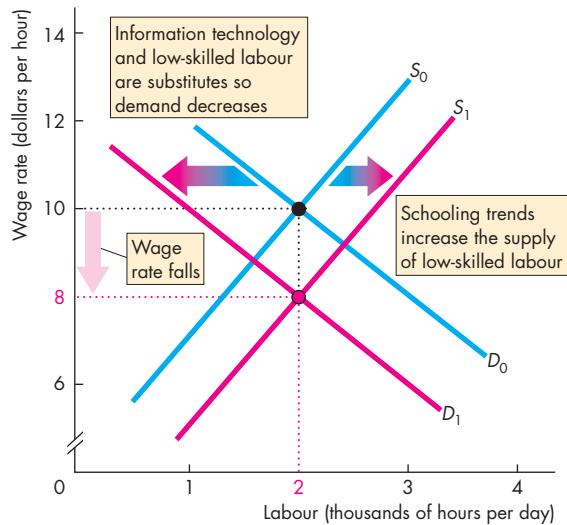
As changes in information technology have increased the growth rate of the demand for high-skilled labour, trends in schooling have lowered the growth rate of the supply of high-skilled labour. Since 1995, the trend growth rate of human capital through education has slowed. Before 1995, the percentage 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.

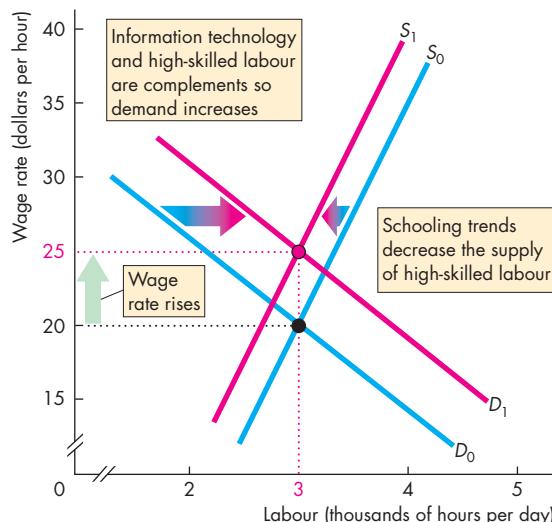
Figure 19.9 illustrates this outcome. In Fig. 19.9(a), the demand for low-skilled labour decreases from D_0 to D_1 and the supply of low-skilled labour increases from S_0 to S_1 . The wage rate falls from \$10 per hour to \$8 per hour. In Fig. 19.9(b), the demand for high-skilled labour increases from 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.

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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.

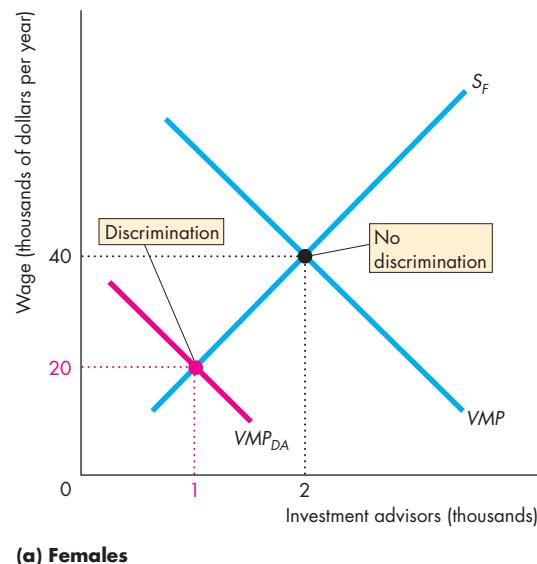
Suppose that the perceived value of marginal product of the females, when discriminated against, is VMP_{DA} . Suppose that the perceived value of marginal product for males, the group discriminated in favour of, is VMP_{DF} . With these VMP curves, females earn \$20,000 a year and only 1,000 females 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.

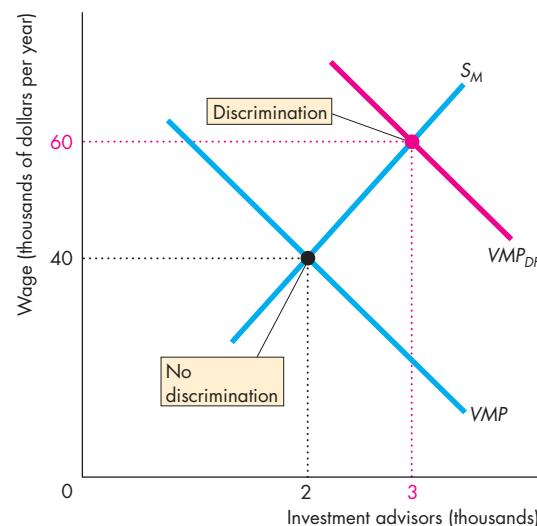
Suppose, as is true in manufacturing, that a firm's customers never meet its workers. If such a firm discriminates against women (or against visible minorities), it can't compete with firms that hire these groups because the firm that discriminates has higher costs than those of the nonprejudiced firms. 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.

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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.

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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

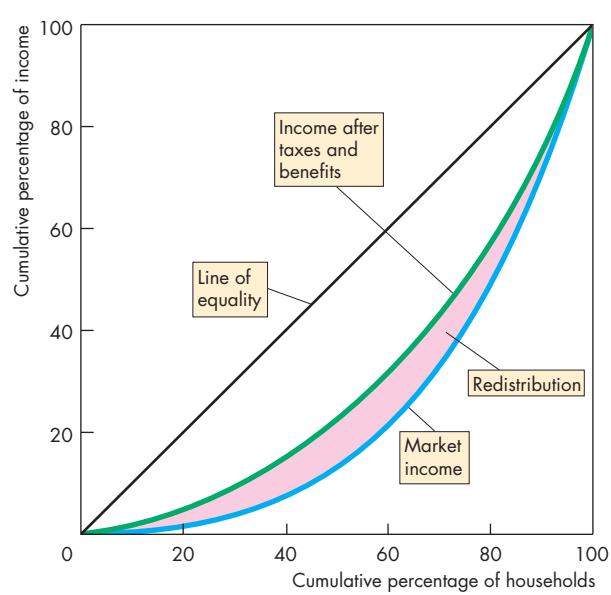


Figure 1 Income Distribution Before and After Redistribution

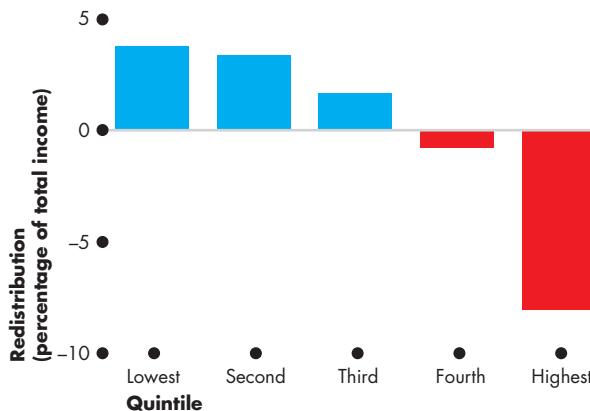


Figure 2 The Scale of Redistribution

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.

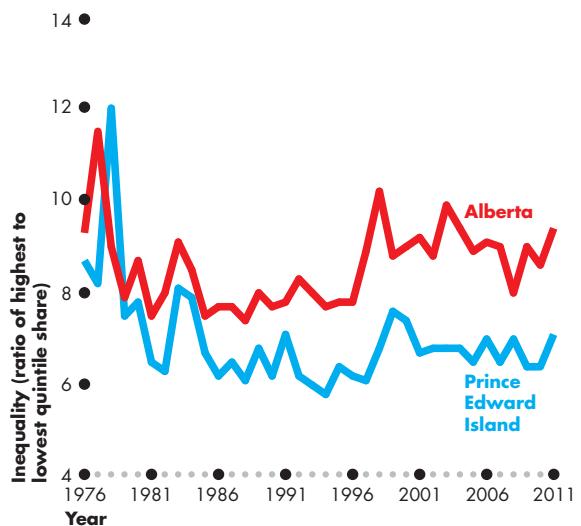
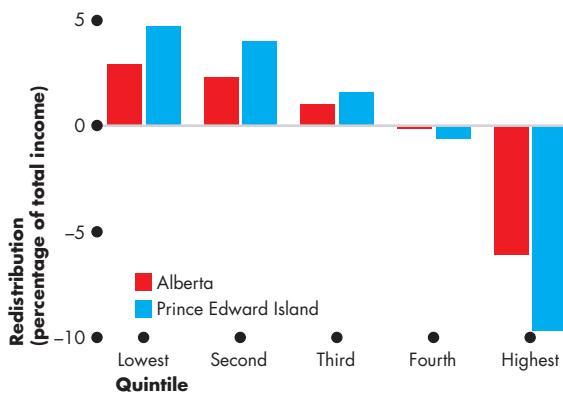


Figure 1 Inequality in Alberta and Prince Edward Island Compared



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.

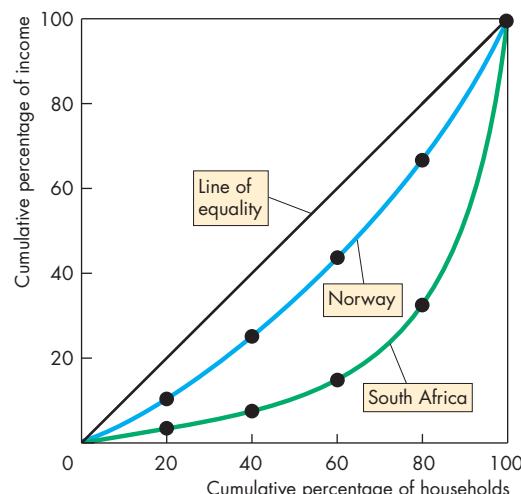
Key Point: The closer is the Lorenz curve to the line of equality, the more equal is the distribution.

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.

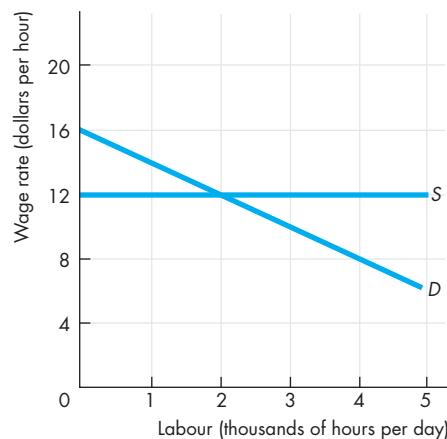
Use the following table to work Problems 4 and 5. The table shows the income shares in the United States and the United Kingdom.

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.

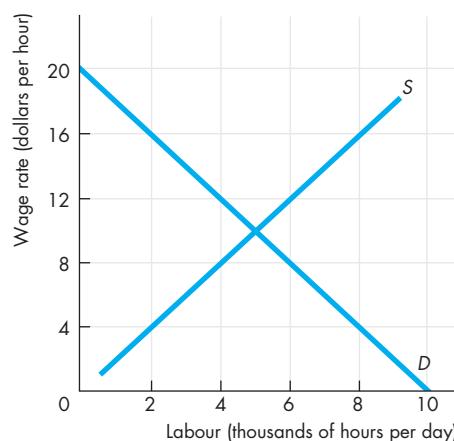
Households (quintile)	Income share (percentage of total)
Lowest	7
Second	13
Third	18
Fourth	24
Highest	38

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.

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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
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- 5 Making Traffic Flow Efficiently 120
- 6 Push to Raise the Minimum Wage 144
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- 16 A Carbon Reduction Plan 384
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- 18 Degree Major and Job Prospects 421
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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.

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- 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
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