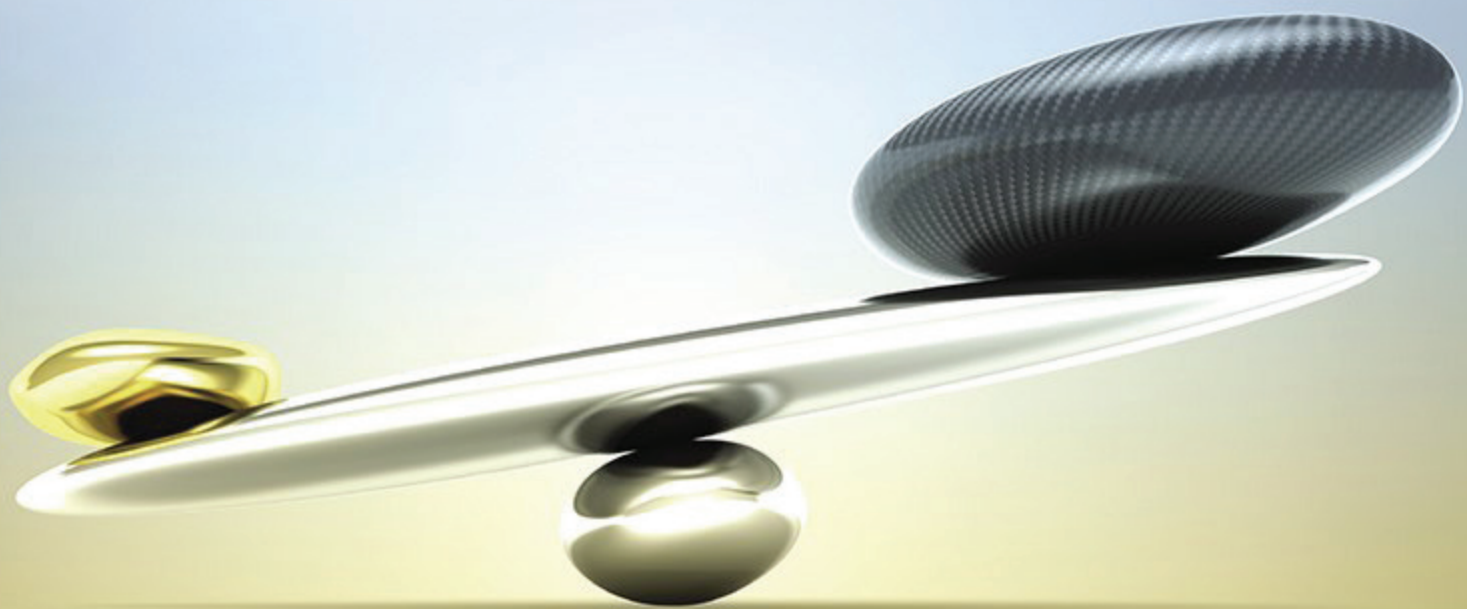


THIRD EDITION

MANAGERIAL ECONOMICS AND STRATEGY



JEFFREY M. PERLOFF
JAMES A. BRANDER



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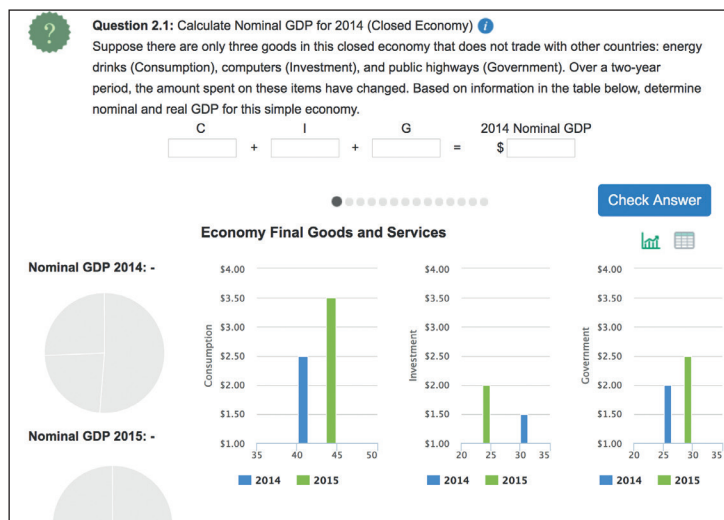
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Homework: Chapter 5

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Concept: Market Demand Private Good

Suppose a market consists of 2 buyers, each of whom is assumed to have the demand schedule given by:

Price (\$ per unit)	Quantity Demanded - Buyer	Quantity Demanded - Pat
\$5	4	1
\$4	10	5
\$3	15	10
\$2	20	15
\$1	25	20

On the graph:

Using the line drawing tool, draw and label the market demand curve.

Carefully follow the instructions above, and only draw the required object.

Market Demand

Price (\$ per unit)

Quantity Demanded

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Click the graph, choose a tool in the palette and follow the instructions to create your graph.

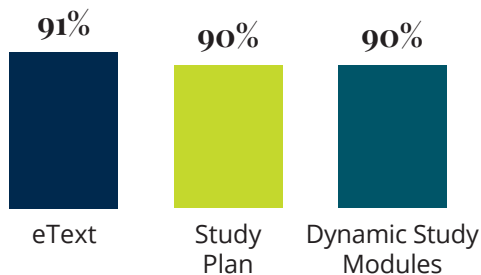
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Symbols Used in This Book

Δ [capital delta] = a change in the following variable—for example, the change in p between Periods 1 and 2 is $\Delta p = p_2 - p_1$, where p_i is the price in Period i)

ε [epsilon] = the price elasticity of demand

π [pi] = profit = revenue – total cost = $R - C$

θ = proportion or probability or share

Abbreviations, Variables, and Function Names

AFC = average fixed cost = fixed cost divided by output = F/q

AVC = average variable cost = variable cost divided by output = VC/q

AC = average cost = total cost divided by output = C/q

AP_i = average product of input i —for example, AP_L is the average product of labor

C = total cost = variable cost + fixed cost = $VC + F$

CS = consumer surplus

D = market demand curve

DWL = deadweight loss

F = fixed cost

i = interest rate

I = indifference curve

K = capital

L = labor

LR = long run

m = constant marginal cost

MC = marginal cost

MP_i = marginal (physical) product of input i —for example, MP_L is the marginal product of labor

MR = marginal revenue

MRS = marginal rate of substitution

$MRTS$ = marginal rate of technical substitution

n = number of items such as firms in an industry

p = price

PS = producer surplus

Q = market (or monopoly) output

q = firm output

R = revenue = pq

r = price of capital services

s = per-unit subsidy

S = market supply curve

SR = short run

t = specific or unit tax

T = tax revenue (tQ)

TS = total surplus

U = utility

VC = variable cost

w = wage

Y = income or budget

Managerial Economics and Strategy

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Managerial Economics and Strategy

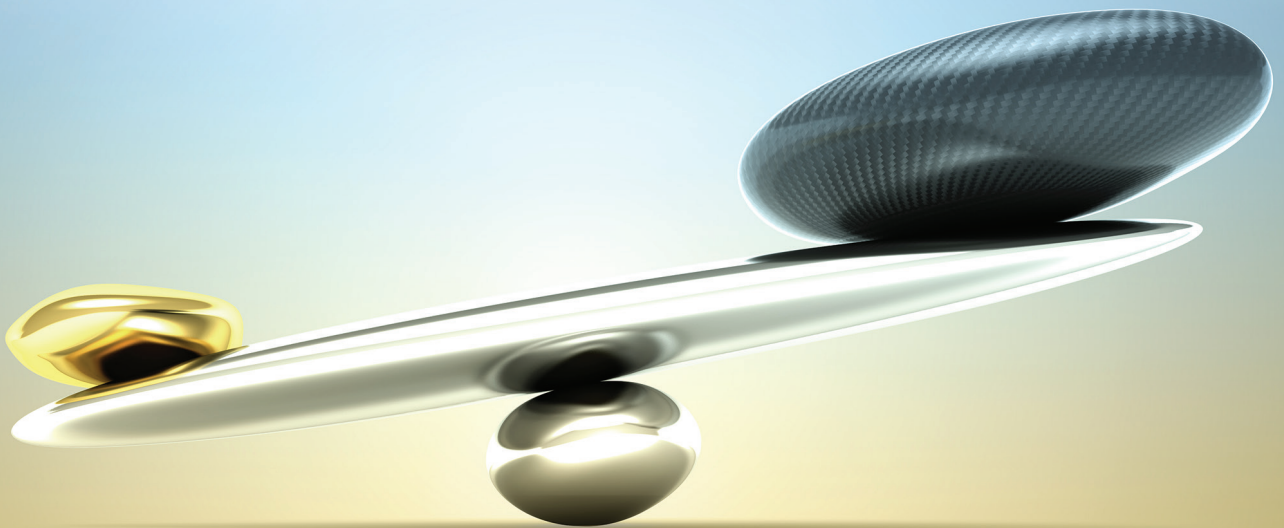
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Preface

What's New in the Third Edition

We have substantially revised the third edition based in large part on the very helpful suggestions of instructors and students who used the second edition. We have updated and revised every chapter. Key revisions include:

- Spreadsheet-based Q&A Exercises are a new feature in Chapters 3, 6–10, and 12–16. This major innovation helps students learn how to address real-world business problems using spreadsheets, which is an increasingly important skill in today's business world.
- Chapters 1, 5, 6, 7, 9, and 14 have a new theme on *disruptive innovations*: innovations, such as online retailing, 3D printing, and social media, that dramatically change consumer options or the way an industry is structured, possibly creating new industries and destroying old ones.
- A new feature is the 21 *Common Confusions*, which explain why a widely held belief is incorrect.
- Over three-quarters of the Mini-Cases (brief applications of the theory) are new (22) or revised (48).
- Of the 655 end-of-chapter questions, 150 are new or revised.
- Nearly a quarter of the Managerial Implications (brief discussions of how to use economic theory to improve managerial decisions) are new or substantially revised.
- This edition is even more user-friendly. It drops some of the more technical material from Chapters 2, 4, 6, 7, 8, and 11, and adds more emphasis on current managerial issues in both the main text and the features.
- Because instructors and students enjoyed the cartoons in the second edition, this edition has 45% more cartoons. In addition to providing entertainment, these cartoons convey important economic points in a memorable way.

The Managerial Economics Program

This book differs from other managerial economics books in three main ways:

1. **Modern Theories.** We place greater emphasis than other texts on modern theories that are increasingly useful to managers. These include:
 - Modern contract theory to show students how to write contracts to avoid or minimize problems
 - Behavioral economics to explain why people deviate from rational behavior

- Game theory to help students think about business strategies and choose strategies that maximize profits
 - Analysis of real-world pricing tools.
- 2. Real-world Examples.** We make more extensive use of real-world business examples to illustrate how to use economic theory in making business decisions. To illustrate important economic concepts, we use calculations, graphs, and spreadsheets based on actual markets and real data.
 - 3. Problem-based Learning.** We employ a problem-based learning approach to demonstrate how to apply economic theory to specific business decisions. In each chapter, we solve problems using a step-by-step approach to model good problem-solving techniques, and each end of chapter section includes an extensive set of questions.

These innovative hallmarks are woven throughout the text.

To improve student results, we recommend pairing the text content with **MyLab Economics**, which is the teaching and learning platform that empowers instructors to reach every student. By combining trusted author content with digital tools and a flexible platform, MyLab personalizes the learning experience and will help students learn and retain key course concepts while developing skills that future employers are seeking in their candidates. MyLab Economics allows professors increased flexibility in designing and teaching their courses. Learn more at www.pearson.com/mylab/economics.

Solving Teaching and Learning Challenges

As teachers, we understand the challenges of managerial economics courses. Our experience teaching managerial economics at the Wharton School (University of Pennsylvania) and the Sauder School of Business (University of British Columbia) as well as teaching a wide variety of students at the Massachusetts Institute of Technology; Queen's University; and the University of California, Berkeley, has convinced us that students do best with an emphasis on problem solving and real-world issues and examples from actual markets. In the features of the book and MyLab Economics, we show how to apply economic theory to managerial decisions using actual business examples and real data.

We demonstrate that economics is practical and useful to managers by examining real markets and actual business decisions. Successful managers make extensive use of economic tools to reduce the cost of production, to choose pricing structures or output levels to maximize profit, and to make many other managerial decisions. We highlight applications of these tools in the *Managerial Problems*, *Mini-Cases*, *Managerial Implications*, and *Q&As* throughout the book, and the videos in MyLab Economics.

Managerial Problems

After the introductory chapter, each chapter starts with a *Managerial Problem* that motivates the chapter by posing a real-world managerial question. At the end of each chapter, we answer this question in the *Managerial Solution* using the economic

principles discussed in that chapter. Thus, each Managerial Problem–Managerial Solution pair combines the essence of a Mini-Case and a Q&A.

Managerial Problem

Paying Employees to Relocate

When Google wants to transfer an employee from its Washington, D.C., office to its London branch, it must decide how much compensation to offer the worker to move. International firms are increasingly relocating workers throughout their home countries and internationally.

As you might expect, workers are not always enthusiastic about being relocated. In a survey by Runzheimer International, 79% of firms' relocation managers responded that they experienced resistance from employees who were asked to relocate to high-cost locations. A survey of some of their employees found that 81% objected to moving because of fear of a lowered standard of living.

One possible approach to enticing employees to relocate is for the firm to determine the goods and services consumed by employees in the original location and then pay those employees enough to allow them to consume essentially the same items in the new location. According to a survey by Mercer, 79% of international firms reported that they provided their workers with enough income abroad to maintain their home lifestyle.

However, economists who advise on compensation packages point out that such an approach will typically overcompensate employees by paying them more than they need to obtain the same level of economic well-being they have in the original city. How can a firm's human resources (HR) manager use consumer theory to optimally compensate employees who are transferred to other cities?



Mini-Cases

The *Mini-Cases* apply economic theory to interesting and important managerial problems. For example, Mini-Cases demonstrate how price increases on iTunes affect music downloads using actual data, how to estimate Crocs' production function for shoes using real-world data, why top-end designers limit the number of designer bags customers can buy, the effect of cyberattacks, how Pfizer used limit pricing to slow the entry of rivals, why advertisers pay so much for Super Bowl commercials, and how managers of auto manufacturing firms organize production and trade to avoid taxes and tariffs.

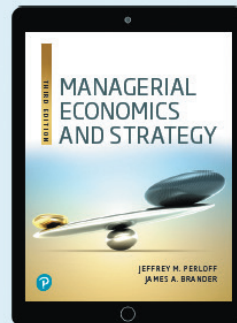
Mini-Case

Apple's iPad

Apple's iPad was the first commercially successful tablet. Users interact with the iPad using Apple's multi-touch, finger-sensitive touchscreen (rather than the pressure-triggered stylus that most previous tablets used) and a virtual onscreen keyboard (rather than a physical one). Most importantly, the iPad offers an intuitive interface and is well integrated with Apple's iTunes, eBooks, and various application programs.

People loved the original iPad. Even at \$499 for the basic model, Apple had a virtual monopoly in its first year in 2010, with 87% of the tablet market. Moreover, the other tablets available in 2010 were not viewed by most consumers as close substitutes. Apple reported that it sold 25 million iPads worldwide in its first full year.

Unfortunately for Apple, its monopoly was short lived. Within a year of the iPad's introduction, over a hundred iPad want-to-be tablets were available. Apple's share of the tablet market fell to 29% by early 2018.



Managerial Implications

The *Managerial Implications* feature provides bottom-line statements of economic principles that managers can use to make key managerial decisions. For example, we describe how managers can assess whether they are maximizing profit. We also show how they can structure discounts to maximize profits, promote customer loyalty, design auctions, prevent gray markets, and use important insights from game theory to make good managerial decisions.

Managerial Implication

Taking Advantage of Limited Strategic Thinking

Managers should consider the level of strategic sophistication of customers (and rivals). For example, successful managers of Hollywood movie studios anticipate limited strategic thinking by moviegoers. Normally Hollywood studios release movies for prescreening by critics before general release to generate buzz through positive reviews. This technique works well for good movies, but has the opposite effect for movies that get poor reviews.

If a studio is not confident about a movie's quality it can use a *cold opening*, releasing the movie with no prescreenings for movie critics. A fully rational moviegoer understands this tactic and is less likely to go to movies with cold opens. Thus, if everyone were rational, studios wouldn't use cold openings.

However, Brown, Camerer, and Lovallo (2012) found that while some moviegoers instantly understand the system, some never catch on to this pattern. As a result, cold opens generate more revenue and more profit on average than comparable not-very-good movies that are prescreened. And, on average, moviegoers are disappointed by cold opens relative to other movies. Thus, a manager should not overestimate the reasoning ability of the general movie-going public.

Q&As and End-of-Chapter Questions

The largest challenge facing students is learning how to apply economics concepts to solve problems. To help them learn this crucial skill, we provide three to five Q&As (Questions & Answers) in each chapter after the introductory chapter. Each Q&A poses a qualitative or quantitative problem and then uses a step-by-step approach to solve the problem. The Q&As focus on important managerial issues such as how a cost-minimizing firm should adjust to changing factor prices, how a manager prices bundles of goods to maximize profits, how to determine Intel's and AMD's profit-maximizing quantities and prices using their estimated demand curves and marginal costs, and how to allocate production across plants internationally.

Q&A 3.1

In 2018, Amazon raised the annual subscription fee for its Prime membership service, which provides free two-day shipping on many goods and other benefits, from \$99 to \$119. Piper Jaffray, an investment bank, estimated that before the price increase, Prime had 77 million U.S. subscribers.³ The bank speculated that the number of members would fall to about 62 million. If so, what is the arc elasticity of demand for a Prime membership?

Answer

Use Equation 3.2 to calculate the arc elasticity. The change in the price is $\Delta p = \$119 - \$99 = \$20$, and the change in quantity is $\Delta Q = 62 - 77 = -15$. The average price is $\bar{p} = (\$99 + \$119)/2 = \$109$, and the average quantity is $\bar{Q} = (77 + 62)/2 = 69.5$ million. Plugging these values into Equation 3.2, we find that the arc price elasticity of demand for Prime memberships is

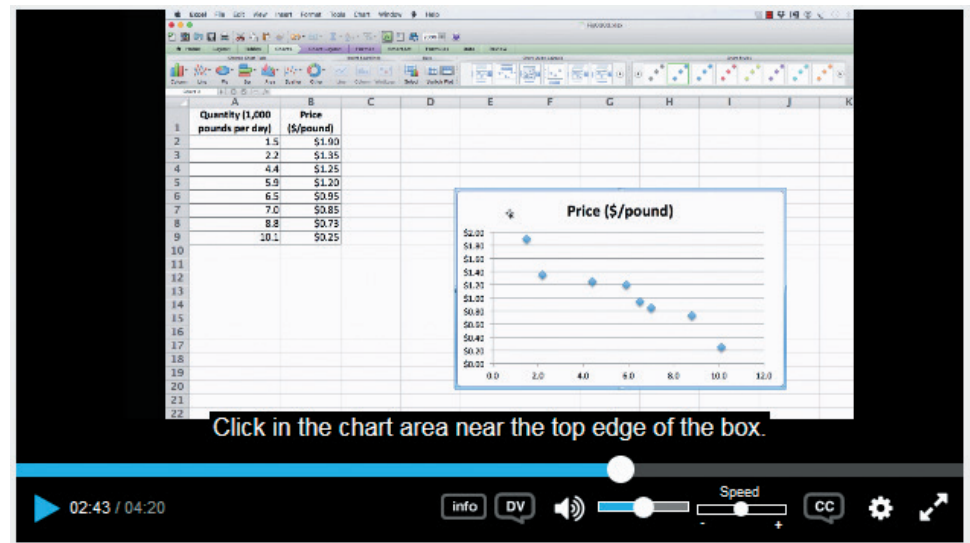
$$\varepsilon = \frac{\Delta Q / \bar{Q}}{\Delta p / \bar{p}} = \frac{-15/69.5}{20/109} \approx -\frac{0.216}{0.183} \approx -1.18.$$

When price rose by 18.3%, the quantity demanded was estimated to fall by 21.6%, so the arc elasticity of demand is $\varepsilon = -1.18$. Based on this elasticity, a 1% rise in price would cause the quantity demanded to fall by 1.18 percent.

At the end of the book, we provide solutions to selected end-of-chapter questions. In addition, detailed answers to all the end-of-chapter questions are provided in MyLab Economics so that students can confirm their understanding without having to contact a professor and also be better prepared for exams.

MyLab Economics Videos

Today's students learn best when they analyze and discuss topics in the text outside of class. To further students' understanding of what they are reading and discussing in the classroom, we provide a set of videos in MyLab Economics. In these videos, Tony Lima presents key figures, tables, Excel applications and concepts in step-by-step animations with audio explanations that discuss the economics behind each step. For example, some of these show students how to use Excel to run regressions, analyze different pricing strategies, cover applications of game theory, address risk and diversification, and choose contracts that reduce moral hazard in principal-agent relationships.



Using Calculus Sections and Calculus Exercises

Some students learn economics best using verbal or graphical explanations. However, others find mathematical explanations clearer. Consequently, some managerial economics courses use calculus while others do not. Both types of course can use this book effectively due to the optional *Using Calculus* sections in the text. Non-calculus courses can omit these short sections with no loss of continuity. For courses that require calculus, *Using Calculus* sections reinforce the graphical, verbal, and algebraic treatment of major topics.

In contrast, many other books relegate calculus to appendices, mix calculus in with other material where it cannot easily be skipped, or avoid calculus entirely. Our approach has proven effective in courses that use no calculus and have very limited mathematical prerequisites, and in courses with significant calculus content. End-of-chapter questions that require calculus are clearly indicated.

Using Calculus**Profit Maximization
with a Specific Tax**

We can use calculus to solve the problem in Q&A 8.1. After the government imposes the specific tax t , the competitive firm's profit is

$$\pi = pq - [C(q) + tq],$$

where $C(q)$ is the firm's before-tax cost and $C(q) + tq$ is its after-tax cost. We obtain a necessary condition for the firm to maximize its after-tax profit by taking the first derivative of profit with respect to quantity and setting it equal to zero:

$$\frac{d\pi}{dq} = \frac{d(pq)}{dq} - \frac{d[C(q) + tq]}{dq} = p - \left[\frac{dC(q)}{dq} + t \right] = p - [MC + t] = 0.$$

Thus, the competitive firm maximizes its profit by choosing q such that its after-tax marginal cost, $MC + t$, equals the market price.

Developing Career Skills

You may be asking yourself, why study economics if I want to manage a business or work as a consultant, as a financial analyst, as an investment banker, in human resources, or in marketing? The reason is that employers know that you need economic skills to perform well. To get a great job upon graduation and have a successful career, you need a range of economic skills and need to know how to apply these skills to solve traditional and new managerial challenges.

How to Use Economic Reasoning on the Job

This book starts by illustrating how to use economic reasoning to analyze and solve a variety of problems. It trains you to use logical analysis based on empirical evidence. You will learn how to apply a variety of techniques that firms value such as how to work with spreadsheets to solve decision problems, conduct regression analyses and interpret the results, use game trees to map strategic decisions, and analyze the effects of pricing decisions.

The book shows you how to approach problems that you are likely to encounter on the job. These applications include using basic economic tools to predict the effects of input price changes or government actions on a market. But they also include using modern economic theories to address new managerial challenges such as

- developing strategies to compete in oligopolistic markets,
- structuring stock options to motivate executives,
- using online platforms (two-sided markets) that bring buyers and sellers together, such as eBay,
- responding to cyberattacks and to potentially disruptive innovations such as 3D printing.

Spreadsheet Exercises

In contrast to other managerial economics textbooks, a major feature of this book helps you develop a facility in using spreadsheets and shows how to use them to solve real-world managerial problems.

Managers increasingly rely on spreadsheets. Spreadsheets make it easier than ever to apply economic principles to managerial decisions. Earlier editions of this book included spreadsheet-based end-of-chapter questions. In this edition, we've added 11 spreadsheet Q&As, which train you by taking you step-by-step through spreadsheets to solve a managerial problem. These Q&As show how to use spreadsheets to calculate elasticities, determine the effect of price changes on revenue and profit, calculate present values, assess the benefits of dynamic pricing, simplify decision-making under uncertainty, and analyze other important questions.

Q&A 6.2

Suppose that a small guitar firm has experimented with the cost of producing different quantities of output per hour by varying the number of workers, holding the size of the plant fixed and using just one CNC machine. It has estimated its cost function as $C = 125 + 10q - 5q^2 + q^3$ where q is quantity produced per hour and C is measured in dollars. The corresponding marginal cost function is $MC = 10 - 10q + 3q^2$.⁴ Use an Excel spreadsheet to show the fixed cost, and to calculate variable cost, total cost, average cost, and marginal cost for output levels from 1 to 10 in one-unit increments. Use the spreadsheet to find the output level at which average cost is minimized and verify that $AC = MC$ at this output level.

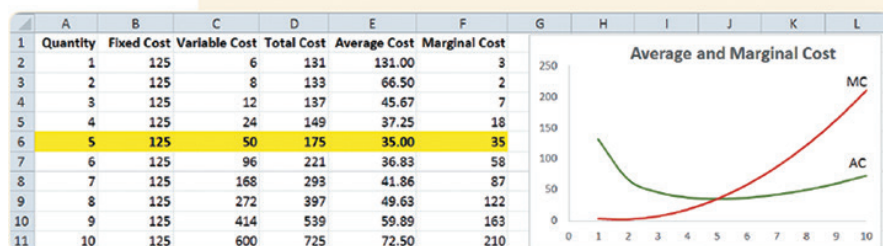
Answer

1. Open an Excel spreadsheet and put titles Quantity, Fixed Cost, Variable Cost, Total Cost, Average Cost, and Marginal Cost in cells A1 through F1. Fill in the numbers 1 through 10 in one-unit increments in cells A2–A11 and enter the number 125 (fixed cost) in each cell from B2 through B11.
2. Fill in the other columns using appropriate formulas. Enter “=10*A2–5*A2^2+A2^3” in cell C2 and copy this formula into the remaining cells in column C. Enter “=B2+C2” in cell D2, then copy that formula into the rest of column D up to cell D11. Enter “=D2/A2” into cell E2 and copy that formula

into the rest of column E. Enter “=10–10*A2+3*A2^2” into cell F2 and also copy that formula into the rest of column F. The formulas are shown in the screenshot.

	A	B	C	D	E	F
1	Quantity	Fixed Cost	Variable Cost	Total Cost	Average Cost	Marginal Cost
2	1	125	=10*A2-5*A2^2+A2^3	=B2+C2	=D2/A2	=10-10*A2+3*A2^2
3	2	125	=10*A3-5*A3^2+A3^3	=B3+C3	=D3/A3	=10-10*A3+3*A3^2
4	3	125	=10*A4-5*A4^2+A4^3	=B4+C4	=D4/A4	=10-10*A4+3*A4^2
5	4	125	=10*A5-5*A5^2+A5^3	=B5+C5	=D5/A5	=10-10*A5+3*A5^2
6	5	125	=10*A6-5*A6^2+A6^3	=B6+C6	=D6/A6	=10-10*A6+3*A6^2
7	6	125	=10*A7-5*A7^2+A7^3	=B7+C7	=D7/A7	=10-10*A7+3*A7^2
8	7	125	=10*A8-5*A8^2+A8^3	=B8+C8	=D8/A8	=10-10*A8+3*A8^2
9	8	125	=10*A9-5*A9^2+A9^3	=B9+C9	=D9/A9	=10-10*A9+3*A9^2
10	9	125	=10*A10-5*A10^2+A10^3	=B10+C10	=D10/A10	=10-10*A10+3*A10^2
11	10	125	=10*A11-5*A11^2+A11^3	=B11+C11	=D11/A11	=10-10*A11+3*A11^2

3. Look in the Average Cost column to identify the output at which average cost is minimized. Average cost reaches its lowest level in cell E6, where the quantity produced is 5 and average cost is 35. At this output level, marginal cost is also equal to 35, as the screenshot shows. (The average cost column has been formatted to show two digits after the decimal point.)



Note: It is possible to use Excel to draw any of the cost curves by inserting a scatterplot. The screenshot shows the average and marginal cost curves.

In addition to these Q&As, each chapter except the first has three end-of-chapter spreadsheet exercises addressing topics such as choosing the profit-maximizing level of advertising and designing compensation contracts to motivate employees. All spreadsheet exercises are available in MyLab Economics as static exercises, and select exercises (marked with an **X** in the text) are available in an auto-graded format. Using proven, field-tested technology, auto-graded Excel Projects let professors seamlessly integrate Microsoft® Excel® content into the course without having to manually grade spreadsheets. Students can practice important skills in Excel, helping you master key concepts and gain proficiency with the program. Simply download a spreadsheet, work live on a problem in Excel, and then upload that file back to MyLab Economics. Within minutes, you will receive a report that provides personalized, detailed feedback and, if necessary, pinpoints where you went astray in the problem. This feedback helps nurture your understanding of the key topics in the course while building confidence in your Excel skills, preparing you for success in class and in your career.

8. MyLab Economics Spreadsheet Exercises²³

- 8.1 A monopolist's inverse demand function is $p = 100 - 2Q$, so its marginal revenue is $MR = 100 - 4Q$. Its cost function is $C = 25 + 4Q + 2Q^2$ and its marginal cost is therefore $MC = 4 + 4Q$.
- Create a spreadsheet with column headings Q , p , MR , MC , R , C , profit, and CS (consumer surplus). Enter the values 1 to 25 in one-unit increments in the quantity column and enter the appropriate formulas in all the other cells. Determine the profit maximizing output and price for an unregulated monopoly. What is the monopoly's profit and the consumer surplus at this output and price?
 - Now use your spreadsheet to determine the price, quantity, profit, and consumer surplus if the regulator imposes a price cap (ceiling) of 70.
 - Which of the two pricing structures yields the highest total surplus? If the regulator wants to use price cap regulation *and* wants to maximize total surplus, what price cap should the regulator choose?

Table of Contents Overview

Because instructors differ in the order in which they cover material and in the range of topics they choose to teach, this text allows for flexibility. The most common approach to teaching managerial economics is to follow the sequence of the chapters in order. However, many variations are possible. For example, some instructors choose to address empirical methods (Chapter 3) first.

Instructors may skip consumer theory (Chapter 4) without causing problems in later chapters. Or, they may cover consumer theory after the chapters on production and cost (Chapters 5 and 6).

Chapter 7, "Firm Organization and Market Structure," provides an overview of the key issues that are discussed in later chapters, such as types of firms, profit

maximization and its alternatives, and the structure of markets. We think that presenting this material early in the course is ideal, but an instructor can cover all of this material except for the section on profit maximization later.

An instructor may teach pricing with market power (Chapter 10) at any point after discussing monopoly (Chapter 9). Because game theory is introduced in two chapters (Chapters 12 and 13), instructors can conveniently choose how much game theory to present. Although Chapter 11 on oligopoly and monopolistic competition precedes the game theory chapters, a course could cover the game theory chapters first.

A common variant is to present Chapter 14 on uncertainty earlier in the course. A course could present asymmetric information (Chapter 15) at any point after the uncertainty chapter. Thus, a course could cover both the uncertainty and information chapters early.

Chapter 16 on government and business discusses market failures, government regulation, externalities, public goods, and intellectual property. A course could cover this material earlier. For example, the regulation and intellectual property material could follow monopoly. The externality and public good treatment could be presented at any point after Chapter 8 on competitive firms and markets.

The final chapter, Global Business (Chapter 17), is valuable in a course that stresses international issues. An instructor could cover this chapter at any point after the competition and monopoly chapters.

Instructor Teaching Resources

This book has a full range of supplementary materials that support teaching and learning. This program comes with the following teaching resources:

Supplements available to instructors at www.pearsonhighered.com	Features of the Supplement
Instructor's Manual Authored by Matt Roelofs of Western Washington University	• <i>Chapter Outlines</i> include key terminology, teaching notes, and lecture suggestions. • <i>Teaching Tips</i> and <i>Additional Discussion Questions</i> provide tips for alternative ways to cover the material and brief reminders on additional help to provide students. • <i>Solutions</i> are provided for all problems in the book.
Test Bank Authored by Todd Fitch of the University of California, Berkeley	• Multiple-choice problems of varying levels of complexity, suitable for homework assignments and exams • Many of these draw on current news and events
Computerized TestGen	TestGen allows instructors to: • Customize, save, and generate classroom tests • Edit, add, or delete questions from the Test Item Files • Analyze test results • Organize a database of tests and student results.
PowerPoints Authored by Nelson Altamirano of National University	• Slides include all the graphs, tables, and equations in the textbook, as well as lecture notes. • PowerPoints meet accessibility standards for students with disabilities. Features include, but not limited to: • Keyboard and Screen Reader access • Alternative text for images • High color contrast between background and foreground colors

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J. M. P.

J. A. B.

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Introduction

1

An Economist's Theory of Reincarnation: If you're good, you come back on a higher level. Cats come back as dogs, dogs come back as horses, and people—if they've been very good like George Washington—come back as money.

If all the food, clothing, entertainment, and other goods and services we wanted were freely available, no one would study economics, and we would not need managers. However, most of the good things in life are scarce. We cannot have everything we want. Consumers cannot consume everything but must make choices about what to purchase. Similarly, managers of firms cannot produce everything and must make careful choices about what to produce, how much to produce, and how to produce it. Studying such choices is the main subject matter of economics. **Economics** is the study of decision making in the presence of scarcity.¹

Managerial economics is the application of economic analysis to managerial decision making. It focuses on how managers make economic decisions by allocating the scarce resources at their disposal. To make good decisions, a manager must understand the behavior of other decision makers, such as consumers, workers, other managers, and governments. In this book, we examine decision making by such participants in the economy, and we show how managers can use this understanding to be successful.

Learning Objectives

1. Describe the major business decisions managers face.
2. Explain how economic models are useful in managerial decision making.
3. Illustrate how a knowledge of economics can help your career.

1.1 Managerial Decision Making

A firm's managers allocate the limited resources available to them to achieve the firm's objectives. The objectives vary for different managers within a firm but each managerial task is constrained by resource scarcity. At any moment in time, a production manager has to use the existing factory and a marketing manager has a limited marketing budget. Such resource limitations can change over time, but managers always face constraints.

¹Many dictionaries define economics as the study of the production, distribution, and consumption of goods and services. However, professional economists think of economics as applying more broadly, including any decisions made subject to scarcity.

Profit

The main objective of most private-sector firms is to maximize *profit*, which is the difference between revenue and cost. Senior managers of a firm might have other concerns as well, including social responsibility and personal career objectives. However, the primary responsibility of senior managers to the owners of the firm is to focus on the *bottom line*: maximizing profit.

Managers have a variety of roles in the profit maximization process. The production manager seeks to minimize the cost of producing a particular good or service. The market research manager determines how many units of any particular product can be sold at a given price, which helps to determine how much output to produce and what price to charge. The research and development (R&D) manager supervises the development of new products that will be attractive to consumers. The most senior manager, usually called the *chief executive officer* (CEO), coordinates the firm's managerial functions and sets its overall strategy.

Trade-Offs

People and firms face trade-offs because they can't have everything. Managers must focus on the trade-offs that directly or indirectly affect profits. Evaluating trade-offs often involves *marginal* reasoning: considering the effect of a small change. Key trade-offs include:

- **How to produce:** To produce a given level of output, a firm trades off inputs, deciding whether to use more of one and less of another. Car manufacturers choose between metal and plastic for many parts, which affects the car's weight, cost, and safety.
- **What prices to charge:** Some firms, such as farms, have little or no control over the prices at which their goods are sold and must sell at the price determined in the market. However, many other firms set their prices. When a manager of such a firm sets the price of a product, the manager must consider whether raising the price by a dollar increases the profit margin on each unit sold by enough to offset the loss from selling fewer units. Consumers, given their limited budgets, buy fewer units of a product when its price rises. Thus, ultimately, the manager's pricing decision is constrained by the scarcity under which consumers make decisions.
- **Whether to innovate:** One of the major trade-offs facing managers is whether to maximize profit in the short run or in the long run. For example, a forward-looking firm may invest substantially in innovation—designing new products and better production methods—which lowers profit in the short run, but may raise profit in the long run.

Other Decision Makers

It is important for managers of a firm to understand how the decisions made by consumers, workers, managers of other firms, and governments constrain their

firm. Consumers purchase products subject to their limited budgets. Workers decide on which jobs to take and how much to work given their scarce time and limits on their abilities. Rivals may introduce new, superior products or cut the prices of existing products. Governments around the world may tax, subsidize, or regulate products.

Interactions between economic decision makers take place primarily in markets. A **market** is an exchange mechanism that allows buyers to trade with sellers. A market may be a town square where people go to trade food and clothing, or it may be an international telecommunications network over which people buy and sell financial securities. When we talk about a single market, we refer to trade in a single good or group of goods that are closely related, such as soft drinks, movies, novels, or automobiles. The primary participants in a market are firms that supply the product and consumers who buy it, but government policies such as taxes also play an important role in the operation of markets.

Strategy

When competing with a small number of rival firms, senior managers consider how their firm's products are positioned relative to those of its rivals. The firm uses a strategy—a battle plan that specifies the *actions* or *moves* that the firm will make to maximize profit. A strategy might involve choosing the level of output, the price, or the type of advertising now and possibly in the future. For example, in setting its production levels and prices, Pepsi's managers must consider what choices Coca-Cola's managers will make. One tool that is helpful in understanding and developing such strategies is *game theory*, which we use in several chapters.

1.2 Economic Models

Economists use economic models to explain how managers and other decision makers make decisions and to interpret the resulting market outcomes. A **model** is a description of the relationship between two or more variables. Models are used in many fields. For example, astronomers use models to describe and predict the movement of comets and meteors, medical researchers use models to describe and predict the effect of medications on diseases, and meteorologists use models to predict weather.

Business economists construct models dealing with economic variables and use such models to describe and predict how a change in one variable will affect another variable. Such models are useful to managers in predicting the effects of their decisions and in understanding the decisions of others. Models allow managers to consider hypothetical situations—to use a *what-if analysis*—such as “What would happen if we raised our prices by 10%?” or “Would profit rise if we phased out one of our product lines?” Models help managers predict answers to what-if questions and to use those answers to make good decisions.

Mini-Case

Using an Income Threshold Model in China

According to the *income threshold model*, people whose incomes are below a threshold do not buy a particular consumer durable, while many people whose income exceeds that threshold buy it.

If this theory is correct, we predict that, as most people's incomes rise above the threshold in lower-income countries, consumer durable purchases will increase from near zero to large numbers virtually overnight. This prediction is consistent with evidence from Malaysia, where the income threshold for buying a car is about \$4,000.

In China, incomes have risen rapidly and now exceed the threshold levels for many types of durable goods. In response to higher incomes, Chinese car purchases have taken off.

For example, Li Rifu, a 46-year-old Chinese farmer and watch repairman, thought that buying a car would improve the odds that his 22- and 24-year-old sons would find girlfriends, marry, and produce grandchildren. Soon after Mr. Li purchased his Geely King Kong for the equivalent of \$9,000, both sons met girlfriends, and his older son got married.

Given the rapid increase in Chinese incomes in the past couple of decades, four-fifths of all new cars sold in China are bought by first-time customers. An influx of first-time buyers was responsible for Chinese car sales increasing by a factor of nearly 18 between 2000 and 2017. In 2005, China produced fewer than half as many cars as the United States. In 2017, China was by far the largest producer of cars in the world. It produced nearly three times as many cars as the United States—the second largest producer—as well as 39% more than the entire European Union. One out of every three cars in the world is produced in China.²

Simplifying Assumptions

Everything should be made as simple as possible, but not simpler. —Albert Einstein

A model is a simplification of reality. The objective in building a model is to include the essential issues, while leaving aside the many complications that might distract us or disguise those essential elements. For example, the income threshold model focuses on only the relationship between income and purchases of durable goods. Prices, multiple car purchases by a single consumer, and other factors that might affect durable goods purchases are left out of the model. Despite these simplifications, the model—if correct—gives managers a good general idea of how the automobile market is likely to evolve in countries such as China.

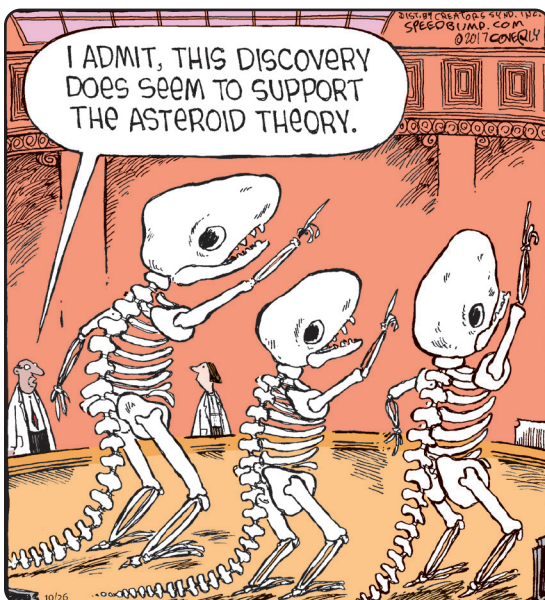
We have described the income threshold model in words, but we could have presented it using graphs or mathematics. Representing economic models using mathematical formulas in spreadsheets has become very important in managerial decision making. Regardless of how the model is described, an economic model is a simplification of reality that contains only its most important features. Without simplifications, it is difficult to make predictions because the real world is too complex to analyze fully.

²The sources for Mini-Cases are available at the back of the book.

Economists make many *assumptions* to simplify their models. When using the income threshold model to explain car purchasing behavior in China, we *assume* that factors other than income, such as the color of cars, do not have an important effect on the decision to buy cars. Therefore, we ignore the color of cars that are sold in China in describing the relationship between income and the number of cars consumers want. If this assumption is correct, by ignoring color, we make our analysis of the auto market simpler without losing important details. If we're wrong and these ignored issues are important, our predictions may be inaccurate. Part of the skill in using economic models lies in selecting a model that is appropriate for the task at hand.



An alternative theory.



Testing Theories

Blore's Razor: When given a choice between two theories, take the one that is funnier.

Economic *theory* refers to the development and use of a model to formulate *hypotheses*, which are proposed explanations for some phenomenon. A useful theory or hypothesis is one that leads to clear, testable predictions. A theory that says "If the price of a product rises, the quantity demanded of that product falls" provides a clear prediction. A theory that says "Human behavior depends on tastes, and tastes change randomly at random intervals" is not very useful because it does not lead to testable predictions.

Economists test theories by checking whether the theory's predictions are correct. If a prediction does not come true, they might reject the theory—or at least reduce their confidence in the theory. Economists use a model until it is refuted by evidence or until a better model is developed for a particular use.

A good model makes sharp, clear predictions that are consistent with reality. Some very simple models make sharp or precise predictions that are incorrect. Some more realistic and therefore more complex models make ambiguous predictions, allowing for any possible outcome, so they are untestable. Neither incorrect models nor untestable models are helpful. The skill in model building lies in developing a model that is simple enough to make clear predictions but realistic enough to be accurate. Any model is only an approximation of reality. A good model is one that is a close enough approximation to be useful.

Although economists agree on the methods they use to develop and apply testable models, they often disagree on the specific content of those models. One model might present a logically consistent argument that prices will go up next quarter. Another, using a different but equally logical theory, may contend that prices will fall next quarter. If the economists are reasonable, they will agree that pure logic alone cannot resolve their dispute. Indeed, they

will agree that they'll have to use empirical evidence—facts about the real world—to find out which prediction is correct. One goal of this book is to teach managers how to think like economists so that they can build, apply, and test economic models to deal with important managerial problems.

Positive and Normative Statements

Economic analysis sometimes leads to predictions that seem undesirable or cynical. For instance, an economist doing market research for a producer of soft drinks might predict that “if we double the amount of sugar in this soft drink we will significantly increase sales to children.” An economist making such a statement is not seeking to undermine the health of children by inducing them to consume excessive amounts of sugar. The economist is only making a scientific prediction about the relationship between cause and effect: More sugar in soft drinks is appealing to children.

Such a scientific prediction is known as a **positive statement**: a testable hypothesis about matters of fact such as cause-and-effect relationships. *Positive* does not mean that we are certain about the truth of our statement; It indicates only that we can test the truth of the statement.

An economist may test the hypothesis that the quantity of soft drinks demanded decreases as the price increases. Some may conclude from that study that “The government should tax soft drinks so that people will not consume so much sugar.” Such a statement is a value judgment. It may be based on the view that people *should* be protected from their own unwise choices, so the government *should* intervene.

This judgment is *not* a scientific prediction. It is a **normative statement**: a belief about whether something is good or bad. A normative statement cannot be tested because a value judgment cannot be refuted by evidence. A normative statement concerns what somebody believes *should* happen; a positive statement concerns what *is* or what *will* happen. Normative statements are sometimes called *prescriptive* statements because they prescribe a course of action, while positive statements are sometimes called *descriptive* statements because they describe reality. Although a normative conclusion can be drawn without first conducting a positive analysis, a policy debate will be better informed if a positive analysis is conducted first.³

Good economists and managers emphasize positive analysis. This emphasis has implications for what we study and even for our use of language. For example, many economists stress that they study people's *wants* rather than their *needs*. Although people need certain minimum levels of food, shelter, and clothing to survive, most people in developed economies have enough money to buy goods well in excess of the minimum levels necessary to maintain life. Consequently, in wealthy countries, calling something a “need” is often a value judgment. You almost certainly have been told by someone that “you *need* a college education.” That person was probably making a value judgment—“you *should* go to college”—rather than a scientific prediction that you will suffer terrible economic deprivation if you do not go to college. We can't test such value judgments, but we can test a (positive) hypothesis such as “Graduating from college or university increases lifetime income.”

³Some argue that, as (social) scientists, we economists should present only positive analyses. Others argue that we shouldn't give up our right to make value judgments just like the next person (who happens to be biased, prejudiced, and pigheaded, unlike us).

New Theories

One of the strengths of economics is that it is continually evolving, for two reasons. First, economists—like physicists, biologists, and other scientists—are always trying to improve their understanding of the world around them.

For example, traditional managerial textbooks presented theories based on the assumption that decision makers always optimize: They do the best they can with their limited resources. While we cover these traditional theories, we also present another recently developed approach referred to as *behavioral economics*, which is the study of how psychological biases and cognitive limits can prevent managers and others from optimizing.⁴

Second, economic theory evolves out of necessity. Unlike physical and biological scientists, economists and managers also have to develop new ways to think about *disruptive innovations*. Although most innovations are incremental, some are sufficiently disruptive to dramatically change the way an industry is structured—or even to create new industries and destroy old ones.

The internet is an example of a disruptive innovation. Internet-based online retailing has displaced much traditional brick-and-mortar retailing, online payment systems have largely replaced cash and checks, and online media, especially social media, have changed the way most people acquire and transmit information.

To analyze the economic effects of the internet and other disruptive innovations, economists have extended established theories and developed new ones. For example, the internet has given rise to many services that allow two groups of users to interact—such as auction services, dating sites, job matching services, and payment services. In response, economists have developed the theory of such *two-sided* markets, which has been important to the ongoing evolution of these markets and to government policy toward them.⁵ This book describes economic theories of the internet and of two-sided markets, along with other recent developments in economics.

1.3 Using Economic Skills in Your Career

This book will help you develop skills in economic analysis that are crucial in business decision-making. Some readers will get jobs that use economic analysis intensively, as in assessing financial investment options for financial institutions. Others may work in setting prices or planning other actions based on formal analyses, such as spreadsheet-based economic modeling. Other students will get jobs that emphasize different skills, but economic decisions come up everywhere in business.

All readers will benefit from familiarity with the applications of economics presented in this book. Many managers as well as concerned citizens regularly use these skills to predict the likely outcomes from government actions and other events. Readers will also find that much of the analysis in the book is relevant to their own personal decisions, such as investment or educational choices.

⁴The 2017 Nobel Prize in Economic Sciences was awarded to Richard H. Thaler “for his contributions to behavioral economics.”

⁵For example, economist Hal Varian used two-sided market theory to help Google develop its auction-based approach to selling ads. Courts have relied on economic analyses of two-sided markets in credit card, merger, and other cases.

SUMMARY

1. Managerial Decision Making. Economic analysis helps managers develop strategies to pursue their objectives effectively in the presence of scarcity. Various managers within a firm face different objectives and different constraints, but the overriding objective in most private-sector firms is to maximize profits. Making decisions subject to constraints implies making trade-offs. To make good managerial decisions, managers must understand how consumers, workers, other managers, and governments will act. Economic theories normally (but not always) assume that all decision makers attempt to maximize their well-being given the constraints they face.

2. Economic Models. Managers use models based on economic theories to help make predictions and

decisions, which they use to run their firms. A good model is simple to use and makes clear, testable predictions that are supported by evidence. Economists use models to construct *positive* hypotheses such as causal statements linking changes in one variable, such as income, to its effects, such as purchases of automobiles. These positive propositions can be tested. In contrast, *normative* statements, which are value judgments, cannot be tested.

3. Using Economic Skills in Your Career. A knowledge of economics will be valuable to you in a career in management, economics, or other fields. It will also be useful in your everyday life.

Supply and Demand

2

Talk is cheap because supply exceeds demand.

Managerial Problem

Carbon Taxes

Burning fossil fuels such as gasoline, coal, and heating oil releases gases containing carbon into the air.¹ These "greenhouse" gases are widely believed to contribute to global warming. To reduce this problem and raise tax revenues, many environmentalists and political leaders have proposed levying a *carbon tax* on the carbon content in fossil fuels.²

When governments impose carbon taxes on gasoline, managers of firms that sell gasoline need to think about how much of the tax they have to absorb and how much they can pass through to firms and consumers who buy gasoline. Similarly, managers of firms that purchase gasoline must consider how any pass-through charges will affect their costs of shipping, air travel, heating, and production. This pass-through analysis is critical in making managerial decisions concerning how much to produce, how to set prices, whether to undertake long-run capital investments, and whether to operate or shut down.

Finland and Sweden implemented the first broad-based carbon taxes on fuels containing carbon (such as gasoline) in the early 1990s. Various other countries followed suit, including Ireland and India in 2010 and the United Kingdom in 2013. However, strong opposition to carbon taxes has limited adoption in other parts of the world.

The first North American carbon tax was introduced in 2006 in Boulder, Colorado (where it was applied to only electricity generation), and this tax was renewed in 2012. In 2007 and 2008, the Canadian provinces of Quebec and British Columbia became the first provinces or states in North America to impose a broad-based carbon tax. Canada is set to impose a national carbon tax in 2018.

Such carbon taxes harm some industries and help others. The tax hurts owners and managers of gasoline retailing firms, who need to consider whether they can stay in business in the face of a significant carbon tax. Shippers and manufacturers that use substantial amounts of fuel in production, as well as other firms, would also see their operating costs rise.

In contrast, a carbon tax creates opportunities for other firms and industries. For example, wind and solar power, which are alternatives to fossil fuels in generating electricity, would become



¹Starting with this chapter, each chapter begins with a Managerial Problem that contains a specific question, which is answered at the end of the chapter using the theories presented in the chapter. Sources for the Managerial Problems, Mini-Cases, and Managerial Implications appear at the back of the book.

²Their political opponents object, claiming that fears about global warming are exaggerated and warning of large price increases from such taxes.

much more attractive. Anticipating greater opportunities in this market in the future, PacifiCorp, a utility owned by Warren Buffett, announced a plan in 2017 to spend \$3.5 billion over three years to bring hundreds of new wind turbines online. It also plans to greatly expand its use of solar power. In 2018, the Solar Corporation of India (SECI) called for bids ("tenders") to build two large solar power projects.

Managers in the motor vehicle industry would need to consider whether to change their product mix in response to a carbon tax, perhaps focusing more on fuel-efficient vehicles. Even without a carbon tax, when gas prices rise, many consumers switch from sports utility vehicles (SUVs) to smaller cars. A carbon tax would favor fuel-efficient vehicles even more.

At the end of this chapter, we will return to this topic and answer a question of critical importance to managers in the motor vehicle industry and in other industries affected by gasoline prices: What would be the effect of imposing a carbon tax on the price of gasoline?

To analyze the effects of carbon taxes on gasoline prices and other variables, managers use an economic tool called the *supply-and-demand model*. Managers who use this model to anticipate the effects of events make more profitable decisions.

The supply-and-demand model provides a good description of many markets and applies particularly well to those with many buyers and many sellers, as in most agricultural markets, much of the construction industry, many retail markets (such as gasoline retailing), and several other major sectors of the economy. In markets where this model is applicable, it allows us to make clear, testable predictions about the effects of new taxes or other shocks on prices and additional market outcomes.

Learning Objectives

1. Explain how the quantity of a good or service that consumers want depends on its price and other factors.
2. Describe how the quantity of a good or service that firms want to sell depends on its price and other factors.
3. Show how the interaction between consumers' demand curve and producers' supply curve determines the market price and quantity of a good or service.
4. Predict how an event that affects consumers or firms changes the market price and quantity.
5. Analyze the market effects of government policy using the supply-and-demand model.
6. Discuss when to use the supply-and-demand model.

2.1 Demand

Consumers decide whether to buy a particular good or service and, if so, how much to buy based on its price and on other factors, including their incomes, the prices of other goods, their tastes, and the information they have about the product. Government regulations and other policies also affect buying decisions. Before concentrating on the role of price in determining quantity demanded, let's look briefly at some other factors.

Income plays a major role in determining what and how much to purchase. People who suddenly inherit great wealth might be more likely to purchase expensive Rolex watches or other luxury items and would probably be less likely to buy inexpensive Timex watches and various items targeted toward lower-income consumers. More broadly, when a consumer's income rises, that consumer will often buy more of many goods.

The *price of a related good* might also affect consumers' buying decisions. Related goods can be either *substitutes* or *complements*. **Substitutes** are a pair of goods or services for which an increase in the price of one causes a consumer to demand a larger quantity of the other. Before deciding to go to a movie theater, a consumer considers the price of a substitute, such as streaming a movie online. The more expensive a trip to a movie theater is, the more likely that the consumer purchases a streamed movie to watch at home instead. Different brands of a good are often close substitutes. Before buying a pair of Levi's jeans, a customer might check the prices of other brands and substitute one of those brands for Levi's if its price is sufficiently attractive.

Complements are a pair of goods or services for which an increase in the price of one causes a consumer to demand a smaller quantity of the other. Smartphones, such as the iPhone and Samsung Galaxy, and music purchased online and downloaded to the smartphone are complements. A decline in the price of smartphones increases the demand for online music.

Consumers' *tastes* are important in determining their demand for a good or service. Consumers do not purchase foods they dislike or clothes they view as unfashionable or uncomfortable. The importance of fashion illustrates how changing tastes affect consumer demand. Clothing items that have gone out of fashion often languish in discount sections of clothing stores even though they commanded high prices a couple of years (or even a few weeks) earlier when they were in fashion. Firms devote significant resources to trying to change consumer tastes through advertising.

Similarly, *information* about the effects of a good has an impact on consumer decisions. In recent years, positive health outcomes linked to various food items have created greater demand for these healthy foods (such as soy products and high-fiber breads) when the information became well known.

Government rules and regulations affect demand. If a city government bans the use of skateboards on its streets, demand for skateboards in that city falls. Governments might also restrict sales to particular groups of consumers. For example, many political jurisdictions do not allow children to buy tobacco products, which reduces the quantity of cigarettes consumed.

Other factors might also affect the demand for specific goods. For example, consumers are more likely to use Facebook if most of their friends use Facebook. This *network effect* arises from the benefits of being part of a network and from the potential costs of being outside the network.

Although many factors influence demand, economists focus most on how a good's *own* price affects the quantity demanded. The relationship between price and quantity demanded plays a critical role in determining the market price and quantity in supply-and-demand analysis. To determine how a change in price affects the quantity demanded, economists ask what happens to quantity when price changes and other factors affecting demand, such as income and tastes, are held constant.

The Demand Curve

The amount of a good that consumers are *willing* to buy at a given price, holding constant the other factors that influence purchases, is the **quantity demanded**. The quantity demanded of a good or service can exceed the quantity *actually* sold. For

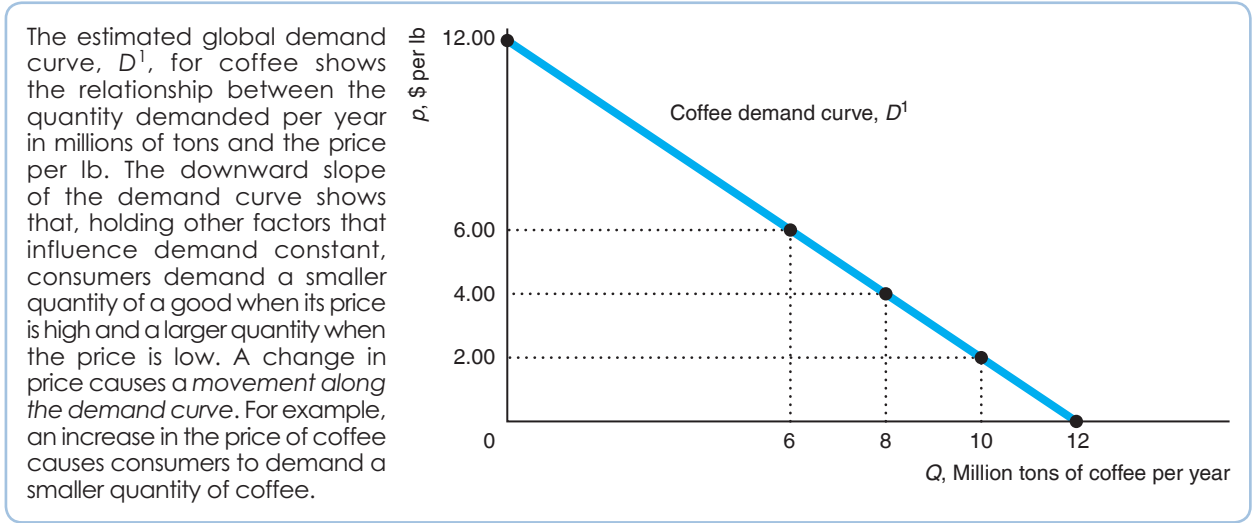
example, as a promotion, a local store might sell Ghirardelli dark chocolate bars for \$1 each today only. At that low price, you might want to buy 10 chocolate bars, but because the store has only 5 remaining, you can buy at most 5 chocolate bars at this price. The quantity you demand at this price is 10 chocolate bars—it's the amount you want—even though the amount you actually buy is only 5.



Using a diagram, we can show the relationship between price and the quantity demanded. A **demand curve** shows the quantity demanded at each possible price, holding constant the other factors that influence purchases. Figure 2.1 shows the estimated annual world demand curve, D^1 , for coffee, which is one of the world's most valuable traded commodities. The internationally traded commodity is unroasted ("green") coffee beans. These unroasted beans are sold to Starbucks, Folgers, Maxwell House, and other firms that roast and sell coffee to retail consumers.³ In this section, we analyze the market for unroasted coffee beans, which we call *coffee*. Although this demand curve is a straight line, demand curves may also be smooth curves or wavy lines. By convention, the vertical axis of the graph measures the price, p , per unit of the good. We measure the price of coffee in dollars per pound (abbreviated *lb*). The horizontal axis measures the quantity, Q , of the good, which is usually a *physical measure per time period*. This figure measures the quantity of coffee in millions of tons (2,000 lb) per year.

The demand curve hits the vertical axis at \$12, indicating that the quantity demanded is zero when the price is \$12 per lb or higher. The demand curve hits the horizontal (quantity) axis at 12 tons, the quantity of coffee buyers would want each year if the price were zero. To find out how much consumers demand at a price between zero and \$12, say, \$6, we draw a horizontal line from that price on the vertical axis until we hit the demand curve, and then we draw a vertical line down to the horizontal quantity axis. As the figure shows, the quantity demanded at a price of \$6 per lb is 6 million tons per year.

FIGURE 2.1 A Demand Curve



³We estimated the demand curve using data from the Food and Agriculture Organization, Commodity Review and Outlook and the International Coffee Organization, www.ico.org, and World Bank, World Development Indicators. We rounded the numbers for simplicity.

One of the most important things to know about a demand curve is what it does *not* show. All relevant economic variables that the demand curve graph does not explicitly display—income, prices of related goods (such as tea or sugar), tastes, information, and so on—are held constant. Thus, the demand curve shows how quantity varies with price but not how quantity varies with income, the prices of related goods, tastes, information, or other variables.

Effects of a Price Change on the Quantity Demanded. One of the most important results in economics is the **Law of Demand**: Consumers demand more of a good if its price is lower, holding constant income, the prices of other goods, tastes, and other factors that influence the amount they want to consume. According to the Law of Demand, *demand curves slope downward*, as in Figure 2.1.

A downward-sloping demand curve illustrates that consumers demand a larger quantity of this good when its price is low and a smaller quantity when its price is high. What happens to the quantity of coffee demanded if the price of coffee drops and all other variables remain constant? If the price falls from \$6 per lb to \$4 per lb in Figure 2.1, the annual quantity buyers want to purchase increases from 6 million tons to 8 million tons per year. Similarly, if the price drops from \$4 to \$2 per lb, the quantity buyers demand increases from 8 to 10 million tons.⁴

These changes in the quantity demanded in response to changes in price are *movements along the demand curve*. Thus, the demand curve is a concise summary of the answer to the question “What happens to the quantity demanded as the price changes, when all other factors are held constant?”

Although we generally expect demand curves to have a clear downward slope, as the coffee demand curve does, a vertical or horizontal demand curve is possible. We can think of horizontal and vertical demand curves as being extreme cases of downward-sloping demand. The Law of Demand rules out demand curves that have an upward slope.

The Law of Demand is an empirical claim—a claim about what actually happens. It is not a claim about general theoretical principles. It is theoretically possible that a demand curve could slope upward. However, the available empirical evidence strongly supports the Law of Demand.

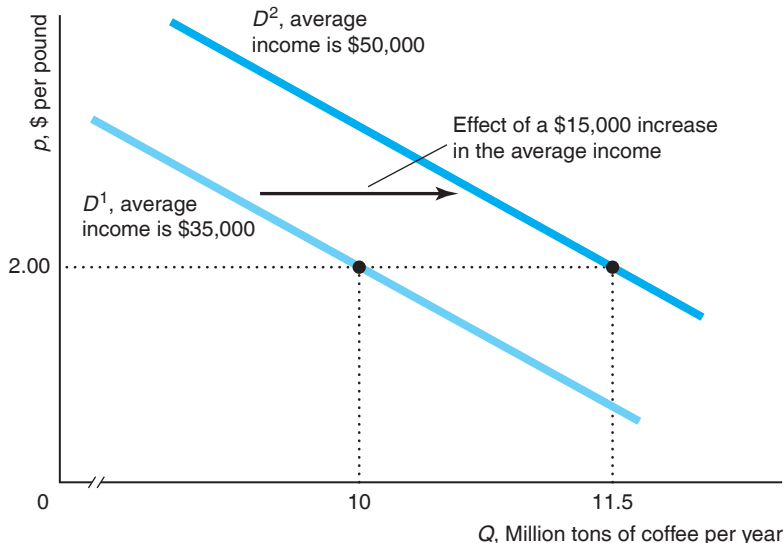
Effects of Other Factors on Demand. If a demand curve shows how a price change affects the quantity demanded, holding constant all other factors that affect demand, how can we use demand curves to show the effects of a change in one of these other factors, such as income? One approach is to draw the demand curve in a three-dimensional diagram with the price of coffee on one axis, income on a second axis, and the quantity of coffee on the third axis. But just thinking about drawing such a diagram probably makes your head hurt.

Economists use a simpler approach to show the effect of factors other than a good’s own price on demand. A change in any relevant factor other than the price of the good causes a *shift of the demand curve* rather than a *movement along the demand curve*. We illustrate such a shift in Figure 2.2. This figure shows that the coffee demand curve shifts *to the right* from the original demand curve D^1 to a new demand curve D^2 if average annual household income in high-income countries, which consume most of the world’s coffee, increases by \$15,000, from \$35,000 to \$50,000. On the new

⁴From now on, we will not state the physical and time period measures unless they are particularly relevant. Thus, we say that the price is \$2 (with the “per lb” understood) and the quantity is 10 (with the “million tons per year” understood).

FIGURE 2.2 A Shift of the Demand Curve

The global demand curve for coffee shifts to the right from D^1 to D^2 as average annual household income in high-income countries rises by \$15,000, from \$35,000 to \$50,000. As a result of the increase in income, more coffee is demanded at any given price.



demand curve, D^2 , consumers demand more coffee at any given price than on D^1 because income has risen, encouraging consumers to buy more coffee. At a price of \$2 per lb, the quantity of coffee demanded goes from 10 million tons on D^1 , before the increase in income, to 11.5 million tons on D^2 , after the increase.

The prices of related goods—substitutes and complements—also affect the quantity of coffee demanded. Consumers who view tea and coffee as substitutes demand more coffee at any given price of coffee as the price of tea rises. That is, their demand curve for coffee shifts to the right.

Complements have the opposite effect. Consumers who view sugar and coffee as complements demand less coffee at any given price of coffee as the price of sugar rises. That is, their demand curve for coffee shifts to the left.

In addition, changes in other factors that affect demand, such as information, can shift a demand curve. Reinstein and Snyder (2005) found that movie reviews affect the demand for some types of movies, but not others. Holding price constant, they determined that if a film received “two-thumbs-up” reviews on a popular movie-review television program, the opening weekend demand curve shifted to the right by 25% for a drama, but the demand curve did not significantly shift for an action film or a comedy.

To properly analyze the effects of a change in some variable on the quantity demanded, we must distinguish between a *movement along a demand curve* and a *shift of a demand curve*. A change in the good’s own price causes a *movement along a demand curve*. A change in any other relevant factor besides the good’s own price causes a *shift of the demand curve*.

The Demand Function

The demand curve shows the relationship between the quantity demanded and a good’s own price, holding other relevant factors constant at some particular levels. We illustrate the effect of a change in one of these other relevant factors by shifting the demand curve. We can also represent the same information—information about how price, income, and other variables affect quantity demanded—using a

mathematical relationship called the *demand function*. This function shows the effect of a good's own price and other relevant factors on the quantity demanded. Any factors not explicitly listed in the demand function are assumed to be irrelevant or held constant. For example, we could specify the demand for coffee as a function of the price of coffee, income, the price of tea, the price of sugar, the prices of other related goods, and possibly other factors as well. However, if we hold constant all potentially relevant factors except the price of coffee, p , the price of sugar, p_s , and income, Y , the demand function is

$$Q = D(p, p_s, Y), \quad (2.1)$$

where Q is the quantity of coffee demanded, D is the demand function, p is the price of coffee, and Y is income. This expression shows how the quantity of coffee demanded varies with the price of coffee and the income of consumers.

Equation 2.1 is a general functional form—it does not specify a particular form for the relationship between quantity, Q , and the explanatory variables, p and Y . The estimated demand function that corresponds to the demand curve D^1 in Figures 2.1 and 2.2 has the specific (linear) form

$$Q = 8.56 - p - 0.3p_s + 0.1Y, \quad (2.2)$$

where Q is the quantity of coffee in millions of tons per year, p is the price of coffee in dollars per lb, p_s is the price of sugar in dollars per lb, and Y is the average annual household income in high-income countries in thousands of dollars.

When we draw the demand curve D^1 in Figures 2.1 and 2.2, we set p_s and Y at specific values, $p_s = \$0.20$ per lb and $Y = \$35$ thousand per year. By substituting these values for p_s and Y in Equation 2.2, we can express the quantity demanded as a function of only the price of coffee:

$$\begin{aligned} Q &= 8.56 - p - 0.3p_s + 0.1Y \\ &= 8.56 - p - (0.3 \times 0.2) + (0.1 \times 35) \\ &= 12 - p. \end{aligned} \quad (2.3)$$

The demand function in Equation 2.3 corresponds to the straight-line demand curve D^1 in Figure 2.1 with $Y = 35$. The constant term, 12, in Equation 2.3 is the quantity demanded (in millions of tons per year) if the price is zero. Setting the price equal to zero in Equation 2.3, we find that the quantity demanded is $Q = 12 - 0 = 12$. Figure 2.1 shows that $Q = 12$ where D^1 hits the quantity axis—where price is zero.

Equation 2.3 also shows us how quantity demanded varies with a change in price: a movement *along* the demand curve. If the price falls from p_1 to p_2 , the change in price, Δp , equals $p_2 - p_1$. (The Δ symbol, the Greek letter delta, means “change in” the variable following the delta, so Δp is the “change in the price.”) If the price of coffee falls from $p_1 = \$4$ to $p_2 = \$2$, then $\Delta p = \$2 - \$4 = -\$2$. Quantity demanded changes from $Q_1 = 8$ at a price of $\$4$ to $Q_2 = 10$ at a price of $\$2$, so $\Delta Q = Q_2 - Q_1 = 10 - 8 = 2$ million tons per year, as Figure 2.1 shows.

More generally, the quantity demanded at p_1 is $Q_1 = D(p_1)$, and the quantity demanded at p_2 is $Q_2 = D(p_2)$. The change in the quantity demanded, $\Delta Q = Q_2 - Q_1$, in response to the price change (using Equation 2.3) is

$$\begin{aligned} \Delta Q &= Q_2 - Q_1 \\ &= D(p_2) - D(p_1) \\ &= (12 - p_2) - (12 - p_1) \\ &= -(p_2 - p_1) \\ &= -\Delta p. \end{aligned}$$

Thus, the change in the quantity demanded, ΔQ , is $-\Delta p$ in this case.

For example, if $\Delta p = -\$2$, then $\Delta Q = -1\Delta p = -1(-2) = 2$. That is, a \$2 decrease in price causes the quantity demanded to rise by 2 million tons per year. The change in quantity demanded is positive—the quantity demanded increases—when the price falls. This effect is consistent with the Law of Demand. Similarly, raising the price would cause the quantity demanded to fall.

Using Calculus

Deriving the Slope of a Demand Curve

We can use calculus to determine how the quantity changes as the price increases. Given the demand function for coffee of $Q = 12 - p$, the derivative of the demand function with respect to price is $dQ/dp = -1$. Therefore, the slope of the demand curve in Figure 2.1, which is $dp/dQ = 1/(dQ/dp)$, is also -1 . More generally, the Law of Demand states that the derivative of the demand function with respect to price is negative, $dQ/dp < 0$.

Summing Demand Curves

The overall demand for coffee is composed of the demand of many individual consumers. If we know the demand curve for each of two consumers, how do we determine the total demand curve for the two consumers combined? The total quantity demanded *at a given price* is the sum of the quantity each consumer demands at that price.

We can use individual demand functions to determine the total demand of several consumers. Suppose that the demand function for Consumer 1 is

$$Q_1 = D^1(p)$$

and the demand function for Consumer 2 is

$$Q_2 = D^2(p).$$

At price p , Consumer 1 demands Q_1 units, Consumer 2 demands Q_2 units, and the total quantity demanded by both consumers is the sum of these two quantities:

$$Q = Q_1 + Q_2 = D^1(p) + D^2(p).$$

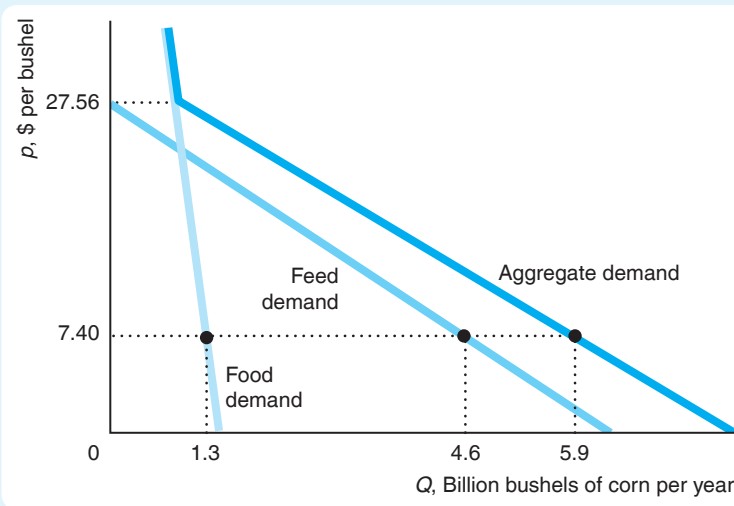
We can generalize this approach to look at the total demand for three, four, or more consumers, or we can apply it to groups of consumers rather than just to individuals. It makes sense to add the quantities demanded only when all consumers face the same price. Adding the quantity Consumer 1 demands at one price to the quantity Consumer 2 demands at another price would not be meaningful for this purpose—the result would not show us a point on the combined demand curve.

Mini-Case

Summing Corn Demand Curves

We illustrate how to sum individual demand curves to get a summed or combined demand curve graphically, using estimated demand curves for corn (McPhail & Babcock, 2012). The figure shows the U.S. feed demand (the use of corn to feed animals) curve, the U.S. food demand curve, and the summed demand curve from these two sources.⁵

⁵For graphical simplicity, we do not show the other major sources of U.S. demand for corn: export, storage, and use in biofuels (ethanol). Thus, this summed demand curve is not the total demand curve for corn.



To derive the sum of the quantity demanded for these two uses at a given price, we add the quantities from the individual demand curves at that price. That is, we add the demand curves horizontally. At a price for corn of \$7.40, the quantity demanded for food is 1.3 billion bushels per year and the quantity demanded for feed is 4.6 billion bushels. Thus, the summed quantity demanded at that price is $Q = 1.3 + 4.6 = 5.9$ billion bushels.

When the price of corn exceeds \$27.56 per bushel, farmers stop using corn for animal feed, so the quantity demanded for this use equals zero. As a result, the summed demand curve is the same as the food demand curve at prices above \$27.56.

2.2 Supply

Knowing how much consumers want to buy at any given price is not enough by itself to tell us the market price and quantity. We also need to know how much firms want to supply at any given price. Firms determine how much of a good to supply given the price of that good and other factors, including the costs of producing the good. Usually, we expect firms to supply more at a higher price. Before concentrating on the role of price in determining supply, we describe the role of some other factors.

Costs of production (how much the firm pays for factors of production such as labor, fuel, and machinery) affect how much of a product firms want to sell. As a firm's cost falls, it is usually willing to supply more, holding price and other factors constant. Conversely, a cost increase will often reduce a firm's willingness to produce. If the firm's cost exceeds what it can earn from selling the good, the firm will produce nothing. Thus, factors that affect costs also affect supply. If a *technological advance* allows a firm to produce its good at lower cost, the firm supplies more of that good at any given price, holding other factors constant.

Government rules and regulations can also affect supply directly without working through costs. For example, in some parts of the world, retailers may not sell most goods and services on particular days of religious significance. Supply on those days is constrained by government policy to be zero.

The Supply Curve

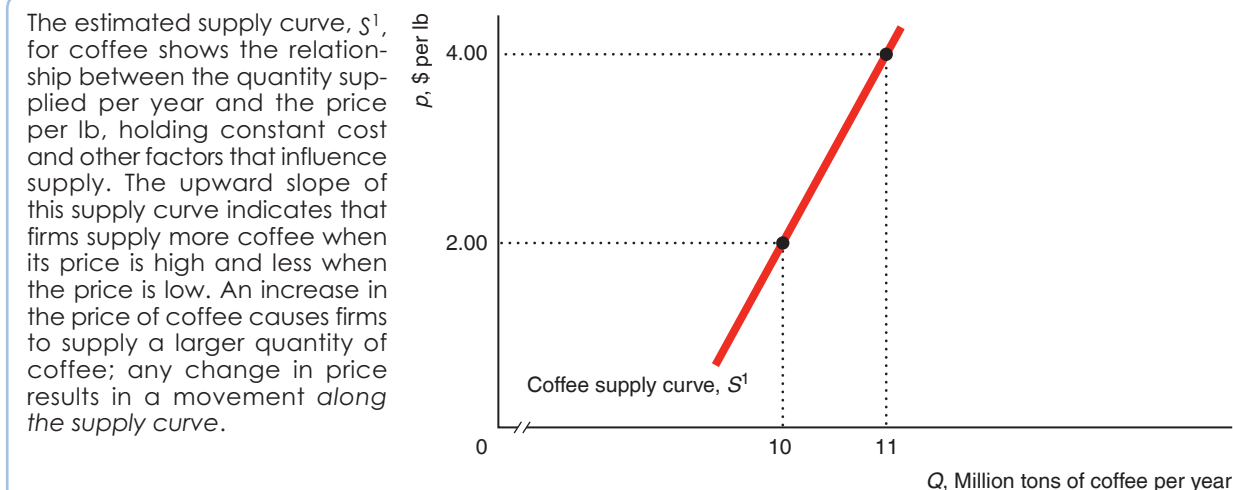
The **quantity supplied** is the amount of a good that firms *want* to sell at a given price, holding constant other factors that influence firms' supply decisions, such as costs and government actions. We can show graphically the relationship between price and the quantity supplied. A **supply curve** displays the quantity supplied at each possible price, holding constant the other factors that influence firms' supply decisions. Figure 2.3 shows the estimated supply curve, S^1 , for coffee. As with the demand curve, the price on the vertical axis is measured in dollars per physical unit (dollars per lb), and the quantity on the horizontal axis is measured in physical units per period (millions of tons per year). Because we hold fixed other variables that may affect supply, the supply curve concisely answers the question "What happens to the quantity supplied as the price changes, holding all other relevant factors constant?"

Effects of Price on Supply. We illustrate how price affects the quantity supplied using the supply curve for coffee in Figure 2.3. The supply curve is upward sloping. As the price increases, firms supply more. If the price is \$2 per lb, the quantity supplied by the market is 10 million tons per year. If the price rises to \$4, the quantity supplied rises to 11 million tons. An increase in the price of coffee causes a *movement along the supply curve*: firms supply more coffee.

Although the Law of Demand states that the demand curve slope downward, *no* corresponding "Law of Supply" states that the supply curve must slope in a particular way. We observe supply curves that are vertical, horizontal, or downward sloping in particular situations. However, supply curves are commonly upward sloping. Accordingly, if we lack specific information about the slope, we usually draw upward-sloping supply curves. Along an upward-sloping supply curve, the higher the price, the larger the quantity that firms supply, holding other factors constant.

Effects of Other Variables on Supply. A change in a relevant variable other than the good's own price causes the entire *supply curve to shift*. One such variable is the price of cocoa (which is a major component in chocolate). The land

FIGURE 2.3 A Supply Curve



on which coffee is grown can also grow cocoa. When the price of cocoa rises, many coffee farmers switch to producing cocoa. Therefore, when the price of cocoa rises, the amount of coffee produced at any given price for coffee falls.

In Figure 2.4, when the cocoa price increases from \$3 per lb to \$6 per lb, the supply curve for coffee shifts leftward from S^1 to S^2 . At a price of \$2 per lb for coffee, the quantity supplied falls from 10 million tons on S^1 to 9.4 million tons on S^2 .

It is important to distinguish between a *movement along a supply curve* and a *shift of the supply curve*. When the price of coffee changes, the change in the quantity supplied reflects a *movement along the supply curve*. When the price of cocoa or other variables that affect supply change, the entire *supply curve shifts*.

The Supply Function

We can write the relationship between the quantity supplied and price and other factors as a mathematical relationship called the *supply function*. Using a general functional form, we can write the coffee supply function, S , as

$$Q = S(p, p_c), \quad (2.4)$$

where Q is the quantity of coffee supplied, p is the price of coffee, and p_c is the price of cocoa. The supply function, Equation 2.4, might also incorporate other factors such as wages, transportation costs, and the state of technology, but by leaving them out, we are implicitly holding them constant.

Our estimated supply function for coffee is

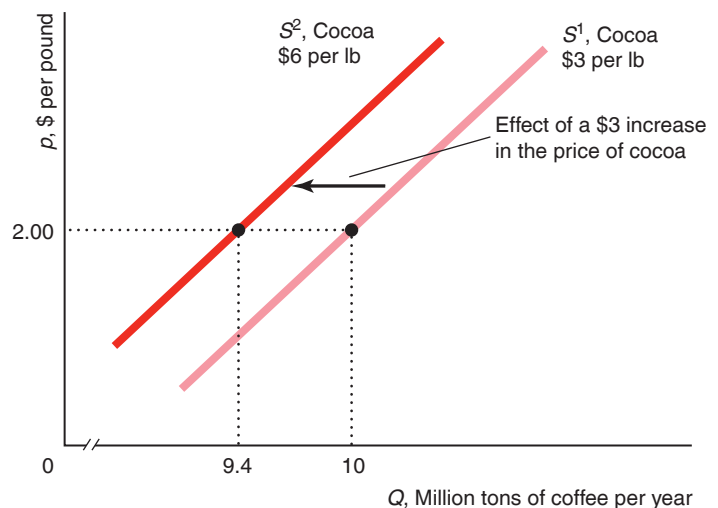
$$Q = 9.6 + 0.5p - 0.2p_c, \quad (2.5)$$

where Q is the quantity in millions of tons per year, p is the price of coffee in dollars per lb, and p_c is the price of cocoa in dollars per lb. If we hold the cocoa price fixed at \$3 per lb, we can rewrite the supply function in Equation 2.5 as solely a function of the coffee price. Substituting $p_c = \$3$ into Equation 2.5, we find that

$$Q = 9.6 + 0.5p - (0.2 \times 3) = 9 + 0.5p. \quad (2.6)$$

FIGURE 2.4 A Shift of a Supply Curve

A \$3 per lb increase in the price of cocoa, which farmers can grow instead of coffee, causes the supply curve for coffee to shift leftward from S^1 to S^2 . At a coffee price of \$2 per lb, the quantity supplied falls from 10 on S^1 to 9.4 on S^2 .



What happens to the quantity supplied if the price of coffee increases by $\Delta p = p_2 - p_1$? As the price increases from p_1 to p_2 , the quantity supplied goes from Q_1 to Q_2 , so the change in quantity supplied is

$$\Delta Q = Q_2 - Q_1 = (9 + 0.5p_2) - (9 + 0.5p_1) = 0.5(p_2 - p_1) = 0.5\Delta p.$$

Thus, a \$1 increase in price ($\Delta p = 1$) causes the quantity supplied to increase by $\Delta Q = 0.5$ million tons per year. This change in the quantity of coffee supplied as p increases is a *movement along the supply curve*.

Summing Supply Curves

The total supply curve shows the total quantity produced by all suppliers at each possible price. The overall amount of coffee supplied at any given price is the sum of the quantity supplied by Brazilian, Vietnamese, Colombian, and other producers in various countries.

2.3 Market Equilibrium

The supply and demand curves jointly determine the price and quantity at which a good or service is bought and sold. The demand curve shows the quantities consumers want to buy at various prices, and the supply curve shows the quantities firms want to sell at various prices. Unless firms set the price so that consumers want to buy exactly the same amount that suppliers want to sell, some consumers cannot buy as much as they want or some sellers cannot sell as much as they want.

When all market participants are able to buy or sell as much as they want, we say that the market is in **equilibrium**: a situation in which no participant wants to change its behavior. A price at which consumers can buy as much as they want and sellers can sell as much as they want is the *equilibrium price*. At this price, the quantity demanded equals the quantity supplied. This quantity is the *equilibrium quantity*. Thus, if the government does not intervene in the market, the supply-and-demand model is in equilibrium when the *market clears* in the sense that buyers and sellers are both able to buy or sell as much as they want at the market price—no one is frustrated and all goods that are supplied to the market are sold.

Using a Graph to Determine the Equilibrium

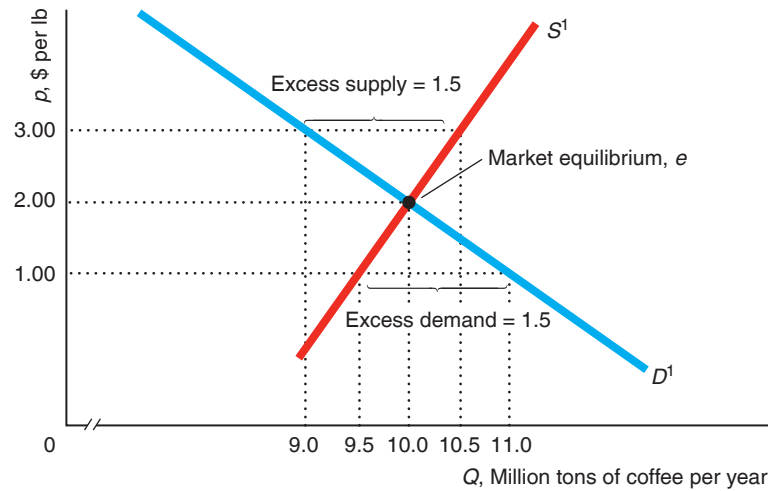
To illustrate how supply and demand curves determine the equilibrium price and quantity, we use the coffee example. Figure 2.5 shows the supply curve, S^1 , and demand curve, D^1 , for coffee. The supply and demand curves intersect at point e , the market equilibrium. The equilibrium price is \$2 per lb, and the equilibrium quantity is 10 million tons per year, which is the quantity firms want to sell *and* the quantity consumers want to buy.

Using Math to Determine the Equilibrium

We can determine the coffee equilibrium mathematically, using supply and demand functions that correspond to the supply and demand curves. We use these two

FIGURE 2.5 Market Equilibrium

The intersection of the supply curve, S^1 , and the demand curve, D^1 , for coffee determines the market equilibrium point, e , where $p = \$2$ per lb and $Q = 10$ million tons per year. At the lower price of $p = \$1$, the quantity demanded is 11, but the quantity supplied is only 9.5, so the excess demand is 1.5. At $p = \$3$ the price exceeds the equilibrium price. As a result, the market has an excess supply of 1.5 because the quantity demanded, 9, is less than the quantity supplied, 10.5. With either excess demand or excess supply, market forces drive the price back to the equilibrium price of \$2.



equations to solve for the equilibrium price at which the quantity demanded equals the quantity supplied (the equilibrium quantity). The demand function, Equation 2.3, is the relationship between the quantity demanded, Q_d , and the price:⁶

$$Q_d = 12 - p.$$

The supply function, Equation 2.6, is the relationship between the quantity supplied, Q_s , and the price:

$$Q_s = 9 + 0.5p.$$

We want to find the equilibrium price, p , at which $Q_d = Q_s = Q$. Thus, we set the right sides of these two equations equal,

$$12 - p = 9 + 0.5p,$$

and solve for the price.

Adding p to both sides of this expression and subtracting 9 from both sides, we find that $3 = 1.5p$. Dividing both sides of this last expression by 1.5, we learn that the equilibrium price is $p = \$2$. We can determine the equilibrium quantity by substituting this p into either the supply function or the demand function. Using the demand function, we find that the equilibrium quantity is

$$Q = 12 - 2 = 10$$

million tons per year. We can obtain the same quantity by using the supply function:

$$Q = 9 + (0.5 \times 2) = 10.$$

⁶Usually, we use Q to represent both the quantity demanded and the quantity supplied. However, for clarity in this discussion, we use Q_d and Q_s .

Forces That Drive the Market to Equilibrium

A market equilibrium is not just an abstract concept or a theoretical possibility.⁷ Economic forces cause markets to adjust to the equilibrium. At the equilibrium, price and quantity remain stable until some new event occurs that shifts the demand or supply curve.

Remarkably, an equilibrium occurs without any explicit coordination between consumers and firms. In a competitive market such as that for most agricultural products, millions of consumers and thousands of firms make their buying and selling decisions independently. Yet each firm can sell the quantity it wants at the market price and each consumer can buy the quantity he or she wants at that price. It is as though an unseen market force like an *invisible hand* (a phrase coined by Adam Smith in 1776) directs people and firms to coordinate their activities to achieve equilibrium.

What forces cause the market to move to equilibrium? If the price is not at the equilibrium level, consumers or firms have an incentive to change their behavior in a way that will drive the price to the equilibrium level, as we now illustrate.

If the price were initially lower than the equilibrium price, consumers would want to buy more than suppliers want to sell. If the price of coffee is \$1 in Figure 2.5, firms are willing to supply 9.5 million tons per year but consumers demand 11 million tons. At this price, the market is in *disequilibrium*: the quantity demanded is not equal to the quantity supplied. This market has **excess demand**—the amount by which the quantity demanded exceeds the quantity supplied at a specified price. If the price is \$1 per lb, the market has an excess demand of $11 - 9.5 = 1.5$ million tons per year.

Some consumers are lucky enough to buy the coffee at \$1 per lb. Other consumers cannot find anyone who is willing to sell them coffee at that price. What can they do? Some frustrated consumers may offer to pay suppliers more than \$1 per lb.

Alternatively, suppliers, noticing these disappointed consumers, might raise their prices. Such actions by consumers and producers cause the market price to rise. As the price rises, the quantity that firms want to supply increases and the quantity that consumers want to buy decreases. This upward pressure on price continues until it reaches the equilibrium price, \$2, which eliminates the excess demand.

If, instead, the price is initially above the equilibrium level, suppliers want to sell more than consumers want to buy. For example, at a price of \$3, suppliers want to sell 10.5 million tons per year but consumers want to buy only 9 million tons, as Figure 2.5 shows. This market has an **excess supply**—the amount by which the quantity supplied exceeds the quantity demanded at a specified price—of 1.5 ($= 10.5 - 9$) million tons at a price of \$3. Not all firms can sell as much as they want. Rather than allow their unsold coffee to get stale, firms lower the price to attract additional customers. As long as the price remains above the equilibrium price, some firms cannot sell as much coffee as they want, so they lower the price further. The price falls until it reaches the equilibrium level, \$2, which eliminates the excess supply and hence removes the pressure to lower the price further.

Not all markets reach equilibrium through the independent actions of many buyers or sellers. In institutionalized or formal markets, such as the Chicago Mercantile Exchange—where coffee and other agricultural commodities, financial instruments,

⁷**MyLab Economics** has games (called *experiments*) for the Managerial Economics and Strategy course. These online games allow you to play against the computer. The *Market Experiment* illustrates the operation of the supply-and-demand model, allowing you to participate in a simulated market. To play, go to **MyLab Economics** Multimedia Library, Single Player Experiment, and set the Chapter field to “All Chapters.”