14TH EDITION

Managerial ECONOMICS

APPLICATIONS, STRATEGY, AND TACTICS

McGuigan Moyer Harris

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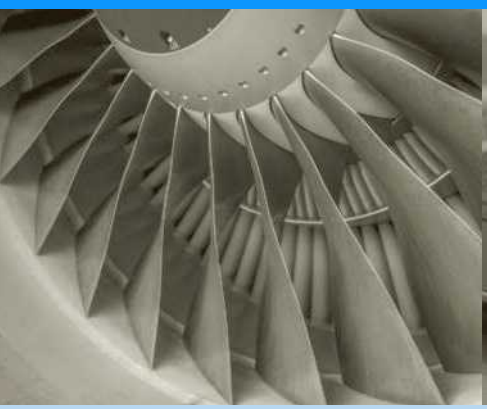

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***Managerial Economics: Applications, Strategy, and Tactics*, Fourteenth Edition**

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To my family
J.R.M.

To Sally, Laura, and Craig
R.C.M.

To Nancy, Taylor, Sarah and Ken Elzinga
F.H.B.H.

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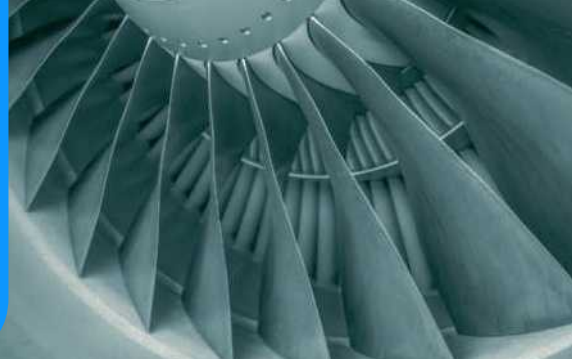

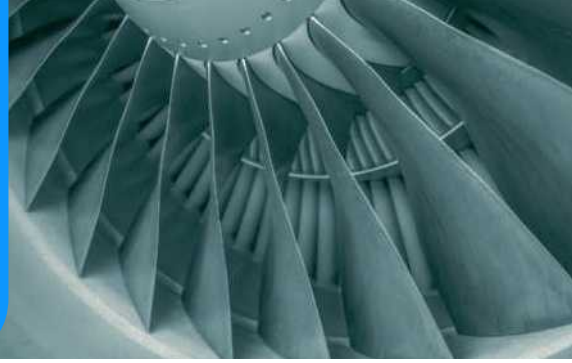

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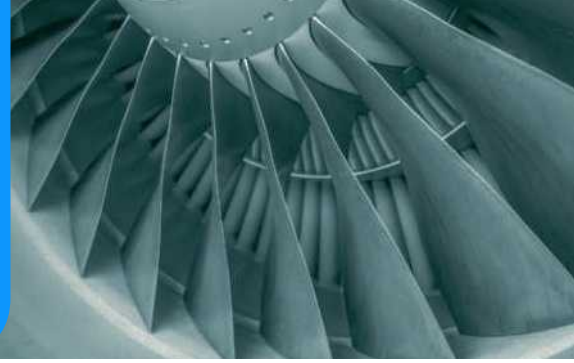

ORGANIZATION OF THE TEXT

The 14th edition has been thoroughly updated with 45 new applications and dozens of new figures and tables.

We continue to expand the review of microeconomic fundamentals in Chapters 2 and 3, employing a wide-ranging discussion of the equilibrium price of crude oil and gasoline as well as the marginal analysis of long-lasting lightbulbs. This new emphasis supports the use of the book for pre-experience MA in Management and specialized MS programs in business schools.

The text is structured, like many others, around demand, production, cost and pricing theory in context, but the difference here is the context. We believe students are motivated to learn analytical tools by first becoming immersed in and motivated by deep fact situation contexts. Consequently, in each of the first 12 chapters we teach the students why a new technique is important by first demonstrating what it can be used to accomplish in business practice. Only then, do we delve into the theory that applies.

Another distinctive feature of the book is the extensive treatment in Chapter 6 of global business, import-export trade, exchange rates, free trade areas, and trade policy. There is more comprehensive material on applied game theory in Chapters 13, 13A, 15, 15A, and the Web Appendix Case Study than in any other managerial economics textbook. And a unique treatment of revenue (yield) management appears in Chapter 14A. Part V includes the hot topics of corporate governance, information economics, auction design, and the choice of organizational architecture. Chapter 16 on Regulation includes an extensive discussion of market mechanisms for addressing externalities. Chapter 17 now leads off with a capital budgeting decision by GE to return appliance manufacturing to the United States.

By far the most distinctive feature of the book is its 300 boxed examples, Managerial Challenges, What Went Right/What Went Wrong explorations of corporate practice, and mini-case examples on every other page demonstrating what each analytical concept is used for in practice. This list of concept applications is highlighted on the inside front and back covers.

STUDENT PREPARATION

The text is designed for use by upper-level undergraduates and first-year graduate students in business schools, departments of economics, and professional schools of management, public policy, and information science as well as in executive training programs. Students are presumed to have a background in the basic principles of microeconomics, although Chapter 2 offers an extensive review of those topics. No prior work in statistics is assumed; development of all the quantitative concepts employed is self-contained. The book makes occasional use of elementary concepts of differential

calculus. In all cases where calculus is employed, at least one alternative approach, such as graphical, algebraic, or tabular analysis, is also presented. Spreadsheet applications have become so prominent in the practice of managerial economics that we now address optimization in that context.

PEDAGOGICAL FEATURES OF THE 14TH EDITION

The 14th edition of *Managerial Economics* makes extensive use of pedagogical aids to enhance individualized student learning. The key features of the book are:

1. **Managerial Challenges.** Each chapter opens with a Managerial Challenge (MC) illuminating a real-life problem faced by managers that is closely related to the topics covered in the chapter. Instructors can use the discussion questions following each MC to "hook" student interest at the start of the class or in conjunction with MindTap preclass preparation assignments.
2. **What Went Right/What Went Wrong.** This feature allows students to relate business mistakes and triumphs to what they have just learned, and helps build that elusive goal of managerial insight.
3. **Extensive Use of Boxed Examples.** More than 300 real-world applications and examples derived from actual corporate practice are highlighted throughout the text. These applications help the analytical tools and concepts to come alive and thereby enhance student learning. They are listed on the inside front and back covers to highlight the prominence of this feature of the book.
4. **Sustainability and the Environment Symbol.** A wind vane symbol highlights numerous passages that address environmental effects and sustainability issues throughout the book.
5. **Exercises.** Each chapter contains a large problem analysis set. Check answers to selected problems color-coded in blue type are provided in Appendix D at the end of the book. Problems that can be solved using Excel are highlighted with an Excel icon. The book's Web site (www.cengage.com/economics/mcguigan) has answers to all the other textbook problems.
6. **Case Exercises.** Most chapters include mini-cases that extend the concepts and tools developed into a deep fact situation context of a real-world company, allowing the students to practice what they encounter on every other page in the 300 boxed examples and applications.
7. **Chapter Glossaries.** In the margins of the text, new terms are defined as they are introduced. The placement of the glossary terms next to the location where the term is first used reinforces the importance of these new concepts and aids in later studying.
8. **International Perspectives.** Throughout the book, special International Perspectives sections that illustrate the application of managerial economics concepts to an increasingly global economy are provided. A globe symbol highlights this internationally relevant material.
9. **Point-by-Point Summaries.** Each chapter ends with a detailed, point-by-point summary of important concepts from the chapter.
10. **Diversity of Presentation Approaches.** Important analytical concepts are presented in several different ways, including tabular, spreadsheet, graphical, and algebraic analysis to individualize the learning process.

ANCILLARY MATERIALS

A complete set of ancillary materials is available to adopters to supplement the text, including the following:

Instructor's Manual and Test Bank

The instructor's manual and test bank that accompany the book contain suggested answers to the end-of-chapter exercises and cases. The authors have taken great care to provide an error-free manual for instructors to use. The manual is available to instructors on the book's Web site. The test bank, containing a large collection of true-false, multiple-choice, and numerical problems, is available to adopters and is also available on the Web site in Word format, as well as on the IRCD.

MindTap

MindTap is an extensive online learning system that includes the ebook, assignments that bring course concepts to life, supplemental readings, video and discussions questions, and practice and apply exercises. This cloud-based platform integrates learning applications ("apps") into an easy-to-use and easy-to-access tool that supports a personalized learning experience. MindTap combines student learning tools—readings, multimedia, activities and assessments—into a singular Learning Path that guides students through the course.

Mindtap Support Web Site

When you adopt *Managerial Economics: Applications, Strategy, and Tactics,* 14e, you and your students will have access to a rich array of teaching and learning resources that you won't find anywhere else. Located at www.CengageBrain.com, this outstanding site features additional instructor and student resources.

PowerPoint Presentation

Available on the product companion Web site, this comprehensive package provides an excellent lecture aid for instructors. These slides cover many of the most important topics from the text, and they can be customized by instructors to meet specific course needs.

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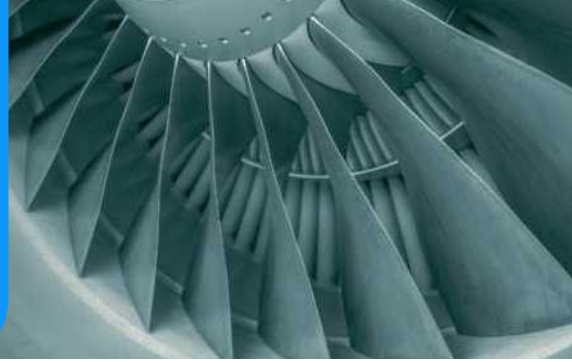
James R. McGuigan
R. Charles Moyer
Frederick H. deB. Harris



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James R. McGuigan owns and operates his own numismatic investment firm. Prior to this business, he was Associate Professor of Finance and Business Economics in the School of Business Administration at Wayne State University. He also taught at the University of Pittsburgh and Point Park College. McGuigan received his undergraduate degree from Carnegie Mellon University. He earned an M.B.A. at the Graduate School of Business at the University of Chicago and his Ph.D. from the University of Pittsburgh. In addition to his interests in economics, he has coauthored books on financial management. His research articles on options have been published in the *Journal of Financial and Quantitative Analysis*.

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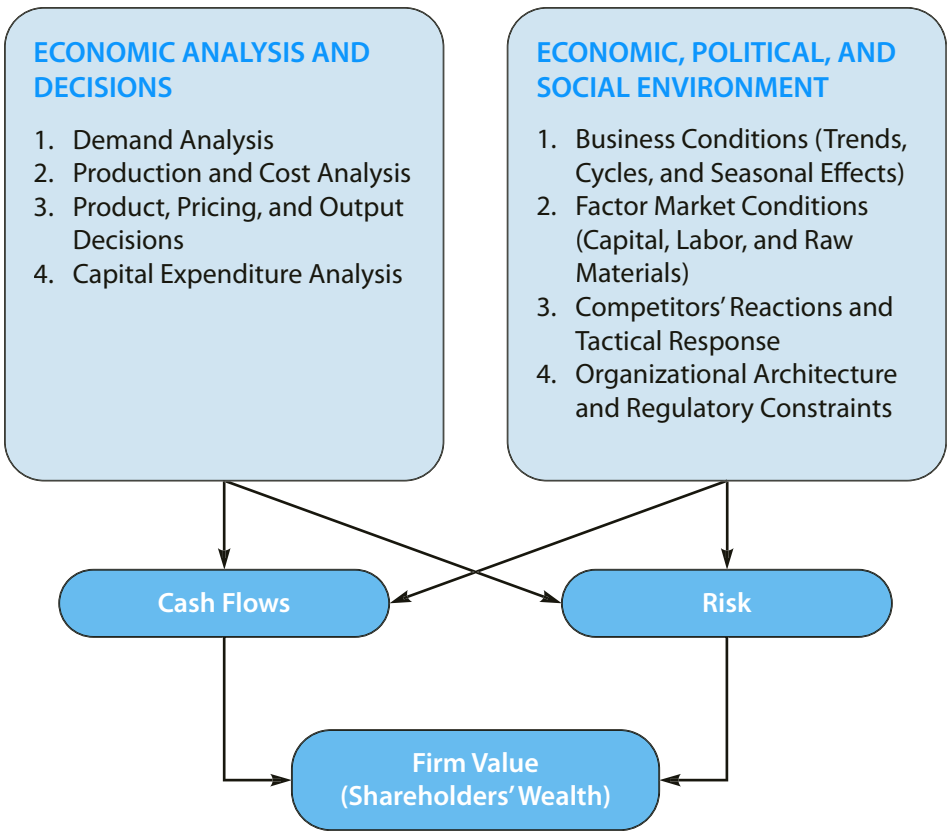
Professor Harris has published widely in leading journals, including the *Review of Economics and Statistics, Journal of Financial and Quantitative Analysis, Journal of Operations Management, Journal of Industrial Economics, Journal of Banking and Finance, Journal of Business Ethics,* and *Journal of Financial Markets*. From 1988 through 1993, Professor Harris served on the Board of Associate Editors of the *Journal of Industrial Economics*.

His path breaking work on price discovery has been frequently cited in leading academic journals, and several articles with practitioners have been published in the *Journal of Trading from Institutional Investor Journals*. In addition, he often benchmarks the pricing, order processing, and capacity planning functions of large companies against state-of-the-art techniques in revenue management and writes about his findings in journals such as the AMA's *Marketing Management* and INFORMS's *Journal of Revenue and Pricing Management*.

PART I

Introduction



CHAPTER

1 Introduction and Goals of the Firm

CHAPTER PREVIEW

Managerial economics is the application of microeconomics to decision problems faced in the private and public sectors. Managerial economics assists managers in efficiently allocating scarce resources, planning organizational strategy, and executing effective tactics. In this chapter, the meaning of economic profit is explored, and the role of profits in allocating resources in a free enterprise system is examined. The primary goal of the firm to maximize shareholder wealth is developed along with a full discussion of critical resources and feedback effects attributable to stakeholders. Management's role in resolving problems associated with the separation of ownership and control, moral hazard in teams, and principal-agent relationships is explored.

MANAGERIAL CHALLENGE

How to Achieve Sustainability: Southern Company Electric Power Generation[1]

In the second decade of the twenty-first century, companies all across the industrial landscape are seeking to achieve sustainability. Sustainability is a powerful metaphor but an elusive goal. It means much more than aligning oneself with a commitment to environmental sensitivity, which tests higher in opinion polling of the latent preferences of Americans and Europeans than any other response. Sustainability also implies renewability and longevity of business plans that are adaptable to changing circumstances. But what exactly should management pursue as a set of objectives to achieve this goal?

Management response to pollution abatement illustrates one type of sustainability challenge. At the insistence of the prime minister of Canada during the Reagan Administration, the U.S. Congress enacted a bipartisan cap-and-trade bill to address smokestack emissions. Sulfur dioxide and nitrous oxide (SOx and NOx) emissions precipitate as acid rain, mist, and ice, imposing damage downwind hundreds of miles away to trees, painted and stone surfaces, and asthmatics. The Clean Air Act (CAA) of 1990, amended in 1997 and 2003, granted tradable pollution allowances (TPAs) to known polluters. The CAA also authorized an auction market for these TPA assets. The Environmental Protection Agency Web site (www.epa.gov) displays on a daily basis the equilibrium, market-clearing price of these new TPAs on the balance sheet. Most importantly, the cap-and-trade system literally identified for the first time a price for the use of what had previously been unpriced common property resources—namely, acid-free air and rainwater. As a result, large point-source polluters like power plants and steel mills now incur an actual cost per ton for the SOx and NOx–laden soot by-products of burning lots of high sulfur coal. These amounts were promptly placed in spreadsheets designed to find ways of minimizing the sum of operating plus pollution by-product costs.[2] Thereafter, each polluter felt powerful

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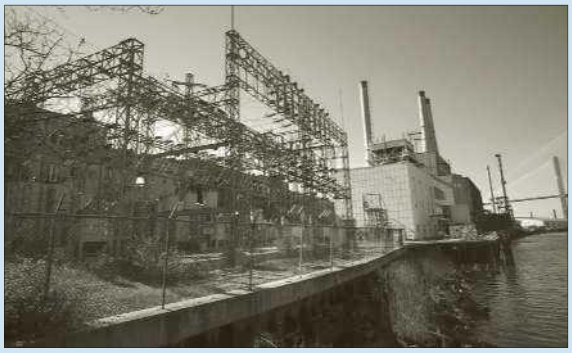
MANAGERIAL CHALLENGE *Continued*



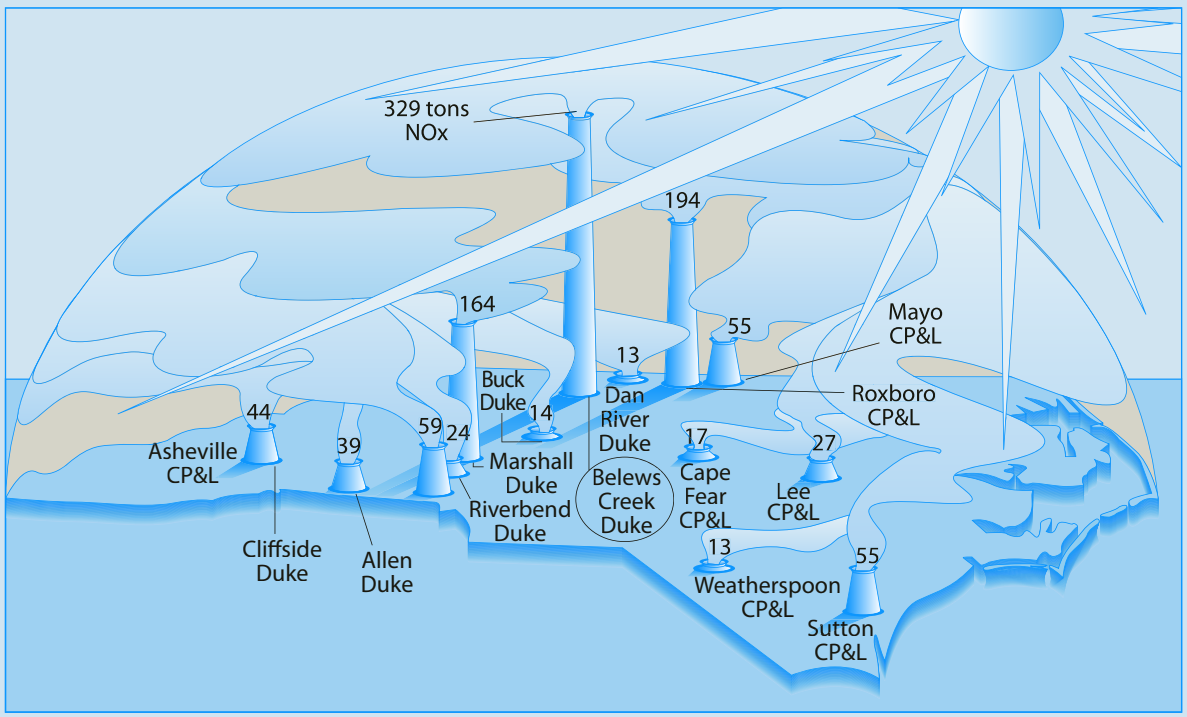
AP Images/Stephen Morton

incremental incentives to reduce compliance cost by abating pollution. And an entire industry devoted to developing pollution abatement technology sprang up.

The TPAs granted were set at approximately 80 percent of the known pollution taking place at each plant in 1990. For example, Duke Power's Belews Creek power plant, generating 120,085 tons of nitrous oxide acidic soot annually from burning 400 train carloads of coal every day, was granted 96,068 tons of allowances (see Figure 1.1). Although TPAs "grandfathered" a substantial amount of pollution, the gradual transition provided by cap-and-trade legislation was pivotally important to its widespread success. Industries such as steel and electric power were given five years to comply with the regulated emissions requirements, and then in 1997, the initial allowances were cut in half. Duke Power initially bought 19,146 allowances for Belews Creek at prices ranging from $131 to $480 per ton and then in 2003 built two 30-story smokestack scrubbers that reduced the NOx emissions by 75 percent.

Another major electric utility, Southern Company, analyzed three compliance choices on a least-cost cash flow basis: (1) buying allowances, (2) installing smokestack scrubbers, or (3) adopting fuel-switching technology to burn low-sulfur coal or even cleaner natural gas. In a widely studied case, the Southern Company found its huge Bowen plant in North Georgia would require a $657 million scrubber that after tax deductions for capital equipment depreciation and offsets from excess allowance revenue implied a $476 million cost. Alternatively, continuing to burn

FIGURE 1.1 Nitrous Oxide from Coal-Fired Power Plants (Daily Emissions in Tons, pre Clean Air Act)



Source: NC Division of Air Quality.

Cont.

MANAGERIAL CHALLENGE *Continued*

high-sulfur coal from the nearby Appalachian Mountains and purchasing the requisite allowances in the cap-and-trade market was projected to cost $266 million. And finally, switching to low-sulfur coal while adopting fuel-switching technology was found to cost $176 million. All these analyses were performed on a present value basis with cost projections over 25 years. Chapter 2 offers a quick primer on the net present value concept.

Southern Company's decision to switch to low-sulfur coal was hailed far and wide as environmentally sensitive and sustainable. Many electric utilities support cap-and-trade policies and actively pursue the mandate of the states in which they operate to derive 15 percent of their power from renewable energy (RE). In a Case Study at the end of the chapter, we analyze wind and tidal power RE alternatives for generating electricity.

The choice of fuel-switching technology to abate smokestack emissions was a shareholder value-maximizing choice for Southern Company for two reasons. First, switching to low-sulfur coal minimized their projected cash flow compliance costs under the CAA but, in addition, the fuel-switching technology created a strategic flexibility (a "real option") and that in itself created additional shareholder value. In this chapter, we will see what maximizing capitalized value of equity (shareholder value) entails and what is does not.

Discussion Questions

- What is the basic externality problem with acid rain? What objectives should management serve in responding to the acid rain problem?
- How did the Clean Air Act's cap-and-trade approach to air pollution affect the Southern Company's analysis of the previously unpriced common property air and water resources damaged by smokestack emissions?
- How should management comply with the Clean Air Act, or should the Southern Company simply pay the EPA's fines? Why? How would you decide?
- Which among Southern Company's three alternatives for compliance offered the most strategic flexibility? Explain.

[1]Based on Frederick Harris, Alternative Energy Symposium, Wake Forest Schools of Business (September 2008); and "Acid Rain: The Southern Company," Harvard Business School Publishing, HBS: 9-792-060.

[2]EPA fines for noncompliance of $2,000 per ton often exceed the auction market price of tradeable pollution allowances by a factor of 10.

1-1 WHAT IS MANAGERIAL ECONOMICS?

Managerial economics extracts from microeconomic theory those concepts and techniques that enable managers to select strategic direction, to allocate efficiently the resources available to the organization, and to respond effectively to tactical issues. All such managerial decision making seeks to do the following:

1. identify the alternatives,
2. select the choice that accomplishes the objective(s) in the most efficient manner,
3. taking into account the constraints,
4. and the likely actions and reactions of rival decision makers.

For example, consider the following stylized decision problem:

Example

Capacity Expansion at Honda, N.A., and Toyota Motors, N.A.

Honda and Toyota are attempting to expand their already substantial assembly operations in North America. Both companies face increasing demand for their U.S.-manufactured vehicles, especially Toyota Camrys and Honda Accords. Camrys and Accords rate extremely highly in consumer reports of durability and reliability.

(continued)

The demand for used Accords is so strong that they depreciate only 45 percent in their first four years. Other competing vehicles may depreciate as much as 65 percent in the same period. Toyota and Honda have identified two possible strategies (S1NEW and S2USED) to meet the growing demand for Camrys and Accords. Strategy S1NEW involves an internal expansion of capacity at Toyota's $700 million Princeton, Indiana, plant and Honda's Marysville, Ohio, plant. Strategy S2USED involves the purchase and renovation of assembly plants now owned by General Motors. The new plants will likely receive substantial public subsidies through reduced property taxes. The older plants already possess an enormous infrastructure of local suppliers and regulatory relief.

The objective of Toyota's managers is to maximize the value today (present value) of the expected future profit from the expansion. This problem can be summarized as follows:

Objective function:	Maximize the present value (P.V.) of profit (S1NEW, S2USED)
Decision rule:	Choose strategy S1NEW if P.V. (Profit S1NEW) > P.V. (Profit S2USED) Choose strategy S2USED if the reverse.

This simple illustration shows how resource-allocation decisions of managers attempt to maximize the value of their firms across forward-looking dynamic strategies for growth while respecting all ethical, legal, and regulatory constraints.

1-2 THE DECISION-MAKING MODEL

The ability to make good decisions is the key to successful managerial performance. All decision making shares several common elements. First, the decision maker must *establish the objectives*. Next, the decision maker must *identify the problem*. For example, the CEO of electronics retailer Best Buy may note that the profit margin on sales has been decreasing. This could be caused by pricing errors, declining labor productivity, or the use of outdated retailing concepts. Once the source or sources of the problem are identified, the manager can move to an *examination of potential solutions*. The choice between these alternatives depends on an *analysis of the relative costs and benefits*, as well as other organizational and societal constraints that may make one alternative preferable to another.

The final step in the decision-making process, after all alternatives have been evaluated, is to analyze the best available alternative under a variety of changes in the assumptions before making a recommendation. This crucial final step is referred to as a *sensitivity analysis*. Knowing the limitations of the planned course of action as the decision environment changes, the manager can then proceed to an *implementation of the decision*, monitoring carefully any unintended consequences or unanticipated changes in the market. The case problem at the end of the chapter highlights the role of sensitivity analysis in analyzing wind turbines as a renewable energy source of electricity.

1-2a The Responsibilities of Management

In a free enterprise system, managers are responsible for a number of goals. Managers are responsible for proactively solving problems in the current business model before

WHAT WENT RIGHT • WHAT WENT WRONG

Saturn Corporation[3]

When General Motors (GM) rolled out their "different kind of car company," J.D. Powers rated product quality 8 percent ahead of Honda, and customers liked the no-haggle selling process. Saturn achieved the 200,000 unit sales enjoyed by the Honda Civic and the Toyota Corolla in two short years and caught the 285,000 volume of the Ford Escort in Saturn's fourth year. Making interpersonal aspects of customer service the number-one priority and possessing superior inventory and MIS systems, Saturn dealerships proved very profitable and quickly developed a reputation for some of the highest customer loyalty in the industry.

However, with pricing of the base Saturn model $1,200 below the $12,050 rival Japanese compact cars, the GM parent earned only a $400 gross profit margin per vehicle. In a typical year, this meant GM was recovering only about $100 million of its $3 billion capital investment, a paltry 3 percent return. Netting out GM's 11 percent cost of capital, each Saturn was losing approximately $1,000. These figures compare to a $3,300 gross profit margin per vehicle in some of GM's other divisions. Consequently, cash flow was not reinvested in the Saturn division, products were not updated, and the models stagnated. By 1997, sales were slumping at −9 percent and in 1998 they fell an additional 20 percent. In 2009, GM announced it was permanently closing the Saturn division.

GM managers had not established the next Saturn business model which would have transferred young childless couples to more profitable GM divisions as their lifecycle called for bigger sedans, minivans, and SUVs. Rather than trading up to Buick, middle-aged loyal Saturn owners sought to trade up within Saturn, and finding no sporty larger models available, they switched to larger Japanese imports like the Honda Accord and Toyota Camry. After almost collapsing, Saturn introduced a sport wagon, an efficient SUV, and a high-profile sports coupe. GM ultimately abandoned the brand in 2009.

[3]Based on M. Cohen, "Saturn's Supply-Chain Innovation," *Sloan Management Review* (Summer 2000), pp. 93–96; "Small Car Sales Are Back" and "Why Didn't GM Do More for Saturn?" *BusinessWeek*, September 22, 1997, pp. 40–42, and March 16, 1998, p. 62.

they become crises and for selecting strategies to assure the more likely success of the next business model. Research In Motion built the world's best international cell phone (the Blackberry) but missed the market as customer demand evolved to web-enabled smart phones with 500,000 and then millions of apps. In addition, managers create organizational structure and culture based on the organization's mission. Senior management especially is responsible for establishing a vision of new business directions and setting stretch goals to get there. In addition, managers coordinate the integration of marketing, operations, and finance functions. If plant managers don't know the realized margins from particular segments targeted by the sales team, then they will often expedite and fulfill orders to the wrong customers. Finally, managers undertake the critical responsibility of motivating and monitoring teamwork.

1-2b Moral Hazard in Teams

Teamwork skills and the ability to motivate teams is widely acknowledged as the single most critical trait of effective managers. This applies equally to Navy Seal teams, factory work cell teams, brand management teams, or consulting teams. Why is that? Why is teamwork so important, and why is attaining good teamwork so hard? The essence of teamwork is synergistic value creation in excess of the sum of the parts. As individuals on a team, we can each "pull our own weight" or contribute more than that and compound our extra effort with the extraordinary efforts of those around us. Just as in sports, 110 percent effort on company teams often defeats more skilled opponents and sometimes even those with better resources. But how does a manager attain the commitment from a team to put forth 110 percent effort when doing less would not impose as much personal sacrifice, and when individual shirking on one's effort may not be transparently obvious? This constitutes the so-called moral hazard problem in team-making.

If penalties and sanctions are few and far between, only a sense of moral duty induces full-effort teamwork rather than the reduced effort associated with free-riding.

Consider the following example of the teamwork involved in bringing a product to market. Mack and Myer are collaborating on a product launch. Each has specialized skills that are required to achieve the maximum output and a gross profit of $100 if they each "Pull Hard," devoting their best effort to the project. In that event, $25 personal cost for each leaves $25 net profit available to each of them. If either shirks and reduces effort unilaterally, the output is reduced and gross profit declines by 30 percent to $70 to be divided between them, but the shirker reduces his or her personal cost to $0, thereby yielding a $35 net profit to the free rider and only $10 to the dutiful teammate who Pulled Hard. If both shirk and fail to provide best effort, then output collapses, gross profit falls to $30, yielding each just $15 net profit. These payoffs are depicted in the normal form game matrix Figure 1.2, Panel A.

What if this is a one-time-only situation, and each player must decide simultaneously without knowing the choice of his or her teammate? One of the insights of game theory is that in the absence of repeated games involving the same teammates, rational players in such situations will ignore reputation effects and select the action whose payoff dominates all others. In this case, that means each player will choose to Shirk since the $35 outcome exceeds $25, and the $15 outcome exceeds $10. In short, the outcomes from the action Shirk in the right-hand column dominate those in the Pull Hard column (and so too in the rows of the payoff matrix). Each team member therefore prefers to defect (by choosing Shirk), whatever the choice of his or her teammate; Shirk is said to be a dominant strategy. Therefore, {Shirk, Shirk} emerges as a dominant strategy outcome with great predictability.

But if they both do so, a tragic dilemma arises. In the southeast {Shirk, Shirk} cell, the payoff to each player is just $15, and total value added is only $30. Both teammates

FIGURE 1.2
Payoffs from Team Production with and without a Supervisor

Panel A No Supervisor

		Mack: Pull Hard	Mack: Shirk
Meyer: Pull Hard		$25 / $25	$10 / $35
Meyer: Shirk		$35 / $10	$15 / $15

Panel B Supervisor Present. A $10 Manager is Hired as a Monitor of Shirking for which A $15 Penalty is Imposed.

		Mack: Pull Hard	Mack: Shirk
Meyer: Pull Hard		$20 / $20	$5 / $15
Meyer: Shirk		$15 / $5	$–5 / $–5

realize, however, that if they had just found a way to elicit cooperation from one another, \$50 net profit would have been available in the northwest {Pull Hard, Pull Hard} cell. Their individually optimal decision-making (reflected by the dominant strategy to defect from cooperative arrangements) leaves −\$20 foregone profits until the players themselves organize their team-making differently. As a result, we might well expect that the players would evolve mechanisms for contracting around the moral hazard problem in order to capture the foregone value. How can this be accomplished?

What if the team hired a manager as project supervisor to monitor the teamwork and punish shirking fairly? Splitting the cost of paying a manager \$10 leaves \$40 gross profit in the {Pull Hard, Pull Hard} cell, to be divided evenly between Mack and Meyer. In the diagonal cells, the manager now penalizes whichever teammate shirks their duty −\$15. The payoff for this unilateral defector now becomes $(\$70/2 = \$35) - \$15 - \$5 = \$15$, less than the $(\$100/2 = \$50) - \$25 - \$5 = \$20$ associated with the cooperative decision to Pull Hard. And this is a symmetric payoff game, so both players now conclude the same thing—that is, it pays to adopt mutually cooperative teamwork and deliver full effort. Since each player will receive only $(\$30/2 = \$15) - \$15 - \$5 = -\$15$ in the event they both shirk their duties, and $(\$70/2 = \$35) - \$25 - \$5 = \$5$ in the event their Hard Pull is unilaterally defected upon, each decides to Pull Hard. Indeed, examining the new payoff matrix in Figure 1.2, Panel B the choice pair {Pull Hard, Pull Hard} has now become the dominant strategy. So, in conclusion, moral hazard in teams can be avoided. What is needed is a manager as supervisor who imposes sanctions for the shirking behavior of teammates that decide to free ride.

Managers in a capitalist economy are motivated to monitor teamwork ultimately because of their overarching goal to maximize returns to the owners of the business—that is, economic profits.

economic profit The difference between total revenue and total economic cost. Economic cost includes a "normal" rate of return on the capital contributions of the firm's partners.

Economic profit is the difference between total sales revenue (price times units sold) and total economic cost. The *economic cost* of any activity may be thought of as the highest valued alternative opportunity that is forgone. To attract labor, capital, intellectual property, land, and matériel, the firm must offer to pay a price that is sufficient to convince the owners of these resources to forego other alternative activities and commit their resources to this use. Thus, economic costs should always be thought of as *opportunity costs*—that is, the costs of attracting a resource such as investment capital from its next best alternative use.

1-3 THE ROLE OF PROFITS

In a free enterprise system, economic profits play an important role in guiding the decisions made by the thousands of competing independent resource owners. The existence of profits determines the type and quantity of goods and services that are produced and sold, as well as the resulting derived demand for resources. Several theories of profit indicate how this works.

1-3a Risk-Bearing Theory of Profit

Economic profits arise in part to compensate the owners of the firm for the risk they assume when making their investments. Because a firm's shareholders are not entitled to a fixed rate of return on their investment—that is, they are claimants to the firm's residual cash flows after all other contractual payments have been made—they need to be compensated for this risk in the form of a higher rate of return.

The risk-bearing theory of profits is explained in the context of normal profits, where *normal* is defined in terms of the relative risk of alternative investments. Normal profits for a high-risk firm, such as Las Vegas hotels and casinos, a biotech pharmaceutical company, or an oil field exploration well operator, should be higher than normal profits for firms of lesser risk, such as water utilities. For example, in 2005, the industry average return on net worth for the casino hotel/gaming industry was 12.6 percent, compared to 9 percent for the water utility industry.

1-3b Temporary Disequilibrium Theory of Profit

Although there exists a long-run equilibrium normal rate of profit (adjusted for risk) that all firms should tend to earn, at any point in time, firms may find themselves earning a rate of return above or below this long-run normal return level. This can occur because of temporary dislocations (shocks) in various sectors of the economy. Rates of return in the oil industry rose substantially when the price of crude oil doubled from $75 in mid-2007 to $146 in July 2008. However, those high returns declined sharply in 2014–2015, when oil market conditions led to excess supplies and the price of crude oil fell to $45.

1-3c Monopoly Theory of Profit

In some industries, one firm is effectively able to dominate the market and persistently earn above-normal rates of return. This ability to dominate the market may arise from economies of scale (a situation in which one large firm, such as Boeing, can produce additional units of 747 aircraft at a lower cost than can smaller firms), control of essential natural resources (crude oil), control of critical patents (biotech pharmaceutical firms), or governmental restrictions that prohibit competition (cable franchise owners). The conditions under which a monopolist can earn above-normal profits are discussed in greater depth in Chapter 11.

1-3d Innovation Theory of Profit

The innovation theory of profit suggests that above-normal profits are the reward for successful innovations. Firms that develop high-quality products (such as Porsche) or successfully identify unique market opportunities (such as Apple) are rewarded with the potential for above-normal profits. Indeed, the U.S. patent system is designed to ensure that these above-normal return opportunities furnish strong incentives for continued innovation.

1-3e Managerial Efficiency Theory of Profit

Closely related to the innovation theory is the managerial efficiency theory of profit. Above-normal profits can arise because of the exceptional managerial skills of well-managed firms. No single theory of profit can explain the observed profit rates in each industry, nor are these theories necessarily mutually exclusive. Profit performance is invariably the result of many factors, including differential risk, innovation, managerial skills, the existence of monopoly power, and chance occurrences.

1-4 OBJECTIVE OF THE FIRM

These theories of simple profit maximization as an objective of management are insightful, but they do not quantify the timing and risk of profit streams. Shareholder wealth maximization as an objective overcomes both these limitations.

Example

Shareholder Wealth Maximization at Berkshire Hathaway

Warren E. Buffett, chairman and CEO of Berkshire Hathaway, Inc., has described the long-term economic goal of Berkshire Hathaway as follows: "to maximize the average annual rate of gain in intrinsic business value on a per-share basis."[4] Berkshire's book value per share increased from $19.46 in 1964, when Buffett acquired the firm, to $199,900 in 2015, a compound annual rate of growth of 23 percent. The Standard and Poor's 500 companies experienced 11 percent growth over this same time period.

Berkshire's directors are all major stockholders. In addition, at least four of the directors have over 50 percent of their family's net worth invested in Berkshire. Managers and directors own over 47 percent of the firm's stock. As a result, Buffett's firm has always placed a high priority on the goal of maximizing shareholder wealth.

[4]*Annual Report*, Berkshire Hathaway, Inc. (2005).

1-4a The Shareholder Wealth-Maximization Model of the Firm

shareholder wealth A measure of the value of a firm. Shareholder wealth is equal to the value of a firm's common stock, which, in turn, is equal to the present value of all future cash returns expected to be generated by the firm for the benefit of its owners.

Shareholder wealth is measured by the market value of a firm's common stock, which is equal to the present value of all expected future cash flows to equity owners discounted at the shareholders' required rate of return, plus a value for the firm's embedded real options:

$$V_0 \cdot (\text{Shares Outstanding}) = \frac{\pi_1}{(1+k_e)^1} + \frac{\pi_2}{(1+k_e)^2} + \frac{\pi_3}{(1+k_e)^3} + \cdots + \frac{\pi_\infty}{(1+k_e)^\infty} + \text{Real Option Value}$$

$$V_0 \cdot (\text{Shares Outstanding}) = \sum_{t=1}^{\infty} \frac{\pi_t}{(1+k_e)^t} + \text{Real Option Value} \quad [1.1]$$

where V_0 is the current value of a share of stock (the stock price), π_t represents the economic profits expected in each of the future periods (from period 1 to ∞), and k_e equals the required rate of return.

A number of different factors (like interest rates and economy-wide business cycles) influence the firm's stock price in ways that are beyond the manager's control, but many factors (like innovation and cost control) are not. Real option value represents the cost savings or revenue expansions that arise from preserving flexibility in the business plans the managers adopt. For example, the Southern Company saved $90 million in complying with the Clean Air Act by adopting fuel-switching technology that allowed burning of alternative fuels (coal, fuel oil or natural gas) whenever the full cost of one input became cheaper than another.

Note that Equation 1.1 does take into account the timing of future profits. By discounting all future profits at the required rate of return, k_e, Equation 1.1 shows that a dollar received in the future is worth less than a dollar received immediately. (The techniques of discounting to present value are explained in more detail in Chapter 2 and Appendix B at the end of the book.) Equation 1.1 also provides a way to evaluate different levels of risk since the higher the risk the higher the required rate of return k_e used to discount the future cash flows, and the lower the present value. In short, shareholder value is determined by the amount, timing, and risk of the firm's expected future profits.

Example

Resource-Allocation Decisions and Shareholder Wealth: Apple Computer[5]

In distributing its stylish iPad personal computers and high tech iPhone smart phones, Apple has considered three distribution channels. On the one hand, copying Dell's direct-to-the-consumer approach would entail buying components from Motorola, AMD, Intel, and so forth and then hiring third-party manufacturers to assemble what each customer ordered just-in-time to fulfill Internet or telephone sales. Inventories and capital equipment costs would be very low indeed; almost all costs would be variable. Alternatively, Apple could enter into distribution agreements with an independent electronics retailer like ComputerTree. Finally, Apple could retail its own products in Apple Stores. This third approach entails enormous capital investment and a higher proportion of fixed cost, especially if the retail chain sought high visibility locations and needed lots of space.

When Apple opened its 147th retail store on Fifth Avenue in New York City, the location left little doubt as to the allocation of company resources to this new distribution strategy. Apple occupies a sprawling subterranean space topped by a glass cube that Steve Jobs himself designed, across from Central Park, opposite the famed Plaza Hotel. Apple's profits in this most heavily trafficked tourist and retail corridor will rely on several initiatives: (1) in-store theatres for workshop training on iMac programs to record music or edit home movies, (2) numerous technical experts available for troubleshooting with no waiting time, and (3) continuing investment in one of the world's most valuable brands. Shortly after opening, Apple made $151 million in operating profits on $2.35 billion in sales at these Apple Stores, a 6.4 percent profit margin relative to approximately a 2 percent profit margin company wide.

[5]Based on Nick Wingfield, "How Apple's Store Strategy Beat the Odds," *Wall Street Journal* (May 17, 2006), p. B1.

1-5 SEPARATION OF OWNERSHIP AND CONTROL: THE PRINCIPAL-AGENT PROBLEM

Profit maximization and shareholder wealth maximization are very useful concepts when alternative choices can be easily identified and when the associated costs and revenues can be readily estimated. Examples include scheduling capacity for optimal production runs, determining an optimal inventory policy given sales patterns and available production facilities, introducing an established product in a new geographic market, and choosing whether to buy or lease a machine. In other cases, however, where the alternatives are harder to identify and the costs and benefits less clear, the goals of owners and managers are seldom aligned.

1-5a Divergent Objectives and Agency Conflict

As sole proprietorships and closely held businesses grow into limited liability corporations, the owners (the principals) frequently delegate decision-making authority to professional managers (the agents). Because the manager-agents usually have much less to lose than the owner-principals, the agents often seek acceptable levels (rather than a

maximum) of profit and shareholder wealth while pursuing their own self-interests. This is known as a principal-agent problem or "agency conflict."

For example, as crude oil prices fluctuated wildly by 30 to 50 percent, Exxon-Mobil's managers once diversified the company into product lines like computer software development—an area where Exxon-Mobil had little or no expertise or competitive advantage. The managers were hoping that diversification would smooth out their executive bonuses tied to quarterly earnings, and it did. However, the decision to diversify ended up causing an extended decline in the value of Exxon-Mobil's stock.

Pursuing their own self-interests can also lead managers to focus on their own long-term job security. In some instances this can motivate them to limit the amount of risk taken by the firm because an unfavorable outcome resulting from the risk could lead to their dismissal. Kodak is a good example. In the early 2000s, Kodak's executives didn't want to risk developing immature digital photography products. When the demand for digital camera products subsequently soared, Kodak was left with too few markets for its traditional film products. In 2012, Kodak filed for bankruptcy.

Finally, the cash flow to owners erodes when the firm's resources are diverted from their most productive uses to perks for managers. In 1988, RJR Nabisco was a firm that had become bloated with corporate retreats in Florida, an extensive fleet of corporate airplanes and hangars, and an executive fixation on an awful-tasting new product (the "smokeless" cigarette Premier). This left RJR Nabisco with substantially less value in the marketplace than would have been possible with better resource allocation decisions. Recognizing the value enhancement potential, Kohlberg Kravis Roberts & Co. (KKR) initiated a hostile takeover bid and acquired RJR Nabisco for $25 billion in early 1989. The purchase price offered to common stockholders by KKR was $109 per share, much better than the $55 pre-takeover price. The new owners moved quickly to sell many of RJR's poorly performing assets, slash operating expenses, and cancel the Premier project. Although the deal was heavily leveraged with a large amount of debt borrowed at high interest rates, a much-improved cash flow allowed KKR to pay down the debt within seven years, substantially ahead of schedule.

To forge a closer alliance between the interests of shareholders and managers, some companies structure a larger proportion of the manager's compensation in the form of performance-based payments. For example, in 2011, CEO of Exxon-Mobil, Rex Tillotson received $17.9 million in restricted stock as long-term incentive pay (in addition to his $1.8 million salary and $2.3 million bonus for current performance). If Mr. Tillotson succeeds in raising shareholder value, he will profit handsomely when his deferred compensation stock grants can be sold and converted to cash. Other firms like Hershey Foods, CSX, Union Carbide, and Berkshire Hathaway require senior managers and directors to own a substantial amount of company stock in order to align the pocketbook interests of managers directly with those of stockholders. In sum, how motivated a manager will be to act in the interests of the firm's stockholders depends on the structure of his or her compensation package, the chance of dismissal, and the threat of takeover by a new group of owners.

Example

Agency Costs and Corporate Restructuring: O.M. Scott & Sons[6]

The existence of high agency costs sometimes prompts firms to financially restructure themselves to achieve higher operating efficiencies. For example, the lawn products firm, O.M. Scott & Sons, was purchased by the Scott managers in a highly leveraged

(continued)

buyout (an MBO). Faced with large interest and principal payments and having the potential to profit directly from more efficient operation of the firm, the new owner-managers quickly put in place accounting controls and operating procedures designed to improve Scott's performance. By monitoring inventory levels more closely and negotiating more aggressively with suppliers, the firm was able to reduce its average monthly working capital investment from $75 million to $35 million. At the same time, new incentive pay for the sales force caused revenue to increase from $160 million to a record $200 million.

[6]A more complete discussion of the Scott experience can be found in Brett Duval Fromson, "Life after Debt: How LBOs Do It," *Fortune* (March 13, 1989), pp. 91–92.

1-5b Agency Problem

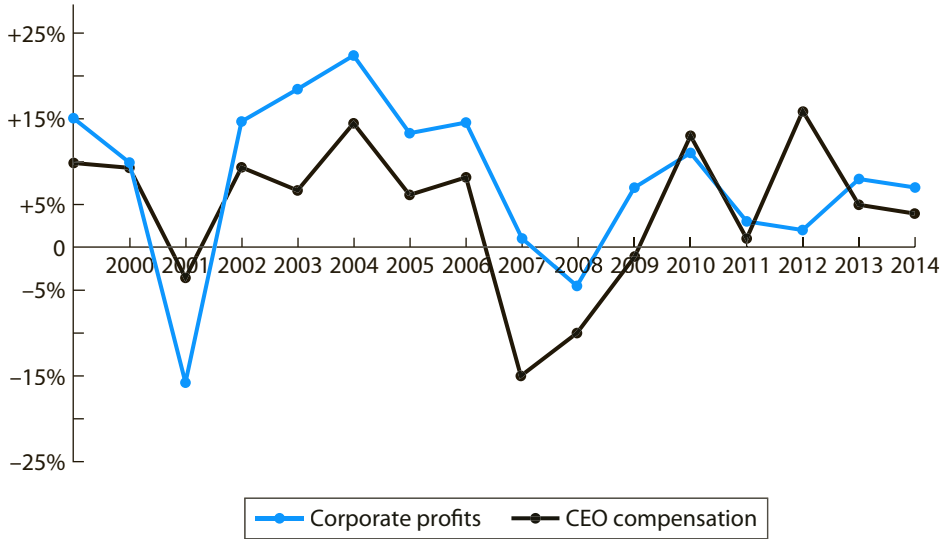
Principal-agent problems arise from the inherent unobservability of managerial effort combined with the presence of random disturbances in team production. The job performance of piecework garment workers is easily monitored, but the work effort of managers may not be observable at less-than-prohibitive cost. The creative ingenuity in anticipating and then proactively solving problems before they arise is inherently unobservable. Yet, this is what senior managers are hired to do. Owners know creative ingenuity when they see it, but often do not recognize when it is missing because a manager's creative ingenuity is often inseparable from good and bad luck. Owners therefore find it difficult to know when to reward managers for upturns and when to blame them for poor performance.

Separation of ownership (shareholders) and control (management) in large corporations permits managers to pursue goals, such as maximization of their own personal welfare, that are not always in the long-term interests of shareholders. As a result of pressure from large institutional shareholders, such as Fidelity Funds, from statutes such as Sarbanes-Oxley mandating stronger corporate governance, and from federal tax laws severely limiting the deductibility of executive pay, a growing number of corporations are seeking to assure that a larger proportion of the manager's pay occurs in the form of performance-based bonuses. They are doing so by (1) tying executive bonuses to the performance of comparably situated competitor companies, (2) by raising the performance hurdles that trigger executive bonuses, and (3) by eliminating severance packages that provide windfalls for executives whose poor performance leads to a takeover or their own dismissal.

Just prior to the Global Financial Crisis (GFC), CEOs of the 350 largest U.S. corporations were paid $6 million in 2005 in median total direct compensation. The 10 companies with the highest shareholder returns the previous five years paid $10.6 million in salary, bonus, and long-term incentives. The 10 companies with the lowest shareholder returns paid $1.6 million. Figure 1.3 shows that across these 350 companies, CEO total compensation has mirrored corporate profitability, spiking when profits grow and collapsing when profits decline. In the midst of the GFC 2007–2009, CEO salaries declined in 63 percent of NYSE Euronext companies, and bonuses and raises were frozen, cut, or eliminated in 47 and 52 percent, respectively.[7]

[7]"NYSE Euronext 2010 CEO Report," NYSEMagazine.com (September 2009), p. 27.

FIGURE 1.3
CEO Pay Trends Reflect Corporate Performance



Source: Mercer Human Resource Consulting and The Hay Group.

Example

Executive Performance Pay: General Electric[8]

As a representative example of a performance-based pay package, General Electric CEO Jeff Immelt had in 2006 a salary of $3.2 million, a cash bonus of $5.9 million, and gains on long-term incentives that converted to stock options of $3.8 million. GE distributes stock options to 45,000 of its 300,000 employees, but the GE Board of Directors decided that one-half of CEO Jeff Immelt's 250,000 "performance share units" should convert to stock options only if GE cash flow grew at an average of 10 percent or more for five years, and the other one-half should convert only if GE shareholder return exceeded the five-year cumulative return on the S&P 500 index.

Basing these executive pay packages on demonstrated performance relative to industry and sector benchmarks has become something of a cause célèbre in the United States. The reason is that by 2014 median CEO total compensation of $16.1 million had grown to 303 times the $52,685 salary of the average U.S. production worker. In Europe, the comparable figure is 36 times the median salary of $42,123, and similar multipliers to those in Europe apply in Asia. So, what U.S. CEOs get paid is the focus of much public policy discussion; in 2010 the Dodd-Frank Wall Street Reform Act mandated that companies disclose these ratios to stockholders.

[8]Based on http://people.forbes.com/rankings/jeffrey-r-immelt/36126; L. Mishel and A. Davis, "CEOs Make 300 Times More than Typical Workers" (June 21, 2015), Economic Policy Institute, Wahington, DC.

agency costs Costs associated with resolving conflicts of interest among shareholders, managers, and lenders.

In an attempt to mitigate these agency problems, firms incur several **agency costs**, which include the following:

1. Grants of stock options or restricted stock from Treasury stock so executive compensation aligns the incentives for management with shareholder interests.
2. Internal audits and accounting oversight boards to monitor management's actions. In addition, many large creditors, especially banks, now monitor financial ratios and investment decisions of large debtor companies on a monthly or even biweekly basis. These initiatives strengthen the firm's *corporate governance*.
3. Bonding expenditures and fraud liability insurance to protect the shareholders from managerial dishonesty.
4. Complex internal approval processes to limit discretion, but which prevent timely responses to business opportunities.

1-6 IMPLICATIONS OF SHAREHOLDER WEALTH MAXIMIZATION

Critics of those who want to align the interests of managers with equity owners often allege that maximizing shareholder wealth focuses on short-term payoffs—sometimes to the detriment of long-term profits. However, the evidence suggests just the opposite. Short-term cash flows reflect only a small fraction of the firm's share price; the first 5 years of expected dividend payouts explain only 18 percent, and the first 10 years only 35 percent of the share prices of U.S. stocks.[9] The goal of shareholder wealth maximization requires a long-term focus.

WHAT WENT RIGHT • WHAT WENT WRONG

Eli Lilly Depressed by Loss of Prozac Patent[10]

Pharmaceutical giants like GlaxoSmithKline, Merck, Pfizer, and Eli Lilly expend an average of $802 million to develop a new drug. It takes 12.3 years to research and test for efficacy and side effects, conduct clinical trials, and then produce and market a new drug. Only 4 in 100 candidate molecules or screening compounds lead to investigational new drugs (INDs). Only 5 in 200 of these INDs display sufficient efficacy in animal testing to warrant human trials. Clinical failure occurs in 6 of 10 human trials, and only half of the FDA-proposed drugs are ultimately approved. In sum, the joint probability of successful drug discovery and development is just $0.04 \times 0.025 \times 0.4 \times 0.5 = 0.0002$, two hundredths of 1 percent. Those few patented drugs that do make it to the pharmacy shelves, especially the blockbusters with several billion dollars in sales, must contribute enough operating profit to recover the cost of all these R & D failures.

In 2000, when Eli Lilly lost a patent extension on its blockbuster drug for the treatment of depression, Prozac, sales declined 70 percent. CEO Sidney Taurel then moved quickly to establish a new management concept throughout the company. Now, each new Eli Lilly drug is assigned a team of scientists, marketers, and regulatory experts who oversee the entire life cycle of the product from research inception to patent expiration. The key function of these cross-functionally integrated teams is contingency analysis and scenario planning to deal with the unexpected.

Simialrly, when Merck's patents on Singulair and Claritin expired in 2013, sales plummeted by 76% from $5.1 billion to $337 million. Generic equivalents quickly attracted all the other price-sensitive customers.

[10]C. Kennedy, F. Harris, and M. Lord, "Integrating Public Policy and Public Affairs into Pharmaceutical Marketing: Differential Pricing and the AIDS Pandemic," *Journal of Public Policy and Marketing* (Fall 2004), pp.1–23; "Eli Lilly: Bloom and Blight," *The Economist* (October 26, 2002), p. 60; and "Merck Struggles with Patent Cliff,"*Wall Street Journal* (May 2, 2013), p. B3.

[9]J. R. Woolridge, "Competitive Decline: Is a Myopic Stock Market to Blame?" *Journal of Applied Corporate Finance* (Spring 1988), pp. 26–36.

Admittedly, value-maximizing managers must manage change—sometimes radical changes in competition (free-wheeling electric power), in technology (Internet signal compression), in revenue collection (music), and in regulation (cigarettes)—but they must do so with an eye to the long-run sustainable profitability of the business. In short, value-maximizing managers must anticipate change and make contingency plans.

Shareholder wealth maximization also reflects dynamic changes in the information available to the public about a company's expected future cash flows and foreseeable risks. An accounting scandal at Krispy Kreme caused the stock price to plummet from $41 to $20 per share in one month. Stock price also reflects not only the firm's preexisting positive net present value investments, but also the firm's strategic investment opportunities (the "embedded real options") a management team develops. Amgen, a biotechnology company, had shareholder value of $42 million in 1983 despite no sales, no cash flow, no capital assets, no patents, and poorly protected trade secrets. By 1993, Amgen had sales of over $1.4 billion and cash flow of $408 million annually. Amgen had developed and exercised enormously valuable strategic opportunities.

Example

Amgen's Potential Profitability Is Realized

Amgen, Inc. uses state-of-the-art biotechnology to develop human pharmaceutical and diagnostic products. After a period of early losses during their start-up phase, profits increased steadily from $19 million in 1989 to $355 million in 1993 to $670 million in 1996. On the strength of royalty income from the sale of its Epogen product, a stimulator of red blood cell production, profits jumped to $900 million per year by 1999. In 2009, Amgen was valued at $60 billion with revenues and cash flows having continued to grow throughout the previous 10 years at 19 percent annually.

In general, only about 85 percent of shareholder value can be explained by even 30 years of cash flows.[11] The remainder reflects the capitalized value of strategic flexibility to expand some profitable lines of business, to abandon others, and to retain but delay investment in still others until more information becomes available. These additional sources of equity value are referred to as *embedded real options*.

We need to address why NPV and option value are additive concepts. NPV was invented to value bonds where all the cash flows are known and guaranteed by contract. As a result, the NPV analysis adjusts for timing and for risk but ignores the value of flexibility present in some capital budgeting projects but not others. These so-called embedded options present the opportunity but not the obligation to take actions to maximize the upside or minimize the downside of a capital investment. For example, investing in a fuel-switching technology in power plants allows Southern Company to burn fuel oil when that input is cheap and burn natural gas when it is cheaper. Similarly, building two smaller assembly plants, one in Japan and another in the United States, allows Honda Camry production to be shifted as currency fluctuations cause costs to fall in one plant location relative to the other. In general, a company can create flexibility in their capital budgeting by: (1) facilitating follow-on projects through *growth options*, (2) exiting early without penalty through *abandonment options*, or (3) staging investment over a learning period until better information is available through *deferral options*.

[11] Woolridge, *op. cit.*

The scenario planning that comes from such financial thinking compares the value of expanding, leaving, or waiting to the opportunity loss from shrinking, staying, or immediate investment. Strategic flexibility of this sort expands upon the NPV from discounted cash flow alone.

Example

Real Option Value Attributable to Fuel-Switching Technology at Southern Company

Ninety-six percent of all companies employ NPV analysis.[12] Eighty-five percent employ sensitivity analysis to better understand their capital investments. Only 67 percent of companies pursue the scenario planning and contingency analysis that underlies real option valuation. A tiny 11 percent of companies formally calculate the value of their embedded real options. That suggests an opportunity for recently trained managers to introduce these new techniques of capital budgeting to improve stockholder value. Southern Company recently calculated that its embedded real option from fuel-switching technology was worth more than $45 million on a capital budgeting proposal of approximately 500 million dollars—so, the strategic flexibility of a real option reduced cost approximately by almost 10 percent.

[12]Based on P. Ryan and G. Ryan, "Capital Budgeting Practices of the Fortune 1000: How Have Things Changed?" *Journal of Business and Management* (Fall 2002). pp. 355–364

Value-maximizing behavior on the part of managers is also distinguishable from satisficing behavior. Satisficers strive to "hit their targets" (e.g., on sales growth, return on investment, or safety ratings). Not value maximizers. Rather than trying to meet a standard like 97, 99, or 99.9 percent error-free takeoffs and landings at O'Hare field in Chicago, or deliver a 9, 11, or 12.1 percent return on shareholders' equity, the value-maximizing manager will commit himself or herself to continuous incremental improvements. Any time the marginal benefits of an action exceed its marginal costs, the value-maximizing manager will respond "Just do it!"

1-6a Caveats to Maximizing Shareholder Value

Managers should concentrate on maximizing shareholder value alone only if three conditions are met. These conditions require: (1) complete markets, (2) no significant asymmetric information, and (3) known recontracting costs. We now discuss how a violation of any of these conditions necessitates a much larger view of management's role in firm decision making.

Complete Markets To directly influence a company's cash flows, forward or futures markets as well as spot markets must be available for the firm's inputs, outputs, and by-products. For example, forward and futures markets for crude oil and coffee bean inputs allow Texaco-Chevron and Starbucks coffeehouses to plan their costs with more accurate cash flow projections. For a small 3 to 5 percent fee known in advance, value-maximizing managers can lock in their input expense using the commodity futures markets and avoid unexpected cost increases. This completeness of the markets allows a reduction in the cost-covering prices of gasoline and cappuccino.

Example

Tradable Pollution Permits at Duke Power[13]

By establishing a market for tradable air pollution permits, the Clean Air Act set a price on the sulfur dioxide (SO_2) by-product from burning high-sulfur coal. Uncontrolled SO_2 emissions from coal-fired power plants in the Midwest raised the acidity of rain and mist in eastern forests from Maine to Georgia to levels almost 100 times higher than the natural acidity of rainfall. Dead trees, peeling paint, increased asthma, and stone decomposition on buildings and monuments were the result.

To elicit substantial pollution abatement at the least cost, the Clean Air Act of 1990 authorized the Environmental Protection Agency to issue tradable pollution allowances (TPAs) to 467 known SO_2 polluters for approximately 70 percent of the previous year's emissions. The utility companies doing the polluting then began to trade the allowances. Companies that were able to abate their emissions at a low cost sold their allowances to plants that couldn't abate their emissions as cost effectively. In other words, the low-cost abaters who were able to cut their emissions cheaply could then sell their permits they didn't need to higher-cost abaters. The result was that the nation's air got 30 percent cleaner at the least possible cost.

As a result of the growing completeness of this market, electric utilities like Duke Power now know what expense line to incorporate in their cash flow projections for the SO_2 by-products of operating with high-sulfur coal. TPAs can sell for more than $100 per ton, and a single utility plant operation may require 15,000 tons of permits or more. The continuous trade-off between installing $450 million pollution abatement equipment, utilizing higher-cost alternative fuels like low-sulfur coal and natural gas, or paying the current market price of these EPA-issued pollution permits can now be explicitly analyzed and the least-cost solutions found.

[13]Based on "Acid Rain: The Southern Company," Harvard Business School Publishing, HBS: 9-792-060; "Cornering the Market," *Wall Street Journal* (June 5, 1995), p. B1; and *Economic Report of the President*, February 2000 (Washington, DC: U.S.G.P.O., 2000), pp. 240–264.

No Asymmetric Information Monitoring and coordination problems within the corporation and contracting problems between sellers and buyers often arise because of asymmetric information. Line managers and employees can misunderstand what senior executives want when they challenge employees to find a thousand different ways to save 1 percent. At Food Lion such miscommunications elicited undesirable shortcuts in food preparation and storage. Diane Sawyer of ABC News then secretly recorded seafood-counter employees spraying old salmon with a light concentration of ammonia to restore the red appearance of fresh fish. Clearly, this was not what the senior executives at Food Lion intended.

Building a good reputation with customers, workers, and the surrounding tax jurisdiction is one way companies deal with the problem of asymmetric information, and managers must attend to these reputational effects on shareholder value. We discuss the implications of asymmetric information further in Chapter 10.

Known Recontracting Costs Finally, to focus exclusively on the discounted present value of future cash flows necessitates that managers obtain not only sales revenue and expense estimates but also forecasts of future *recontracting costs* for pivotal inputs. Owners of professional sports teams are acutely aware of how unknown recontracting costs with star players can affect the value of their franchises. The same thing can occur with an indispensable corporate executive. A CFO, COO, CMO, or CIO can often "hold up" the

firm's owners when the time comes for contract renewals. In another arena, Westinghouse entered into long-term supply contracts to provide fuel rods to nuclear power plants across the country. Thereafter, when the market price of uranium quadrupled, Westinghouse refused to deliver the promised fuel rods, and recontracting costs skyrocketed. Value-maximizing managers must anticipate and mitigate these recontracting problems.

To the extent markets are incomplete, information is asymmetric, or recontracting costs are unknown, managers must attend to these matters in order to maximize shareholder wealth rather than simply focus myopically on maximizing profits.

1-6b Residual Claimants

Why is it that the primary duty of management and the board of directors of a company is to the shareholders themselves? Shareholders have a residual claim on the firm's net cash flows after all expected contractual returns have been paid. All the other stakeholders (employees, customers, bondholders, banks, suppliers, the surrounding tax jurisdictions, the community in which plants are located, etc.) have *contractual* expected returns. If expectations created by those contracts are not met, any of these stakeholders has access to the full force of the contract law in securing what they are due. Shareholders have contractual rights, too, but those rights simply entitle them to whatever is left over, that is, to the residual. As a consequence, when shareholder owners hire a CEO and a board, they create a fiduciary duty to allocate the company's resources in such a way as to maximize the net present value of these residual claims. This is what constitutes the objective of shareholder wealth maximization.

Be very clear, however, that the value of any company's stock is quite dependent on reputation effects. Underfunding a pension plan or polluting the environment results in massive losses of capitalized value because the financial markets anticipate (correctly) that such a company will have reduced future cash flows to owners. Labor costs to attract new employees will rise; tax jurisdictions will reduce the tax preferences offered in new plant locations; customers may boycott; and the public relations, lobbying, and legal costs of such a company will surely rise. All this implies that wealth-maximizing managers must be very carefully attuned to stakeholder interests precisely because it is in their shareholders' best interests to do so.

1-6c Goals in the Public Sector and Not-for-Profit Enterprises[14]

The value-maximization objective developed for private sector firms is not an appropriate objective in the public sector or in not-for-profit (NFP) organizations. These organizations pursue a different set of objectives because of the nature of the goods and services they supply and the manner in which they are funded.

There are three characteristics of NFP organizations that distinguish them from for-profit enterprises and influence their decision making. First, no one possesses a right to receive profit or surpluses in an NFP enterprise. This absence of a profit motive can have a serious impact on the incentive to be efficient. Second, NFP enterprises are exempt from taxes on corporate income. Finally, donations to NFPs are tax deductible, which gives NFP enterprises an advantage when competing for capital.

Not-for-profit organizations include performing arts groups, museums, libraries, hospitals, churches, volunteer organizations, cooperatives, credit unions, labor unions, professional societies, foundations, and fraternal organizations. Some of these organizations

[14]This section draws heavily on Burton A. Weisbrod, *The Nonprofit Economy* (Cambridge, MA: Harvard University Press, 1988).

offer services to a group of clients, such as the patients of a hospital. Others provide services primarily to their members such as tennis clubs or credit unions. Finally, some NFP organizations produce products to benefit the general public. Local symphony and theater companies are examples.

NFPs as well as government agencies tend to provide services that have significant public-good characteristics. In contrast to private goods, like a bite-sized candy bar, a public good can be consumed by more than one person. Moreover, excluding those who do not pay can only be done at a prohibitively high cost. Examples of **public goods** include national defense and flood control. If an antiballistic missile system or a flood control levy is constructed, no one can be excluded from its protection even those that refuse to contribute to the cost. Therefore, even if exclusion were feasible, the indivisibility of missile defense or flood control makes the incremental cost (and therefore the efficient price) of adding another participant quite low.

public goods Goods that may be consumed by more than one person at the same time with little or no extra cost, and for which it is expensive or impossible to exclude those who do not pay.

Some goods, such as recreational facilities and the performing arts, have both private-good and public-good characteristics. For example, concerts and parks may be shared (within limits) and are partially non-excludable in the sense that they convey prestige and quality-of-life benefits to the entire community.[15] The more costly the exclusion, the more likely the good or service will be provided by the public sector rather than the private sector. Portrait artists and personal fitness trainers offer pay-as-you-go private fee arrangements. Chamber music fans and tennis court users often organize in consumption-sharing and cost-sharing clubs. At the end of the spectrum, open-air symphony concerts and large parks usually necessitate some public financing.

1-6d Not-for-Profit Objectives

Several organizational objectives have been suggested for the NFP enterprise. These include the following:

1. Maximizing the quantity and quality of output subject to a break-even budget constraint.
2. Maximizing the outcomes preferred by the NFP's contributors.
3. Maximizing the longevity of the NFP's administrators.

1-6e The Efficiency Objective in Not-for-Profit Organizations

Cost-benefit analysis has been developed to more efficiently allocate public and NFP resources among competing uses. Because government and NFP spending is normally constrained by a budget ceiling, the goals actually used in practice can be any one of the following:

cost-benefit analysis A resource-allocation model that can be used by public sector and not-for-profit organizations to evaluate programs or investments on the basis of the magnitude of the discounted costs and benefits.

1. Maximize the benefits for given costs.
2. Minimize the costs while achieving a fixed level of benefits.
3. Maximize the net benefits (benefits minus costs).

Cost-benefit analysis is only one factor in the final decision, however. It does not incorporate many of the more subjective considerations or less easily quantifiable objectives, like how fair it might be. Such matters must be introduced at a later stage in the analysis, generally through the political process.

[15]William J. Baumol and W. G. Bowen, *Performing Arts: The Economic Dilemma* (Brookfield, VT: Ashgate Publishing Co., 1993).

SUMMARY

- Managers are responsible for proactively solving problems in the current business model, for setting stretch goals, establishing the vision, and setting strategy for future business, for monitoring teamwork, and integrating the operations, marketing, and finance functions.
- Teamwork is subject to moral hazard because shirking one's duty is a dominant strategy in one-time-only prisoners' dilemmas. Hiring managers as monitors of teamwork may mitigate the moral hazard problem and elicit mutually cooperative best efforts from all members of a team.
- *Economic profit* is defined as the difference between *total revenues* and *total economic costs*. Economic costs include a normal rate of return on the capital contributed by the firm's owners. Economic profits exist to compensate investors for the risk they assume, because of temporary disequilibrium conditions, because of the existence of monopoly power, and as a reward to firms that are especially innovative or highly efficient.
- As an overall objective of the firm, the *shareholder wealth-maximization* model is flexible enough to account for differential levels of risk and timing differences in the receipt of benefits and the incurring of future costs. Shareholder wealth captures the net present value of future cash flows to owners from positive NPV projects plus the value of embedded real options. The latter place a dollar value on strategic flexibility.
- Managers may not always behave in a manner consistent with the shareholder wealth-maximization objective. The agency costs associated with preventing or at least mitigating these deviations from the owner-principal's objective are substantial.
- Random changes in company performance, perhaps unrelated to a manager's effort, combined with the unobservable nature of their task—to apply creative ingenuity in proactive problem solving—presents a difficult *principal-agent problem* to resolve. Owner-principals seldom know when to blame manager-agents for weak company performances or give them credit for strong performances either of which may have resulted from chance.
- *Governance mechanisms* (including internal monitoring by subcommittees appointed by boards of directors and large creditors, internal/external monitoring by large block shareholders, auditing and variance analysis) can be used to limit managerial discretion and thereby mitigate agency problems.
- Shareholder wealth maximization implies a firm should be forward-looking, dynamic, and have a long-term outlook; anticipate and manage change; acquire strategic investment opportunities; and maximize the present value of expected cash flows to owners within the boundaries of the statutory law, administrative law, and ethical standards of conduct.
- Shareholder wealth maximization will be difficult to achieve when firms suffer from problems related to incomplete markets, asymmetric information, and unknown recontracting costs. In the absence of these complications, managers should maximize the present value of the discounted future net cash flows to residual claimants—namely, equity owners. If any of the complicating factors is present, managers must first attend to those issues before attempting to maximize shareholder wealth.
- Not-for-profit enterprises exist to supply a good or service desired by their primary contributors.
- Public sector organizations often provide services having significant public-good characteristics. Public goods are goods that can be consumed by more than one person at a time with little additional cost, and for which excluding those who do not pay for the goods is exceptionally difficult or prohibitively expensive.
- Regardless of their specific objectives, both public and private institutions should seek to furnish their goods or services in the most efficient way, that is, at the least cost possible.

Exercises

Answers to the exercises in blue can be found in Appendix D at the back of the book.

1. One of the approaches for the Southern Company to comply with the Clean Air Act is to adopt fuel-switching technology. Do you think this strategic flexibility would have value to Southern Company's shareholders? Why?
2. Explain several dimensions of the shareholder-principal conflict with manager-agents known as the principal-agent problem. To mitigate agency problems between senior executives and shareholders, should the compensation committee of the board devote more to executive salary and bonus (cash compensation) or more to long-term incentives? Why? What role does each type of pay play in motivating managers?
3. Corporate profitability declined by 20 percent from 2008 to 2009. What performance percentage would you use to trigger executive bonuses for that year? Why? What issues would arise with hiring and retaining the best managers?
4. In the Southern Company Managerial Challenge, which alternative for complying with the Clean Air Act creates the greatest real option value? How exactly does that alternative save money? Why? Explain why installing a scrubber "burns" this option.
5. Firms in the patented pharmaceutical industry earned an average return on net worth of 22 percent in 2006, compared with an average return of 14 percent earned by over 1,400 firms followed by *Value Line*. Which theory or theories of profit do you think best explain(s) the performance of the drug industry?
6. In the context of the shareholder wealth-maximization model of a firm, what is the expected impact of each of the following events on the value of the firm? Explain why.
   a. New foreign competitors enter the market.
   b. Strict pollution control requirements are enacted.
   c. A previously nonunion workforce votes to unionize.
   d. The rate of inflation increases substantially.
   e. A major technological breakthrough is achieved by the firm, reducing its costs of production.
7. In 2012–2015, the price of jet and diesel fuel used by air freight companies decreased dramatically. As the CEO of FedEx, you have been presented with the following proposals to deal with the situation:
   a. Reduce shipping rates to reflect the expense reduction.
   b. Increase the number of deliveries offered per day in some markets.
   c. Make long-term contracts to buy jet fuel and diesel at a fixed price for the next two years and set shipping rates to a level that will cover these costs.

   Evaluate these alternatives in the context of the decision-making model presented in the text.
8. How would each of the following actions be expected to affect shareholder wealth?
   a. Southern Company adopts fuel-switching technology at its largest power plants.
   b. Ford Motor Company pays $2.5 billion for Jaguar.
   c. General Motors offers large rebates to stimulate sales of its automobiles.
   d. Rising interest rates cause the required returns of shareholders to increase.
   e. Import restrictions are placed on the French competitors of Napa wineries.
   f. There is a sudden drop in the expected future rate of inflation.
   g. A new, labor-saving machine is purchased by Wonder Bread and results in the layoff of 300 employees.

Case Exercises

Designing a Managerial Incentives Contract

Specific Electric Co. asks you to implement a pay-for-performance incentive contract for its new CEO and four EVPs on the Executive Committee. The five managers can either work really hard with 70 hour weeks at a personal opportunity cost of $200,000 in reduced personal entrepreneurship and increased stress-related health care costs or they can reduce effort, thereby avoiding the personal costs. The CEO and EVPs face three possible random outcomes: the probability of the company experiencing good luck is 30 percent, medium luck is 40 percent, and bad luck is 30 percent. Although the senior management team can distinguish the three "states" of luck as the quarter unfolds, the Compensation Committee of the Board of Directors (and the shareholders) cannot do so. Once the board designs an incentive contract, soon thereafter the good, medium, or bad luck occurs, and thereafter the senior managers decide to expend high or reduced work effort. One of the observable shareholder values listed below then results.

	SHAREHOLDER VALUE		
	GOOD LUCK (30%)	MEDIUM LUCK (40%)	BAD LUCK (30%)
High Effort	$1,000,000,000	$800,000,000	$500,000,000
Reduced Effort	$800,000,000	$500,000,000	$300,000,000

Assume the company has 10 million shares outstanding offered at a $65 initial share price, implying a $650,000,000 initial shareholder value. Since the EVPs and CEOs effort and the company's luck are unobservable to the owners and company directors, it is not possible when the company's share price falls to $50 and the company's value to $500,000,000 to distinguish whether the company experienced reduced effort and medium luck or high effort and bad luck. Similarly, it is not possible to distinguish reduced effort and good luck from high effort and medium luck.

Answer the following questions from the perspective of a member of the Compensation Committee of the board of directors who is aligned with shareholders' interests and is deciding on a performance-based pay plan (an "incentive contract") for the CEO and EVPs.

Questions

1. What is the maximum amount it would be worth to shareholders to elicit high effort all of the time rather than reduced effort all of the time?
2. If you decide to pay 1 percent of this amount (in Question 1) as a cash bonus, what performance level (what share price or shareholder value) in the table should trigger the bonus? Suppose you decide to elicit high effort by paying a bonus should the company's value rise to $800,000,000. What two criticisms can you see of this incentive contract plan?
3. Suppose you decide to elicit high effort by paying a bonus only for an increase in the company's value to $1,000,000,000. When, and if, good luck occurs, what two criticisms can you see of this incentive contract plan?
4. Suppose you decide to elicit high effort by paying the bonus when the company's value falls to $500,000,000. When, and if, bad luck occurs, what two criticisms can you see of this incentive contract plan?
5. If the bonus compensation scheme must be announced in advance, and if you must pick one of the three choices in Questions 2, 3 and 4, which one would you pick and

why? In other words, under incomplete information, what is the optimal decision by the Board's Compensation Committee dedicated to act in the shareholders' interest?

6. Audits are basically sampling procedures to verify with a predetermined accuracy the sources and uses of the company receipts and expenditures; the larger the sample, the higher the accuracy. In an effort to identify the share price that should trigger a bonus, how much would you, the Compensation Committee, be willing to pay an auditing consultant who could sample the expense and revenue flows in real time and deliver perfect forecasting information about the "luck" the firm's sales force is experiencing? Compare shareholder value with this perfect forecast information relative to the best choice among the bonus plans you selected in Question 5. Define the difference as the Potential Value of Perfect Forecast Information.
7. Design a stock option-based incentive plan to elicit high effort. Show that one million stock options at a $70 exercise price improve shareholder value relative to the best of the cash bonus plans chosen in Question 5.
8. Design an incentive plan that seeks to elicit high effort by granting restricted stock. Show that one-half million shares granted at $70 improves shareholder value relative to all prior alternatives.
9. Sketch the game tree for designing this optimal managerial incentive contract among the alternatives in Question 2, 3, and 4. Who makes the first choice? Who the second? What role does randomness play? Which bonus pay contract represents a best reply response in each endgame? Which bonus pay contract should the Compensation Committee of the Board select to maximize expected value? How does that compare with your selection based on the contingent claims analysis in Questions 7 and 8?

Shareholder Value of Renewable Energy from Wind Power at Hydro Co.: Is RE < C?[16]

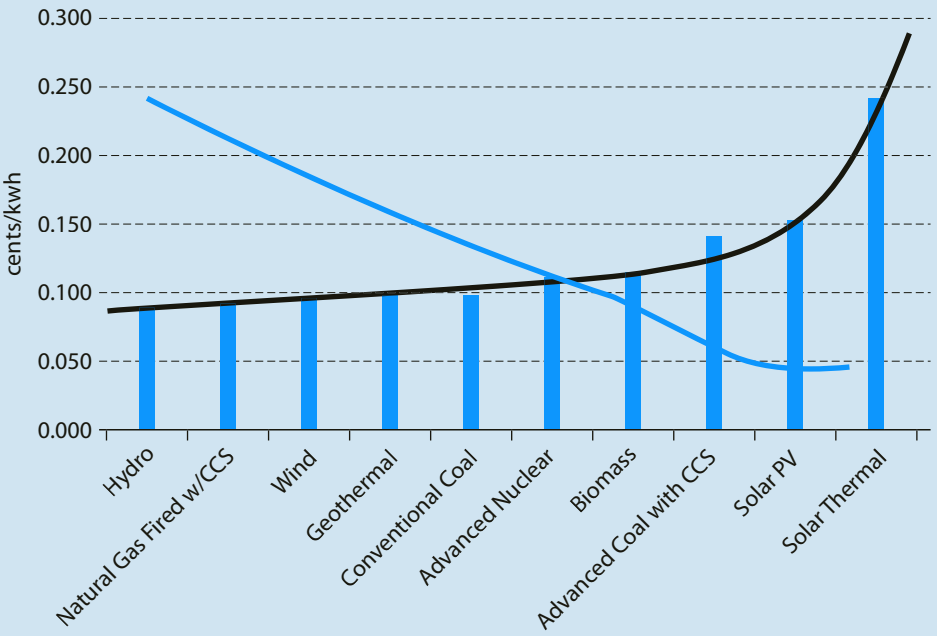
Despite a decade of subsidies and considerable success in Denmark, Germany, and Britain, renewable energy in the U.S. accounts for only 7 or 8 percent of total energy consumption. Hydroelectric power remains the most successful source of renewable energy in the United States where it accounts for 2.8 percent at a cost of $0.09/kwh (see Figure 1.4). Ethanol and other biofuels account for 1.6 percent, and surprisingly wind power and solar power are good for only 0.7 and 0.1 percent, respectively. Part of the explanation is that the EU is more ambitious, setting a hard goal of 20 percent of energy consumption from renewables by 2020.

Electricity from renewables in the United States must compete against conventional fossil fuels averaging approximately $.11/kwh costs nationwide. Land-based wind turbines, for example, have now become as inexpensive as conventional coal and natural gas at $.096/kwh and $.098/kwh, respectively, accounting for plant construction, fuel, maintenance, and other operating costs (again see Figure 1.4). Of course with carbon capture and storage, coal becomes much more expensive at $.141/kwh. The extensive shale gas discoveries in the United States have made combined-cycle natural gas-fired power plants cheaper than coal at $.092/kwh.

Solar energy remains a huge disappointment. Photovoltaic technology and storage has progressed but remains in its infancy such that the ratio of yield onto the electric grid relative to 24-hour potential capacity is only 25 percent. Steam-generating solar farms have an even lower *energy conversion factor* of 20 percent. Consequently even though solar capacity can be dispersed to individual rooftop installations and transmission costs are

[16]Based on Frederick Harris, Alternative Energy Symposium, Wake Forest University (September 19, 2008).

FIGURE 1.4
U.S. Average Cost for Electricity Generation 2012 (Equilibrium P = $0.11/kwh)



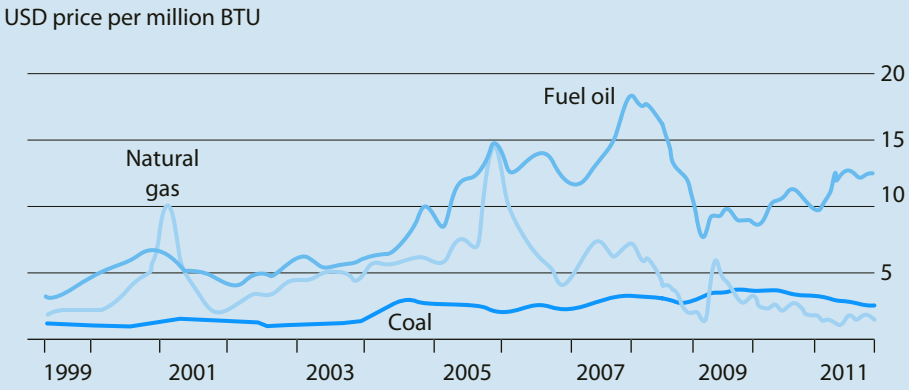
therefore much lower than wind or geothermal power, solar energy remains the most expensive source of renewable energy at $.153/kwh. With much better technology, geothermal and biomass are major RE successes at $.098/kwh and $.115/kwh, respectively.

Wind farms and massive solar collector arrays already provide 20 percent of the electric power generation in Denmark and 15 percent in Germany. Hydro, a Norwegian aluminum company, has established wind turbine pilot projects where entire communities are electricity self-sufficient. At 80 meters of elevation, class 3 wind energy (steady 22 kph breeze) is available almost everywhere on the planet, implying wind power potential worldwide of 72 million megawatts. Harvesting just the best 5 percent of this wind energy (3.6 million megawatts) would make it possible to retire *several thousand* coal-fired power plants, 617 of which operate in the United States today.[17]

So-called alternative energy is: (1) renewable, (2) in abundant local supply, and (3) generates a low carbon footprint. Renewables are naturally replenishing sources including wind, solar, hydro, biofuel, biomass, geothermal, tidal, ocean current, and wave energy. Nuclear energy is not renewable because of the waste disposal issues. To date, by far the most successful renewables are hydroelectric power plants and ethanol-based biofuels, each accounting for about 2 percent of energy worldwide. New sources of renewable energy such as wind and solar power are often judged against fuel oil at $15, natural gas at $3, and coal at $4 per million BTUs (see Figure 1.5). One ton of plentiful high-sulfur-content coal generates approximately a megawatt of electricity and a ton of carbon dioxide (CO_2). In 2008, the European Union's cap-and-trade legislation to reduce carbon emissions imposed a $.023 per ton additional CO_2 emissions charge atop the $.085 purchase price

[17]Older, smaller 500-megawatt coal-fired plants have adopted little pollution abatement technology. Nuclear power plants are much larger, generating typically 2,000 megawatts of electricity. Duke Power's Belews Creek plant at 2,200 megawatts is one of the largest coal-fired power plants in the United States (see Figure 1.1). Following the installation of a $450 million smokestack scrubber, it is also one of the cleanest.

FIGURE 1.5
RE ≥ C? Can Renewable Energy Cost Less Than Coal? 1999–2011



Source: Thomson Datastream; U.S. Energy Information Administration.

of coal. Finding renewable energy sources that have full costs lower than coal's $.023 + $.085 = $.108 for a megawatt hour (RE < C) is a reasonable objective of energy policy.

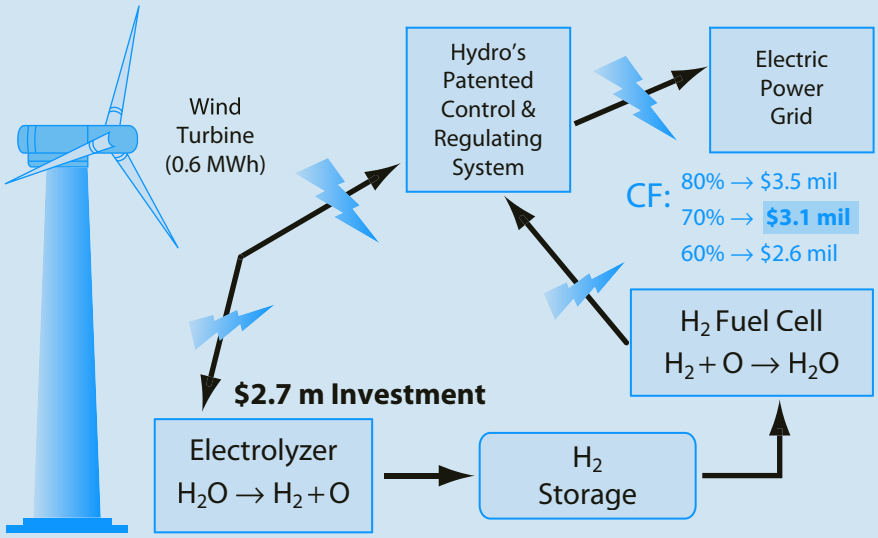
Why pursue wind and solar power rather than other alternative energy sources? Nuclear energy has a decades-long timeline for construction and permitting especially of nuclear waste disposal sites. Corn-based ethanol runs up the cost of animal feedstocks and raises food prices. In addition, corn contains only one-eighth the BTUs of sugarcane, which is in abundant supply in the Caribbean and Brazil. Unfortunately, the U.S. Congress has placed a $0.54 per gallon tariff on sugarcane-based ethanol. Natural gas is 80 percent cleaner than coal and extraordinarily abundant in the United States, the world's biggest energy user. The United States contains almost 30 percent of the known deposits worldwide of natural gas (and coal) but only 3 percent of the proven reserves of readily available and relatively easily accessible crude oil.

A 0.6 megawatt wind turbine that costs $1.2 million today will generate $4.4 million in discounted net present value of electricity over a 15-year period, sufficient to power 440 Western European or American households with 100 percent capacity utilization and continuous 15 mph wind.[18] Mechanical energy in the turbine is converted directly into electrical potential energy with a magnetic coil generator. When the wind does not blow, Hydro has demonstrated and patented a load-shifting technology that consists of a hydrolysis electrolyzer splitting water into oxygen and hydrogen, a hydrogen storage container, and a fuel cell to convert the hydrogen chemical energy back to electrical current (see Figure 1.6). With the three extra pieces of equipment, the capital investment rises from $1.2 million to $2.7 million. Even so, wind power can be quite profitable with full cost recovery periods as short as seven years under ideal operating conditions.

Of course, frequently the operating conditions with wind power are far less than ideal. Despite the presence of wind at elevation across the globe, few communities want 80+ meter wind turbines as tall as a football field in their backyard sight lines. Lower installations result in less wind and therefore less electricity. In addition, the conversion of one form of energy to another always burns energy. In Hydro's load-shifting process of converting

[18]600,000 kilowatt hours × $0.11 average electricity rates × 24 hours × 365 days equals $578,160 per year for 15 years of expected working life of the turbine. Based on "Hydro: From Utsira to Future Energy Solutions," Ivey School of Business, Case #906M44, 2006.

FIGURE 1.6
Continuous Electricity from Wind Power



mechanical energy from the turbine to chemical energy in the electrolyzer and then to electrical energy in the hydrogen fuel cell, about 30 percent of the maximum energy coming directly to the electrical grid from the turbine's generator when the wind is blowing hard and steady is lost. Experiments in many wind conditions at the Utsira site suggest that baseline output of Hydro's pilot project in Norway has a maximum energy conversion factor (CF) of 70 percent with 60 percent more typical. Even lower 45 percent CFs are expected in typical operating conditions elsewhere. Seventy percent CF realizes $3.1 million of electricity per turbine.

Questions

1. As a value-maximizing aluminum company, should Hydro invest in wind power in light of the Utsira pilot project? Why or why not?
2. Larger-scale turbines increase the electricity more than proportionately to the increase in costs. A 1 megawatt turbine costs $2.6 million, with the remaining equipment costs unchanged, for a total required investment of $4.1 million to power approximately 760 households. Electricity revenue over 15 years rises to $7.2 million in discounted present value. What conversion factor allows cost recovery of this larger-scale turbine?
3. If the net present value of the Utsira project is negative, yet Hydro goes ahead and funds the investment anyway, what ethical obligations does Hydro have to its shareholders? Discuss the role of corporate social responsibility and of back-up plans to address the possible full costing of coal, as in the European Union where carbon permits for a ton of coal have at times increased coal resource costs by 25 percent.
4. On what basis could shareholder value possibly rise if Hydro invests in negative NPV wind power projects?
5. Energy entrepreneur T. Boone Pickens has proposed converting the trucking fleet in the United States to liquefied natural gas (LNG) and using wind power to replace the missing LNG in electric power production. What infrastructure issues do you see that must be resolved before the Pickens plan could be adopted?

CHAPTER

2 Fundamental Economic Concepts

CHAPTER PREVIEW

A few fundamental microeconomic concepts provide cornerstones for all of the analysis in managerial economics. Four of the most important are demand and supply, marginal analysis, net present value, and the meaning and measurement of risk. We will first review how the determinants of demand and supply establish a market equilibrium price for gasoline, crude oil, and hybrid electric cars. Marginal analysis tools are central when a decision maker is seeking to optimize some objective, such as maximizing cost savings from changing a lightbulb (e.g., from normal incandescent to compact fluorescent lights [CFL] or light-emitting diodes [LED]). The net present value concept makes alternative cash flows occurring at different points in time directly comparable. In so doing, it provides the linkage between the timing and risk of a firm's projected profits and the shareholder wealth-maximization objective. Risk-return analysis is important to an understanding of the many trade-offs that managers must consider as they introduce new products, expand capacity, or outsource overseas in order to increase expected profits at the risk of greater variation in profits.

Two appendices elaborate these topics for those who want to know more analytical details and seek exposure to additional application tools. Appendix C develops the relationship between marginal analysis and differential calculus. Web Appendix F shows how managers incorporate explicit probability information about the risk of various outcomes into individual choice models, decision trees, risk-adjusted discount rates, simulation analysis, and scenario planning.

MANAGERIAL CHALLENGE

Why Charge $25 per Bag on Airline Flights?

In May 2008, American Airlines (AA) announced that it would immediately begin charging $25 per bag on all AA flights, not for extra luggage but for the first bag! Crude oil had nearly doubled from $70 to $130 per barrel in the previous 12 months, and jet fuel prices had accelerated even faster. AA's new baggage policy applied to all ticketed passengers except first class and business class. On top of incremental airline charges for sandwiches and snacks introduced the previous year, this new announcement stunned the travel public. Previously, only a few deep discount U.S. carriers with very limited route structures such as People Express had charged separately for both food and baggage service. Since American Airlines and many other major carriers had belittled that policy as part of their overall marketing campaign against deep discounters, AA executives faced a dilemma.

Jet fuel surcharges had recovered the year-over-year average variable cost increase for jet fuel expenses, but incremental variable costs (the marginal cost) remained uncovered. A quick back-of-the-envelope calculation outlines the problem. If total variable costs for a

Cont.

MANAGERIAL CHALLENGE *Continued*

500-mile flight on a 180-seat 737–800 rise from $22,000 to $36,000 because of $14,000 of additional fuel costs, then competitively priced carriers would seek to recover $14,000/180 = $78 per seat in jet fuel surcharges. The average variable cost rise of $78 would be added to the price for each fare class. For example, the $188 Super Saver airfare, restricted to 14-day advance purchase and Saturday night stayovers, would go up to $266. Class M airfares, requiring 7-day advance purchase but no Saturday stayovers, would rise from $289 to $367. Full coach economy airfares without purchase restrictions would rise from $419 to $497, and so on.

The problem was that by 2008 Q2, the marginal cost for jet fuel had risen to approximately $1 for each pound transported 500 miles. Carrying an additional 170-pound passenger in 2007 had resulted in $45 of additional fuel costs. By May 2008, the marginal fuel cost was $170, $125 higher! So although the $78 fuel surcharge was offsetting the accounting expense increase when one averaged in cheaper earlier fuel purchases, additional current purchases were much more expensive. Managers realized they should focus on this much higher $170 marginal cost when deciding on incremental seat sales and deeply discounted prices.

And similarly, this marginal $1 per pound for 500 miles became the focus of attention in analyzing baggage cost. A first suitcase was traveling free under the prior baggage policy, as long as it weighed less than 42 pounds. But that maximum allowed suitcase imposed $42 of marginal cost in May 2008. Therefore, American Airlines (and now other major carriers) announced a $25 baggage fee for the first bag in order to cover the marginal cost of the representative suitcase on AA, which weighs 25.4 pounds.

AP Images/Jeff Roberson

Discussion Questions

- How should the airline respond when presented with an overweight bag (more than 42 pounds) if an extra 100 pounds imposes $1.8 million per year per flight added cost?
- Explain whether or not each of the following should be considered a variable cost that increases with each additional airline seat sale: baggage costs, crew costs, commissions on ticket sales, airport parking costs, food costs, and additional fuel costs from passenger weight.
- Jet fuel prices have now reversed their upward trend and are in a steep decline. Fuel surcharges based on average variable cost have caught up with and surpassed marginal costs. Given a usage of 57 million gallons of jet fuel per week, how should American Airlines respond if marginal cost declines to $15 per suitcase?

2-1 DEMAND AND SUPPLY: A REVIEW

Demand and supply simultaneously determine equilibrium market price (P_{eq}). P_{eq} equates the desired rate of purchase Q_d/t with the planned rate of sale Q_s/t. Both concepts address intentions—that is, purchase intentions and supply intentions. Demand is therefore a potential concept often distinguished from the transactional event of "units sold." In that sense, demand is more like the potential sales concept of customer traffic than it is the accounting receivables concept of revenue from completing an actual sale. Analogously, supply is more like scenario planning for operations than it is like actual production, distribution, and delivery. In addition, supply and demand are explicitly rates per unit time period (e.g., autos per week at a Chevy dealership and the aggregate purchase intentions of the households in the surrounding target market). Hence, P_{eq} is a projected market-clearing equilibrium concept, a price that equates the flow rates of intended purchase and planned sale.