For Lisa, Halley, Jake, and Chris
# BRIEF CONTENTS

Preface: Teaching Students to Solve Problems  

## SECTION I  
Problem Solving and Decision Making  

1 Introduction: What This Book Is About 2  
2 The One Lesson of Business 10  
3 Benefits, Costs, and Decisions 23  
4 Extent (How Much) Decisions 40  
5 Investment Decisions: Look Ahead and Reason Back 51  

## SECTION II  
Pricing, Costs, and Profits  65  

6 Simple Pricing 66  
7 Economies of Scale and Scope 82  
8 Understanding Markets and Industry Changes 94  
9 Relationships Between Industries; The Forces Moving Us Towards Long-Run Equilibrium 115  
10 Strategy—The Quest to Keep Profit from Eroding 125  
11 Using Supply and Demand; Foreign Exchange, Trade, and Bubbles 137 

## SECTION III  
Pricing for Greater Profit  151  

12 More Realistic and Complex Pricing 152  
13 Direct Price Discrimination 163  
14 Indirect Price Discrimination 172  

## SECTION IV  
Strategic Decision Making  183  

15 Strategic Games 184  
16 Bargaining 207  

## SECTION V  
Uncertainty  219  

17 Making Decisions with Uncertainty 220  
18 Auctions 233  
19 The Problem of Adverse Selection 244  
20 The Problem of Moral Hazard 255  

## SECTION VI  
Organizational Design  267  

21 Getting Employees to Work in the Firm’s Best Interests 268  
22 Getting Divisions to Work in the Firm’s Best Interests 281  
23 Managing Vertical Relationships 295  

## SECTION VII  
Wrapping Up  307  

24 You Be the Consultant 308  

Epilogue: Can Those Who Teach, Do?  317  

Glossary 319  

Index 325
## Table of Contents

**Preface: Teaching Students to Solve Problems**  x

### Section I: Problem Solving and Decision Making  1

#### Chapter 1: Introduction: What This Book Is About  2
- Problem Solving  2
- Ethics and Economics  4
- Economics in Job Interviews  6
- Summary & Homework Problems  8

#### Chapter 2: The One Lesson of Business  10
- Capitalism and Wealth  11
- Do Mergers Move Assets To Higher-Valued Uses?  13
- Does the Government Create Wealth?  14
- Economics versus Business  15
- Wealth Creation in Organizations  19
- Summary & Homework Problems  20

#### Chapter 3: Benefits, Costs, and Decisions  23
- Background: Variable, Fixed, and Total Costs  23
- Background: Accounting versus Economic Profit  25
- Costs Are What You Give Up  27
- Fixed- or Sunk-Cost Fallacy  28
- Hidden-Cost Fallacy  30
- Economic Value Added  31
- Does EVA® work?  32
- Psychological Biases and Decision Making  33
- Summary & Homework Problems  35

#### Chapter 4: Extent (How Much) Decisions  40
- Background: Average and Marginal Costs  41
- Marginal Analysis  42
- Incentive Pay  45
- Tie Pay to Performance Measures that Reflect Effort  46
- If Incentive Pay Is So Good, Why Don’t More Companies Use it?  47
- Summary & Homework Problems  48
<table>
<thead>
<tr>
<th>CHAPTER 5</th>
<th>INVESTMENT DECISIONS: LOOK AHEAD AND REASON BACK 51</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to Determine Whether Investments Are Profitable 51</td>
<td></td>
</tr>
<tr>
<td>Break-Even Analysis 53</td>
<td></td>
</tr>
<tr>
<td>Choosing the Right Manufacturing Technology 55</td>
<td></td>
</tr>
<tr>
<td>Shutdown Decisions and Break-Even Prices 56</td>
<td></td>
</tr>
<tr>
<td>Sunk Costs and Post-Investment Hold-Up 57</td>
<td></td>
</tr>
<tr>
<td>Solutions to the Hold-Up Problem 59</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems 60</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION II</th>
<th>Pricing, Costs, and Profits 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAPTER 6</td>
<td>SIMPLE PRICING 66</td>
</tr>
<tr>
<td>Background: Consumer Surplus and Demand Curves 67</td>
<td></td>
</tr>
<tr>
<td>Marginal Analysis of Pricing 69</td>
<td></td>
</tr>
<tr>
<td>Price Elasticity and Marginal Revenue 71</td>
<td></td>
</tr>
<tr>
<td>What Makes Demand More Elastic? 74</td>
<td></td>
</tr>
<tr>
<td>Forecasting Demand Using Elasticity 76</td>
<td></td>
</tr>
<tr>
<td>Stay-Even Analysis, Pricing, and Elasticity 77</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems 78</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 7</th>
<th>ECONOMIES OF SCALE AND SCOPE 82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing Marginal Cost 83</td>
<td></td>
</tr>
<tr>
<td>Economies of Scale 85</td>
<td></td>
</tr>
<tr>
<td>Learning Curves 86</td>
<td></td>
</tr>
<tr>
<td>Economies of Scope 88</td>
<td></td>
</tr>
<tr>
<td>Diseconomies of Scope 89</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems 90</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 8</th>
<th>UNDERSTANDING MARKETS AND INDUSTRY CHANGES 94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which Industry or Market? 94</td>
<td></td>
</tr>
<tr>
<td>Shifts in Demand 95</td>
<td></td>
</tr>
<tr>
<td>Shifts in Supply 97</td>
<td></td>
</tr>
<tr>
<td>Market Equilibrium 98</td>
<td></td>
</tr>
<tr>
<td>Predicting Industry Changes Using Supply and Demand 99</td>
<td></td>
</tr>
<tr>
<td>Explaining Industry Changes Using Supply and Demand 102</td>
<td></td>
</tr>
<tr>
<td>Prices Convey Valuable Information 105</td>
<td></td>
</tr>
<tr>
<td>Market Making 107</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems 110</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 9</th>
<th>RELATIONSHIPS BETWEEN INDUSTRIES: THE FORCES MOVING US TOWARDS LONG-RUN EQUILIBRIUM 115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Industries 116</td>
<td></td>
</tr>
<tr>
<td>The Indifference Principle 118</td>
<td></td>
</tr>
<tr>
<td>Monopoly 122</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems 123</td>
<td></td>
</tr>
</tbody>
</table>
## TABLE OF CONTENTS

### CHAPTER 10  STRATEGY—THE QUEST TO KEEP PROFIT FROM ERODING  125

- Strategy Is Simple  126
- Sources of Economic Profit  127
- The Three Basic Strategies  132
- Summary & Homework Problems  134

### CHAPTER 11  USING SUPPLY AND DEMAND: FOREIGN EXCHANGE, TRADE, AND BUBBLES  137

- The Market for Foreign Exchange  138
- Purchasing Power Parity  140
- The Effects of a Currency Devaluation  141
- Bubbles: Past Performance Is No Guarantee of Future Success  143
- Summary & Homework Problems  147

### SECTION III  PRICING FOR GREATER PROFIT  151

#### CHAPTER 12  MORE REALISTIC AND COMPLEX PRICING  152

- Pricing Commonly Owned Products  153
- Revenue or Yield Management  155
- Advertising and Promotional Pricing  157
- Psychological Pricing  158
- Summary & Homework Problems  159

#### CHAPTER 13  DIRECT PRICE DISCRIMINATION  163

- Introduction  163
- Why (Price) Discriminate?  164
- Direct Price Discrimination  167
- Robinson–Patman Act  168
- Implementing Price Discrimination Schemes  169
- Only Schmucks Pay Retail  170
- Summary & Homework Problems  170

#### CHAPTER 14  INDIRECT PRICE DISCRIMINATION  172

- Indirect Price Discrimination  174
- Volume Discounts as Discrimination  176
- Bundling Different Goods Together  178
- Summary & Homework Problems  179

### SECTION IV  STRATEGIC DECISION MAKING  183

#### CHAPTER 15  STRATEGIC GAMES  184

- Sequential-Move Games  185
- Simultaneous-Move Games  188
- What Can I Learn from Studying Games Like the Prisoners’ Dilemma?  194
- Other Games  196
- Summary & Homework Problems  201
<table>
<thead>
<tr>
<th>CHAPTER 16</th>
<th>BARGAINING</th>
<th>207</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bargaining as a Game of Chicken</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td>How to Improve Your Bargaining Position</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems</td>
<td>214</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION V</th>
<th>UNCERTAINTY</th>
<th>219</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAPTER 17</td>
<td>MAKING DECISIONS WITH UNCERTAINTY</td>
<td>220</td>
</tr>
<tr>
<td>Random Variables</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Uncertainty in Pricing</td>
<td>224</td>
<td></td>
</tr>
<tr>
<td>Run Natural Experiments to Reduce Uncertainty</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td>Minimizing Expected Error Costs</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>Risk versus Uncertainty</td>
<td>228</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems</td>
<td>229</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 18</th>
<th>AUCTIONS</th>
<th>233</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Auctions</td>
<td>234</td>
<td></td>
</tr>
<tr>
<td>Second-Price Auctions</td>
<td>235</td>
<td></td>
</tr>
<tr>
<td>First-Price Auctions</td>
<td>236</td>
<td></td>
</tr>
<tr>
<td>Bid Rigging</td>
<td>237</td>
<td></td>
</tr>
<tr>
<td>Common-Value Auctions</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems</td>
<td>240</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 19</th>
<th>THE PROBLEM OF ADVERSE SELECTION</th>
<th>244</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance and Risk</td>
<td>244</td>
<td></td>
</tr>
<tr>
<td>Anticipating Adverse Selection</td>
<td>245</td>
<td></td>
</tr>
<tr>
<td>Screening</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>Signaling</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Adverse Selection and Internet Sales</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems</td>
<td>252</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 20</th>
<th>THE PROBLEM OF MORAL HAZARD</th>
<th>255</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance</td>
<td>256</td>
<td></td>
</tr>
<tr>
<td>Moral Hazard versus Adverse Selection</td>
<td>257</td>
<td></td>
</tr>
<tr>
<td>Shirking</td>
<td>258</td>
<td></td>
</tr>
<tr>
<td>Moral Hazard in Lending</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>Moral Hazard and the 2008 Financial Crisis</td>
<td>261</td>
<td></td>
</tr>
<tr>
<td>Summary &amp; Homework Problems</td>
<td>262</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION VI</th>
<th>ORGANIZATIONAL DESIGN</th>
<th>267</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAPTER 21</td>
<td>GETTING EMPLOYEES TO WORK IN THE FIRM’S BEST INTERESTS</td>
<td>268</td>
</tr>
<tr>
<td>Principal–Agent Relationships</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>Principles for Controlling Incentive Conflict</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Marketing versus Sales</td>
<td>272</td>
<td></td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>GETTING DIVISIONS TO WORK IN THE FIRM’S BEST INTERESTS</td>
<td>281</td>
</tr>
<tr>
<td></td>
<td>Incentive Conflict between Divisions</td>
<td>281</td>
</tr>
<tr>
<td></td>
<td>Transfer Pricing</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>Functional Silos versus Process Teams</td>
<td>285</td>
</tr>
<tr>
<td></td>
<td>Budget Games: Paying People to Lie</td>
<td>287</td>
</tr>
<tr>
<td></td>
<td>Summary &amp; Homework Problems</td>
<td>290</td>
</tr>
<tr>
<td>23</td>
<td>MANAGING VERTICAL RELATIONSHIPS</td>
<td>295</td>
</tr>
<tr>
<td></td>
<td>Do Not Buy a Customer or Supplier Simply Because They Are Profitable</td>
<td>296</td>
</tr>
<tr>
<td></td>
<td>Evading Regulation, Bundling, Tying, and Exclusion</td>
<td>297</td>
</tr>
<tr>
<td></td>
<td>Eliminating the Double Markup</td>
<td>298</td>
</tr>
<tr>
<td></td>
<td>Aligning Retailer Incentives with the Goals of Manufacturers</td>
<td>299</td>
</tr>
<tr>
<td></td>
<td>Price Discrimination</td>
<td>301</td>
</tr>
<tr>
<td></td>
<td>Outsourcing</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Summary &amp; Homework Problems</td>
<td>303</td>
</tr>
<tr>
<td>24</td>
<td>YOU BE THE CONSULTANT</td>
<td>308</td>
</tr>
<tr>
<td></td>
<td>Excess Inventory of Prosthetic Heart Valves</td>
<td>308</td>
</tr>
<tr>
<td></td>
<td>High Transportation Costs at a Coal-Burning Utility</td>
<td>309</td>
</tr>
<tr>
<td></td>
<td>Overpaying for Acquired Hospitals</td>
<td>310</td>
</tr>
<tr>
<td></td>
<td>Large E&amp;O Claims at an Insurance Company</td>
<td>312</td>
</tr>
<tr>
<td></td>
<td>Losing Money on Homeowner’s Insurance</td>
<td>314</td>
</tr>
<tr>
<td></td>
<td>Quantity Discounts on Hip Replacements</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>What You Should Have Learned</td>
<td>316</td>
</tr>
<tr>
<td></td>
<td>Epilogue: Can Those Who Teach, Do?</td>
<td>317</td>
</tr>
<tr>
<td></td>
<td>Glossary</td>
<td>319</td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>325</td>
</tr>
</tbody>
</table>
When I began teaching at a business school, I taught economics as I had learned it, using formal models and public policy applications. My students could not see its relevance to business, and our late dean, Marty Geisel, threatened to fire me unless customer satisfaction increased.

So I abandoned the public policy applications and began teaching students to exploit inefficiency as a money-making opportunity. I changed from a model-based to a problem-based pedagogy by focusing on business mistakes. I used models sparingly and only to the extent that they helped students to solve business problems. I reduced the analysis to a single lesson\(^1\) that tied the different applications together. These changes kept me from getting fired, but students still had trouble making the connection between what I taught and the kind of decisions they faced at work.

The missing link was provided by the so-called Rochester\(^2\) approach to organizational design. Traditional economic tools teach students to identify profitable decisions; organizational design shows students how to implement them. Teaching one without the other may explain why students have difficulty seeing the relevance of economics to business. Identifying profitable decisions without being able to implement them, or implementing decisions without knowing whether they are profitable, are both fruitless exercises.

Organizational design is particularly useful for teaching students the two components of problem solving. First, to figure out what is wrong, students learn to ask three questions:

- Who made the bad decision?
- Did the decision maker have enough information to make a good decision?
- Did he or she have the incentive to do so?

Answers to these three questions will suggest changes in the organizational design focused on

- letting someone else make the decision,
- changing the information flow, or
- changing incentives.

---

\(^1\)The art of business is to find an asset in a lower-valued use and figure out how to profitably move it to higher-valued use.

I wrote this book only because there was no other that used these ideas to teach MBAs. It differs from traditional managerial economics textbooks in several respects. First, it's relatively short. I cover only the most important ideas because teaching a few ideas well is better than teaching many poorly. In addition, the short text lets professors customize courses with their own supplementary material, knowing that each student, regardless of his or her background, should be able to read the book cover to cover and walk away with a basic understanding of how to use the rational-actor paradigm to identify problems and find ways to fix them.

Second, the book follows a problem-based pedagogy rather than the traditional model-based pedagogy.3 I pose a problem, like the fixed-cost fallacy, and then give students just enough analytic structure to compute the costs and the benefits of various solutions. I then ask them to solve similar problems. Teaching students to solve problems, rather than learn models, is a much better way to teach economics in a terminal MBA economics course. To see this, ask yourself which of the following ideas is more likely to stay with your students after the class is over: the fixed-cost fallacy or that the partial derivative of profit with respect to price is independent of fixed costs.

Third, the problem-based pedagogy means that the book spends as much time applying the tools of economics as it does teaching them. Some professors who use this book supplement it with online interactive programs like the managerial economics module of South-Western’s MBAPrimer.com or Samuel Baker’s Economic Interactive Tutorials.4 These programs teach an idea, like marginal analysis, and then immediately ask the student to apply the idea by filling in cells on a spreadsheet. At the end of each section, students take a quiz. If they do not know the answer to a question, they can scroll back to the relevant material and re-read it. Then, when students are confident that they understand the material, I give them an online closed-book quiz on the same material.

Using online material to teach the tools of benefit–cost analysis accomplishes two things. First, it allows students to learn them at their own pace, which allows a professor to teach students of varying backgrounds in the same class. Those with good analytic ability or economics training can cruise through the online material without much effort but still learn a lot from the in-class business applications, whereas students with less aptitude or training will devote more time to learning the tools. Second, it allows residential MBA programs to differentiate their classes from those in online programs by reserving scarce class time for the application of the tools to real business problems. For example, I begin each class by presenting a problem and cold-call students until they figure out what is wrong and how to fix it. For those of you teaching in executive MBA programs, make sure to reserve some class time for presentations built around the group homework problems. You will hear some great stories from your students, and they will see an immediate payoff from the class as they apply the tools to solve problems in their own

---

4http://hadm.sph.sc.edu/Courses/Econ/Tutorials.html
companies. The group problems are less effective for students with less work experience, so I use them sparingly, or not at all, in the regular MBA program.

Finally, as mentioned, the book integrates organizational design into the traditional economic analysis. Identifying a problem using benefit–cost analysis is only the first step. Fixing it requires an understanding of how organizations behave.

This book is aimed at three different audiences. First, it’s accessible to anyone who can read and think clearly. But because the pedagogy is built around business problems, the book is most effective for those with work experience. Second, the book is useful for executive education, in both degree and non-degree programs. Third, it works in a full-time MBA program. In the degree programs, I supplement the material in the book with online interactive exercises.

In this second edition, we have added stories and applications from the recent financial crisis. The past 18 months have given us one teachable moment after another, and we try to take advantage of them throughout the text. As just one example, we added a new chapter, “Foreign Exchange, Trade, and Bubbles,” that describes the boom-and-bust cycle that rocked Iceland last year. Other stories can be found on the blog we use to support the book (ManagerialEcon.com.) And for obvious reasons, we introduce some well-documented departures from the rational-actor paradigm that economists have begun to use to improve their models. We have a section on prospect theory, and talk about the role that expectations play in asset bubbles.

I wish to acknowledge 15 classes of MBA students, without whom none of this would have been possible—or necessary. Many of my former students will recognize stories from their companies in the book. Most of the stories in the book are from students and are for teaching purposes only.

I owe a special debt to my co-author and new colleague, Brian McCann, not only for contributing significant amounts of original material to the book, but also for re-writing and editing all of the text.

Thanks to everyone who contributed, knowingly or not, to the book. I owe intellectual debts to former colleagues at the U.S. Department of Justice (among them, Cindy Alexander, Tim Brennan, Ken Heyer, Kevin James, Bruce Kobayashi, and Greg Werden); to former colleagues at the Federal Trade Commission (among them Bill Blumenthal, Bob Brogan, Jerry Butters, Liz Callison, James Cooper, Susan Creighton, Pat DeGraba, Tim Deyak, Jeff Fischer, Mark Frankena, Hadeishi Hajime, Dan Hosken, David Hyman, Pauline Ippolito, Jim Lacko, Bill Kovacic, Tom Krattenmaker, Rob McMillan, Joe Mulholland, Tim Muris, Dan O’Brien, Maureen Ohlhausen, Jan Pappalardo, John Parisi, Lydia Parnes, Paul Pautler, Lee Peeler, Dave Schmidt, Joel Schrag, Lou Silvia, Chris Taylor, Steve Tenn, Randy Tritell, and Mike Vita); to colleagues at Vanderbilt (among them, Germain Boer, Jim Bradford, Bill Christie, Mark Cohen, Myeong Chang, Craig Lewis, Doug Meeks, Rick Oliver, David Rados, Steven Tschantz, David Scheffman, Mikhael Shor, and Bart Victor); and to numerous friends and colleagues who offered suggestions, problems, and anecdotes for the book, among them,
Lily Alberts, Olafur Arnarson, Pat Bajari, Roger Brinner, the Honorable Jim Cooper, Matthew Dixon Cowles, Abie Del Favero, Vince Durnan, Jeff and Jenny Hubbard, Dan Kessler, Bev Landstreet (B5), Bert Mathews, Jim Overdahl, Mike Saint, Jon Shayne, Bill Shughart, Whitney Tilson, and Susan Woodward. I owe intellectual and pedagogical debts to Armen Alchian and William Allen, Henry Hazlitt, Shlomo Maital, John MacMillan, Steven Landsburg, Ivan Png, Victor Tabbush, Michael Jensen and William Meckling, and James Brickley, Clifford Smith, and Jerold Zimmerman. Thanks as well to everyone who helped guide us through the publishing process, including Michael Worls, Jennifer Garamy, Lindsay Bethoney, Jean Buttrom, and Betty Jung.

---

11http://www.mbpapramer.com
Armadillo Appliances manufactures a diverse line of appliances for home use (ovens, washers, dryers, etc.). As part of a recent effort to reduce costs, their corporate Purchasing Department switched steel suppliers because a new manufacturer offered a price that was a penny/pound less than the old purchase price. Multiplied by the nine million pounds of steel they use each year, Armadillo anticipated savings of $90,000. Instead, however, acquisition costs increased by $75,000.

It turns out that the Purchasing Department managers failed to account for the “hidden costs” of freight in making their decision to switch manufacturers. Because the new manufacturer was located farther away, increased shipping costs more than offset the lower purchase price.

You might wonder how the managers in the Purchasing Department could make such an obvious mistake. It turns out that these managers were evaluated based on the raw material cost of steel, not the total acquisition cost. Shipping costs were considered to be part of operations, and so were charged to the Manufacturing Division. Consequently, the Purchasing Department managers had no incentive to consider this freight cost when making their decision. After senior managers recognized the problem, they changed the evaluation metrics for the Purchasing Department to include freight costs.

The result was a closer alignment of the incentives of the Purchasing Department with the profitability goals of the company. After the change, Purchasing considered all of the costs that varied with the consequence of their decisions, including freight. The goal of this chapter is to show you how to identify the benefits and costs of the decisions you make.

**BACKGROUND: VARIABLE, FIXED, AND TOTAL COSTS**

For decisions that affect output, knowing how costs vary with output will help you compute some of the costs associated with these decisions. To illustrate, suppose that you are the manager of a new candy factory. To produce candy, you have to build a factory, purchase ingredients, and hire employees to run it and to sell your product. Suppose your factory cost is $1 million, employees cost $50,000 total each, and ingredients cost $0.50/candy bar. If you decided to
produce 1,000 candy bars, you need to hire ten employees, but if you decide to produce 2,000 bars, you need 20 employees. For 2,000 bars, your production costs would be $1,500,500—$1 million for the factory, $500,000 in employee costs, and $500 in ingredient costs. If you decide to produce 2,000 bars, your costs would be $2,001,000—$1 million for the factory, $1 million in employee costs, and $1,000 in ingredients.

Notice that some, but not all, of the costs change as you increase output. Total costs increase as you produce more candy bars, but your factory costs $1 million regardless of the amount you produce. The factory is a fixed cost, as opposed to the labor or ingredients, whose costs vary with input. We call costs that change with output level variable costs. The distinction is a key lesson for this chapter:

*Fixed costs do not vary with the amount of output. Variable costs change as output changes.*

Table 3-1 shows total, fixed, and variable costs for your new candy factory at various production levels. Notice that the fixed costs remain the same whether your factory produces nothing or 5,000 candy bars. Variable costs, on the other hand, rise and fall as output changes. Total costs show a similar pattern with the important exception that total costs are also greater than zero regardless of output.

To reinforce the relationships among these costs, we can also represent them graphically. Figure 3-1 shows the general relationship between output and total, fixed, and variable costs. For output levels of zero, both fixed and total costs are greater than zero. Total and variable costs both increase with output, and variable costs appear as the difference between the total cost curve and the fixed cost line.1 To test your understanding of the distinction between fixed and variable costs, consider which of the following costs are variable:

---

**TABLE 3-1 Candy Factory Costs**

<table>
<thead>
<tr>
<th>Output</th>
<th>Fixed</th>
<th>Variable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,000,000</td>
<td>0</td>
<td>1,000,000</td>
</tr>
<tr>
<td>1,000</td>
<td>1,000,000</td>
<td>500,500</td>
<td>1,500,500</td>
</tr>
<tr>
<td>2,000</td>
<td>1,000,000</td>
<td>1,001,000</td>
<td>2,001,000</td>
</tr>
<tr>
<td>3,000</td>
<td>1,000,000</td>
<td>1,501,500</td>
<td>2,501,500</td>
</tr>
<tr>
<td>4,000</td>
<td>1,000,000</td>
<td>2,002,000</td>
<td>3,002,000</td>
</tr>
<tr>
<td>5,000</td>
<td>1,000,000</td>
<td>2,502,500</td>
<td>3,502,500</td>
</tr>
</tbody>
</table>

---

1Note that the shape of the total cost curve is not a straight line as it would have been if we graphed the costs of the candy factory. The reason: Per unit variable costs often drop with increasing output—a topic we will discuss in later chapters.
- Payments to your accountants to prepare your tax returns
- Electricity to run the candy-making machines
- Fees to design the packaging of your candy bar
- Costs of material for packaging

**BACKGROUND: ACCOUNTING VERSUS ECONOMIC PROFIT**

We now leave our fictitious candy manufacturer to talk about a real one. In 1990, Cadbury India offered its managers free housing in company-owned flats to offset the high cost of living in Bombay. In 1991, when Cadbury added low-interest housing loans to its benefits package, managers took advantage of this incentive and purchased their own homes, leaving the company flats empty. The empty flats remained on the company’s balance sheet for the next six years.

In 1997, Cadbury adopted Economic Value Added (EVA®), a financial performance measure trademarked by Stern Stewart & Co. EVA® charges each division within a firm for the amount of capital it uses and rewards management for increasing its division’s Economic Value Added, or EVA®. EVA® dictated that Cadbury India take on a capital charge of 15%, representing the return that Cadbury could have made had it invested the capital elsewhere.

After EVA® adoption, Bombay’s division saw a charge on its annual income statement equal to $600,000 (15% times $4,000,000—the value of the apartments). To increase their division’s EVA®, senior managers decided to sell the unused apartments. By charging each division for the

---

2Electricity and packaging material are both variable costs. As you make more candy bars, the machines will consume more electricity, and packaging costs will increase. Your accounting fees and packaging design fees will not change as output changes, so they are fixed costs.

3We do not know the actual size of the charges—they should be viewed as illustrative.
amount of capital it uses, the company gives managers incentives to abandon investments earning less than 15% and to undertake only those investments earning more than 15%.

The Bombay Cadbury managers likely had a very good sense of their factories’ variable, fixed, and total costs. So why were they making bad decisions concerning the company-owned flats? To understand this problem, we must recognize another very important distinction: the difference between accounting and economic costs. Table 3-2 presents a recent annual income statement for Cadbury. The firm sold over £6 billion in goods for the year; and after subtracting various expenses, it ended up with a profit of £431 million, or approximately 6.4%. Expense categories include items like the following:

- Costs paid to its suppliers for product ingredients
- General operating expenses, like salaries to factory managers and marketing expenses
- Depreciation expenses related to investments in buildings and equipment
- Interest payments on borrowed funds

These types of expenses are the accounting costs of the business.

---

4Adapted from the Cadbury Schweppes PLC 2004 Annual Report. Note that this income statement is for worldwide Cadbury operations, not just the Bombay Division, and is presented for a general illustration of economic versus accounting costs.
Economists, however, are also interested in implicit costs, costs that likely do not show up in the accounting statements. What’s an example of an implicit cost? Look at the income statement again, and notice that it lists payments to one class of capital providers of the company (debt holders). Interest is the cost that creditors charge for use of their capital. But creditors are not the only providers of capital. Stockholders provide equity, just as bond holders provide debt. Yet the income statement reflects no charge for equity. Suppose that Cadbury had received £4 billion in equity financing. If these equity holders expect an annual return of 10% on their money (or £400 million), we would subtract this amount from the £431 million in net earnings to get a better idea of the economic profit of the business. Similarly, if equity investors expected a 12% annual return (or £480 million), Cadbury would have an economic loss of £49 million (£431 million in net earnings less the £480 million expected return). The economic profit tells investors whether they should keep investing in the firm. Negative economic profit means that the firm is earning less than equity holders expect to make from their investment in the firm.

What does this mean in practical terms? It means that a firm may show an accounting profit while experiencing an economic loss. The two amounts are not equal because economic profit recognizes both the explicit and implicit costs of capital. A failure to consider these implicit costs is why the Cadbury India managers continued to maintain their flats. By adopting EVA®, the firm made visible the hidden cost of equity, and the managers sold the abandoned flats. To be able to calculate these types of implicit costs, it is critical to understand the concept of opportunity costs.

**COSTS ARE WHAT YOU GIVE UP**

So how do we calculate implicit costs? The trick is recognizing how implicit or economic costs relate to the decisions that you are trying to make. When deciding between two alternatives, always choose the one that returns the highest profit. We define the costs of one as the forgone opportunity to earn profit from the other. With this definition, costs imply decision-making rules, and vice versa. If the benefits of the first alternative are larger than its costs—the profit of the second alternative—then choose the first. Otherwise, choose the second.

*The opportunity cost of an alternative is what you give up to pursue it.*

In what follows, when we use the term cost, we refer to opportunity cost. Costs depend on what you give up and this depends on the decision that you are trying to make. The most important lesson of this chapter is that costs and decisions are inherently linked to one another.

To illustrate the link, consider the Cadbury managers’ decision to hold onto the company-owned flats. Management could have sold them and used the capital to expand operations. In other words, the cost to the company of holding onto the apartments was the forgone opportunity to invest capital in the company’s operations and earn a 15% return. Holding onto the flats cost the company $600,000 each year. Unless the benefits to the company of holding onto the apartments were at least $600,000, the capital was not employed in its highest-valued use.
Managers ignored the empty flats on the company’s balance sheet because they had no incentive to do otherwise. To fix the problem, the company began rewarding managers for increasing EVA®—which is more closely associated with the profit that matters to the shareholders. The company-instituted change in measuring costs motivated the managers of the Bombay operation to move the capital tied up in the apartments to a higher-valued use.

*Does your company charge you for the capital that you use? If not, does this lead you to make bad decisions?*

**FIXED- OR SUNK-COST FALLACY**

Opportunity costs are conceptually simple; the hard part is identifying the profit consequences of the associated decisions.

> *When making decisions, you should consider all costs and benefits that vary with the consequence of a decision and only costs and benefits that vary with the decision. These are the relevant costs and relevant benefits of a decision.*

You can make only two mistakes as you make decisions: You can consider irrelevant costs, or you can ignore relevant ones. In this section and the next, we describe these two potential mistakes and how to avoid them.

*The fixed-cost fallacy or sunk-cost fallacy means that you consider costs and benefits that do not vary with the consequences of your decision. In other words, you make decisions using irrelevant costs and benefits.*

As a simple example, consider a football game. You pay $20 for a ticket, but by halftime your team is losing 56–0. You stay because you say to yourself, “I want to get my money’s worth.” Of course, you cannot get your money’s worth, even if you stay. The ticket price does not vary with the decision to stay or leave. You should make the decision without considering the ticket price, which is a *sunk cost* and therefore not relevant to the decision.

One of the most frequent causes of the fixed-cost fallacy in business is the “overhead” allocated to various activities within a company. Because overhead is a fixed or sunk cost, it should not influence most business decisions within a company. If managers make decisions based on their overhead allocations, they commit the fixed-cost fallacy. Look back at the Table 3-2 income statement. Overhead costs appear in the line item of Selling, General, and Administrative Expense. An example of such an overhead expense would be costs associated with the corporate headquarters staff or with the sales force. These costs are considered fixed because output can be increased without the need to increase the corporate staff, like the CFO or CEO. Because these costs will not vary with decisions about changing output, they should be ignored in the decision-making process.
For example, suppose that you are in charge of a new products division, and are considering launching a product that you will be able to distribute through your existing sales force, without incurring extra expenses. However, if you launch the new product, your division will be forced to pay for a portion of the sales force. If this “overhead” charge is big enough to deter an otherwise profitable product launch, then you will commit the fixed-cost fallacy. Overhead expenses are analogous to a “tax” on launching a new product. In this case, the tax deters a profitable product launch.

Depreciation often becomes another case of the fixed-cost fallacy. For example, in 1996, a washing machine firm considered outsourcing its plastic agitator production, rather than making them internally as had been done for several years. The firm received a bid of $0.70 per unit from a trusted supplier and compared this bid with its internal production costs. Play along and make your decision on the basis of Table 3-3.

The relevant comparison should neglect the costs of depreciation and overhead because your firm incurs these costs regardless of whether you decide to outsource. The relevant cost of production is $0.80, and the relevant cost of outsourcing is $0.70. So outsourcing is cheaper.

In this example, however, identifying the right decision was easier than making it for the manager in charge of the washing machine plant. Six years earlier, they had incurred $1 million worth of tooling costs to make molds for the agitators. Following Generally Accepted Accounting Principles, they were charging themselves $100,000/year, over ten years, for the tooling cost. This is called “straight-line depreciation.” But this also meant that there was still $400,000 worth of un-depreciated capital still on the company’s balance sheet. Accountants at his firm told the manager that if he decided to outsource the agitator, these “assets” would

### TABLE 3-3  Outsourcing a Washing Machine Agitator

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
<th>Category</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>$0.60</td>
<td>Material</td>
<td>$0.50</td>
</tr>
<tr>
<td>Labor</td>
<td>$0.20</td>
<td>Labor</td>
<td>$0.10</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$0.10</td>
<td>Tooling</td>
<td>$0.10</td>
</tr>
<tr>
<td>Other Overhead</td>
<td>$0.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Annual unit volume is 1,000,000. Depreciation refers to straight-line depreciation of the $1,000,000 initial tooling cost, equal to $100,000 per year for 10 years ($0.10 = $100,000/1,000,000).

5Depreciation is an accounting methodology to allocate the costs of capital equipment to the years over the lifetime of the capital equipment.

6Labor would not be considered a fixed cost unless the company would keep the workers on payroll regardless of whether the part was produced internally or externally.
“become worthless,” and the manager would be forced to take a charge7 against his division’s profitability. The $400,000 charge would prevent him from reaching his performance goal, and he would have to forgo his bonus. The manager rationally decided not to outsource even though outsourcing would have been a profitable move for the company.

The company’s incentive compensation scheme that rewarded managers for increasing accounting profit rather than economic profit gave him an incentive to commit the sunk-cost fallacy. This leads to an important lesson:

*Accounting profit does not necessarily correspond to real or economic profit.*

Economic profit measures the true profitability of decisions. Rewarding employees for increasing accounting profit may lead to decisions that reduce economic profit. In the case of the washing machine agitator, the company should have rewarded its manager for increasing economic profit. This would have better aligned his incentives with the goals of the shareholders.

Companies find it difficult to avoid the sunk-cost fallacy because the person who decided to make the sunk-cost investment is often the only one who has enough information to know when the investment should be abandoned. If decision makers fear punishment for making what turns out to be a bad investment, then they may continue the investment just to hide the original mistake. We see this in the pharmaceutical industry, where drug development programs are very difficult to stop once they get started, and in companies that continue to develop computer software in-house, even after cheaper and better alternatives become available on the market. In each case, the person or division continues drug and software development long after it should stop to avoid punishment.

**HIDDEN-COST FALLACY**

The second mistake you can make is to ignore hidden costs.

*The hidden-cost fallacy occurs when you ignore relevant costs—those costs that do vary with the consequences of your decision.*

As a simple example of this, consider another football game. You buy a ticket for $20, but at game time scalpers are selling tickets for $50 because your team is playing its cross-state rivals who have legions of fans willing to pay over $50 to go to the game. Even though you do not value the tickets at $50, you go anyway because, you say, “These tickets cost me only $20.”

But wait, the tickets really cost you $50. By going to the game, you give up the opportunity to scalp them. Unless you value going to the game as much as the rival fans, then yours is not the highest-valued use for the ticket. In other words, you are sitting on an unconsummated wealth-creating transaction. Instead, scalp the tickets and stay home!

---

7Taking a “charge” against profitability means that accounting profit would be reduced by the amount of the charge—in this case, $400,000.
Consider another example: Suppose that you wish to fire an employee. You estimate that the employee contributes $2,500 per month to the company and that his compensation package costs the company $1,900 per month. Should you fire the employee? How does your answer change if you can sublet his office for $800 per month?

If you can rent the employee’s office space for $800 per month, the hidden cost of the employee is $800. The total cost of the employee is $2,700 per month, which is higher than the benefit he contributes to the company. Fire him.

The subprime mortgage crisis of 2008 can be traced to a failure to recognize the higher costs of loans made by dubious lenders, like Long Beach Financial, wholly owned by Washington Mutual (now bankrupt).

Long Beach Financial was moving money out the door as fast as it could, few questions asked, in loans built to self-destruct. It specialized in asking homeowners with bad credit and no proof of income to put no money down and defer interest payments for as long as possible. In Bakersfield, California, a Mexican strawberry picker with an income of $14,000 and no English was lent every penny he needed to buy a house for $720,000.8

The credit-rating agencies should have recognized the high cost of the subprime mortgages (high probability of default) but their ratings did not reflect the hidden cost of these very risky loans. As a consequence of this failure, Long Beach financial was able to package and sell the risky loans to Wall Street investors, like Lehman Brothers, who went bankrupt when the loans eventually defaulted.

**ECONOMIC VALUE ADDED**

When making decisions that involve capital expenditures or savings, it is obviously important to explicitly consider what else you could do with the capital—lest you commit the hidden-cost fallacy. As discussed in the Cadbury India story above, EVA® is a performance measure that makes visible the hidden cost of capital by charging each division within a firm for the amount of capital it uses. This gives managers an incentive to increase their division’s EVA® by either liquidating investments earning less than the cost of capital, or by undertaking new investments earning more than the cost of capital. Typically, the cost of capital is computed as the risk-adjusted cost of equity, the cost of debt, or a weighted average of the two, sometimes called the **weighted average cost of capital**, or WACC.

Specifically EVA® is the net operating profit after taxes minus the cost of capital times the amount of capital utilized. In equation form:

\[ \text{EVA}^\circledast = \frac{\text{NOPAT}}{\text{Capital Utilized}} - \left( \frac{\text{Cost of Capital}}{\text{Capital Utilized}} \right) \]

---

By adopting compensation schemes tied to EVA®, firms are less likely to commit the hidden-cost fallacy. As the promotional material of Stern Stewart & Co. puts it:

*The capital charge is the most distinctive and important aspect of EVA®.*

*Under conventional accounting, most companies appear profitable but many in fact are not. As Peter Drucker put the matter in a Harvard Business Review article, “Until a business returns a profit that is greater than its cost of capital, it operates at a loss. Never mind that it pays taxes as if it had a genuine profit. The enterprise still returns less to the economy than it devours in resources . . . Until then it does not create wealth; it destroys it.”*

*EVA corrects this error by explicitly recognizing that when managers employ capital they must pay for it, just as if it were a wage.*

*By taking all capital costs into account, including the cost of equity, EVA® shows the dollar amount of wealth a business has created or destroyed in each reporting period. In other words, EVA® is profit the way shareholders define it. If the shareholders expect, say, a 10% return on their investment, they “make money” only to the extent that their share of after-tax operating profit exceeds 10% of equity capital. Everything before that is just building up to the minimum acceptable compensation for investing in a risky enterprise.*

This is not to say that adopting EVA® can solve all your incentive alignment problems. Implementing EVA® still requires managers to exert a considerable amount of judgment and analysis. Even though EVA® is designed to make visible the hidden cost of capital, unless you can identify all hidden costs, you can still commit the hidden-cost fallacy. For example, if it is difficult to value the uncertain future benefits of an investment, you can commit the fallacy if you ignore the investment’s future benefits while considering current costs. The answer to every difficult economic question is almost always “it depends”—in this case, on being able to identify all the relevant costs and benefits of the investment decision. Stern Stewart & Co. can be credited for designing a system that makes visible the hidden cost of capital, but it is only a performance metric, not a substitute for careful analysis.

**DOES EVA® WORK?**

By adopting EVA®, or a similar economic profit plan (EPP), and linking pay to performance, firms reward managers for making good decisions—those that increase economic profit. If managers begin making better decisions, firms that adopt such plans should experience improved operating performance. Stern Stewart & Co. claims that “more than 300 client companies

---

9See http://www.sternstewart.com/?content=proprietary&p=eva

10Other EPPs include earnings-based bonuses and stock ownership (including employee stock ownership plans, restricted stock, phantom stock, and stock options).
worldwide now use EVA®, and evidence shows that most of them significantly outperform other companies in their industries.”

As expected, Professors Craig Lewis and Chris Hogan find that operating performance of companies adopting EPPs significantly improves following adoption.11 For the companies that they examined, the median return on assets (ROA) increases from 3.5% in the year prior to adoption to 4.7% four years later. Median operating income-to-total assets rises to 16.7% from 15.8% in four years. It appears that firms adopting EPPs realize dramatic long-run improvements in operating performance.

But before we can conclude that adopting an EPP is a good idea, we have to figure out what the firm would have done had it not adopted an EPP. We have to compare EPP adoption with the next-best alternative: That is, what else can firms do to increase profitability? This is the opportunity cost of EPP adoption. To answer this question, Lewis and Hogan set up “natural experiments” matching each adopting company with a comparable firm (same industry, similar operating performance, same size) that did not adopt an EPP. Surprisingly, they found that operating performance of nonadopting firms was statistically indistinguishable from that of adopting firms.12

Although bonus payments increase 39.1% in the adoption year for EPP firms, they also increase 37.4% for the nonadopters. Thus, well-managed firms respond to poor recent performance by strengthening the link between pay and performance, but the choice of performance evaluation metric, whether economic profit (including the hidden cost of capital) or earnings (accounting profit), does not seem to matter.

The bottom line is that new trends, fads, or analytical tools should be viewed skeptically. If a radical change is necessary to kick managers into action, the conclusion could well be that adoption of an economic performance plan is the necessary boot. However, Lewis and Hogan’s research points out that change can also be accommodated within the structure of existing compensation schemes.

**PSYCHOLOGICAL BIASES AND DECISION MAKING**

After reading this chapter, you should be able to recognize the relevant benefits and costs of decisions. But the frequency and magnitude of the mistakes made by businesses cannot be explained by ignorance alone. For that we have to turn to psychology, and the common biases that get in the way of rational decision making.

---


12 For an alternative view of the “fairness” of Lewis and Hogan’s selection methodology, check out the Stern Stewart & Co. Web site. Lewis and Hogan reply, “After reading the attack of our work, we feel reassured knowing that a number of alternative selection techniques have been tried and yielded similar results. Why do we choose the one we report in the paper? Because academics have shown that it has the best statistical properties.”
The *endowment effect* explains how the mere fact of taking ownership of an item increases the value that a person puts on the item. This effect is commonly shown in classroom settings by giving one-half of the class coffee mugs and then comparing the bottom line values of mug owners to the top-dollar values of non-mug owners. If the mugs are randomly distributed, the average of each group should be about the same. But, they’re not. Typically, those with mugs value them twice as much as those without. Retailers are very aware of this bias – why do you think you so often see programs like “Buy now, pay later” or “Try it before you buy it?” The retailers want to get the product in your hands to increase its perceived value to you. This same bias makes it very difficult for managers to pull the plug on businesses or investments that they originally initiated. In making decisions, you should carefully think about how ownership might be affecting your valuation.

*Loss aversion* can also explain the reluctance of managers to abandon projects. Loss aversion means that managers would pay more to avoid losses than to realize gains. In other words, losses have more emotional impact than gains of the same size. This bias also causes stickiness in house prices. Two homeowners, with identical houses, will list the houses at different prices, depending on what they paid for it. This can prevent markets from clearing. During the big bust in the Boston condominium market in the 1990’s, for example, sellers listed properties at a price 35% above the expected sales price, and most properties just sat there, unsold. The market “froze up” because sellers held out for prices that no one would reasonably pay.13 And if the real estate market does not clear, then no one knows how much the mortgage-backed securities are worth because their value depends on the real estate market. This uncertainty has made investors wary and contributed to the run on banks who invested in these mortgage-backed securities.

*Confirmation bias* is a tendency to gather information that confirms your prior beliefs, and to ignore information that contradicts them. To see how this affects decision making, suppose you are a senior manager listening to a project team pitching a new project. The team has talked to project engineers about feasibility, and they’ve run some test marketing to see how consumers might react to the product. Their financial models indicate a very profitable product. Should you invest? Before you do, try to determine whether the team has subconsciously filtered the information being presented. If they were particularly enthusiastic about the project from the start, it’s likely that they have gathered mostly favorable information. Push the analysis to look for disconfirming information they may have missed or ignored.

*Anchoring bias* relates to the effects of how information is presented or framed. The classic illustration of this effect involves asking people to estimate when Genghis Khan died after first asking them to think about the last three digits of their phone number. Those with lower values of the last three digits tend to give lower estimates because they have been anchored to this lower

number. If you pay attention, you will often see retailers trying to anchor you to high numbers: “What would you expect to pay for this beautiful item, $200, $150? Well, it’s available for a short time for only $39.99.” Having been anchored to the values of $200 and $150, all of the sudden $39.99 sounds like a great deal. Anchoring your opponent is often an effective negotiation tool—it gets them thinking about a high number initially and you can negotiate down from there.

Overconfidence bias is the tendency to place too much confidence in the accuracy of your analysis. For example, suppose you are projecting the annual revenues for a new product launch. You’ll probably base your estimate on some test marketing or historical comparisons to similar launches. Study after study has shown that you will likely be overconfident in your analysis. Not only are you likely to have overestimated the sales level, but also your belief in its accuracy will likely be too high. Be aware of this bias as you make decisions. Consider a wider range of scenarios. Analyze what might happen if sales are significantly lower than you anticipate. Think about a more flexible solution that would allow you to adjust your decision as uncertainty about performance is resolved. Dealing with uncertainty is an important topic in decision making and one we will return to in a later chapter.

**SUMMARY & HOMEWORK PROBLEMS**

**Summary of Main Points**
- Costs are associated with decisions.
- The opportunity cost of an alternative is the profit you give up to pursue it.
- Consider all costs and benefits that vary with the consequences of a decision and only costs and benefits that vary with the consequences of a decision. These are the relevant costs and benefits of a decision.
- Fixed costs do not vary with the amount of output. Variable costs change as output changes. Decisions that change output change only variable costs.
- Accounting profit does not necessarily correspond to real or economic profit.
- The fixed-cost fallacy or sunk-cost fallacy means that you consider irrelevant costs. A common fixed-cost fallacy is to let overhead or depreciation costs influence short-run decisions.
- The hidden-cost fallacy occurs when you ignore relevant costs. A common hidden-cost fallacy is to ignore the opportunity cost of capital when making investment or shutdown decisions.
- EVA® is a measure of financial performance that makes explicit the hidden cost of capital.
- Rewarding managers for increasing economic profit increases profitability, but evidence suggests that economic performance plans work no better than traditional incentive compensation schemes based on accounting measures.
Decision makers are subject to a number of psychological biases in evaluating costs and benefits. Be aware of these biases; take advantage of them when you can and consider how your own decisions might be affected.

Multiple-Choice Questions

1. A manufacturing company is considering purchasing a new machine that doubles capacity from 500 to 1,000 units per week. The machine will occupy approximately 500 square feet of vacant (unused) space on the factory floor. Which of the following costs are irrelevant in the decision to purchase this machine?
   a. The additional cost of utilities necessary to run the machine
   b. Monthly rental expense associated with the 10,000-square-foot factory
   c. Additional machinists who will need to be hired to run the machine
   d. Maintenance costs for regular repair and cleaning of the machine

2. A company manufactures both pens and pencils in the same facility. The firm’s production capacity is shared between these two products. Due to a federal ruling requiring all elementary school students to use only pencils, the overall demand for pencils has shifted outward leading to an increase in pencil prices. Surprisingly, this has had no effect on pen demand. The firm will find in the short term that:
   a. the cost of producing pencils rises.
   b. the cost of producing pens falls.
   c. pencils are less profitable than pens.
   d. the cost of producing pens rises.

3. In comparing a firm’s accounting costs with its economic costs, the accounting costs:
   a. are the same, if the firm is earning a normal rate of return.
   b. are larger.
   c. take account of the implicit cost of owned resources.
   d. are smaller.

4. The average capital invested in Firm X during the year is $20,000. During that same year, Firm X produces after-tax income of $3,200. If the firm’s cost of capital is 12%, what is the economic profit?
   a. $0
   b. $800
   c. $1,200
   d. $3,200
5. Which of the following costs always must be considered relevant in decision making?
   a. Variable costs
   b. Avoidable costs
   c. Fixed costs
   d. Sunk costs

**Individual Problems**

3-1 *Production Opportunity Cost*

A can manufacturing company produces and sells three different types of cans: Versions X, Y, and Z. A high-level, simplified profit/loss statement for the company is provided here. Corporate overhead (rent, general and administrative expense, etc.) is allocated equally among the three product versions. After reviewing the statement, company managers are concerned about the loss on Version Z and are considering ceasing production of that version. Should they do so? Why or why not?

<table>
<thead>
<tr>
<th></th>
<th>Version X</th>
<th>Version Y</th>
<th>Version Z</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Can Sales</td>
<td>$180,000</td>
<td>$240,000</td>
<td>$105,000</td>
<td>$525,000</td>
</tr>
<tr>
<td>Variable Costs</td>
<td>105,000</td>
<td>135,000</td>
<td>82,500</td>
<td>322,500</td>
</tr>
<tr>
<td>Corporate Overhead</td>
<td>60,000</td>
<td>60,000</td>
<td>60,000</td>
<td>180,000</td>
</tr>
<tr>
<td>Contribution to Profit</td>
<td>15,000</td>
<td>45,000</td>
<td>37,500</td>
<td>22,500</td>
</tr>
</tbody>
</table>

3-2 *Opportunity Cost of Renting*

You currently pay $10,000 per year in rent to a landlord for a $100,000 house, which you are considering purchasing. You can qualify for a loan of $80,000 at 9% if you put $20,000 down on the house. To raise money for the down payment, you would have to liquidate stock earning a 15% return. Neglect other concerns, like closing costs, capital gains, and tax consequences of owning, and determine whether it is better to rent or own.

3-3 *Opportunity Cost of Steel*

Your firm usually uses about 200 to 300 tons of steel per year. Last year, you purchased 100 tons more steel than needed (at a price of $200 per ton). In the meantime, the price of steel jumped to $250 per ton delivered (which means that any firm selling the steel must pay any shipping costs), and the price has since stabilized at that price. The cost of shipping steel to
the nearest buyer would be $20 per ton. In the meantime, a business next door just went bankrupt, and the bank is offering a special deal where you can buy another 100 tons of steel for $180 per ton. Assume that the interest rate is 0%. Which of the following are correct?

  a. Sell your 100 tons at the going market price of $250, and make a profit of $30 per ton ($50 less $20 cost of shipping).
  b. Buy the 100 tons next door at $180, and resell at a price of $250 less $20 shipping, for a net profit of $50 per ton.
  c. Hold onto your 100 tons, and wait until it is needed for production.
  d. Buy the 100 tons next door at $180, and hold onto it until it is needed in production.

3-4 *Foreign Currency*
You’ve completed your vacation in a foreign country. At the airport, you discover you have the equivalent of $20 local currency left over. The exchange control officer tells you that you can’t convert the local money back to dollars. Nor can you take it out of the country. Because the gift shop was closed, you decided to spend the remaining money on refreshments—for complete strangers! What is the cost of the refreshments?

3-5 *Evaluating Performance in a Small Business*
A few years ago, a construction manager earning $70,000 per year working for a regional home builder decided to open his own home building company. He took $100,000 out of one of his investment accounts that had been earning around 6% a year and used that money to start up the business. He worked hard the first year, hiring one employee (his only salary cost for the business was the $40,000 paid to this employee), and generated total sales of $1,000,000. Total material and subcontracted labor costs for the year were $900,000. Calculate accounting profit. What are the opportunity costs for the manager of being in this business relative to returning to his old job? What is the economic profit of the business?

**Group Problems**

*G3-1 Fixed-Cost Fallacy*
Describe a decision made by your company that involved costs that should have been ignored. Why did your company make the decision? What should they have done? Compute the profit consequences of the change.
**G3-2 Hidden-Cost Fallacy**
Describe a decision that you or your company made that involved opportunity costs that should have been considered. Why did your company make the decision? What should they have done? Compute the profit consequences of the change.

**G3-3 Hidden Cost of Capital**
Does your company charge your division for the capital that it uses? If not, does this lead to bad decisions? What can be done to fix the problem? Compute the profit consequences of the change.

**G3-4 Sunk Cost of Depreciation or Fixed Cost of Overhead**
Does your company make decisions based on depreciation or overhead? If so, does this lead to bad decisions? What can be done to fix the problem? Compute the profit consequences of the change.
SECTION II

Pricing, Costs, and Profits

CHAPTER 6  Simple Pricing
CHAPTER 7  Economies of Scale and Scope
CHAPTER 8  Understanding Markets and Industry Changes
CHAPTER 9  Relationships Between Industries: The Forces Moving Us Towards Long-Run Equilibrium
CHAPTER 10  Strategy—The Quest to Keep Profit from Eroding
CHAPTER 11  Using Supply and Demand: Foreign Exchange, Trade, and Bubbles
From early 2007 to the middle of 2008, the average price of a gallon of gas in the United States rose from less than $2.00 to over $4.00. Although this was especially bad news for SUV drivers and airplane passengers, it was really good news for two McMinnville, Tennessee, workers named Dolly and Molly. Dolly and Molly had been unemployed, but the increase in gas prices put them back to work. What made these two workers unique? They’re mules, and when the price of gas rose dramatically, the cost of running a tractor increased, leading to their re-employment.1

Farmers in Rajasthan, India, reacted to higher gas prices in a similar manner. Rather than turning to mules, however, they increased their use of camels on farms. As oil prices rose, demand for camels increased, leading to a tripling of prices for camels over a two-year period.2

The camel breeders could have given a lesson to NNS, a U.S. company producing potash fertilizer. As the cost of inputs rose, including petrochemicals, their price of “generic” potash fertilizer doubled. Historically, NNS had priced its branded fertilizer at a 35% premium above the generic price. However, the rapid increase in costs during the first two quarters of 2008, combined with the NNS policy of revising price quarterly, led to stockouts and a price that was 25% below the generic price. If the premium had been maintained, NNS would have sold the same volume at a higher price and would have earned an additional $13 million.

Pricing is a powerful but oft-neglected tool. We all know that Profit = \( P \times Q - C \times Q \), but many businesses seem to focus on either \( Q \) or \( C \) and forget about \( P \). Think about companies you’ve worked for—I bet they spent more time thinking about how to sell more or how to reduce costs and not a whole lot of time about how to raise price. Roger Brinner, Partner and Chief Economist at The Parthenon Group, argues that most companies can make money by raising price.3 Theory suggests that he is correct. For a company with a pre-tax profit margin of 8.6% (the average for the S&P 500), revenues would have to increase by 12% to get the same payoff as a 1% increase in price.

---

1 For more on Dolly and Molly’s story, see http://www.npr.org/templates/story/story.php?storyId=90840231
BACKGROUND: CONSUMER SURPLUS AND DEMAND CURVES

Let’s consider a simplified relationship between price and quantity purchased by a single consumer, using hot dogs. Table 6-1 shows the number of hot dogs the consumer will purchase at various prices.

It’s easy to see from the table that, as price falls, the consumer purchases more hot dogs, reflecting the First Law of Demand: Consumers demand (purchase) more as price falls, assuming other factors are held constant. This makes intuitive sense. Consider the value you, a hungry consumer, receive from the first hot dog you purchase and consume—it’s likely to be substantial. The additional value you get from consuming the second hot dog is a bit less, and by the time you’re chowing down on your fifth hot dog, the additional value is fairly small. The marginal, or additional, value of consuming each subsequent hot dog diminishes the more you consume.

Suppose the consumer values that first hot dog at $5, the second at $4, the third at $3, and so on. Knowing the value our consumer places on each subsequent hot dog allows us to construct Table 6-2, which shows total and marginal value for the various quantities, where total value is simply the sum of the preceding marginal values.

As always, thinking in marginal terms is critical. Say you just looked at the fact that five hot dogs have a total value of $15. You might be tempted to conclude that if hot dogs were priced at $3, the consumer would purchase five hot dogs since $5 × $3 = $15. Thinking in marginal terms, however, shows us that the marginal value of the fourth hot dog is only $2, so at a price of $3, the

<table>
<thead>
<tr>
<th>Hot Dog Price</th>
<th>Hot Dogs Purchased</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5</td>
<td>1</td>
</tr>
<tr>
<td>$4</td>
<td>2</td>
</tr>
<tr>
<td>$3</td>
<td>3</td>
</tr>
<tr>
<td>$2</td>
<td>4</td>
</tr>
<tr>
<td>$1</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hot Dogs Purchased</th>
<th>Marginal Value</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>2</td>
<td>$4</td>
<td>$9</td>
</tr>
<tr>
<td>3</td>
<td>$3</td>
<td>$12</td>
</tr>
<tr>
<td>4</td>
<td>$2</td>
<td>$14</td>
</tr>
<tr>
<td>5</td>
<td>$1</td>
<td>$15</td>
</tr>
</tbody>
</table>
consumer will purchase just three. If consumers behave optimally, they will try to maximize the surplus they get from consuming hot dogs, the difference between their value and the price they pay. Purchasing three hot dogs at $3 each leads to consumer surplus of $3 (total value of $12 less expenditure of $9). Purchasing five hot dogs at $5 each would lead to consumer surplus of zero.

We can link our two tables to get a measure of how much our consumer gains from eating hot dogs. If the consumer pays less than the total value of the hot dogs, he or she has consumer surplus. Table 6-3 shows the amount of consumer surplus for different numbers of hot dogs consumed.

To describe how consumers will respond to price, economists use demand curves, which tell you how much a single consumer or a group of consumers will consume as a function of price. Recall from the First Law of Demand that we should expect demand curves to slope downward because consumers purchase more as prices fall.

*Demand curves describe buyer behavior and tell you how much consumers will buy at a given price.*

To describe the buying behavior of a group of consumers, we add up all the individual demand curves to get an aggregate demand curve. The simplest way to show this is when each consumer wants only a single item (i.e., the marginal value of a second unit is zero). For example, to construct a demand curve that describes the behavior of seven buyers, simply arrange the buyers by what they are willing to pay (e.g., $7, $6, $5, $4, $3, $2, and $1). At a price of $7, one buyer will purchase; at a price of $6, two buyers will purchase; at $5, three buyers; and so on. At a price of $1, all seven buyers will purchase the good. An aggregate or market demand curve is the relationship between the price and the number of purchases made by this group of consumers. In Figure 6-1, we plot this demand curve.

<table>
<thead>
<tr>
<th>Hot Dog Price</th>
<th>Hot Dogs Purchased</th>
<th>Total Price Paid</th>
<th>Total Value</th>
<th>Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5</td>
<td>1</td>
<td>$5</td>
<td>$5</td>
<td>$0</td>
</tr>
<tr>
<td>$4</td>
<td>2</td>
<td>$8</td>
<td>$9</td>
<td>$1</td>
</tr>
<tr>
<td>$3</td>
<td>3</td>
<td>$9</td>
<td>$12</td>
<td>$3</td>
</tr>
<tr>
<td>$2</td>
<td>4</td>
<td>$8</td>
<td>$14</td>
<td>$6</td>
</tr>
<tr>
<td>$1</td>
<td>5</td>
<td>$5</td>
<td>$15</td>
<td>$10</td>
</tr>
</tbody>
</table>

4Don’t get distracted by the fact that at a price of $6, the buyer is being charged a price exactly equal to his or her value and is thus earning no surplus. At a price of $6, the buyer is exactly indifferent between buying and not buying. This is a result of using whole numbers to describe prices and values. For convenience, imagine that the value is a fraction above the price, so that the buyer will purchase.
Note that price—the independent variable—is on the wrong axis. There are good reasons for this that will become apparent, but for now, just accept that economists like to do things a little differently. Note also that economists have special jargon describing the response of demand to price. We say that as price decreases, “quantity demanded” increases. If something other than price changes stimulate demand, we instead say that the demand curve “shifts” to the right, or “increases,” such that consumers purchase greater quantities at the same prices. We’ll discuss factors that shift demand in a later chapter.

To determine the quantity demanded at each price using the demand curve, look for the quantity on the horizontal axis corresponding to a price on the vertical axis. At a price of $6, buyers demand two units; at a price of $5, three units; and so on. As price falls, quantity demanded increases.

**MARGINAL ANALYSIS OF PRICING**

Demand curves present sellers with a dilemma. Sellers can raise price and sell fewer units, but earn more on each unit sold. Or they can reduce price and sell more, but earn less on each unit sold. This fundamental trade-off is at the heart of pricing decisions. We resolve it by using
marginal analysis. If marginal revenue (MR) is greater than marginal cost (MC), you can increase profit by selling another unit.

Reduce price (sell more) if MR > MC. Increase price (sell less) if MR < MC.

Recall that consumers and sellers are both using marginal analysis. But consumers are using marginal analysis to maximize consumer surplus (make all purchases so that marginal value exceeds price), while sellers use it to maximize profit.

To see how to use marginal analysis to maximize profit, examine Table 6-4. The columns list the Price, Quantity, Revenue, MR, MC, and total Profit for our demand curve. Suppose that the product costs $1.50 to make. At a price of $7, one consumer would purchase, so revenue would be $7. Cost would be $1.50, so profit on the first sale would be $5.50.

If we reduce price to $6, two consumers purchase, so revenue goes up to $12, an increase of $5. We say that the MR of the second unit is $5. If we reduce price further to $5, revenue increases to $15, so that the MR of the third unit is $3.

So far, all of these changes have been profitable because the increase in revenue (MR) has been greater than the increase in cost (MC). We earned $5.50 on the first unit, $3.50 on the second unit, and $1.50 on the third unit. These marginal profits sum to a total profit of $10.50, as indicated in the last column of Table 6-4.

However, if we sell a fourth unit, total profit would go down because the marginal revenue from selling the fourth unit is $1, which is less than the $1.50 marginal cost. So we don’t sell the fourth unit. The optimal quantity is three; and to sell this amount, we look at the demand curve to tell us how much to charge to sell three units: $5.

After going through your analysis to compute the optimal price, suppose your boss looks at you and says, “This is the stupidest thing I’ve ever seen! Since the price is $5, and the cost of producing another good is only $1.50, we’re leaving money on the table.” What do you tell her?

**Table 6-4** Optimal Price

<table>
<thead>
<tr>
<th>Price</th>
<th>Quantity</th>
<th>Revenue</th>
<th>MR</th>
<th>MC</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7.00</td>
<td>1</td>
<td>$7.00</td>
<td>$7.00</td>
<td>$1.50</td>
<td>$5.50</td>
</tr>
<tr>
<td>$6.00</td>
<td>2</td>
<td>$12.00</td>
<td>$5.00</td>
<td>$1.50</td>
<td>$9.00</td>
</tr>
<tr>
<td>$5.00</td>
<td>3</td>
<td>$15.00</td>
<td>$3.00</td>
<td>$1.50</td>
<td>$10.50</td>
</tr>
<tr>
<td>$4.00</td>
<td>4</td>
<td>$16.00</td>
<td>$1.00</td>
<td>$1.50</td>
<td>$10.00</td>
</tr>
<tr>
<td>$3.00</td>
<td>5</td>
<td>$15.00</td>
<td>$1.00</td>
<td>$1.50</td>
<td>$7.50</td>
</tr>
<tr>
<td>$2.00</td>
<td>6</td>
<td>$12.00</td>
<td>$3.00</td>
<td>$1.50</td>
<td>$3.00</td>
</tr>
<tr>
<td>$1.00</td>
<td>7</td>
<td>$7.00</td>
<td>$5.00</td>
<td>$1.50</td>
<td>$3.50</td>
</tr>
</tbody>
</table>

*Marginal profit = MR − MC and is the extra profit from selling one more unit.*
Your boss has confused *average* revenue or price with *marginal* revenue. They’re easy to confuse. Here’s why. As long as price is greater than average cost, it appears that an increase in quantity would increase profit. However, this reasoning is incorrect because it doesn’t recognize the dependence of $Q$ on $P$—you cannot sell more without decreasing price. Put another way, you can say that to sell more, you have to reduce price for *all* customers, not just the additional customers who would be attracted by the reduced price.

Tell your boss that you are already making all profitable sales—those for which marginal revenue exceeds marginal cost. Marginal analysis, not average analysis, tells you where to price or, equivalently, how many to sell.

**PRICE ELASTICITY AND MARGINAL REVENUE**

Unfortunately, you’re never going to see a demand curve like the one in Figure 6-1. In general, it is very difficult to get information about demand at prices above or below the current price. In fact, if anyone—particularly an economic consultant—ever tries to show you a complete demand curve, don’t trust it; the consultant has only a very rough guess as to what demand looks like away from current prices.

At this point (unless it’s past the drop/add period), some students quit the class, shaking their heads and wondering why they have to learn about things they’ll never see. The point of Figure 6-1 and the associated analysis is that you don’t need the entire demand curve to know how to price—all you need is information on MR and MC. If MR > MC, reduce price; if MR < MC, increase price. As we saw earlier, marginal analysis points you in the right direction, but it doesn’t tell you how far to go. You get to the best price by taking steps and then by re-computing MR and MC to see whether you should take another step.

So how do we estimate marginal revenue? The answer involves measuring quantity responses to past price changes, “experimenting” with price changes, or running market surveys to see how quantity would change in response to a price change. If you do get any useful information about demand away from the current price, it’s likely to come in the form of information about **price elasticity of demand**, which we denote by $e$.

$$\text{Price elasticity of demand} (e) = \left( \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} \right)$$

Price elasticity measures the sensitivity of quantity demanded to price changes. A demand curve for which quantity changes more than price is said to be **elastic**, or sensitive to price; and a demand curve for which quantity changes less than price is said to be **inelastic**, or insensitive to price.

---

6Profit = Revenue - Cost = $Q^* (P - AC)$, where $AC$ is average cost.
If \( |e| > 1 \), demand is elastic; if \( |e| < 1 \), demand is inelastic.

Since price and quantity move in opposite directions—as price goes up, quantity goes down, and vice versa—price elasticity is negative; that is, \( e < 0 \). However, people often refer to elasticity without the minus sign, resulting in confusion. To keep things clear, whenever we use price elasticity, as we do here, we will refer to its absolute value, represented by \( |e| \).

To show how you might be able to estimate elasticity, consider this 1999 “natural experiment” at MidSouth, a medium-sized retail grocery store. The store’s managers decreased the price of three-liter Coke (diet, caffeine-free, and classic) from $1.79 to $1.50 because they wanted to match a price offered at a nearby Walmart. In response to the price drop, the quantity sold doubled, from 210 to 420 units per week.

To compute elasticity, simply take the percentage quantity increase and divide by the percentage price decrease. Some confusion inevitably occurs because we can compute percentage changes in several different ways, depending on whether we divide the price or quantity change by initial or final prices and quantities. The most accurate estimate comes from dividing by the midpoint of price \((P_1 + P_2)/2\) and the midpoint of quantity \((Q_1 + Q_2)/2\):

\[
\text{Price Elasticity Estimator}^7 = \frac{\frac{(Q_1 - Q_2)}{(Q_1 + Q_2)}}{\frac{(P_1 - P_2)}{(P_1 + P_2)}}
\]

In the three-liter Coke example, the calculation works like this:

\[
\frac{(210 - 420)/(210 + 420)}{(1.79 - 1.50)/(1.79 + 1.50)}
\]

In this case, the estimated price elasticity is \(-3.8\), indicating that a 1% decrease in price of three-liter Coke leads to a 3.8% increase in quantity.\(^8\) The change in revenue associated with the change is

\[
($1.50 \times 420) - ($1.79 \times 210) = $630 - $375.90 = $254.10
\]

The relationship between revenue and elasticity can be derived from the following formula:

\[
\% \Delta \text{Revenue} \approx \% \Delta \text{Price} + \% \Delta \text{Quantity}^9
\]

The symbol \( \% \Delta \) means “percentage change in.” All this says is that whichever change is bigger (price vs. quantity) determines whether revenue goes up or down. And elasticity tells you this.

---

\(^7\)In computing the midpoints, we use the formulas \((Q_1 + Q_2)/2\) and \((P_1 + P_2)/2\). Since 2 divides both denominator and numerator, the formula simplifies, as here.

\(^8\)Note that if we used the initial price and quantity to compute the percentage changes, the calculation would be \([(420 - 210)/210]/[(1.50 - 1.79)/1.79]\) or \(100%/-16.2\%\)—that is, \(-6.17\).

\(^9\)This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.
For example, if demand is elastic, then a price decrease will be smaller than the corresponding quantity increase, so revenue will rise following a price decrease. Likewise, a price increase will be smaller than the corresponding quantity decrease, so revenue will fall following a price increase. This relationship is illustrated in the bottom row of Table 6-5.

On the other hand, if you try to increase price when demand is elastic, then revenue goes down (top row of Table 6-5). To see this, let’s look at the story of Marion Barry’s 6% tax rate increase on gasoline sales in the District of Columbia. Before the tax was put into law, gas station owners in the District argued against it, predicting that it would reduce quantity by 40%. Since the increase in price (6%) was smaller than the projected decrease in quantity (40%), the gas station owners predicted that gasoline revenue, and the taxes collected out of revenue, would decline.

Since D.C. has many commuters who could buy gasoline in Maryland and Virginia instead of D.C., a reasonable guess would be that demand for gasoline sold in D.C. was very elastic. In fact, the actual reduction in quantity was 38%, very close to what the gas station owners had predicted, indicating that demand for gasoline sold in the District of Columbia was indeed very elastic. This scenario predicted by the gas station owners is illustrated in the top row of Table 6-5.

When demand is inelastic, this relationship is reversed; that is, price increases raise revenue because the price increase is bigger than the corresponding quantity decrease. Conversely, price decreases reduce revenue because the price reduction is bigger than the quantity increase (see Table 6-6).

Let’s test our understanding of the relationship between price changes, elasticity, and revenue by deriving the relationships in Tables 6-5 and 6-6 using the approximation

\[
\%\Delta Revenue \approx \%\Delta Price + \%\Delta Quantity.
\]

**TABLE 6-5** Elastic Demand (|\(e\)| > 1)

| Price increase | Revenue decrease (decrease in \(Q\) is bigger than increase in \(P\)) |
| Price decrease | Revenue increase (increase in \(Q\) is bigger than decrease in \(P\)) |

**TABLE 6-6** Inelastic Demand (|\(e\)| < 1)

| Price increase | Revenue increase (decrease in \(Q\) is smaller than increase in \(P\)) |
| Price decrease | Revenue decrease (increase in \(Q\) is smaller than decrease in \(P\)) |
The exact numerical relationship between marginal revenue (change in revenue) and elasticity is \( MR = P(1 - 1/e) \).\(^{10}\) We can use this formula to express the marginal analysis rule—reduce price if \( MR > MC \), and raise price otherwise—using price elasticity in place of marginal revenue:

\[
MR > MC \text{ means that } (P - MC)/P > 1/e.
\]

This expression has an intuitive interpretation. The left side of the expression is the current markup of price over marginal cost, \((P - MC)/P\), whereas the right side is the desired markup, which is the inverse elasticity, \(1/e\). If the current markup is greater than the desired markup, reduce price because \( MR > MC \), and vice versa. Intuitively, as demand becomes more elastic, the less you can mark up price over marginal cost because you lose too many customers.

For example, after MidSouth Grocery reduced the price of three-liter Coke to $1.50, its actual markup over marginal cost was 2.7%, which is much less than the desired markup of \(1/3.78 = 26\%\), so the price was much too low. Ordinarily, a profit-maximizing store manager would raise the price in such a situation. In this case, however, the managers were using three-liter Coke as a loss leader, deliberately pricing it too low as a way to attract customers to the store. Why? Because they hoped that customers would spend money on other items once they got there. We’ll discuss this and other more complex pricing strategies in later chapters.

**WHAT MAKES DEMAND MORE ELASTIC?**

Given the importance of elasticity (price elasticity of demand) to pricing—the more elastic demand is, the lower the profit-maximizing price is—it’s worthwhile to sharpen our intuitive feel for what would make demand more or less elastic. In this section, we list four factors that affect demand elasticity and optimal pricing.

*Products with close substitutes have elastic demand.*

Consumers respond to a price increase by switching to their next-best alternative. If their next-best alternative is a very close substitute, then it doesn’t take much of a price increase to induce them to switch. For example, when District of Columbia Mayor Barry raised the price of gasoline by 6%, many consumers began purchasing gasoline in nearby Virginia and Maryland.

---

\(^{10}\) \( MR = \Delta \text{Revenue}/\Delta Q = \Delta(PQ)/\Delta Q = (\Delta PQ + \Delta QP)/\Delta Q = P(1 - 1/e) \). The symbol \( \Delta \) means “change in.”
In a similar vein, we see that individual brands have closer substitutes (other brands) than do aggregate product categories that include the brands. This leads to our next maxim.

*Demand for an individual brand is more elastic than industry aggregate demand.*

As a rough rule of thumb, we can say that brand price elasticity is approximately equal to industry price elasticity divided by the brand share. For example, if the elasticity of demand for all running shoes is $-0.4$, and the market share of Nike running shoes is $20\%$, price elasticity of demand for Nike running shoes is $(-0.4/0.20) = -2$. Using our optimal pricing formula, we can see that Nike has a desired markup of about $50\%$.

If you search the Internet, you’ll easily find industry price elasticity estimates that you can combine with market share estimates to get an estimate of brand elasticity. And you can use this estimate to gain a general idea of whether your brand price is too high or low.

*Products with many complements have less elastic demand.*

Products that are consumed as part of a larger bundle of complementary goods—say, shoelaces and shoes—have less elastic demand. If the price of shoelaces increases, you’re not likely to stop buying shoelaces; if you don’t have shoelaces, you don’t have your favorite shoes. Conversely, products that are not part of a bundle of complementary goods have more elastic demand. As their price changes, consumers find it easier to stop consuming the good.

Another factor affecting elasticity is time. Given more time, consumers are more responsive to price changes. They have more time to find more substitutes when price goes up and more time to find novel uses for a good when price goes down. This leads to our third maxim:

*In the long run, demand curves become more elastic: $|e|$ increases.*

This phenomenon could also be explained by the speed at which price information is disseminated. As time passes, information about a new price becomes more widely known, so more consumers react to the change.

As an example, consider automatic teller machine (ATM) fees. In 1997, a bank in Evanston, Indiana, ran an experiment to determine elasticity of demand for ATMs with respect to ATM fees. At a selected number of ATMs, the bank raised user fees from $1.50$ to $2.00$. When informed of the fee increase, users typically completed the current transaction but avoided the higher-priced ATMs in the future. If we define the short run as the current transaction and the long run as future transactions, then the maxim holds.

Our final maxim relates elasticity to the price level. As price increases, consumers find more alternatives to the good whose price has gone up. And with more substitutes, demand becomes more elastic.

*As price increases, demand becomes more elastic: $|e|$ increases.*
For example, high-fructose corn syrup (HFCS) is a caloric sweetener used in soft drinks. For this application, sugar is a perfect substitute for HFCS. However, import quotas and sugar price supports have raised the U.S. domestic price of sugar to about twice that of HFCS. All soft drink bottlers now use HFCS instead of sugar. And because bottlers have no close substitutes for low-priced HFCS, its demand is relatively inelastic. But if the price of HFCS were to rise to that of sugar, sugar would become a good substitute for HFCS. In other words, demand for high-priced HFCS would become very elastic.

**FORECASTING DEMAND USING ELASTICITY**

We can also use elasticity as a forecasting tool. With an elasticity and a percentage change in price, you can predict the corresponding change in quantity:

\[
\% \Delta \text{Quantity} \approx e(\% \Delta \text{Price})
\]

For example, if the price elasticity of demand is $-2$, and price goes up by $10\%$, then quantity is expected to go down by $20\%$.

Remember that price is only one of many factors that affect demand. Income, prices of substitutes and complements, advertising, and tastes all affect demand. To measure the effects of these other variables on demand, we define a factor elasticity of demand:

\[
\text{Factor elasticity of demand} = \frac{\% \text{ change in quantity}}{\% \text{ change in factor}}
\]

For example, demand for bottled water, iced tea, and carbonated soft drinks is strongly influenced by temperature. If the temperature elasticity of demand for beverages is $0.25$, then a $1\%$ increase in temperature will lead to a $0.25\%$ increase in quantity demanded.

**Income elasticity of demand** measures the change in demand arising from changes in income. Positive income elasticity means that the good is normal; that is, as income increases, demand increases. Negative income elasticity means that the good is inferior; that is, as income increases, demand declines. The decreasing incomes associated with the financial crisis of 2008 provided a number of examples of inferior goods. Although most retailers saw dramatic sales declines in 2008, Walmart’s sales increased. Sales of Spam® also shot up in 2008, leading Hormel to add a second shift at its Minnesota factory.

**Cross-price elasticity of demand** for Good A with respect to the price of Good B measures the change in demand of A owing to a change in the price of B. Positive cross-price elasticity means that Good B is a substitute for Good A: As the price of a substitute increases, demand increases. Mules and camels, for example, are substitutes for gas-powered tractors.

---

11This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.
As the cost of operating a tractor increases with rising gas prices, demand for mules and camels increases. The home safe market saw a similar effect in 2008. As interest rates declined, the opportunity cost of keeping cash at home declined, leading to an increase in demand for home safes.

Negative cross-price elasticity means that Good B is a complement to Good A: As the price of a complement increases, demand decreases. Computers, for example, are complements to operating systems that run on them. We can trace part of Microsoft’s success to its strategy of licensing its operating system to competing computer manufacturers. That strategy helped keep the price of computers low but stimulated demand for Microsoft’s operating system.

We can estimate factor elasticities by using a formula analogous to the estimated price elasticity formula, and we can use factor elasticities to forecast or predict changes over time or even changes from one geographic area to another. Suppose you’re trying to compare the year-to-year performance of one of your regional salespeople over a period in which income grew by 3%. If demand for your products has an income elasticity of 2, you would expect quantity to increase by 6%. You don’t want to reward the salesperson for increases in quantity that are largely unrelated to her effort. A performance measure more closely related to effort would subtract 6% from the actual growth because that is the growth related to income.

Alternatively, suppose the New York Times is trying to decide whether to begin home delivery of its newspaper in Nashville. To compute the break-even quantity, you need to know whether enough Nashvillians will choose home delivery to justify the investment in this service. If the New York Times recently began home delivery in Charlotte, and the income in Nashville is 5% higher than in Charlotte, you would expect a 10% higher per-capita consumption of the newspaper in Nashville than in Charlotte if the income elasticity of demand for the paper is 2. If the forecast quantity would allow you to break even, then begin home delivery in Nashville.

**STAY-EVEN ANALYSIS, PRICING, AND ELASTICITY**

Stay-even analysis is a simple but powerful tool that allows you to do marginal analysis of pricing. In particular, it is used to determine the volume required to offset a change in price. For example, you know from the First Law of Demand that raising price will result in selling fewer units. Stay-even analysis tells you how many unit sales you can lose before a price increase becomes unprofitable. When combined with information about elasticity of demand, the analysis will give you a quick answer to the question of whether changing price makes sense. If the predicted quantity decrease is bigger than the stay-even quantity decrease, then the price increase is not profitable, and vice versa.

---

12This section was inspired by material from Mike Shor’s pricing class at Vanderbilt University.
The stay-even quantity is a simple function of the size of the price increase and the contribution margin, \( \% \Delta Q = \% \Delta P/(\% \Delta P + \text{margin}) \), where \( \text{margin} = (P - MC)/P \). If you are considering a price increase, and the predicted quantity decrease is bigger than the stay-even quantity decrease, the price increase is unprofitable.

This type of analysis persuaded a judge to allow the Whole Foods-Wild Oats merger in 2008. With retail margins of 40\%, a 5\% price increase would require a quantity loss of no more than 11.1\% to be profitable. Citing marketing studies showing that customers shopped at Whole Foods as well as other grocery stores, former FTC Chief Economist and colleague David Scheffman argued that the actual quantity lost would be greater than 11.1\%, presumably to stores outside the category. This persuaded the judge that the merged firm would not find it profitable to raise price.\(^{13}\)

### SUMMARY & HOMEWORK PROBLEMS

#### Summary of Main Points
- **Aggregate demand**, or market demand, is the total number of units that will be purchased by a group of consumers at a given price.
- Pricing is an extent decision. Reduce price (increase quantity) if \( \text{MR} > \text{MC} \). Increase price (reduce quantity) if \( \text{MR} < \text{MC} \). The optimal price is where \( \text{MR} = \text{MC} \).
- **Price elasticity of demand**, \( e = (\% \text{ change in quantity demanded}) / (\% \text{ change in price}) \)
  - Estimated price elasticity = \( [(Q_1 - Q_2)/(Q_1 + Q_2)] / [(P_1 - P_2)/(P_1 + P_2)] \) is used to estimate demand from a price and quantity change.
  - If \(|e| > 1\), demand is **elastic**; if \(|e| < 1\), demand is **inelastic**.
- \( \% \Delta \text{Revenue} \approx \% \Delta \text{Price} + \% \Delta \text{Quantity} \)
- Elastic Demand \((|e| > 1)\): Quantity changes more than price.

<table>
<thead>
<tr>
<th>( \Delta \text{Revenue} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price ↑</td>
</tr>
<tr>
<td>Price ↓</td>
</tr>
</tbody>
</table>

Inelastic Demand ($|e| < 1$): Quantity changes less than price.

<table>
<thead>
<tr>
<th>$\Delta$ Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price ↑</td>
</tr>
<tr>
<td>Price ↓</td>
</tr>
</tbody>
</table>

MR $>$ MC implies that $(P - MC)/P > 1/|e|$; that is, the more elastic demand is, the lower the price.

Four factors make demand more elastic:
- Products with close substitutes (or distant complements) have more elastic demand.
- Demand for brands is more elastic than industry demand.
- In the long run, demand becomes more elastic.
- As price increases, demand becomes more elastic.

Income elasticity, cross-price elasticity, and advertising elasticity are measures of how changes in these other factors affect demand.

It is possible to use elasticity to forecast changes in demand:

\[
\%\Delta \text{Quantity} \approx (\text{factor elasticity})(\%\Delta \text{Factor}).
\]

Stay-even analysis can be used to determine the quantity change required to offset a price change. The stay-even quantity is

\[
\%\Delta Q = \%\Delta P/(\%\Delta P + \text{margin}).
\]

**Multiple-Choice Questions**

1. A company currently sells 60,000 units a month at $10 per unit. The marginal cost per unit is $6. The company is considering raising the price by 10% to $11. If the price elasticity of demand is ______________ in that price range, then profit would increase if the company decided to raise the price by 10%.
   a. equal to $-3$
   b. greater than $+1$
   c. less than $-3.5$
   d. greater than $-2$

2. The price elasticity of demand for bread is $-0.5$. If the price falls by 5%, the quantity demanded will change by:
   a. $-2.5\%$
   b. $+2.5\%$
   c. $-1.0\%$
   d. $+10\%$
3. Actions a firm can take to change a product’s demand curve include:
   a. reducing the price of a substitute product the firm also produces.
   b. reducing the price of a complementary product the firm also produces.
   c. differentiating its product from competitors by offering an extended warrantee.
   d. All of the above will change a product’s demand curve.

4. A product can be classified as a normal good if an increase in the income of buyers causes:
   a. a decrease in quantity demanded.
   b. a decrease in demand.
   c. an increase in demand.
   d. an increase in quantity demanded.

5. Assume that beer and pretzels are complements in consumption; if the price of beer increases, we would expect to see:
   a. an increase in the demand for pretzels.
   b. a decrease in the demand for pretzels.
   c. an increase in the quantity of pretzels demanded.
   d. a decrease in the quantity of potatoes demanded.

**Individual Problems**

6-1 *Optimal Pricing for an Aggregate Demand Curve*
Suppose you have 10 individuals with values [$1, $2, $3, $4, $5, $6, $7, $8, $9, $10]. Your marginal cost of production is $2.50. What is the profit-maximizing price?

6-2 *But What About Fixed Cost?*
Using information from Question 6-1, your boss tells you that price cannot drop below $9 because you cannot earn enough profit to cover your fixed cost. What should you tell her?

6-3 *Pricing ATM Machines*
A bank in a medium-sized midwestern city, Firm X, currently charges $1 per transaction at its ATMs. To determine whether to raise price, the bank managers experimented with a number of higher prices (in 25-cent increments) at selected ATMs. The marginal cost of an ATM transaction is $0.50.
What ATM fee should the bank charge?

**6-4 Kentucky Racetracks**
There are five horseracing tracks in Kentucky. The Kentucky legislature allows only one track to be open at a time. How does this restriction affect the price the track can charge for its product?

**6-5 Optimal Markup**
If elasticity is $-2$, price is $10$, and marginal cost is $8$, should you raise or lower price?

**Group Problem**

**G6-1 Pricing**
Describe a pricing decision your company has made. Was it optimal? If not, why not? How would you adjust price? Compute the profit consequences of the change.