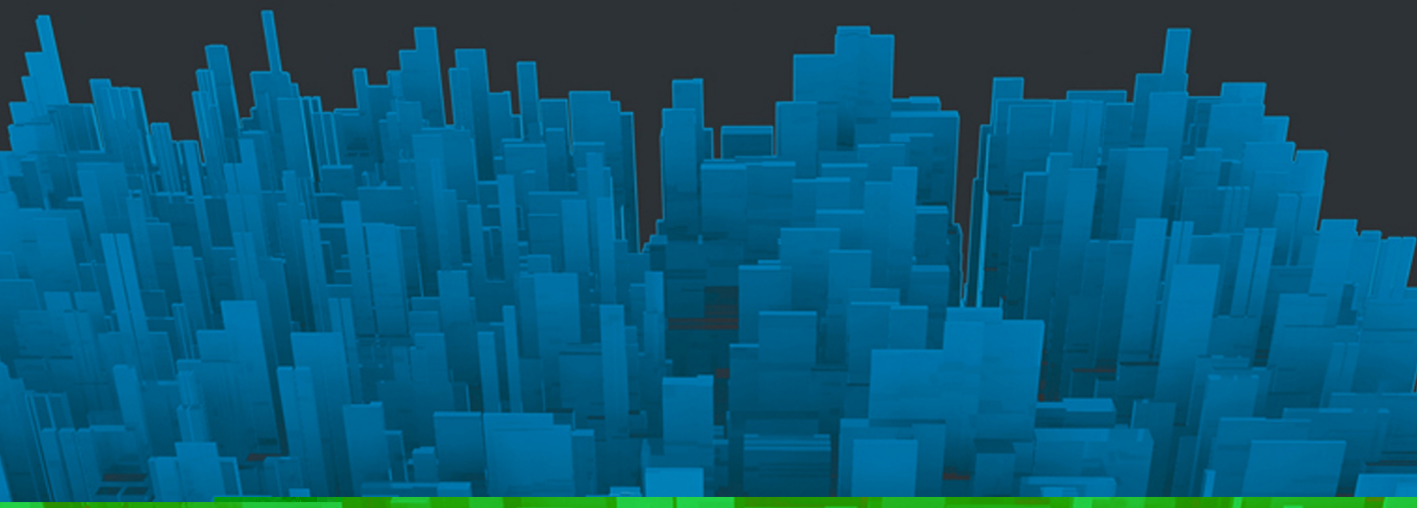
MANAGERIAL ECONOMICS

A PROBLEM SOLVING APPROACH

THIRD EDITION



Froeb / McCann / Ward / Shor

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Luke M. Froeb
Vanderbilt University

Brian T. McCann
Vanderbilt University

Mikhael Shor
University of Connecticut

Michael R. Ward
University of Texas, Arlington

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Luke M. Froeb, Brian T. McCann, Mikhael Shor, Michael R. Ward

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For our families: Lisa, Jake, Halley, Chris, Leslie, Jacob, Eliana, Cindy, Alex, and Chris

BRIEF CONTENTS

CONTENTS

PREFACE

Teaching Students to Solve Problems[1]

by Luke Froeb

The supply of business education (professors are trained to provide abstract theory) is not closely matched to demand (students want practical knowledge). This mismatch is found throughout academia, but it is perhaps most acute in a business school. Students expect a return on a fairly sizable investment and want to learn material that has immediate and obvious value.

One implication of this mismatch is that teaching economics in the usual way—with models and public policy applications—is not likely to satisfy student demand. In this book, we use what we call a "problem-solving pedagogy" to teach microeconomic principles to business students. We begin each chapter with a business problem, like the fixed-cost fallacy, and then give students just enough analytic structure to show students how to solve the problem.

Teaching students to solve problems, rather than learn models, satisfies student demand in a straightforward way as it allows students to "see" the value of the education they are receiving. The problem-solving approach also allows students to absorb the lessons of economics without as much of the analytical "overhead" as a model-based pedagogy. This is an advantage, especially in a terminal or stand-alone course, like those typically taught in a business school. To see this, ask yourself which of the following ideas is more likely to stay with a student 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.

ELEMENTS OF A PROBLEM-SOLVING PEDAGOGY

Our problem-solving pedagogy has three elements.

Begin with a Business Problem

Beginning with a real-world business problem puts the particular ahead of the abstract and motivates the material in a straightforward way. We use narrow, focused problems whose solution requires students to use the analytical tools of interest.

Use Economic Analysis to Identify Profitable Decisions

The second element of our pedagogy is to show students how to use the rational actor paradigm to identify problems (mistakes) and solutions (profitable ones). To do this, we turn the traditional focus of economics on its head. Instead of teaching students to spot and then eliminate inefficiency, for instance, by changing public policy, we teach them to view each underemployed asset a money-making opportunity. Making money is simple in principle, find an underemployed asset, buy it, and then sell it to someone who places a higher value on it.

Find Ways to Implement Them

In practice, it is rarely that simple, particularly when the inefficiency occurs within a larger organization. The third element of our pedagogy addresses the problem of implementation: how to design an organization where employees have enough information to make profitable decisions, and the incentive to do so.

If people act rationally, optimally and self-interestedly, then mistakes have only one of two causes: either people lack the *information* necessary to make good decisions; or the *incentive* to do so. This immediately suggests a problem-solving algorithm, ask:

1. Who is making the bad decision?
2. Do they have enough information to make a good decision?; and
3. The incentive to do so?

Answers to these three questions will point to the source of the problem, and suggest one of three potential solutions:

1. Let someone else make the decision, someone with better information or incentives;
2. Give more information to the current decision maker; or
3. Change the current decision-maker's incentives.

The book begins by showing students how to use this algorithm, and then each chapter illustrates its use in a different context, such as investments, pricing, principal-agent relationships, and uncertain environments.

USING THE BOOK

The book is designed to be read cover-to-cover as it is short, concise, and accessible to anyone who can read and think clearly. The pedagogy is built around business problems, so the book is most effective for those with some work experience. Its relatively short length makes it relatively easy to customize with ancillary material.

The authors use the text in Executive, full-time MBA programs, healthcare management programs and nondegree executive education. However, some of our biggest customers use the book in online business classes, at both the graduate and undergraduate levels.

In degree programs, we supplement the material in the book with online interactive programs like the managerial economics module of South-Western's MBAPrimer.com or Samuel Baker's *Economic Interactive Tutorials*.[2] Complete Blackboard courses, including syllabi, quizzes, homework, slides, and syllabi, video lectures by the authors, and links to supplementary material, can be downloaded from the Cengage website. Our *ManagerialEcon.com* blog is a good source of new business applications for each of the chapters.

In this third edition, we have added updated new stories and applications, and updated and improved upon the presentation and pedagogy of the book. We have also added two new coauthors. Both are award-winning teachers, and bring not only fresh ideas, but a wealth of examples and material that we have added to the text and the ancillary material that accompanies it. Mike Shor has been teaching game theory and pricing classes at the MBA level for about a decade, and he has dramatically upgraded those parts of the book. Mike Ward has been teaching out of the book since the first edition, and his experience and knowledge have dramatically improved the exposition, as well upgraded and expanded the ancillary material that accompanies the book. Our test bank has doubled in size.

We wish to acknowledge numerous classes of MBA, exec MBA, and Healthcare Management students, without whom none of this would have been possible—or necessary. Many of our 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.

Thanks to everyone who contributed, knowingly or not, to the book. Professor Froeb owes intellectual debts to former colleagues at the U.S. Department of Justice (among them, Cindy Alexander, Tim Brennan, Ken Heyer, Kevin James, Bruce Kobayahsi, and Greg Werden); to former colleagues at the Federal Trade Commission (among them James Cooper, Pauline Ippolito, Tim Muris, Dan O'Brien, Maureen Ohlhausen, Paul Pautler, Mike Vita, and Steven Tenn); to colleagues at Vanderbilt (among them, Germain Boer, Jim Bradford, Bill Christie, Mark Cohen, Myeong Chang, Craig Lewis, Rick Oliver, David Parsley, David Rados, Steven Tschantz, David Scheffman, and Bart Victor); and to numerous friends and colleagues who offered suggestions, problems, and anecdotes for the book, among them, Kelsey Duggan, Lily Alberts, Raj Asirvatham, Olafur Arnarson, Pat Bajari, Fadi Bousamra, Roger Brinner, the Honorable Jim Cooper, Matthew Dixon Cowles, Abie Del Favero, Vince Durnan, Marjorie Eastman, Keri Floyd, Josh Gapp, Bill Hostettler, Jeff and Jenny Hubbard, Brad Jenkins, Dan Kessler, Bev Landstreet (B5), Bert Mathews, Christine Millner, Jim Overdahl, Rich Peoples, Annaji Pervaje, Jason Rawlins, Mike Saint, Jon Shayne, Bill Shughart, Doug Tice, Whitney Tilson, Pam Wilmoth and Susan Woodward. We owe intellectual and pedagogical debts to Armen Alchian and William Allen,[3] Henry Hazlitt,[4] Shlomo Maital,[5] John MacMillan,[6] Steven Landsburg,[7] Ivan Png,[8] Victor Tabbush,[9] Michael Jensen and William Meckling,[10] and James Brickley, Clifford Smith, and Jerold Zimmerman.[11] Thanks as well to everyone who helped guide us through the publishing process, including Michael Worls, Daniel Noguera, and Vanavan Jayaraman.

END NOTES

1. Much of the material is taken from Luke M. Froeb, and James C. Ward, "Teaching Managerial Economics with Problems Instead of Models," in *The International Handbook On Teaching and Learning in Economics*, ed. Gail Hoyt, KimMarie McGoldrick, (Edward Elgar Publishing, 2012).
2. http://hadm.sph.sc.edu/Courses/Econ/Tutorials.html.
3. Armen Alchian and William Allen, *Exchange and Production,* 3rd ed. (Belmont, CA: Wadsworth, 1983).
4. Henry Hazlitt, *Economics in One Lesson* (New York: Crown, 1979).
5. Shlomo Maital, *Executive Economics: Ten Essential Tools for Managers* (New York: Free Press, 1994).
6. John McMillan, *Games, Strategies, and Managers* (Oxford: Oxford University Press, 1992).
7. Steven Landsburg, *The Armchair Economist: Economics and Everyday Life* (New York: Free Press, 1993).
8. Ivan Png, Managerial Economics (Malden, MA: Blackwell, 1998).
9. http://www.mbaprimer.com.
10. Michael Jensen and William Meckling, *A Theory of the Eirm: Governance, Residual Claims and Organizational Forms* (Cambridge, MA: Harvard University Press, 2000).
11. James Brickley, Clifford Smith, and Jerold Zimmerman, *Managerial Economics and Organizational Architecture* (Chicago: Irwin, 1997).

SECTION 1

Problem Solving and Decision Making

CHAPTER 1

Introduction: What This Book Is About

In 1992, a junior geologist was preparing a bid recommendation for an oil tract in the Gulf of Mexico. He suspected that this tract contained a large accumulation of oil because his company, Oil Ventures International (OVI), had an adjacent tract with several productive wells. Since no competitors had neighboring tracts, none of them suspected a large accumulation of oil. Because of this, he thought that the track could be won relatively cheaply, and recommended a bid of $5 million. Surprisingly, OVI's senior management ignored the recommendation and submitted a bid of $21 million. OVI won the tract–over the next-highest bid of $750,000.

If the board of directors asked you to review the bidding procedures at OVI, how would you proceed? What questions would you ask? Where would you begin your investigation?

You'd find it difficult to gather information from those closest to the bidding. Senior management would be suspicious and uncooperative because no one likes to be singled out for bidding $20 million more than was necessary. Likewise, our junior geologist would be reluctant to criticize his superiors. You might be able to rely on your experience—provided that you had run into a similar problem. But without experience, or when facing novel problems, you would have to rely on your analytic ability.

This book is designed to give you the analytic framework that would allow you to complete an assignment like this.

USING ECONOMICS TO SOLVE PROBLEMS

To solve a problem like OVI's, first, figure out what's causing the problem, and then how to fix it. In this case, you would want to know whether the $21 million bid was too high at the time it was made, not just in retrospect. If the bid was too aggressive, then you'd have to figure out why the senior managers overbid and how to make sure they don't do it again.

Both steps require that you predict how people behave in different circumstances, and this is where the economic content of the book comes in. The one thing that unites economists is

their use of the **rational-actor paradigm** to predict behavior. Simply put, it says that people act rationally, optimally, and self-interestedly. In other words, they respond to incentives. The paradigm not only helps you figure out why people behave the way they do but also suggests ways to motivate them to change. To change behavior, you have to change self-interest; and you do that by changing incentives.

Incentives are created by rewarding good performance with, for example, a commission on sales or a bonus based on profitability. The performance evaluation metric (sales, profit, or similar outcome) is separate from the reward structure (commission, bonus, raise, promotion, or other reward), but they work together to create an incentive to behave a certain way.

Let's go back to OVI's story, and try to find the source of the problem. After his company won the auction, our geologist increased the company's oil reserves by the amount of oil estimated to be in the tract. But when the company drilled a well, they discovered only a small amount of oil, so the acquisition did little to increase the size of the company's oil reserves. Using the information from the well, our geologist updated the reservoir map and reduced the reserve estimate by two-thirds.

Senior management rejected the lower estimate and directed the geologist to "do what he could" to increase the size of the estimated reserves. So he revised the reservoir map again, adding "additional" reserves to the company's asset base. Several months later, OVI's senior managers resigned, collecting bonuses tied to the increase in oil reserves that had accumulated during their tenure.

The incentive created by the bonus plan allows us to understand the behavior of senior management. Both the overbidding and the effort to inflate the reserve estimate were rational, self-interested responses to the incentive created by the bonus. Even if you didn't know about the geologist's bid recommendation, you'd still suspect that the senior managers overbid because they had the incentive to do so. Senior managers' ability to manipulate the reserve estimate made it difficult for shareholders and their representatives on the board of directors to spot the mistake.

To fix this problem, you have to find a way to better align managers' incentives with the company's goals. To do this, find a way to reward management for increasing profitability, not just for acquiring reserves. This is not as easy as it sounds because it is difficult to measure a manager's contribution to company profitability. You can do this subjectively, with annual performance reviews, or objectively, using company earnings or stock price appreciation as performance metrics. But each of these performance metrics can create problems, as we'll see in later chapters.

PROBLEM SOLVING PRINCIPLES

This story illustrates two principles that will help you learn to diagnose and solve problems. Notice that (1) we reduced the problem (overbidding) to a bad decision by someone at the firm (senior management) and (2) we used economics to diagnose the source of the problem. Under the rational actor paradigm, bad decisions happen for one of two reasons: Either decision makers do not have enough information to make good decisions, or they lack incentive to do so. Using this insight, you can isolate the source of almost any problem by asking three simple questions:

1. Who is making the bad decision?
2. Does the decision maker have enough information to make a good decision?
3. Does the decision maker have the incentive to make a good decision?

Answers to these three questions not only point to the source of the problem, but will also suggest ways to fix it by:

1. letting someone else—someone with better information or better incentives—make the decision,
2. giving more information to the current decision maker, or
3. changing the current decision makers' incentives.

In OVI's case, we see that (1) senior management made the bad decision to overbid; (2) they had enough information to make a good decision, but (3) they didn't have the incentive to do so. One potential fix is to change the incentives of senior management so that they are based on profitability, not oil reserves.

When reading about various business mistakes in this book, you should ask yourself these three questions to see if you can diagnose the cause of each problem, and then try one of the three solutions to fix it. By the time you finish the book, the analysis should become second nature.

Here are some practical tips that will help you develop problem-solving skills:

Think about the problem from the organization's point of view. Avoid the temptation to think about the problem from the employee's point of view because you will miss the fundamental problem of goal alignment: how does the organization give employees enough information to make good decisions and the incentive to do so?

Think about the organizational design. Once you identify a bad decision, avoid the temptation to solve the problem by simply reversing the decision. Instead, think about why the bad decision was made, and how to make sure that similar mistakes won't be made in the future.

What is the trade-off? Every solution has costs as well as benefits. Avoid the temptation to think only about the benefits, as it will make your analysis seem as if it were done to justify a foregone conclusion. Use the three questions to spot problems with a proposed solution; that is, in whatever solution you propose, make sure decision makers have enough information to make good decisions and the incentive to do so.

Don't define the problem as the lack of your solution. This kind of thinking may cause you to miss the best solution. For example, if you define a problem as "the lack of centralized purchasing," then the solution will be "centralized purchasing" regardless of whether that is the best option. Instead, define the problem as "high acquisition cost," and then examine "centralized purchasing" versus "decentralized purchasing" (or some other alternative) as potential solutions to the problem.

Avoid jargon because most people misuse it. Force yourself to spell out what you mean in simple language. It will help your thinking and communication.

TEST YOURSELF

In 2006, an investigative news program sent a TV reporter with a perfectly good car into a garage owned by National Auto Repair (NAR). The reporter came out with a new muffler and transmission—and a bill for over $8,000. After the story aired on national TV,

consumers began avoiding NAR, and profit plunged. What is the problem, and how do you fix it?

Let's run the problem through our problem-solving algorithm:

1. Who is making the bad decision?
   The mechanic recommended unnecessary repairs.
2. Does the decision maker have enough information to make a good decision?
   Yes, in fact, the mechanic is the only one with enough information to know whether repairs are necessary.
3. Does the decision maker have the incentive to make a good decision?
   No, the mechanic is evaluated based on the amount of repair work he does, and receives bonuses or commissions tied to the amount of repair work.

Answers to the three questions suggest that the use of quotas, commissions, or similar compensation provides an incentive for mechanics to recommend unnecessary auto repair services in order to meet quotas or receive larger commissions.

NAR tried two different solutions to fix the problem. First, they reorganized into two divisions: one responsible for recommending repairs where mechanics were paid a flat salary, and the other responsible for doing them. Rather than solving the problem, however, mechanics in the two divisions got together and began colluding. In exchange for recommending unnecessary repairs, the recommending mechanic received a portion of the commission received by the service mechanic for the work that was done.

After they recognized this new problem, NAR went back to the old organizational structure, but they adopted flat pay for the mechanics. This removed the incentive to do unnecessary repairs, but it also removed the incentive to work hard. Since the mechanics made the same amount of money regardless of whether they recommended and performed repairs, the mechanics ignored all but the most obvious problems.

This example illustrates several of the problem-solving principles above. First, it highlights the crucial role played by information. If you are going to let someone else make the decision, as in the first solution, you have to ask whether the new decision maker has enough information to make good decisions, as well as the incentive to do so. As a third potential solution to this problem, I would keep the original commission scheme, but develop new sources of information (an additional performance evaluation metric) based on reports provided by "secret shoppers" who bring cars into the garage in order to see if the mechanics are ordering unnecessary repairs.

The example also illustrates the trade-offs you face when proposing solutions. The first solution involved the costly duplication of effort by the two recommending and service mechanics, the second led to mechanic shirking, and the third would require a new reward scheme based not only on a sales commission, but also on the reports of the secret shopper. Figuring out which solution is most profitable involves weighing the trade-offs, and figuring out whether the benefits of a particular solution are bigger than its costs.

ETHICS AND ECONOMICS

Using the rational-actor paradigm in this way—to change behavior by changing incentives—makes some students uncomfortable because it seems to deny the altruism, affection, and personal ethics that most people use to guide their behavior. These students resist learning the paradigm because they think it implicitly endorses self-interested behavior, as if the primary purpose of economics were to teach students to behave rationally, optimally, and selfishly.

These students would probably agree with a *Washington Post* editorial, "When It Comes to Ethics, B-Schools Get an F,"[1] which blames business schools in general, and economists in particular, for the ethical lapses at Enron, Goldman Sachs and other companies.

> A subtle but damaging factor in this is the dominance of economists at business schools. Although there is no evidence that economists are personally less ethical than members of other disciplines, approaching the world through the dollar sign does make people more cynical.

What these students and the author, a former Harvard ethics professor, do not understand is that to control unethical behavior, you first have to understand why it occurs. When we analyze problems like the one at OVI, we're *not* encouraging students to behave opportunistically. Rather, we're teaching them to anticipate opportunistic behavior and to design organizations that are less susceptible to it. Remember, the rational-actor paradigm is only a tool for analyzing behavior, not advice on how to live your life.

It is also important to realize that these kinds of debates are really debates about value systems. Deontologists judge actions as good or ethical by whether they conform to a set of principles, like the Ten Commandments or the Golden Rule. Consequentialists, on the other hand, judge actions by their consequences. If the consequences of an action are good, then the action is deemed to be good or moral. To illustrate these contrasting value systems, consider this story about price gouging.[2]

When Notre Dame entered the 2006 season as one of the top-ranked football teams in the country, demand for local hotels during home games rose dramatically. In response, local hotels raised room rates. According to the *Wall Street Journal,* the Hampton Inn charged $400 a night on football weekends for a room that cost only $129 a night on nonfootball dates. Rates climbed even higher for games against top-ranked foes. For the game against the University of Michigan, the South Bend Marriott charged $649 per night—$500 more than its normal weekend rate of $149.

On a campus founded by priests of the Congregation of Holy Cross, where many students dedicate their year after graduation to working with the underprivileged, these high prices caused alarm. The *Wall Street Journal* quotes Professor Joe Holt, a former priest who teaches ethics in the school's executive MBA program: "It is an 'act of moral abdication' for businesses to pretend they have no choice but to charge as much as they can based on supply and demand." The article further reports Mr. Holt's intention to use the example of rising hotel rates on football weekends for a case study in his class on the integration of business and values.

Deontologists like Professor Holt would object on principle to the practice of raising prices in times of shortage.[3] We might label one such principle, the *Spider Man principle*: With great power comes great responsibility. The laws of capitalism allow corporations to amass significant power; in turn, society should demand a high level of responsibility from corporations. In particular, property rights might give a hotel the *option* of increasing prices, but possession of these rights does not relieve the hotel of its *obligations* to be concerned about the consequences of its choices. A simple beneficence argument might suggest that keeping prices low would be better for consumers.

Economics, on the other hand, provides us a *consequentialist* defense of high prices by comparing them to the implied alternative. In the case of the South Bend hotels, we would compare the world with high prices to the alternative of *not* raising prices during periods of high demand. Economists would show, using supply-demand analysis, that if prices did not rise, the *consequence* would be excess demand for hotel rooms. Would-be guests would find their rooms rationed, perhaps on a first-come/first-served basis. More likely, arbitrageurs would set up a black market, by making early reservations, then "selling" their reservations to customers willing to pay the market-clearing price. Without the ability to earn additional

profit during times of scarcity, hotels would have less incentive to build additional rooms, which would make the long-run problem even worse!

Versions of this debate—between those who criticize business on ethical grounds, and those who are simply trying to make money—have been going on in this country since its founding. Although a full treatment of the ethical dimensions of business is beyond the scope of this book, many disagreements are really about whether morality should be defined by deontology or consequentialism. Once you realize that a debate is really a debate between value systems, it becomes much easier to understand opposing points of view, and to reach compromise with your adversaries. For example, if the government were considering price-gouging laws that made it illegal to raise prices on football weekends, you might offer to donate some of the profits earned on football weekends to a local charity. This might assuage the concerns of those who ascribe to the Spider Man principle.

As a footnote to our story of prices in South Bend, when someone offered our former priest $1,500 for his apartment on home-game weekends, he took the offer and now spends his weekends in Chicago. Apparently his principles became too costly for him.

ECONOMICS IN JOB INTERVIEWS

If this well-reasoned introduction doesn't motivate you to learn economics, read the following interview questions—all from real interviews of my students. These questions should awaken interest in the material for those of you who think economics is merely an obstacle between you and a six-figure salary.

-------Original Message-------

From: "Student A"
Sent: Friday, January 2, 2009 3:57 PM
Subject: Economics Interview Questions

I had an interview a few weeks ago where I was told that the position paid a very low base and was mostly incentive compensation. I responded that I understood he was simply "screening out" low productivity candidates [low productivity candidates would not earn very much under a system of incentive compensation, and would be less likely to accept the position]. I "signaled" back to him that this compensation structure was acceptable to me, as I was confident in my abilities to produce value for the company, and for me. [Note: "Signalling" and "screening" are both solutions to the problem of adverse selection, the topic of Chapter 19.]

-------Original Message-------

From: "Student B"
Sent: Tuesday, January 18, 2000 1:22 PM
Subject: Economics Interview Questions

I got a question from Compaq last year for a marketing internship position that partially dealt with sunk costs. It was a "true" case question where the interviewer used the Internet to pull up the actual products as he asked the question.

"I am the product manager for the new X type server with these great features. It is to be launched next month at a cost of $5,500. Dell launched their new Y type server last week; it has the same features (and even a few more) for a cost of $4,500. To date, Compaq has put over $2.5 million in the development process for this server, and as such my manager is expecting above normal returns for the investment.

My question to you is "what advice would you give to me on how to approach the launch of the product, i.e. do I go ahead with it at the current price, if at all, even though Dell has a better product out that is less expensive, not forgetting the fact that I have spent all the development money and my boss expects me to report a super return?"

I laughed at the question because it was the very first thing we spoke about in the interview, catching me off-guard a bit. He wanted to see if I got caught worrying about all the development costs in giving advice to scrap the launch or continue ahead as planned. (I'm not an idiot and could see that coming a mile away . . . thanks to economics, right? ! ! !) [NOTE: this is a version of what is called the "sunk cost fallacy" which is covered in Chapter 3.]

-------Original Message-------

From: "Student C"
Sent: Tuesday, January 18, 2000 1:37 PM
Subject: Economics Interview Questions

I got questions regarding transfer price within entities of a company. What prices could be used and why. [NOTE: the problem of transfer pricing is one of the most common sources of conflict between divisions and is covered in Chapters 22 and 23.]

-------Original Message-------

From: "Student D"
Sent: Tuesday, January 18, 2000 1:28 PM
Subject: Economics Interview Questions

You are a basketball coach with five seconds on the clock, and you are losing by two points. You have the ball and can take only one more shot (there is no chance of a rebound). There is a 70% chance of making a two-pointer, which would send the game into overtime with each team having an equal chance of winning. There is only a forty percent chance of making a three-pointer (winning if made). Should you shoot the two- or the three-point shot? [NOTE: This is an example of decision-making under uncertainty, the subject of Chapter 17. For those of you who cannot wait, the answer is take the three-point shot because it results a higher probability of winning, 40% as opposed to 35% with a two-point shot.]

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Problem solving requires two steps: First, figure out why mistakes are being made; and then figure out how to make them stop.
- The **rational-actor paradigm** assumes that people act rationally, optimally, and self-interestedly. To change behavior, you have to change incentives.
- Good incentives are created by rewarding good performance.
- A well-designed organization is one in which employee incentives are aligned with organizational goals. By this we mean that employees have enough information to make good decisions, and the incentive to do so.
- You can analyze any problem by asking three questions: (1) Who is making the bad decision? (2) Does the decision maker have enough information to make a good decision and (3) the incentive to do so?
- Answers to these questions will suggest solutions centered on (1) letting someone else make the decision, someone with better information or incentives; (2) giving the decision maker more information; or (3) changing the decision maker's incentives.

Multiple-Choice Questions

See the end of the next chapter for multiple-choice questions.

Individual Problems

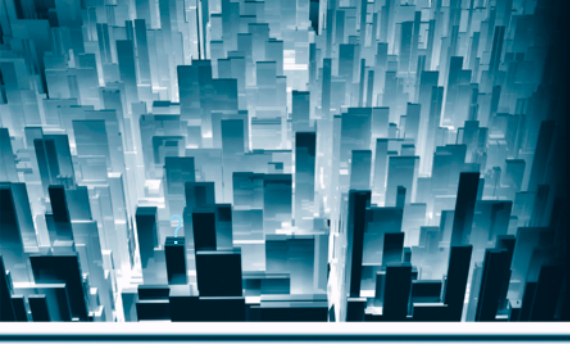
See the end of the next chapter for individual homework problems.

Group Problems

See the end of the next chapter for group homework problems.

END NOTES

1. Amitai Etzioni, "When It Comes to Ethics, B-Schools Get an F," *Washington Post,* August 4, 2002.
2. Ilan Brat, "Notre Dame Football Introduces Its Fans to Inflationary Spiral," *Wall Street Journal,* September 7, 2006.
3. We thank Bart Victor for his enumeration of these objections.



CHAPTER 2

The One Lesson of Business

In the spring of 2011, Rick Ruzzamenti of Riverside, California, decided to donate his kidney to an organization set up to match donors and recipients. His selfless act set off a domino chain of 60 operations involving 17 hospitals in 11 different states.[1] Donors, unable to help their loved ones because of incompatible antibodies, instead donated kidneys to others who donated to others, and so on, until the chain ended six months later in Chicago, Illinois.

The good news is that 30 people received new kidneys, and escaped the living hell of dialysis. The bad news is that this complex barter system is the only legal way for Americans to get kidneys.[2] It is so inefficient that only 17,000 of the 90,000 people on waiting lists received kidneys last year.

To understand how complex and cumbersome this process is, imagine trying to use it to find a new apartment. To make this concrete, suppose you wanted to move from Detroit to Nashville. You would first try to find someone moving in the opposite direction, from Nashville to Detroit. Failing that, you might try to find a three-way trade: find someone moving from Nashville to Los Angeles, and another person moving from Los Angeles to Detroit. Then swap the first apartment for the second, the second for the third, and the third for the first. Finding a matched set of trades that have the desired moving times and locations and types of apartments causes the same kinds of compatibility problems that trading kidneys does.

There are two common, but very different, reactions to this kind of inefficiency. Economists see it as a threat, and something to be eleminated by, for example, getting rid of the prohibition on buying and selling organs. Businesspeople, on the other hand, see it as an opportunity, and something to be exploited. In this case, a creative entrepreneur could borrow $100 million at 20% interest, buy a hospital ship, anchor it in international waters, and begin selling kidneys. Set up a database to match donors to recipients, broker sales, and fly in experienced transplant teams. If she charges $200,000 and earns 10% on each transaction, the break-even quantity is just 1,000 transplants each year. This represents only 1% of the potential demand in the United States alone.

The goal of this chapter is to teach you how to find and profitably exploit money making opportunities like this one. Students who've had some economics training will find that

they have a slight head start, but learning how to make money requires as much creativity and imagination as analytic ability.

CAPITALISM AND WEALTH

To identify money-making opportunities, like those in the kidney market, we first have to understand how wealth is created and destroyed.

Wealth is created when assets move from lower- to higher-valued uses.

An individual's **value** for a good or service is measured as the amount of money he or she is willing to pay for it.[3] To "value" a good means that you want it and can pay for it.[4]

If we adopt the linguistic convention that buyers are male and the sellers are female, we say that a buyer's "value" for an item is how much he will pay for it, his "top dollar." Likewise, a seller won't accept less than her value, "cost," or "bottom line."

The biggest advantage of capitalism is that it creates wealth by letting a person follow his or her self-interest.[5] A buyer willingly buys if the price is below his value, and a seller sells for the same selfish reason—because the price is above her value. Both buyer and seller gain; otherwise, they would not transact.

Voluntary transactions create wealth.

Suppose that a buyer values a house at $240,000 and a seller at $200,000. If they can agree on a price—say, $210,000—they both gain. In this case, the seller gets to sell at a price that is $10,000 higher than her bottom line and the buyer gets to buy at a price that is $30,000 below her top dollar.

Formally, the difference between the agreed-on price and the seller's value is called **seller surplus.**

Likewise, **buyer surplus** is the buyer's value minus the price. The total surplus or *gains from trade* created by the transaction is the sum of buyer and seller surplus ($40,000), the difference between the buyer's top dollar and the seller's bottom line.

To see how well you understand the wealth creating process, try to figure out which assets are moving to higher-valued uses in the following examples:

- Factory owners purchase labor from workers, borrow capital from investors, and sell manufactured products to consumers. In essence, factory owners are intermediaries who move labor and capital from lower-valued to higher-valued uses, determined by consumers' willingness to pay for the labor and capital embodied in manufactured products.
- AIDS patients sometimes sell their life insurance policies to investors at a discount of 50% or more. The transaction allows patients to collect money from investors, who must wait until the patient dies to collect from the insurance company. This transaction moves money across time, from investors who are willing and able to wait to those who don't want to wait.
- RentStuff.com is an online, secure, collateral-backed mechanism to facilitate transactions between those who have stuff and those who want to rent stuff.
- When consumers purchase insurance, they pay an insurance company to assume risk for them. In this context, you can think of risk as a "bad," the opposite of a "good," moving from consumers willing to pay to get rid of it to insurance companies willing to assume it for a fee.

- In video games like Diablo III or World of Warcraft, thousands of people in less-developed countries spend time playing the games to acquire "currency" that can be used to acquire add-ons. These "gold farmers" sell the currency to other players for cash on Web sites outside of the game environment.

Here's a final example that is not so obvious. In 2004, a private equity consortium purchased Mervyn's, a department store located in the western United States. They sold off the real estate on which the stores were located, and the new owners set store rents at market rates. As a consequence, rent payments doubled and the 59-year-old retailer went out of business, throwing 30,000 employees out of work.

So how was wealth created by this transaction?

The answer is that the transactions moved the real estate to a higher-valued use. Charging market rates to the retailer uncovered the real source of Mervyn's profit, its low rents. And once Mervyn's had to pay market rates, the retail operation was exposed as a money-losing operation. The private equity group made money by shutting it down. The laid-off workers were unhappy, of course, but they had been working for a firm producing a service whose cost was above what consumers were willing to pay for it. The economy, as a whole, is better off with assets in higher valued uses, but we recoginize that individual workers may not be able to find a higher-valued use for their labor.

How do you create wealth? Which assets do you move to higher-valued uses?

We close this section with a warning against critics of capitalism who think that if one person makes money, someone else must be losing it. This is such a common mistake that it even has a name, the "zero sum fallacy." Policy makers often invoke this fallacy to justify limits on pay, profitability, or prices, or even trade itself. They are missing the big idea, that the voluntary nature of trade ensures that both parties gain.

DOES THE GOVERNMENT CREATE WEALTH?

Governments play a critical role in the wealth-creating process by enforcing property rights and contracts—legal mechanisms that facilitate voluntary transactions.[6] By making sure that buyers and sellers can keep the gains from trade, our legal system makes trade much more likely and is responsible for our nation's enormous wealth-creating ability.[7]

Conversely, the absence of property rights contributes to poverty. The reasons are simple: Without private property and contract enforcement, wealth-creating transactions are less likely to occur,[8] and this stunts development. Ironically, many poor countries survive largely on the wealth created in the so-called underground, or black market, economy, where transactions are hidden from the government.

Interestingly, secure property rights are also associated with measures of environmental quality and human well-being. In nations where property rights are well protected, more people have access to safe drinking water and sewage treatment and people live about 20 years longer.[9] In other words, if you give people ownership to their property, they take care of it, invest in it, and keep it clean.

WHY ECONOMICS IS USEFUL TO BUSINESS

Economics can be used by business people to spot money-making opportunities (assets in lower-valued uses). To see this, we begin with "efficiency," one of the most useful ideas in economics.

An economy is efficient if all assets are employed in their highest-valued uses.

Economists obsess about efficiency. They search for assets in lower-valued uses and then suggest public policies to move them to higher-valued ones. A good policy facilitates the movement of assets to higher-valued uses; and a bad policy prevents assets from moving or, worse, moves assets to lower-valued uses.

Determining whether an economic policy is good or bad requires analyzing all of its effects—the unintended as well as the intended effects. Henry Hazlitt, former editorial page editor of the *Wall Street Journal,* reduced all of economics into a single lesson:[10]

> *The art of economics consists in looking not merely at the immediate but at the longer effects of any act or policy; it consists of tracing the consequences of that policy not merely for one group but for all groups.*[11]

For example, recent proposals to prevent lenders from foreclosing on houses helps the delinquent homeowners, but it also hurts lenders. They respond by raising the cost of new loans, which hurts prospective home buyers. Determining whether the policy is good or bad requires that we look not only at the happy faces of the family that gets to stay in a foreclosed home, but also at the sad faces of the family that can no longer afford to buy a house because the cost of borrowing has increased. The trick to "seeing" these indirect effects is to look at the incentives.

But public policy is not the focus of this book. Rather it is how to make money.

Making money is simple in principle—find an asset employed in lower-valued use, buy it, and then sell it to someone who places a higher value on it.

> ***The one lesson of business:*** *The art of business consists of identifying assets in low-valued uses and devising ways to profitably move them to higher-valued ones.*

In other words, each underemployed asset represents a potential wealth-creating transaction. The art of business is to identify these transactions and find ways to profitably consummate them.

For example, once the government banned kidney sales, it simultaneously created an incentive to try to circumvent the ban. Buying a hospital ship and sailing to international waters is just one solution. According to recent research, there is a thriving illegal or "black market" for kidneys in the United States. For about $150,000, organ brokers will connect wealthy buyers with poor foreign donors, who receive a few thousand dollars and the chance to visit an American city. Once there, transplants are performed at "broker-friendly" hospitals with surgeons who are either complicit in the scheme or willing to turn a blind eye. Kidney brokers often hire clergy to accompany their clients into the hospital to ensure that the process goes smoothly.[12]

If the movement of assets to higher valued uses creates wealth, then anything that impedes asset movement destroys wealth. We discuss three such impediments: taxes, subsidies, and price controls. These regulations create inefficiency but simultaneously create opportunities to make money.

Taxes

The government collects taxes out of the total surplus created by a transaction. If the tax is larger than the surplus, the transaction will not take place. In our housing example, if a sales tax is 25%, for instance, as in Italy, the tax will be at least $50,000 because the price has to be above the seller's bottom line ($200,000). Since the tax is more than the surplus created by the transaction, the buyer and seller cannot find a mutually agreeable price that lets them pay the tax.[13]

The intended effect of a tax is to raise revenue for the government, but the unintended consequence of a tax is that it deters some wealth-creating transactions.

These unconsummated transactions represent money-making opportunities. For example, in 1983, Sweden imposed a 1% "turnover" (sales) tax on stock sales on the Swedish Stock Exchange. Before the tax, large institutional investors paid commissions that averaged 25 basis points (0.25%). The turnover tax, by itself, was four times the size of the old trading costs, and it fell most heavily on these big institutional investors.

After the tax was imposed, institutional traders began trading shares on the London and New York Stock Exchanges, and the number of transactions on the Swedish Stock Exchange fell by 40%. Smart brokers recognized this opportunity and profited by moving their trades to London and New York. The Swedish government finally removed the turnover tax in 1990, but the Swedish Stock Exchange has never regained its former vitality.

Subsidies

The opposite of a tax is a subsidy. By encouraging low-value consumers to buy or high-value sellers to sell, subsidies destroy wealth by moving assets from higher- to lower-valued uses—in exactly the wrong direction.

For example, government policies designed to extend credit to low-income Americans increased homeownership from 64% to 69% of the population. Many of these recipients, like Victor Ramirez, were able to afford houses only due to the subsidies. Once the housing bubble burst, they could not afford to stay in them. "This was our first home. I had nothing to compare it to," Mr. Ramirez says. "I was a student making $17,000 a year, my wife was between jobs. In retrospect, how in hell did we qualify?"[14]

He qualified due to government subsidies. We know that these subsidies destroy wealth because without them, the money would have been spent on different and higher-valued uses. To see this, offer each potential homeowner a payment equal to the amount of the subsidy. If they would rather spend the money on something besides a home loan, then there is a higher-valued use for the money.

The same logic can be used to identify ways to profit from inefficiency. To see this, let's look at health insurance that fully subsidizes visits to the doctor. If you get a cold, you go to the doctor, who charges the insurance company $200 for your care. This subsidy destroys wealth if you would rather self-medicate and keep the $200.

Employers who recognize this are starting to offer insurance that requires a large deductible or copayment. These fees stop low-value doctor visits and dramatically reduce the cost of insurance. Employers either keep the money or use it to raise workers' wages (by the amount they save on insurance) to attract better workers. These high-deductible policies are becoming more popular as companies struggle with the high costs of health care.

Price Controls

A **price control** *is a regulation that allows trade only at certain prices.*

Two types of price controls exist: **price ceilings,** which outlaw trade at prices above the ceiling, and **price floors,** which outlaw trade at prices below the floor. The prohibition on buying and selling kidneys is a form of price ceiling. Americans are allowed to buy and sell kidneys—but only at a price of zero or less.

Price floors above the buyer's top dollar and price ceilings below a seller's bottom line deter wealth-creating transactions.[15] In our kidney example, potential kidney sellers are deterred from selling because they can do so only at a price of zero.

To see how to profit from this inefficiency, we turn to the case of taxis, which are regulated with a price ceiling.

As a result, taxis won't take you to the outer reaches of your metropolitan area because regulated fares won't let taxis recover the cost of return trip. Taxis are poorly maintained because the regulated fares don't allow taxis to charge for better quality. Finally, taxis have a well-deserved reputation for recklessness because there is no way for taxis to increase earnings except by increasing volume, which they do by driving from place to place as fast as possible.

Über is an alternative to taxis that makes money by alleviating these inefficiencies. They use a sophisticated dispatch service to match passengers to more lightly regulated livery and limo services. Because the drivers are allowed to negotiate higher prices for better service, Über's cars have an incentive to travel to distant destinations, clean their cars, and drive safely. You can tell that they are successful by the complaints from the taxis to subject Über to the same price controls that taxis face.[16]

WEALTH CREATION IN ORGANIZATIONS

Companies can be thought of as collections of transactions, from buying raw materials like capital and labor to selling finished goods and services. In a successful company, these transactions move assets to higher-valued uses and thus make money for the company.

As we saw from the story of the oil company in the introductory chapter, a firm's organizational design influences decision making within the firm. Some designs encourage profitable decision making; others do not. A poorly designed company will consummate unprofitable transactions or fail to consummate profitable ones.

The inability of organizations to move assets to higher-valued uses is analogous to the wealth-destroying effects of government policies. Organizations impose "taxes," "subsidies," and "price controls" within their companies that lead to unprofitable decisions. For example, overbidding at the oil company was caused by a "subsidy" paid to management for acquiring oil reserves. Senior management responded to the subsidy by acquiring reserves, regardless of the price. Our solution to the problem was to eliminate the subsidy.

The analogy from the market-level problems created by taxes, subsidies, and price-controls, to the organization-level problems of goal alignment means that we are using the same economic tools to analyze both types of problems. The target of the analysis changes—from markets to organizations—but the analysis remains the same.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Voluntary transactions create wealth by moving assets from lower- to higher-valued uses.
- Anything that impedes the movement of assets to higher-valued uses, like taxes, subsidies, or price controls, destroys wealth. Such inefficiency implies a money-making opportunity.
- The art of business consists of finding assets in low-valued uses and devising ways to profitably move them to higher-valued ones.
- A company can be thought of as a series of transactions. A well-designed organization rewards employees who identify and consummate profitable transactions or who stop unprofitable ones.

Multiple-Choice Questions

1. An individual's value for a good or service is the
   a. the amount of money he or she used to pay for a good.
   b. the amount of money he or she is willing to pay for it.
   c. the amount of money he or she has to spend on goods.
   d. none of the above.
2. The biggest advantage of capitalism is that
   a. It generates equality.
   b. Prices assist in moving assets from high-value to low-value uses.
   c. It is fair.
   d. It creates wealth by letting a person follow his or her own self-interest.
3. Wealth-creating transactions are more likely to occur
   a. With private property rights.
   b. With strong contract enforcement.
   c. With black markets.
   d. All of the above.
4. Government regulation
   a. provides incentives to conduct business in an illegal black market.
   b. plays no role in generating wealth.
   c. is the best way to eliminate poverty.
   d. does not enforce property rights.
5. An example of a price floor is
   a. minimum wages.
   b. rent controls in New York.
   c. Both a and b
   d. None of the above
6. A price ceiling
   a. is a government-set maximum price.
   b. is an implicit tax on producers and an implicit subsidy to consumers.
   c. will create a surplus.
   d. causes an increase in consumer and producer surplus.
7. Taxes:
   a. Impede the movement of assets to higher-valued uses.
   b. reduce incentives to work.
   c. decreases the number of wealth creating transactions.
   d. All the above
8. A consumer values a car at $30,000 and it costs a producer $20,000 to make the same car. If the transaction is completed at $24,000, the transaction will generate:
   a. no surplus.
   b. $4,000 worth of seller surplus and unknown amount of buyer surplus.
   c. $6,000 worth of buyer surplus and $4,000 of seller surplus.
   d. $6,000 worth of buyer surplus and unknown amount of seller surplus.
9. A consumer values a car at $525,000 and a producer values the same car at $485,000. If sales tax is 8% and is levied on the seller, then the sellers bottom line price is
   a. $527,000.
   b. $523,800.
   c. $525,000.
   d. $500,000.
10. Efficiency implies opportunity,
    a. Always.
    b. Never.
    c. Only if accompanied by secure property rights.
    d. None of the above.

Individual Problems

2-1 Airline Delays

How will commercial airlines respond to the threat of new $27,500 fines for keeping passengers on the tramac for more than 3 hours? What inefficiency will this create?

2-2 Selling Used Cars

I recently sold my used car. If no new production occurred for this transaction, how could it have created value?

2-3 Flood Insurance

The U.S. government subsidizes flood insurance because those who want to buy it live in the flood plain and cannot get it at reasonable rates. What inefficiency does this create?

2-4 Goal Alignment among Physicians

An elderly physician has built up his own practice into a quite valuable business. Now that he is thinking of retiring, he wants to take on a partner to learn the business and eventually buy the practice in three years. Her compensation will be a salary plus 25% of the profits if they are below the historical average and 50% for any increase above the historical average. The eventual purchase price for the practice will be 5 times the average profits over the three years. Discuss the efficiency aspects of such a contract. Are the incentives of the buyer and seller aligned?

2-5 Kraft and Cadbury

When Kraft recently bid $16.7 billion for Cadbury, Cadbury's market value rose, but Kraft's market value fell by more. What does this tell you about the value-creating potential of the deal?

2-6 Price of Breast Reconstruction vs. Breast Augmentation

Two similar surgeries, breast reconstruction and breast augmentation, have different prices. Breast augmentation is cosmetic surgery not covered by health insurance. Patients who want the surgery must pay for it themselves. Breast reconstruction following breast removal due to cancer is covered by insurance. The price for one of the surgeries has increased by about 10% each year since 1995 while the other has increased by only 2% per year. Which of the surgeries has the lower inflation rate? Why?

Group Problems

G2-1 Goal Alignment in Your Company

Are your incentives aligned with the goals of your company? If not, identify a problem caused by goal misalignment. Suggest a change that would address the problem. Compute the profit consequences of the change.

G2-2 One Lesson of Business

Identify an unconsummated wealth-creating transaction (or a wealth-destroying one) created by some tax, subsidy, price control, or other government policy, and then figure out how to profitably consummate it (or deter it). Estimate how much profit you would earn by consummating (or deterring) it.

G2-3 One Lesson of Business (within an Organization)

Identify an unconsummated wealth-creating transaction (or a wealth-destroying one) within your organization, and figure out how to profitably consummate it (or deter it). Estimate how much profit you would earn by consummating it (or deterring) it.

END NOTES

1. See Kevin Sack, "60 Lives, 30 Kidneys, All Linked," *New York Times*, February 18, 2012.
2. See Sally Satel and Mark J. Perry, "More Kidney Donors are Needed to Meet a Rising Demand," *Washington Post*, March 7, 2010.
3. This definition of value as "willingness to pay" carries strong normative connotations, just as other definitions of value carry strong alternative normative connotations. For example, under Communism, a labor theory of value is used. Value depends on how much labor produced it. This value (how much labor is embodied in the good) has an independent existence even if no one wants to buy the good. This can lead to situations where goods are produced that nobody wants.

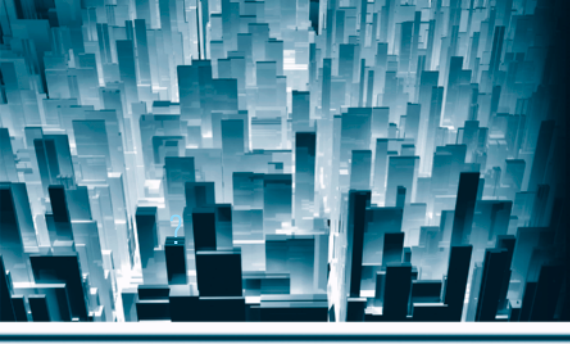
   The defining tenet of Communism is "from each according to his ability; to each according to his need." Communism is bad at creating wealth because it allocates goods according to "needs," not "wants," and because it's tough to gauge how much people need goods. Individuals have great incentive to claim they are "needier" than they really are. In the political arena, groups compete for government funds by claiming they are the "neediest."

   Economists dislike the word *need* because it is so often used to manipulate others into giving away something. Listen to news reports about proposed government spending cuts. Most often those affected claim they "need" the programs targeted for elimination. That sounds better than saying they "want" the programs.

   The definitions of value differ because Communism and Socialism are more concerned with the distribution of wealth than with the creation of wealth, which is capitalism's greatest concern. In other words, capitalism is concerned with making the proverbial "pie" as large as possible, while Socialism and Communism are concerned more about how to slice up that pie. Socialism and Communism are concerned more about how to slice up that pie.
4. It is the ability-to-pay component of value that is behind most critiques of capitalism. Unless you have enough money to purchase an item, then you do not value it.
5. This is the idea behind the French phrase *laissez-faire* (leave them alone).
6. "The only proper functions of a government are: the police, to protect you from criminals; the army, to protect you from foreign invaders; and the courts, to protect your property and contracts from breach or fraud by others, to settle disputes by rational rules, according to objective law." Ayn Rand, *Atlas Shrugged* (New York: Random House, 1957), 977.
7. Tom Bethell, *The Noblest Triumph: Property and Prosperity through the Ages* (New York: St. Martin's Press, 1995).
8. "The inherent vice of capitalism is the unequal sharing of blessings; the inherent virtue of socialism is the equal sharing of miseries" (Winston Churchill).
9. Seth Norton, "Property Rights, the Environment, and Economic Weil-Being," in *Who Owns the Environment?* ed. Peter J. Hill and Roger E. Meiners (Lannam, MD: Rowman and Littlefield, 1998).
10. Henry Hazlitt, *Economics in One Lesson* (New York: Crown, 1979).
11. For chilling examples of the unintended consequences of government policy, read Jagdesh Bhagwati's recent book, *In Defense of Globalization* (New York: Oxford University Press, 2004). In 1993, for example, the U.S. Congress seemed likely to pass Senator Tom Harkin's Child Labor Deterrence Act, which would have banned imports of textiles made by child workers. Anticipating its passage, the Bangladeshi textile industry dismissed 50,000 children from factories. Many of these children ended up as prostitutes. Ironically, the bill, which was designed to help children, had the opposite effect.
12. Jeneen Interlandi, "Not Just Urban Legend," *Newsweek,* January, 19, 2009.
13. With a 25% tax, the seller receives 75% of the sales price. If the tax is levied on the seller, her bottom-line price increases to $266,667 =

$200,000/(0.75), which is above the buyer's top dollar of $240,000. If the tax is levied on the buyer, his top dollar decreases to $192,000, which is below the seller's bottom line.

14. David Streitfeld and Gretchen Morgenson, "Building Flawed American Dreams," *New York Times,* October 18, 2008.
15. Price floors below a seller's bottom line and price ceilings above a buyer's top dollar have no effect.
16. Megan Mcardle, "Why You Can't Get a Taxi," *The Atlantic*, May 2012.



CHAPTER 3

Benefits, Costs, and Decisions

Big Coal Power Company burns two types of coal from the Southern Powder River Basin in Wyoming: 8800 Btu coal and 8400 Btu coal. The numbers refer to the amount of energy contained in one pound of coal. The coal is delivered by rail and barge to power plants that crush it, burn it, and use the heat to create steam that drives generators that produce electricity.

The 8400 coal produces about 5% less electricity per ton than 8800 coal, so when the price of 8400 fell 5% below the price of 8800, the plant manager did the obvious thing and switched to the lower-cost coal. Not only did this move reduce the average cost of electricity produced at his plant (cost/Btu), but it also increased the manager's compensation as the company had adopted average cost as a metric to measure plant performance. Unfortunately, however, the move also reduced company profit.

When the plant manager made the switch to the cheaper but lower-energy coal, electricity output fell by 5%. He could not make up for this decrease by putting a bigger volume of the lower-energy coal through the plant because the conveyor belts and crushers were already working at capacity. His parent company had to replace the lost electricity with higher-cost natural gas, which was even more expensive than the 8800 coal.

The story illustrates several themes that are the topic of this chapter: First, a good decision should have considered the *all* the costs of switching to the lower Btu coal, including the cost of replacing the lost electricity; second, *average costs* can be a lousy indicator of plant performance; and finally, as we have already seen in Chapter 1, problems can arise when the incentives of a business unit are not aligned with the goals of the parent company. In fact, we can use the problem-solving algorithm of Chapter 1 to identify the source of the problem:

1. Who is making the bad decision?
   The plant manager made the switch to the lower-priced 8400 coal.
2. Did he have enough information to make a good decision?
   Yes, presumably he knew that this would reduce his output.
3. Did he have the incentive to make a good decision?
   No, because he was evaluated based on the average cost of electricity produced at his plant.

Even though mistakes like this seem painfully obvious, spotting them before they occur is more difficult than it seems. The goal of this chapter is to teach you to think systematically

about the benefits and costs of the decisions you make. This is an important follow-on lesson to that of Chapter 1, where we showed you how to give employees the information and incentives to make profitable decisions. In this chapter, we introduce benefit-cost analysis to show you how to recognize profitable decisions.

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/year in capital costs (e.g., a $10 million factory and a 10% cost of capital), employees cost $50,000 total each, and ingredients cost $0.50/candy bar. If you decided to produce 1,000 candy bars in a year, you need to hire 10 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 capital costs are $1 million regardless of the amount you produce. The capital cost is a **fixed cost**, as opposed to the labor or ingredients, which vary with input. Costs that change with output level are called **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 the 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.

TABLE 3.1
Candy Factory Costs

	COSTS		
Output	**Fixed**	**Variable**	**Total**
0	1,000,000	0	1,000,000
1,000	1,000,000	500,500	1,500,500
2,000	1,000,000	1,001,000	2,001,000
3,000	1,000,000	1,501,500	2,501,500
4,000	1,000,000	2,002,000	3,002,000
5,000	1,000,000	2,502,500	3,502,500

To illustrate the relationships among these costs, we 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, ask yourself which of the following costs are variable:

- 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[2]

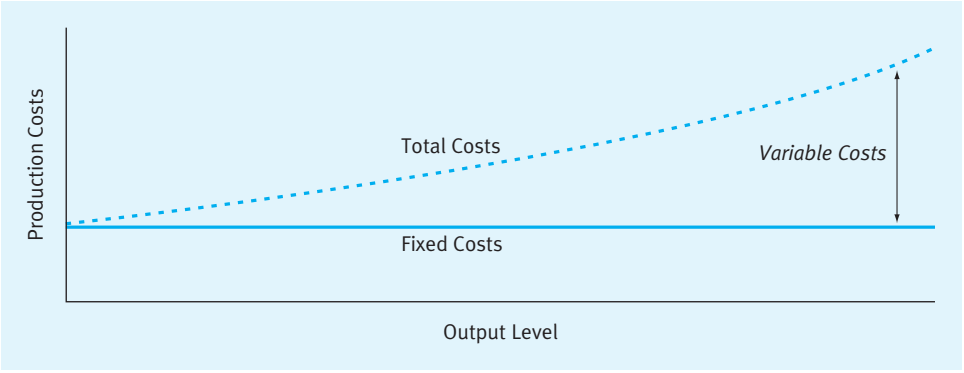


FIGURE **3.1 Cost Curves**

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 (now Mumbai). 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 metric trademarked by Stern Stewart & Co. EVA®, like other economic performance metrics, charges each division within a firm for the amount of capital it uses. This gives management an incentive to incur capital expenditures only if they earn more than they cost. In addition, it gives managers an incentive to reduce capital expenditures if they are earning less than they cost. In this case, the main difference between ordinary accounting profit and EVA® is that EVA® includes a capital charge of 15%, representing the return that Cadbury could have made had it invested the capital elsewhere.

After adopting EVA®, Cadbury India's annual "economic" income dropped by £600,000 (15% cost of capital times the £4,000,000 capital tied up in the apartments).[3] To increase EVA®, senior managers decided to sell the unused apartments. By charging each division for the amount of capital it used, the company gave managers an incentive to sell the apartments because they were earning less than 15%.

TABLE 3.2

Cadbury Income Statement

NET SALES	£6,738	
Cost of Sales	£3,020	
GROSS PROFIT		£3,718
Operating Expenses:		
Selling, General, and Administrative	£2,654	
Depreciation and Amortization	£215	
Total Operating Expenses		£2,869
OPERATING INCOME		£849
Other Income (Expense):		
Net Interest	(£226)	
Other Income	(3)	
Total Other Income (Expense)		(£229)
EARNINGS BEFORE PROVISION FOR INCOME TAXES		£620
Provision for Income Taxes		(£189)
NET EARNINGS		£431
amounts in millions of pounds		

If the Cadbury managers had a good sense of their factories' variable, fixed, and total costs, why were they making bad decisions concerning the company-owned flats?

To answer this question, we recognize another important distinction: the difference between accounting costs and what economists call "economic costs." This difference is especially important for big decisions about whether to buy or sell assets. For these decisions, you have to take account of the costs of capital, which accounting costs do not do.

Table 3-2 presents a recent annual income statement for Cadbury.[4] 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, which represents a return of approximately 6.4% on sales. 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.

Economists, however, are interested in all the relevant costs of decision making, including the **implicit costs** that 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 bondholders 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 (£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. 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. For example, 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). In other words, they were earning less than what their investors could earn elsewhere.

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 mangers sold the abandoned flats.

In general, managers should consider all the benefits and costs of a decision. To show you how to do this, we introduce the idea of what economists call "opportunity costs."

COSTS ARE WHAT YOU GIVE UP

When deciding between two alternatives, you obviously want to choose the one that returns the highest profit. Accordingly, we define the "opportunity cost" of one alternative 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 cost—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 are referring to opportunity cost. Costs depend on what you give up, and this depends on the decision that you are trying to make. The main 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?

SUNK-COST FALLACY

The general rule for making decisions is simple.

> *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 consequence of the decision. These are the relevant* ***costs*** *and relevant benefits of a decision.*

But implementing the rule is tricky. In general there are two types of mistakes that you will make: 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* ***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 sunk-cost fallacy in business is the "overhead" allocated to various activities within a company. Decisions regarding overhead levels are made independently from most day-to-day decisions. Because overhead is not affected by most business decisions, it should not influence them. 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. These costs are considered sunk because they have already been incurred. Because these costs do not vary with decisions about changing output, they should be ignored in decisions about output changes.

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 commit the sunk-cost fallacy. Using the analysis of Chapter 2, overhead expenses are analogous to a "tax" on launching a new product. In this case, the tax deters a profitable product launch, a wealth-creating transaction.

Depreciation[5] is another common cause of the sunk-cost fallacy. To see how this causes problems consider a washing machine plant that was considering 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[6] 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, the plant had

incurred $1 million worth of tooling costs to make molds for the agitators. Following Generally Accepted Accounting Principles, the cost of the tooling was recorded as an "asset" on the plant's balance sheet. Each year, the accountants charged the plant $100,000/year for using this asset, which was expected to last 10 years. After the first year, the size of the asset had shrunk to $900,000; after the second, $800,000, and so on. This is called "straight-line depreciation."

Six years after incurring the tooling expense, there was still $400,000 worth of undepreciated capital left on the company's balance sheet. Accountants at his firm told the manager that if he decided to outsource the agitator, these "assets" would become "worthless," and the manager would be forced to take a charge[7] 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.

TABLE 3.3

Outsourcing a Washing Machine Agitator

INTERNAL PRODUCTION		OUTSOURCING	
Category	**Cost**	**Category**	**Cost**
Material	$0.60	Material	$0.50
Labor	$0.20	Labor	$0.10
Depreciation	$0.10	Tooling	$0.10
Other Overhead	$0.10		

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).

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 economic profit.

In other words, the accounting costs do not necessarily correspond to the relevant costs of a decision. In this case, rewarding employees for increasing accounting profit led to a decision (not outsourcing) that reduced economic profit.

If you remember the discussion in Chapter 1, a question should immediately occur to you: "how can the company better align the incentives of the plant manager with the profitability goals of the parent company." If we allow the plant manager to walk away from the sunk costs, then we create incentives for him to make sunk cost investments regardless of whether they are profitable. On the other hand, if we punish the plant manager for making the bad investment, then we create incentives for him to stick with sunk-cost investments long after they should have been abandoned. 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 both of these examples, the person or division continues development long after it should stop to avoid potential

punishment for making the original decision. The problem is that the person who has the best information about whether to stop development rarely has the incentive to do so. The right answers depends on all of the benefits and costs of outsourcing, including the incentive effects of whatever organizational form you use.

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."

This is a mistake because the tickets really cost you $50. By going to the game, you give up the opportunity to scalp them. Unless you place a value on going to the game that is as high as the price, 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!

The example in the introduction also illustrates the hidden-cost fallacy. In this case, the plant manager did not consider the hidden cost of replacing the lost electricity from the decision to switch to lower-priced, but also lower-energy coal.

In fact, the subprime mortgage crisis of 2008 can be traced to a failure to recognize the hidden costs of loans made by dubious lenders, like Long Beach Financial, 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 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 hidden-cost fallacy, 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.

A FINAL WARNING

The mistakes in this chapter may seem obvious, but they were all made by sophisticated and experienced managers in some of the best-run companies in the world. It is not much of a stretch to predict that you will make some of the same mistakes, and for the same reasons: you will either lack the information necessary to make a good decision, or you won't have the incentive to do so.

When you find yourself trying to make a hard decision, remember two things: first, recognize the relevant benefits and costs of a decision. This is sometimes hard to do because it is easy to get lost in the data. Decision makers are often distracted by irrelevant numbers,

and they simply jump in and forget why they are analyzing the numbers. They forget the most important lesson of this chapter, that costs are defined by the decisions you are trying to make. So when you find yourself in this position, step back, and focus on the decision you are trying to make. Don't forget this simple maxim:

If you begin with the costs, you will always get confused; but if you begin with the decision, you will never get confused.

Second, remember to consider the consequences of the decision from your company's point of view. Like the plant manager in this chapter, you may find yourself penalized for doing the right thing. Given the number and types of decisions that managers have to make, it is impossible to design compensation schemes that perfectly align manager's incentives with the company's goals. When this happens, and it almost certainly will, consider sacrificing some of your individual short-term rewards for the good of the company. Your supervisor may recognize these sacrifices and try to reward you with a promotion.

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 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.
- If you begin with by looking at the costs, you will always get confused; if you begin with the decision you are considering, you will never get confused.

Multiple-Choice Questions

1. A business owner makes 1,000 items a day. Each day he or she contributes eight hours to produce those items. If hired, elsewhere he or she could have earned $250 an hour. The item sells for $15 each. Production does not stop during weekends. If the explicit costs total $150,000 for 30 days, the firm's accounting profit for the month equals
   a. $300,000.
   b. $60,000.
   c. $450,000.
   d. $240,000.
2. A business owner makes 1,000 items a day. Each day he or she contributes eight hours to produce those items. If hired, elsewhere he or she could have earned $250 an hour. The item sells for $15 each. Production does not stop during weekends. If the explicit costs total $150,000 for 30 days, the economic profit for the month equals:
   a. $300,000.
   b. $60,000.
   c. $450,000.
   d. $240,000.
3. If a firm is earning negative economic profits, it implies
   a. that the firm's accounting profits are zero.
   b. that the firm's accounting profits are positive.

c. that the firm's accounting profits are negative.
d. that more information is needed to determine accounting profits.

4. Opportunity costs arise due to
a. resource scarcity.
b. interest rates.
c. limited wants.
d. unlimited scarcity.

5. After graduating from college, Jim had three choices, listed in order of preference: (1) move to Florida from Philadelphia, (2) work in a car dealership in Philadelphia, or (3) play soccer for a minor league in Philadelphia. His opportunity cost of moving to Florida includes
a. the benefits he could have received from playing soccer.
b. the income he could have earned at the car dealership.
c. Both a and b
d. Cannot be determined from the given information

6. Economic Value Added helps firms to avoid the hidden-cost fallacy
a. by ignoring the opportunity costs to using capital.
b. by differentiating between sunk and fixed costs.
c. by taking all capital costs into account including the cost of equity.
d. None of the above

7. The fixed-cost fallacy occurs when
a. a firm considers irrelevant costs.
b. a firm ignores relevant costs.
c. a firm considers overhead or depreciation costs to make short-run decisions.
d. Both a and c

8. Mr. D's Barbeque of Pickwick, TN produces 10,000 dry-rubbed rib slabs per year. Annually Mr. D's fixed costs are $50,000. The average variable cost per slab is a constant $2. The average total cost per slab then is
a. $7.
b. $2.
c. $5.
d. Impossible to determine

9. All the following are examples of variable costs, except
a. labor costs.
b. cost of raw materials.
c. accounting fees.
d. electricity cost.

10. The U.S. government bought 112,000 acres of land in southeastern Colorado in 1968 for $17,500,000. The cost of using this land today exclusively for the reintroduction of the black-tailed prairie dog
a. is zero, because they already own the land.
b. is zero, because the land represents a sunk cost.
c. is equal to the market value of the land.
d. is equal to the total dollar value the land would yield if used for farming and ranching.

Individual Problems

3-1 Concert Opportunity Cost

You won a free ticket to see a Bruce Springsteen concert (assume the ticket has no resale value). U2 has a concert the same night, and this represents your next-best alternative activity. Tickets to the U2 concert cost $80, and on any particular day, you would be willing to pay up to $100 to see this band. Assume that there are no additional costs of seeing either show. Based on the information presented here, what is the opportunity cost of seeing Bruce Springsteen?

3-2 Concert Opportunity Cost 2

You were able to purchase two tickets to an upcoming concert for $100 apiece when the concert was first announced three months ago. Recently, you saw that StubHub was listing similar seats for $225 apiece. What does it cost you to attend the concert?

3-3 Housing Bubble

Due to the housing bubble, many houses are now selling for much less than their selling price just two to three years ago.

There is evidence that homeowners with virtually identical houses tend to ask for more if they paid more for the house. What fallacy are they making?

3-4 Opportunity Cost

The expression "3/10, net 45" means that the customers receive a 3% discount if they pay within 10 days; otherwise, they must pay in full within 45 days. What would the seller's cost of capital have to be in order for the discount to be cost justified? (*Hint*: Opportunity Cost)

3-5 Starbucks

Starbucks is hoping to make use of its excess restaurant capacity in the evenings by experimenting with selling beer and wine. It speculates that the only additional costs are hiring more of the same sort of workers to cover the additional hours and costs of the new line of beverages. What hidden costs might emerge?

3-6 Dropping University Courses

Students doing poorly in courses often consider dropping the courses. Many universities will only offer a refund up to a certain date. Should this affect their drop decisions?

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.

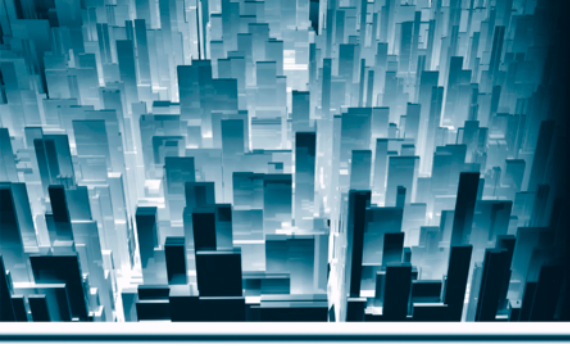
G3-4 Sunk Cost of Depreciation or Fixed Cost of Overhead

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.

END NOTES

1. Note 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.
2. Electricity 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.
3. We do not know the actual size of the charges—they should be viewed as illustrative.
4. Adapted 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.
5. *Depreciation* is an accounting methodology to allocate the costs of capital equipment to the years over the lifetime of the capital equipment.

6. Labor 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.
7. Taking a "charge" against profitability means that accounting profit would be reduced by the amount of the charge—in this case, $400,000.
8. Michael Lewis and David Einhorn, "The End of the Financial World as We Know It," *New York Times,* January 3, 2009.



CHAPTER 4

Extent (How Much) Decisions

The financial crisis began in the subprime housing market. Government policies encouraged lenders to extend credit to low-income borrowers who previously would not have qualified for loans. Lenders then packaged the mortgages into tradable securities and sold them to investors. The ratings agencies—who were selected by the lenders—had an incentive to rate the securities as low risk because favorable risk ratings increased the prices that lenders received when they sold the loans to investors. These high prices encouraged lenders to make even more subprime loans.

Sharmen Lane, a high school dropout who had previously worked as a manicurist before joining subprime lender New Century Mortgage[1] bought loan applications from mortgage brokers on behalf of her lender. As the housing market heated up, competition for these applications became so fierce that some of Ms. Lane's competitors were literally throwing themselves at brokers to get loans. Lane's unwillingness to do this cost her dearly. "Women who had sex for loans were known very quickly," says Lane, who left New Century before it failed in 2007. "I didn't want to be a mortgage slut."

Unfortunately, there were many others who did. They made loans like the one to the strawberry picker mentioned in the last chapter who borrowed money to buy a $720,000 house despite an income of only $14,000.[2] When the price of housing fell, these borrowers had very little ability to pay back the loans, and the lenders went bankrupt.

At this level, the financial crisis can be thought of as of a sequence of bad decisions by borrowers, brokers, lenders, credit rating agencies, and investors who all ignored, for various reasons, the cost of making loans. In the jargon on Chapter 3, they collectively committed the hidden-cost fallacy because they ignored or underestimated the riskiness of the loans.

As a result of this fallacy, too many loans were made. In this chapter, we show you how to make profitable "extent" decisions ("how many" or "how much") by identifying the relevant benefits and costs of these decisions.

BACKGROUND: AVERAGE AND MARGINAL COSTS

In 2005, Memorial Hospital's chief executive officer (CEO) conducted performance reviews of the hospital's departments. As part of this review process, the chief of obstetrics proposed increasing the number of babies being delivered by his department. The CEO examined the department's financial statements and noted that the cost of 540 deliveries was $3,132,000, but revenues were only $2,754,000. The CEO asked why anyone would want to do more of something that was losing $700 every time the hospital delivered another baby.

As most of you should now recognize, the CEO is committing the *fixed-cost fallacy*. As we learned in the last chapter, the relevant costs and benefits of this decision ("how many babies should the hospital deliver") are those that vary with the consequences of the decision. Instead of starting with the question—should we be delivering more babies?—the hospital CEO began with the costs. And since average costs include fixed costs that do *not* vary with consequences of the decision, he made a mistake. Had the CEO ignored the fixed costs, he would have realized that increasing the number of deliveries would increase hospital profit. This leads to the following piece of advice:

Average cost (AC) is irrelevant to an extent decision.

Because average costs "hide" fixed costs by lumping them together with variable costs, this mistake is easy to make. For the 500 deliveries it made, Memorial Hospital had fixed costs of $1 million and variable costs of $3,000/delivery; total costs equaled $2.5 million ($1,000,000 + [$3,000 x 500]). Average costs are total costs divided by the number of deliveries. We plot this average cost curve in Figure 4-1.[3] Average total cost falls throughout the range of output, but variable cost remains constant at $3,000/patient.

Marginal cost is the extra cost required to make and sell one additional unit of output. At Memorial Hospital, increasing output from 500 to 501 babies raised total cost by only $3,000.

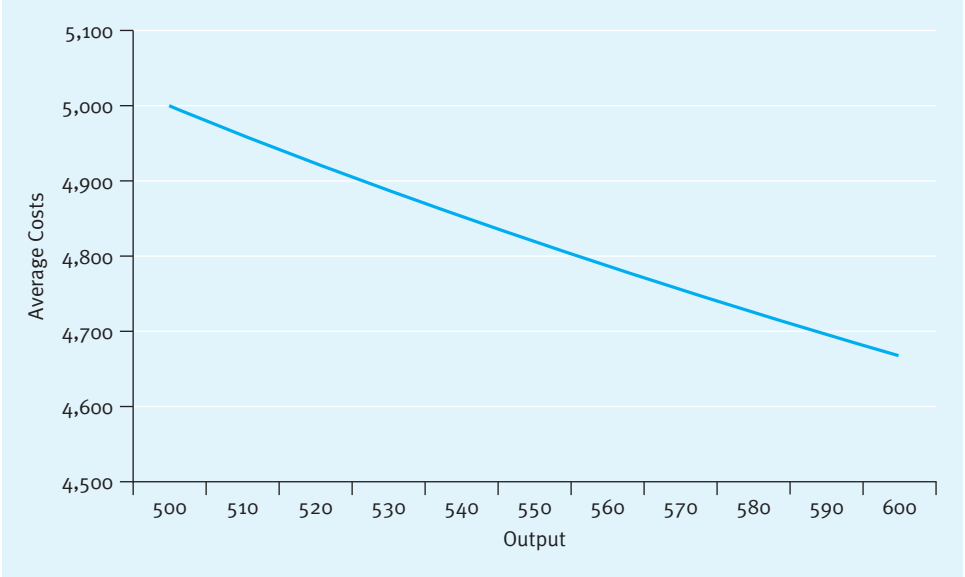


FIGURE **4.1 Average Cost Curve**

In the hospital example, the marginal cost is below the average cost so the average is falling, but this is not always the case. If the marginal is above the average, then the average will rise with output. This could occur, for example, in a factory that is already operating near capacity and wants to increase output. If workers run out of space, productivity falls which means that more inputs are required to make additional output, or that the marginal cost is above the average. In other words, if further output is more expensive than past output, then the marginal is above the average, the average rises with output.

MARGINAL ANALYSIS

To analyze extent decisions, we break down the decision into small steps and then compute the costs and benefits of taking another step. If the benefits of taking another step are greater than the costs, then take another step. Otherwise, step backwards.

We call this approach *marginal analysis*. To illustrate, we analyze the decision of how much to sell, where marginal analysis applies to both costs and revenues.

Marginal cost (MC) is the additional cost incurred by producing and selling one more unit.

Marginal revenue (MR) is the additional revenue gained from selling one more unit.

If the benefits of selling another unit (MR) are bigger than the costs (MC), then sell another unit.

Sell more if MR > MC; sell less if MR < MC. If MR = MC, you are selling the right amount (maximizing profit).

Marginal analysis works for any extent decision, like whether to change the level of advertising, the quality of service, the size of your staff, or the number of parking spaces to lease. The same principle applies to each decision—do more if MR > MC, and do less if MR < MC.

This formula is deceptively useful. For example, suppose you are trying to decide when to cut down a tract of trees. The benefit of waiting is that the trees grow. The cost of waiting is the money you could have earned by cutting the trees down this year and investing the proceeds. If your investments are expected to earn, say 5%/year, then you should let the trees keep growing as long as they grow by more than 5%/year. When the trees stop growing as fast as your investments, cut them down.

Returning to the example of Memorial Hospital, managers computed the *marginal* cost of a delivery at approximately $3,000, whereas marginal revenue was around $5,000. Because MR > MC, we know that the hospital was not delivering enough babies. Contrary to the CEO's initial view, Memorial could increase profit by delivering *more* babies, not by reducing the number of deliveries.

The main difficulty in applying marginal analysis is measuring the marginal cost and marginal benefit of an additional step. To illustrate, suppose you are working for a mobile phone company trying to decide whether to adjust the amount you spend for TV advertising. Suppose you recently increased your TV advertising budget by $50,000, and the ads yielded 1,000 new customers.

In this example, we have only data on a big discrete change (1,000 new customers), so we estimate the marginal effect of another dollar of advertising by dividing the cost of the change ($50,000) by 1,000 customers to get $50 per customer, sometimes called the *customer acquisition cost*. This means that our best estimate of the marginal cost of acquiring

another customer is $50. If the marginal benefit of another customer is bigger than $50, then increase advertising. Otherwise, do not.

Note that marginal analysis points you in the right direction, but it cannot tell you how far to go. The reason for this is that marginal cost typically rises, and marginal revenue falls, with additional steps. So after taking a step, you have to recompute marginal cost and benefit to see whether further steps are warranted.

Managers often have to decide between competing strategies to achieve the same end. If you do not have precise enough information about marginal revenue, you can still use marginal analysis to compare the marginal costs of alternatives. For example, suppose that you are trying to decide how to adjust your promotional budget, currently allocated between TV advertising and telephone solicitation. How much should you spend on advertising for each medium?

In this case, the *opportunity cost* of spending *one more* dollar on TV advertising is the forgone opportunity to spend *that* dollar on telephone solicitation. To increase profit, increase spending on whichever medium has a higher marginal effect, and pay for the increase by reducing spending on the other. In other words, compute the marginal acquisition cost of customers for each medium, and then shift spending toward the cheaper one. This will increase profit even if you don't know what the marginal benefit is.

For example, if you recently decreased your telephone solicitation budget and this saved $10,000, but you lost 100 customers, the marginal acquisition cost of another customer is $100. Since the *marginal customer acquisition cost* of TV ($50) is lower than that of phone solicitation ($100), shift dollars to TV from phone. After making the change, remeasure and decide whether to make further changes.

When you adjust your advertising expenditures, you might want to make the changes one at a time because you lose valuable information about the marginal impact of each change when you change both at the same time. Only by changing them separately can you measure the marginal effectiveness of each. You may not need this information if all you are deciding on is how much of the advertising budget to shift. In this case, all you need to know is whether shifting dollars increases the number of customers.

It is common to confuse marginal cost with average cost. Average cost is total cost divided by the number of units produced. In our current example, the average per-customer cost for TV would be computed by dividing the total spent on TV advertising by the total number of customers gained. But remember that average costs are not what you need to make extent decisions. Using average cost can lead to poor decisions. To compute marginal cost, look only at the *additional* cost of producing one more unit. The two cost figures may be very different. For example, some psychological models of advertising say that any fewer than four exposures to an advertisement has no effect on purchase decisions. The *marginal* effectiveness of that fourth exposure is thus very large, but the *average* effectiveness of the entire advertising budget would be much lower.

Now that you understand the differences between marginal and average analysis, let's try to use marginal analysis to figure out how to reduce costs at a Fortune 50 company that produces textile products at various manufacturing plants in Latin America. The plants operate as cost centers, meaning that plant managers are rewarded for reducing costs of production. To evaluate the cost centers, the firm measures production using standard absorbed hours (SAH). For each garment produced, the firm computes the time required to complete each step in the manufacturing process. Complex garments like overalls require more time and thus are assigned a higher SAH (15 minutes) than simple garments like

T-shirts (two minutes). The output of a factory is thus measured in SAH, and each factory is evaluated based on how much it costs to get one hour's worth of production in terms of cost per SAH.

Obviously, measuring output in this way allows managers to identify lower-cost factories. Suppose that a factory in the Yucatan operates at $20/SAH, and a factory in the Dominican Republic operates at $30/SAH. As a manager, do you think you could save $10/SAH by shifting production from the Dominican Republic to the Yucatan? Remember, this is an extent decision about how much to produce at each factory, so you want to measure the marginal costs at each plant. The extent decision here is similar to our hospital's decision of how many babies to deliver.

Before answering this question, you might want to remember the big lesson of the previous chapter: that costs are defined by the decision you are trying to make. If you start your analysis with the costs, it is likely that you will get confused. Instead, step back and remind yourself of the decision you are trying to make. Here you are trying to decide whether to shift output from one factory to another. If the costs used to compute cost per SAH include overhead that cannot be avoided, then you won't save on overhead as you shift production—overhead is irrelevant for this extent decision. So, first you must adjust the cost per SAH to remove the influence of any fixed-costs, lest you commit the fixed-cost fallacy.

Second, make sure that cost per SAH is a good proxy for marginal costs. To check whether this is so, make sure that when you reduce output in the Dominican Republic, you really are avoiding close to $30/SAH, and make sure that you are incurring only about $20/SAH for each SAH of output increase in the Yucatan. If this is not correct, then cost per SAH is a poor proxy for marginal cost.

If you are convinced that $10 cost per SAH is a reasonable proxy for difference in marginal costs between the two factories, then you can lower costs by moving production from the Dominican Republic to the Yucatan. Finally, remember that marginal analysis tells you what direction to go (shift production), but it doesn't tell you *how far* to go. Decide how far to go by taking a step and then remeasuring marginal costs to determine whether to take another step.

In this example, the company shifted some production, but not as much as the managers wanted because they had to maintain good working relationships with politicians in the Dominican Republic who would have been upset if too many local workers lost jobs.

INCENTIVE PAY

How hard to work is an extent decision, so marginal analysis can be used to design incentives to encourage hard work. To illustrate this idea, suppose you are a landowner evaluating two different bids for harvesting a tract of timber containing 100 trees. One bid is for $150 per tree, and the other bid is for $15,000 for the right to harvest all the trees. Which bid should you accept? (*Hint*: Consider the effects of the two bids on the incentives of the logger.)

Although both bids have the same face value, they have dramatically different effects on the logger's incentives. If you charge a fixed fee of $15,000 for the right to harvest all the trees, the logger treats the price paid to the landowner as a fixed or sunk cost. He should, by our reasoning in Chapter 3, ignore that cost when deciding how many trees to cut down. In other words, under the fixed fee contract, the MC of cutting down trees is zero. This gives the logger an incentive to cut down trees as long as the value of each tree

is greater than the cost of harvesting it. Under this contract, the logger will end up cutting down all the trees that are profitable to cut down.

On the other hand, if you charge the logger a royalty rate of $150 per tree, the logger will cut down only those trees with a value greater than $150. If the forest is a mix of pine worth $200 per tree and fir worth $100 per tree, the logger will harvest only the pine and leave the fir.[4] Consequently, the landowner will receive less money under a royalty contract because the logger will harvest only the pine trees. The incentive effect of a royalty rate are analogous to that of a sales tax because it deters some wealth-creating transactions (i.e., the fir trees are not harvested).[5]

The same idea can be applied to the problem of motivating salespeople. To see this, suppose you want to evaluate the incentive effects of two different compensation schemes. One is based on a 10% commission rate, where the salesperson is paid 10% of sales. The other compensation plan pays a 5% commission rate plus a $50,000 per year flat salary. Each year, you expect salespeople to sell 100 units at a price of $10,000 per unit. Which incentive compensation scheme should you use? (*Hint*: Consider the effects of the two schemes on the incentives of the salesperson.)

As in our earlier example, the two payment schemes have the same face value but dramatically different effects on the behavior of the salesperson. If you pay a 10% commission, then the marginal benefit to the salesperson of making a sale is $1,000. If you pay a 5% commission, the marginal benefit is only $500. If some sales are relatively easy to make (i.e., the salesperson gives up less than $500 worth of time and effort to make them), and some sales are relatively difficult to make (i.e., they require at least $800 worth of effort), then only the easy sales will be made under the 5% commission. Both the easy and difficult sales will be made under the 10% commission.

In essence, the sales force responds to the smaller *marginal benefit* of selling with less effort, which we call *shirking*. This kind of shirking is analogous to the decision of the logger to harvest only the high-value, low-cost trees when he pays a royalty rate for each tree harvested. The logger responds negatively to the *high marginal costs of logging* just as the salesperson responds negatively to the *low marginal benefit of selling*. To induce higher effort, use incentives that reduce marginal costs or increase marginal benefits. Fixed costs or benefits do not change effort.[6]

TIE PAY TO PERFORMANCE MEASURES THAT REFLECT EFFORT

How to reward good performance is a critical part of the design of any organization, as the following story illustrates. In 1997, a 50-year-old chief operating officer (COO) with a bachelor's degree in journalism and a law degree managed a consulting firm with 10 account executives. The COO was in charge of keeping clients happy and ensuring that the account executives were working in the best interests of the company. The COO earned a flat salary of $75,000.

After taking classes in human resources, economics, and accounting, the CEO of the company became convinced of the merits of incentive pay. He sat down with his COO, and together they set profit goals for the year. All revenues counted toward the COO's profit goal. But only the expenses that the COO controlled directly—like compensation and office expenses—were "charged" against his profit. All overhead items, like rent, were placed in another budget because the COO could not control them; that is, they were "fixed" with respect to his effort.

By creating this new budget, the CEO recognized that the usual accounting profits were inadequate for evaluating COO performance.

The CEO and the COO both agreed that without much effort, the COO could earn[7] $150,000 each quarter. But earning an amount over $150,000 would take more effort. To motivate the COO to exert the extra effort, they agreed on an incentive compensation scheme that paid the COO one-third of each dollar that the company earned above $150,000.

After making the change, the COO's compensation jumped to $177,000—an increase of 136%—whereas the firm's revenues jumped from $720,000 to $1,251,000—an increase of 74%. A good economy certainly contributed to the increase in revenues, but the compensation plan also helped. Revenue increased because the COO pushed hard to make and exceed earnings goals and, for the first time, he worried about expenses. For example, he attempted to contain costs by asking why phone bills were so high.

Along with changing the COO's compensation scheme, the CEO also moved to a system of incentive pay for the account representatives. This had equally dramatic effects on the account representatives—except for one employee who was going through a divorce. The incentive pay scheme did little to increase his marginal incentives because half of everything he earned went to his estranged wife. In other words, the marginal benefit of extra work for this employee was half as much as that of other employees, and he responded by working less hard.

Although the benefits of incentive pay seem clear, it is not a panacea—especially in cases where it is difficult to measure performance. For example, if you reward software programmers for finding and fixing "bugs" in software, you also create an incentive for the same programmers to deliberately produce bugs so they can be found later on. Research has found that incentive schemes are most effective when "effort matters, there is little intrinsic desire to do the job, and money boosts the recipient's social status."[8]

On a related note, recognize that it is virtually impossible to measure and reward all the different tasks and activities you want an employee to undertake. This is especially true of managers, who typically have a wider scope of responsibility. For them, do not put too much faith in monetary incentives alone. Recognize that the success of an organization often depends on managers who exert effort above and beyond the incentives set up for them. Firms should let these managers know that they are appreciated, and promote and reward them as best it can.

IS INCENTIVE PAY UNFAIR?

Some employees and managers will resist even well-designed incentive pay schemes because they consider them "unfair." Incentive pay almost certainly leads to differences among workers: If you reward productivity, more productive workers, or those who work harder than others, will get paid more. Moreover, incentive pay schemes typically expose workers to risk beyond their control. For example, salespeople compensated on sales commission will earn less if the macro economy does poorly, through no fault of their own.

However, these criticisms of incentive pay make the mistake of confusing procedural fairness (everyone has the same opportunity) with outcome equality (everyone has the same outcome). If you adopt incentive pay, you get higher productivity but at the expense of some inequality.

The reluctance of voters to accept this trade-off can make it difficult for firms to raise productivity. For example, Spain's policy of *finiquito* whereby firms have to pay fired workers 1.5 months of salary for every year worked, makes it difficult to motivate long-time employees. The severance pay starts looking so good that long-term employees start

trying to get fired. One 17-year employee speculated in a blog post, "how hard should I really be working?"[9] These kinds of policies are making it very difficult for the Southern European countries to grow their way out of the recession.

But countries aren't the only ones who resist incentive pay. Consider this reaction from a "faculty" member in the "corporate learning center" of a Fortune 50 company to a suggestion that the U.S. company adopt an incentive compensation plan:

> *Forfeiting our most recently espoused values of equal ownership in Firm X's success is not the answer. I fear that we will be attempting to compete for employees interested in a class-oriented system of compensation. From where I sit, this is the last thing a corporation needing vast, systemic, team-oriented change should be trying to do to compete in the global marketplace. Many folks know I am a staunch opponent of incentive plans, and I often quote Alfie Kohn (1993), whose research shows that rewards punish. Saying "If you do this, you'll get that" differs little from saying "Do this or this will happen to you." Incentives are controlling.*
>
> *However, another aspect of the punishment is much more evident in this change of policy: "Not receiving a reward one expects to receive is also indistinguishable from being punished." Just ask all those who don't receive the bonuses they were previously entitled to how they feel about it. The incentive pay policy is overt in its support of class separation over collective team participation. It ignores the premises of modern systems thinking and reverts to the mechanistic theories of Descartes and Newton for justification. A typical business school text from the 1950s would have suggested instituting such an aristocratic policy.*

If you want to short the stock of this company, call me and I will tell you which one it is.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Do not confuse average and marginal costs.
- **Average cost** (AC) is total cost (fixed and variable) divided by total units produced.
- Average cost is irrelevant to an extent decision.
- **Marginal cost** (MC) is the additional cost incurred by producing and selling one more unit.
- **Marginal revenue** (**MR**) is the additional revenue gained from selling one more unit.
- The relevant costs and benefits of an extent decision are marginal costs and marginal revenue. If the marginal revenue of an activity is larger than the marginal cost, then do more of it.

  Sell more if MR > MC; sell less if MR < MC. If MR = MC, you are selling the right amount (maximizing profit).

- An incentive compensation scheme that increases marginal revenue or reduces marginal cost will increase effort. Fixed fees have no effects on effort.
- A good incentive compensation scheme links pay to performance measures that reflect effort.

Multiple-Choice Questions

1. When economists speak of "marginal," they mean
   a. opportunity.
   b. scarcity.
   c. incremental.
   d. unimportant.
2. Managers undertake an investment only if
   a. marginal benefits of the investment are greater than zero.
   b. marginal costs of the investment are greater than marginal benefits of the investment.

c. marginal benefits are greater than marginal costs.
d. investment decisions do not depend on marginal analysis.

3. A firm produces 500 units per week. It hires 20 full-time workers (40 hours/week) at an hourly wage of $15. Raw materials are ordered weekly, and they cost $10 for every unit produced. The weekly cost of the rent payment for the factory is $2,250. How do the overall costs break down?
   a. Total variable cost is $17,000; total fixed cost is $2,250; total cost is $19,250.
   b. Total variable cost is $12,000; total fixed cost is $7,250; total cost is $19,250.
   c. Total variable cost is $5,000; total fixed cost is $14,250; total cost is $19,250.
   d. Total variable cost is $5,000; total fixed cost is $2,250; total cost is $7,250.
4. Total costs increase from $1,500 to $1,800 when a firm increases output from 40 to 50 units. Which of the following is true if marginal cost is constant?
   a. FC = $100
   b. FC = $200
   c. FC = $300
   d. FC = $400
5. A manager of a clothing firm is deciding whether to add another factory in addition to one already in production. The manager would compare
   a. the total benefits gained from the two factories to the total costs of running the two factories.
   b. the incremental benefit expected from the second factory to the total costs of running the two factories.
   c. the incremental benefit expected from the second factory to the cost of the second factory.
   d. the total benefits gained from the two factories to the incremental costs of running the two factories.
6. A firm is thinking of hiring an additional worker to their organization who they believe can increase total productivity by 100 units a week. The cost of hiring him or her is $1,500 per week. If the price of each unit is $12,
   a. the MR of hiring the worker is $1,500.
   b. the MC of hiring the worker is $1,200.
   c. the firm should not hire the worker since MB < MC.
   d. All the above
7. A retailer has to pay $9 per hour to hire 13 workers. If the retailer only needs to hire 12 workers, a wage rate of $7 per hour is sufficient. What is the marginal cost of the 13th worker?
   a. $117
   b. $9
   c. $33
   d. $84
8. If a firm's average cost is rising, then
   a. marginal cost is less than average cost.
   b. marginal cost is rising.
   c. marginal cost is greater than average cost.
   d. the firm is making an economic profit.
9. After the first week of his MBA Managerial Economics class, one of your pharmaceutical sales representatives accuses you of committing the sunk-cost fallacy by refusing to allow him to reduce price to make what he considers to be a really tough sale. Which of the following suggests the sales representative may be right?
   a. Most of the costs of drug development are sunk, not fixed.
   b. Sales representatives are paid a sales commission on revenue, so they don't care about the costs of drug development.
   c. Sales representatives don't worry that a low price today may make it more difficult for the company's other sales representatives to charge higher prices to their customers, tomorrow.
   d. Sales representatives think only about one thing, sales.
10. A company is producing 15,000 units. At this output level, marginal revenue is $22, and the marginal cost is $18. The firm sells each unit for $48 and average total cost is $40. What can we conclude from this information?
    a. The company is making a loss.
    b. The company needs to cut production.
    c. The company needs to increase production.
    d. Not enough information is provided.

Individual Problems

4-1 Extent versus Discrete Problems

Identify which of the following are extent decisions.

a. Decide whether to expand an existing product into a new region.
b. What discount should be given on products during the upcoming holiday sale?
c. Should the advertising budget be changed for the upcoming year?
d. Should you develop a new product for an existing product line?

4-2 Game Day Shuttle Service

You run a game day shuttle service for parking services for the local ball club. Your costs for different customer loads are 1: $30, 2: $32, 3: $35, 4: $38, 5: $42, 6: $48, 7: $57, and 8: $68. What are your marginal costs for each customer load level? If you are compensated $10 per ride, what customer load would you want?

4-3 Paid for Grades

Children in poor neighborhoods have bleak outlooks on life and do not see much gain to studying. A recent experiment is paying children in poor neighborhoods $100 for each "A" they earn in a six-week grade reporting cycle. How does this affect behavior?

4-4 Supplier Bids

Your company is contemplating bidding on an RFP (Request For Proposal) for 100,000 units of a specialized part. Why might the amount be more than the requesting company actually wants?

4-5 Processing Insurance Claims

Your insurance firm processes claims through its newer, larger high-tech facility and its older, smaller low-tech facility. Each month, the high-tech facility handles 10,000 claims, incurs $100,000 in fixed costs and $100,000 in variable costs. Each month, the low-tech facility handles 2,000 claims, incurs $16,000 in fixed costs and $24,000 in variable costs. If you anticipate a decrease in the number of claims, where will you lay off workers?

4-6 Copier Company

A copy company wants to expand production. It currently has 20 workers who share eight copiers. Two months ago, the firm added two copiers, and output increased by 100,000 pages per day. One month ago, they added five workers, and productivity also increased by 50,000 pages per day. Copiers cost about twice as much as workers. Would you recommend they hire another employee or buy another copier?

Group Problems

G4-1 Extent Decision

Describe an extent decision made by your company. Compute the marginal cost and marginal benefit of the decision. Was the right decision reached? If not, what would you do differently? Compute the profit consequences of the change.

G4-2 Contracts

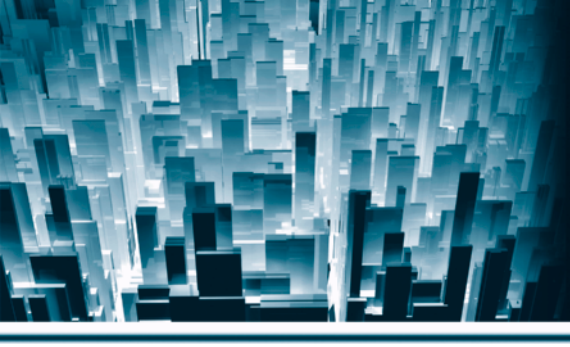
Does your firm use royalty rate contracts or fixed-fee contracts? Describe the incentive effects of the contracts. Should you change the contract from one to the other? Compute the profit consequences of changing the contract.

END NOTES

1. Mara Der Hovanesian, "Sex, Lies, and Subprime Mortgages," *Business Week,* November 13, 2008.
2. Michael Lewis, "The End," *CondeNast Portfolio.com,* December 2008, available at http://www.portfolio.com/news-markets/national-news/portfolio/2008/ll/ll/The-End-of-Wall-Streets-Boom.
3. Average cost curves will generally not slope down indefinitely. At some point, average costs will begin to increase either through the need to add additional fixed costs or from rising per

unit variable costs. We will examine the U-shaped average cost curve in a later chapter.

4. Alternatively, if the trees differ in their harvesting costs (some are near a logging road, and some are not), the logger will cut down only those trees that yield a profit of at least $150.
5. Recall that we noted in Chapter 2 that when a sales tax is larger than the surplus of a transaction, it deters that transaction. Similarly, when the royalty rate is larger than the surplus here, it deters the wealth-creating transaction (the harvesting of the fir tree).
6. The point of discussing these different compensation schemes is not to argue that one or the other is the optimal design but rather to simply note that incentives will affect behavior.
7. *Earnings* refers to company profit.
8. Tyler Cowen. *Discover Your Inner Economist: Use Incentives to Fall in Love, Survive Your Next Meeting, and Motivate Your Dentist* (New York: Dutton, 2007).
9. http://www.lostinsantcugat.com/2010/01/non performance-incentive-pay.html.



CHAPTER 5

Investment Decisions: Look Ahead and Reason Back

In the summer of 2007, Bert Mathews was contemplating the purchase of a 48-unit apartment building in downtown Nashville. The building was 95% occupied and generated $500,000 in annual profit. His investors were expecting a 15% return, and the bank had offered to loan him 80% of the purchase price of the building at a rate of 5.5%. He computed his *weighted average cost of capital* or WACC as 0.2 x (15%) + 0.8 x (5.5%) = 7.4%. Mr. Mathews used his cost of capital to figure out how much he could afford to pay for the property, and still earn enough to satisfy his investors. The answer was $6.75 million, computed as $500,000/($6.75 million) = 7.4%.

Even though the owner was willing to sell at this price, Mr. Mathews decided not to purchase because he was worried about the deteriorating housing market and the rising number of mortgage defaults. This turned out to be a really good decision. A year later, the building's occupancy rate fell to 90%, which reduced annual profit to only $450,000. In addition, lending standards had tightened considerably. Now, the bank was willing to lend only 65% of the purchase price, and at the higher rate of 7.5%. This raised Mr. Matthews cost of capital to 10.125% = 0.35 x (15%) + 0.65 x (7.5%), which reduced the value that he placed on the property. If he was going to earn 10.125%, the most he could afford to pay for the property was $4.4 million, computed as $450,000/$4.4 million = 10.125%, which the owners rejected as too low.

This story illustrates the effect of the financial crisis on the real estate market, but more importantly for our purposes, the relevant costs and benefits of investment decisions, the topic of this chapter.

COMPOUNDING AND DISCOUNTING

All investment decisions involve a trade-off between current sacrifice and future gain. Before investing, you need to know is whether the future gains are bigger than the current sacrifice. *Discounting* is a tool that allows you to figure this out.

The easiest way to understand discounting is to first consider its opposite, *compounding*, (future value, one period in the future) = (present value) x (1 + *r*) where *r* is the rate of return. If, for example, you invest $1 today at a 10% rate, then you would expect to have $1.10 in one year. After two years, $1 becomes $1.21 = $1.10 x (1.10), $1.33, after three years, and so on. The general formula for compounding is

$$(\textit{future value},\ k \textit{ periods in the future}) = (\textit{present value})\ x\ (1+r)^k.$$

A good rule of thumb to know when thinking about compounding is the "rule of 72".[1]

If you invest at a rate of return r, divide 72 by r to get the number of years it takes to double your money.

An investment will roughly double in nine years at an 8% interest rate and in six at 12%. This rule of thumb can be used for compounding, or its inverse, "discounting." Discounting is defined by the formula,

$$\textit{present value} = (\textit{future value},\ k \textit{ periods in the future})/(1+r)^k.$$

So, for example, at a 10% discount rate, $1 next year is worth only ($1)/1.1 = $0.91 today, $1 two years in the future is worth only $0.83 today, and $1 three years in the future is worth only $0.75 today.

The city of Nashville uses discounting to decide how much to save for its future pension obligations. For a pension that pays out $100,000 in 20 years, Nashville must save $20,485 = $100,000/$(1.0825)^{20}$ today, using an 8.25% discount rate. If the city invests the $20,485, and earns 8.25%, the savings will compound and be worth $100,000 in 20 years. If however, the investments return less than 8.25% (in fact they have done much worse), then the city will not have saved enough when the future finally gets here. Of course, a more realistic discount rate, say 6.5%, would mean much higher current savings, 28,380 = $100,000/$(1.065)^{20}$ to fund the same future pension. But higher savings means less current spending. Current spending is politically popular, which explains why we don't see more saving.[2]

HOW TO DETERMINE WHETHER INVESTMENTS ARE PROFITABLE

We are now in a position to use discounting to determine whether an investment is profitable. The rule is simple: discount the future benefits of an investment, and compare them to the current cost of the investment. If the difference is positive (called the "net present value"), then the investment earns more than the cost of capital. This intuition can be formalized into a general decision rule, called the **NPV rule.**

If the net present value of discounted cash flow is larger than zero, then the project earns more than the cost of capital.

To see how this works, consider the returns on two different projects. The first returns $1,200,000 at the end of year 1, and the second returns $1,200,000 at the end of year 2. The company would obviously prefer to get its profit more quickly and so would prefer the first project to the second. Intuitively, this makes sense. Projects that return dollars sooner have higher rates of return, all else being equal.

Most projects, however, are much more difficult to compare. We illustrate two such projects in Figure 5-1. Both projects require an initial investment of $100. Project 1 returns $115 at the end of the first year, whereas Project 2 returns $60 at the end of the first year and $60 at the end of the second. The company's cost of capital is 14%. To determine whether the investments are profitable, we discount all future inflows and outflows to the present so we can compare them to the initial investment.

TABLE 5.1
NPV Example

	Outflow	Inflow 1	Inflow 2	Net
Project 1	–$100	$115	N/A	$15
Project 2	–$100	$60	$60	$20
Present Values				
Project 1	–$100	$100.88	N/A	$0.88
Project 2	–$100	$52.63	$46.17	–$1.20

Inflow 1 is divided by 1.14; Inflow 2 is divided by 1.14^2. From the bottom two lines of Table 5-1, it's clear that Project 1 earns more than the cost of capital while Project 2 does not.

The NPV rule illustrates the link between the idea of "economic profit" introduced in Chapter 3 and investment decisions. Projects with positive NPV create economic profit because they earn a return higher than the company's cost of capital. By calculating the returns of Projects 1 and 2, we find that Project 1's return is higher than 14%, and Project 2's is lower than 14%. Projects with negative NPV may create accounting profit but not economic profit. In making investment decisions, choose only projects with a positive NPV.

In your finance classes, you will learn that NPV analysis is the "correct" way to evaluate investment decisions. And this is certainly correct. It is both a necessary and a sufficient condition for an investment to be profitable. However, after doing NPV analysis in a variety of circumstances, you will begin to develop shortcuts and rules of thumb, like payback periods that give you similar answers. This is a potentially dangerous. When using shortcuts, make sure that you understand the context in which the shortcut is being used, and make sure that it gives the same answer as NPV analysis.

BREAKEVEN ANALYSIS

One of the popular shortcuts is breakeven analysis. Although it can give you the wrong answer, breakeven analysis is easy to do, and it generates simple, intuitive answers. To illustrate, let's examine an entry decision. Instead of asking whether entry is profitable, we are going to ask an easier question, "Can I sell enough to break even?" If you can sell more than the breakeven quantity, then entry is profitable; otherwise, entry is unprofitable.

To compute the breakeven quantity, we have to distinguish between marginal costs (MC), which vary with quantity, and fixed costs *(F),* which don't. Imagine that you incur a fixed cost to enter an industry and a constant[3] per-unit marginal cost when you begin production. You will find that most of your investment decisions can be analyzed using this very simple cost structure.

The breakeven quantity (Q) is

$$Q = F/(P - MC)$$

where F *is annual fixed cost,* P *is price, and* MC *is marginal cost.*

The breakeven quantity is the quantity that will lead to zero profit.[4] The logic behind the calculation is simple. Each unit sold earns the *contribution margin* (*P – MC*), so named because this is the amount that one sale earns. You have to sell at least the breakeven quantity to earn enough to cover fixed costs. If you sell more than the breakeven quantity, you have earned more than enough to cover your fixed costs, or to earn a profit.

For example, consider Nissan's 2008 redesign of its Titan pickup truck. The Titan had only two years left on its eight-year product life cycle, and Nissan had to decide whether to redesign it. Complicating the decision was a weakening demand for U.S. trucks, with sales predicted to fall from 1.3 million in 2008 to only 400,000 trucks per year by 2011.

Nissan managers used a rough breakeven calculation to evaluate their investment alternatives. It would cost $400 million to design and build a new truck from the bottom up. At a 15% cost of capital,[5] the investment would cost Nissan about $60 million per year. Since they earned only $1,500 per truck, they would have to sell at least 40,000 trucks each year to break even. With only a 3% share of the U.S. market, however, Nissan predicted they would sell only 12,000 Titan trucks each year, not enough to break even.

The other option was to ask Chrysler to build the new Titan for them. Chrysler had just made a big investment in updating its Dodge Ram pickup. It had enough spare capacity on its Mexican assembly line and would likely have a lot more capacity by 2011. If Nissan used the Dodge Ram as the base platform for the new Titan, the required investment to build the new model would fall from $400 million to only $80 million. This would reduce the annual capital cost to only $12 million, and reduce the breakeven quantity to only 8,000 trucks. Even if Chrysler were to charge Nissan a higher fee for building the Titan trucks so that the contribution margin fell to $1,250 per truck, the breakeven quantity (9,600) would still be below expected sales.

Outsourcing the Titan to Chrysler would have made economic sense, but in early 2009, the companies issued a joint statement indefinitely postponing the project due to "declining economic conditions."

CHOOSING THE RIGHT MANUFACTURING TECHNOLOGY

We can use a variant of breakeven analysis to choose between different manufacturing technologies. In 1986, John Deere was building a capital-intensive factory to produce large, four-wheel-drive farm tractors. Then the price of wheat dropped dramatically, reducing demand for these tractors because they're used exclusively for harvesting wheat. John Deere stopped construction of its own factory and attempted to purchase Versatile, a Canadian company that assembled tractors in a garage using off-the-shelf components.

We can characterize John Deere's decision as a choice of one manufacturing technology over another. They abandoned their capital-intensive factory, characterized by big fixed costs but small marginal costs, in favor of Versatile's technology, characterized by small fixed costs but big marginal costs. Did John Deere make the right decision?

As you should now begin to realize, the right answer is always "It depends." In this case, it depends on how much John Deere expected to sell. Suppose that the capital-intensive technology had fixed costs of $100 and marginal costs of $10, whereas Versatile's technology had fixed costs of $50 but marginal costs of $20. (Note: We're deliberately choosing easy-to-work-with numbers so that we can illustrate the general point.)

To determine the quantity at which John Deere is indifferent between the two technologies—the breakeven quantity—solve for the quantity that equates the two costs. At a quantity of five units, total costs are $150 for both technologies.[6] If you expect to sell more than five units, choose the low-marginal-cost technology; otherwise, choose the low-fixed-cost technology.

John Deere made the right decision by abandoning its construction project and acquiring Versatile because projected demand for tractors was low. However, the Antitrust Division of the U.S. Department of Justice challenged the acquisition as anticompetitive[7] because John Deere and Versatile were two of just four firms that sold large four-wheel-drive tractors in North America.

We end this section with a warning to avoid a very common business mistake:

Do not invoke breakeven analysis to justify higher prices or greater output.

Managers often reason that they must raise price to cover fixed costs. This is wrong if fixed costs do not vary with the pricing decision. Similarly, managers sometimes reason that since *average* fixed costs decline with quantity, they must sell as much as they can to reduce average cost. Both lines of reasoning are flawed because, as you know, pricing and production are *extent* decisions that require *marginal analysis,* not *breakeven analysis*.

Remember, the relevant costs depend on which question you are asking. And if you start your analysis by looking at costs you will always get confused. Instead, start your analysis by asking a question. For an investment question, fixed or sunk costs are relevant because you haven't yet incurred them. In other words, they vary with the consequence of the investment decision. However, fixed costs do not vary with the consequences of a pricing or quantity decision.

SHUTDOWN DECISIONS AND BREAKEVEN PRICES

To study shutdown decisions, we work with breakeven prices rather than quantities. If you shut down, you lose your revenue, but you get back your **avoidable cost.** If revenue is less than avoidable cost, or equivalently, if price is less than average avoidable cost,[8] then shut down.

The breakeven price is the average avoidable cost per unit.[9]

The only hard part in applying breakeven analysis is deciding which costs are avoidable. For that, we use the Cost Taxonomy, shown in Figure 5-1.[10]

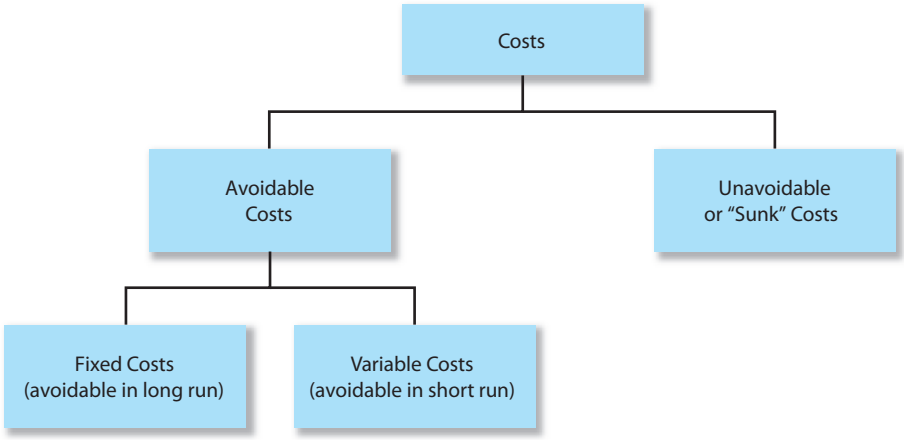


FIGURE **5.1 Cost Taxonomy**

To understand how to use the taxonomy, consider the following problem. Fixed costs are $100/year, marginal costs are $5, and you're producing 100 units per year. How low can price go before it is profitable to shut down?

Again, the answer is "It depends." In this case it depends on which costs are avoidable. In the short run, only marginal cost is avoidable, so the shutdown price is $5. In the long run, fixed costs become avoidable, so they become relevant to the shutdown decision. In the long run, the shutdown price includes average fixed cost and so rises to $6.[11]

To make this concrete, think of the fixed costs as a one-year renewable lease. When the lease comes up for renewal, it is relevant to the shutdown decision because it is avoidable. However, until the lease comes up for renewal—during the period that economists call the *short run*—it is unavoidable, so you should ignore it when deciding whether to shut down.

SUNK COSTS AND POST-INVESTMENT HOLD-UP

By 2000, Mobil Oil (now ExxonMobil) was the leading supplier of industrial lubricants[12] in the United States. It achieved that position—a 13% market share—by bundling engineering services with its high-quality lubricants. With twice as many field engineers as its next-largest competitor, Mobil was able to offer custom-designed lubrication programs to complement sales of their lubricants.

One of its largest customers was TVA, a regional producer of electric power whose annual consumption of lubricants exceeded one million gallons. Early in 2000, Mobil conducted a three-month engineering audit of TVA. This audit included employee training, equipment inspections, and, for each piece of TVA equipment, repair, service, and lubricant recommendations.

TVA made the recommended repairs, but then it gave the lubricant recommendation list to a Mobil competitor that offered lubricants at lower prices. When Mobil failed to match the lower prices, they lost the contract and their three-month investment. Mobil and its managers forgot a basic business maxim: *Look ahead and reason back*. By failing to anticipate self-interested behavior, they were victimized by it.

Economics is often called the "dismal science," partly because of its dark view of human nature. We have already seen the utility of using this perspective to look ahead and

reason back to worst-case scenarios. Nowhere is this more important than in analyzing sunk-cost investments. Sunk costs are unavoidable, even in the long run, so if you make sunk-cost investments, you are vulnerable to *post-investment hold-up*. Let's look at the problem of post-investment hold-up by working again with breakeven prices.

Consider the case of a magazine, like *National Geographic,* trying to negotiate with a regional commercial printer to print its magazine. For the magazine, using a regional printer saves on shipping costs. But to print a high-quality magazine, the printer must buy a $12 million rotogravure printing press. If the marginal cost of printing a single copy is $1 and the printer expects to print one million copies per year over a two-year period, the average cost of printing the magazine over two years is $7, computed as the average fixed cost of the investment ($12 million/2 million copies) plus the marginal cost ($l/copy).[13] This is the breakeven price for the printer and represents her bottom line in negotiations with the magazine. Before they are incurred, sunk costs are relevant to the negotiation.

However, once the printer purchases the printing press, the profit calculus changes. If the printer cannot recover any of the press's value by reselling it, then the cost of the press is *sunk*. Once sunk costs have been incurred, the magazine can *hold up* the printer by renegotiating terms of the deal. Since the cost of the press is unavoidable, the printer's breakeven price falls to the marginal cost of printing the magazine ($1).

If the managers of the commercial printer anticipate hold-up, they will be reluctant to deal with the magazine. Then it becomes not just a problem for the potential victim of hold-up, but also for the potential perpetrator of hold-up. The one lesson of business is to figure out how to profitably consummate the transaction between the printer and the magazine.

If possible, the printer's negotiators will insist on a contract that penalizes the magazine should it decide to hold them up. With the assurance of a contract, the printer may feel confident enough to incur sunk costs. But contracts are often difficult and costly to enforce. A better solution might be to make the magazine purchase the press and then lease it to the printer. In this case, the magazine no longer poses a hold-up threat to the printer because the printer has incurred no sunk costs.[14]

Note that if the cost of the printing press is *fixed,* meaning that it can be recovered by selling the machine, then hold-up is not a problem. If the magazine tries to renegotiate a price less than average cost, the printer will rationally refuse the business, sell the press, and recover his entire investment. Hold-up can occur only if costs are sunk, like those of Mobil's engineering services.

ANTICIPATE HOLD-UP

In general, there are many investments that are vulnerable to hold-up. Anytime that one party makes a **specific investment**—one that is sunk or lacks value outside a trading relationship—the party can be held up by its trading partner. If one party anticipates that she is at risk of being held up, she will be reluctant to make relationship-specific investments, or demand costly safeguards, including compensation in the form of better terms from her trading partner. This gives both parties an incentive to adopt contracts or organizational forms, such as investments in reputation, merger, or the exchange of "hostages" to reduce the risk of hold-up. The goal is to ensure that each party has both the incentive to make relationship-specific investments and to trade after these investments have been made.

For example, consider the problem faced by manufacturers of aluminum. Bauxite (aluminum ore) comes from mines in South America. The refining process used to produce alumina

from bauxite is tailored to the specific qualities of the ore. In addition, transporting bauxite is costly, so it's advantageous to locate the alumina refinery near the mine. Both the technological requirements of the refining process and the high transport costs make the investment in a refinery *specific* to the relationship between the mine and the refinery.

In this industry, the enormous investment required to build a refinery is vulnerable to post-investment hold-up—the bauxite mine could raise the price of ore once the refinery is built. So, we rarely see refineries built without vertical integration or strong long-term requirements contracts[15] between the mine and refinery. These types of organizational forms "solve" the hold-up problem by reassuring the refiner that it will not be held up once its relationship-specific investment is made.

Marriages are vulnerable to the same type of post-investment opportunism that plagues commercial relationships. Parties invest time, energy, and money in a marriage, the kinds of investments that differentiate marriages from more casual relationships, which can be thought of as spot market transactions. These investments are valuable to the marriage parties but are largely specific, in that they have a much lower value outside the relationship. The marriage contract penalizes post-investment hold-up (i.e., divorce) and this makes couples willing to invest more in the marriage.[16]

We close the chapter with the story of an economist and his fiancée who were receiving premarital counseling from a priest before he would marry them. The priest's first question to the couple was "Why do you want to get married?" The economist's fiancée answered, "Because I love him and want to spend the rest of my life with him." As you might imagine, the economist had a different answer, "because long-term contracts induce higher levels of relationship-specific investment."

A year later, trying hard to find the right words to express how he felt about his wife, he wrote an anniversary e-mail—using a cursive font—declaring that his "relationship-specific investment was covering his cost of capital."

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- All investment decisions involve a trade-off between current sacrifice and future gain. Before investing, you need to know is whether the future gains are bigger than the current sacrifice. *Discounting* is a tool that allows you to figure this out.
- Companies, like individuals, have different discount rates, determined by their cost of capital. They invest only in projects that earn a return higher than the cost of capital.
- The **NPV rule** states that if the present value of the net cash flows of a project is larger than zero, the project earns **economic profit** (i.e., the investment earns more than the cost of capital).
- Although NPV is the correct way to analyze investments, not all companies use it. Instead, they use breakeven analysis because it is easier and more intuitive.
- **Breakeven quantity** is equal to fixed cost divided by the contribution margin. If you expect to sell more than the breakeven quantity, then your investment will be profitable.
- **Avoidable costs** can be recovered by shutting down. If the benefits of shutting down (you recover your avoidable costs) are larger than the costs (you forgo revenue), then shut down. The **breakeven price** is average avoidable cost.
- If you incur **sunk costs,** you are vulnerable to **post-investment hold-up.** Anticipate hold-up and choose contracts or organizational forms that give each party both the incentive to make sunk-cost investments and to trade after these investments are made.

Multiple-Choice Questions Individual Problems

1. Which of the following will increase the breakeven quantity?
   a. A decrease in overall fixed costs
   b. A decrease in the marginal costs
   c. A decrease in the price level
   d. A increase in price level
2. The higher the interest rates
   a. the more value individuals place on future dollars.
   b. the more value individuals place on current dollars.
   c. the fewer investments will take place.
   d. Does not affect the investment strategy
3. Assume a firm has the following cost and revenue characteristics at its current level of output: price = $10.00, average variable cost = $8.00, and average fixed cost = $4.00. This firm is
   a. incurring a loss of $2.00 per unit and should shut down.
   b. realizing only a normal profit.
   c. realizing an economic profit of $2.00 per unit.
   d. incurring a loss per unit of $2.00, but should continue to operate in the short run.
4. Sarah's Machinery Company is deciding to dump their current technology A for a new technology B with small fixed costs but big marginal costs. The current technology has fixed costs of $500 and marginal costs of $50 whereas the new technology has fixed costs of $250 and marginal costs of $100. At what quantity is Sarah Machinery indifferent between two technologies?
   a. 5
   b. 6
   c. 7
   d. 8
5. What is the net present value of a project that requires a $100 investment today and returns $50 at the end of the first year and $80 at the end of the second year? Assume a discount rate of 10%.
   a. $10.52
   b. $11.57
   c. $18.18
   d. $30.00
6. You expect to sell 500 cell phones a month, which have a marginal cost of $50. If your fixed costs are $5,000 per month, what is the breakeven price?
   a. $10
   b. $50
   c. $60
   d. $100
7. You are considering opening a new business to sell dartboards. You estimate that your manufacturing equipment will cost $100,000, facility updates will cost $250,000, and on average it will cost you $80 (in labor and material) to produce a board. If you can sell dartboards for $100 each, what is your breakeven quantity?
   a. 1,000
   b. 3,500
   c. 4,375
   d. 17,500
8. Which of the following is NOT true if a firm shuts down and produces zero output in the short run?
   a. Variable costs will be zero.
   b. Losses will be incurred.
   c. Fixed costs will be greater than zero.
   d. Fixed costs will be less than zero.
9. What are some of the solutions for a hold-up problem?
   a. Mergers
   b. Contracts
   c. Exchange of "hostages"
   d. All the above

10. Which of the following is classified as a sunk cost?
    a. Cost of the next-best alternative
    b. Additional cost of producing an additional unit
    c. Research costs to determine the implementation of a technology
    d. Total cost of producing a product

Individual Problems

5-1 George's T-shirt Shop

George's T-Shirt Shop produces 5,000 custom-printed T-shirts per month. George's fixed costs are $15,000 per month. The marginal cost per T-shirt is a constant $4. What is his breakeven price? What would be George's breakeven price if George were to sell 50% more shirts?

5-2 Net Present Value

Suppose an initial investment of $100 will return $50/year for three years (assume the $50 is received each year at the end of the year). Is this a profitable investment if the discount rate is 20%?

5-3 Doctor's Human Capital

Probably the most important source of capital is human capital. For example, most medical doctors spend years learning to practice medicine. Doctors are willing to make large investments in their human capital because they expect to be compensated for doing so when they begin work. In Canada, the government nationalized the healthcare system and reduced doctors' compensation. Is this a form of **post-investment hold-up**?

5-4 Solar Panel Installation

A university spent $1.8 million to install solar panels atop a parking garage. These panels will have a capacity of 500 kw, have a life expectancy of 20 years and suppose the discount rate is 10%.

a. If electricity can be purchased for costs of $0.10 per kwh, how many hours per year will the solar panels have to operate to make this project break even?
b. If efficient systems operate for 2,400 hours per year, would the project break even?
c. The university is seeking a grant to cover capital costs. How big of a grant would make this project worthwhile (to the university)?

5-5 Toy Trucks

Last year, a toy manufacturer introduced a new toy truck that was a huge success. The company invested $2.5 million for a plastic injection molding machine (which can be sold for $2.0 million) and $100,000 in plastic injection molds specifically for the toy (not valuable to anyone else). Labor and the cost of materials necessary to make each truck is about $3. This year, a competitor has developed a similar toy that has significantly reduced demand for the toy truck. Now, the original manufacturer is deciding whether they should continue production of the toy truck. If the estimated demand is 100,000 trucks, what is the breakeven price for the toy truck? Should you shut down?

5-6 Running a Hotel During a Recession

In early 2008, you purchased and remodeled a 120-room hotel to handle the increased number of conventions coming to town. By mid-2008, it became apparent that the recession would kill the demand for conventions. Now, you forecast that you will only be able to sell 20,000 room-nights that cost on average $50 per room per night to service. You spent $20 million on the hotel in 2008, and your cost of capital is 10%. The current going price to sell the hotel is $15million. What is your breakeven price?

Group Problems

G5-1 Shutdown Decision

Describe a shutdown decision your company has made. Compute the opportunity costs and benefits of the decision (using breakeven analysis if appropriate). Did your company make the right decision? If not, what would you do differently? Compute the profit consequences of the decision.

G5-2 Investment Decision

Describe an investment decision your company has made. Compute the opportunity costs and benefits of the decision. Did your company make the right

decision? If not, what would you do differently? Compute the NPV of the investment.

G5-3 Post-investment Hold-Up

Describe an investment or potential investment your company (or one of your suppliers or customers) has made that is subject to post-investment hold-up. What could your company do to solve the hold-up problem and ensure the investment gets made? Compute the profit consequences of the solution.

END NOTES

1. The rule of 72 applies in most situations. There is also a rule of 69 for continuous compounding of interest. Neither is precise enough for actual contracts and should only be used for on-the-spot mental calculations.
2. If voters were perfectly rational, they would recognize that most cities are not saving enough to fund their future pension obligations. That they don't seem to care enough about the future has long been recognized by psychologists, and even has a name "hyperbolic discounting." Most people make decisions using discount rates that are much too high. In other words, they place too much weight on the present, and not enough weight on the future. Businesses, like politicians, take advantage of this irrationality by, for example, offering a low "teaser" price and raising price in the future, or by offering a low price on a consumer durable, like a pod-coffee maker, and then charging a high price on the consumables, like the pod. Hyperbolic discounting implies that when deciding whether to purchase the pod-coffee "system," consumers place too much weight on the "current" low price of the machine, and discount too heavily the "future" high price of the pods. By shifting most of the price to the future, where consumers discount them too heavily, the company can increase demand for the system.
3. In later chapters we will analyze situations in which marginal costs are not constant.
4. 0 = Profit
   0 = Revenue – Total Costs
   0 = Revenue – Variable Costs – Fixed Costs
   $0 = (P \times Q) - (MC \times Q) - F$
   $0 = Q(P - MC) - F$
   $F = Q(P - MC)$
   $F/(P - MC) = Q$
   Q = F/(P – MC)
5. If you invest in an asset that loses its value after some period (like designing a new model truck that will become obsolete after eight years), you can adjust your cost of capital to account for the finite life of the investment by using what is known as a debt constant = r/ (1 – (1 / (1 + r) ^ n)), where r is the cost of capital and n is the number of years before the investment loses its value. For example, if the investment loses its value after eight years, then the debt constant is approximately 15% for a 5% cost of capital.
6. We can represent the different technologies by the following two cost functions:
   $Cost_1 = 100 + 10Q$
   $Cost_2 = 50 + 20Q$

   And solve for the breakeven point by equating costs:

   $Cost_1 = Cost_2$
   $100 + 10Q = 50 + 20Q$
   $50 = 10Q$
   $Q = 5$
7. This was the first big case for one naive but enthusiastic young economist.
8. Profit = Revenue – Cost
   $= (P \times Q) - (AC \times Q)$, where AC = Average Cost = (Total Cost)/Q = $(P - AC)Q$

   Note that if price is less than average cost, profit will be negative.

9. *Revenue < Avoidable cost*
   Revenue/Q < (Avoidable cost)/Q
   Price < Avg. Avoidable Cost
10. Ivan Png, *Managerial Economics* (Maiden, MA: Blackwell, 1998).
11. Average Avoidable Cost = (Fixed Cost + Average Avoidable Cost $\times$ Q)IQ = ($100 + $5 $\times$ 100)/100 = $6.
12. Industrial lubricants are very costly to produce. One 55-gallon barrel of oil yields just two quarts of lubricant.
13. Average Cost = ($12,000,000 + $2,000,000)/(2,000,000) = $7.
14. However, now the magazine can be held up by the printer and may be reluctant to buy the machine unless the printer can reassure the magazine that it will not be held up.
15. Requirements contracts "require" that one party purchase a certain percentage of its materials from the other party.
16. The weakening of the marriage contract in the United States, dramatically reducing penalties for post-investment hold-up, allows a test of this contractual view of marriage. Following the change, we would expect less relationship-specific investment, like the investment in children. Corresponding to the weakening of the contract, we have seen a decline in fertility rates. Couples are having fewer children and having them later in life, when it is easier to drop in and out of the labor market.

SECTION 2

Pricing, Costs, and Profits

CHAPTER 6

Simple Pricing

In 1968, Mattel introduced the inexpensive and wildly popular Hot Wheels line of toy cars. Forty years and four billion cars later, the suggested retail price of the classic Hot Wheels car had never budged above $1 even as production costs continued to climb, squeezing margins. Eventually, some interns working for Mattel suggested that they double both the wholesale price and suggested retail price of the cars.

Initially, Mattel executives balked, reportedly claiming that a price increase could devastate sales. Eventually, Mattel did increase its prices slightly to test the waters and evaluate the wisdom of price adjustments. Shortly following the move, Mattel reported one of its most successful quarters, with revenues unchanged from a year earlier but profits rising by 20%.[1]

Pricing is a powerful but oft-neglected tool. We all know that Profit = (P – C) x Q, but many businesses seem to focus on Q or C and forget about P. Think about companies you've worked for—I suspect they spent most of their time thinking about how to sell more or how to reduce costs and not much time thinking about how to raise price. This is a mistake. According to Roger Brinner, Chief Economist at The Parthenon Group, most companies can make money simply by raising price.[2] Theory suggests that he is correct. For a company with a pretax profit margin of 8.6% (the average for the S&P 500, including fixed costs), sales would have to increase by 4% to get the same profit effect as a 1% increase in price.

In this chapter, we consider "simple pricing," the case of a single firm, selling a single product, at a single price. Although this kind of pricing is rare because most firms sell multiple products, at different prices, and in competition with rivals, it is important to understand simple pricing before moving on to more complex settings. In addition, this simple pricing model has become part of the business vernacular, and it is important to understand it if you are to communicate well with your co-workers. In this chapter, we introduce demand curves, use marginal analysis to choose the most profitable price, and then talk about how firms price in practice.

BACKGROUND: CONSUMER VALUES AND DEMAND CURVES

Let's consider a simplified relationship between price and quantity purchased by a single consumer, using some good, like a slice of pizza. Table 6-1 shows the number of slices the consumer will purchase at various prices.

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

Suppose the consumer values that first slice at $5, the second at $4, the third at $3, and so on. Knowing the value our consumer places on each subsequent slice allows us to construct Table 6-2, which shows marginal value and total value for the various quantities. For the first slice, the total and marginal values are the same, both equal to $5. For the second slice, the marginal value is $4, while the total value of consuming two slices is $9 = $5 + $4. For the third slice, the marginal value is $3, and the total value is $12 = $5 + $4 + $3, and so on.

Because how much to buy is an extent decision, *thinking in marginal terms is critical*. For example, suppose you just looked at the fact that five slices have a total value of $15. You might be tempted to conclude that if slices were priced at $3, the consumer would purchase five slices since 5 x $3 = $15. Thinking in marginal terms, however, shows us that the marginal value of the fourth slice is only $2, less than the price of $3, so the consumer will not purchase it. If consumers behave optimally, they will try to maximize the surplus they get from consuming slices, the difference between their value and the price they pay. Purchasing three slices at $3 each leads to **consumer surplus** of $3 (total value of $12 less expenditure of $9). Purchasing five slices at $3 each would lead to consumer surplus of zero.

TABLE 6.1

Pizza Demand Schedule

Slice Price	Slices Purchased
$5	1
$4	2
$3	3
$2	4
$1	5

We can link our two tables to get a measure of how much our consumer gains from eating pizza slices. If the consumer pays less than the total value of the slices, he or she has

TABLE 6.2
Pizza Value Table

Slices Purchased	Marginal Value	Total Value
1	$5	$5
2	$4	$9
3	$3	$12
4	$2	$14
5	$1	$15

consumer surplus. Table 6-3 shows the amount of consumer surplus for different numbers of slices 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 to consider the case where each consumer wants only a single item (i.e., the marginal value of a second unit is zero). To construct a demand curve that describes the behavior of seven buyers, we 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;[3] 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 6.3
Pizza Consumer Surplus

Slice Price	Slices Purchased	Total Price Paid	Total Value	Surplus
$5	1	$5	$5	$0
$4	2	$8	$9	$1
$3	3	$9	$12	$3
$2	4	$8	$14	$6
$1	5	$5	$15	$10

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

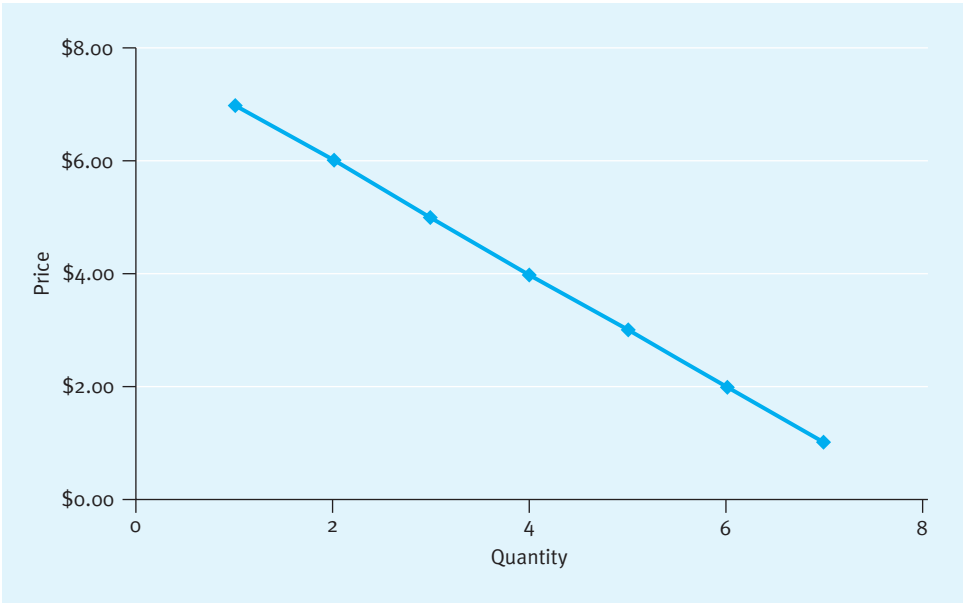


FIGURE **6.1 Demand Curve**

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 causes an increase in demand, we instead say that the "demand shifts" to the right, or "demand increases," such that consumers purchase more 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. We use demand curves to change the pricing decision ("what price should I charge") into a quantity decision ("how much should I sell?") that we already know how to solve using marginal analysis. If marginal revenue (MR) is greater than marginal cost (MC),[4] sell more, and you do this by reducing price.

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 simple market 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 marginal profit on the first sale would be $5.50.

If we reduce price to $6, two consumers purchase, so revenue goes up from $7 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 only $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: at a price of $5, we sell three units.

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

Price	Quantity	Revenue	MR	MC	Profit
$7.00	1	$7.00	$7.00	$1.50	$5.50
$6.00	2	$12.00	$5.00	$1.50	$9.00
$5.00	3	$15.00	$3.00	$1.50	$10.50
$4.00	4	$16.00	$1.00	$1.50	$10.00
$3.00	5	$15.00	–$1.00	$1.50	$7.50
$2.00	6	$12.00	–$3.00	$1.50	$3.00
$1.00	7	$7.00	–$5.00	$1.50	–$3.50

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.[5] 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 you may be shaking your head and wondering why you have to learn about things you will 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 recomputing 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 surveying potential consumers 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*.

Price elasticity of demand (e) = (% *change in quantity demanded)*/(% *change in price)*

Price elasticity measures the sensitivity of quantity to price. 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.

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 Wal-Mart. 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 $(Q_1 + Q_2)/2$:

Price Elasticity Estimator:[6] $[(Q_1 - Q_2)/(Q_1 + Q_2)] \div [(P_1 - P_2)/(P_1 + P_2)]$

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

$$[(210 - 420)/(210 + 420)] \div [(1.79 - 1.50)/(1.79 + 1.50)]$$

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.[7] The change in revenue associated with the change is

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

What this experiment shows is that for elastic demand, if you reduce price, revenue goes up.

Elasticity is important because it tells you how revenue changes as you change price, as the following approximation shows:

$$\%\Delta\text{Revenue} = \%\Delta\text{Price} + \%\Delta\text{Quantity}^{8}$$

The symbol %Δ 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. Tables 6-5 and 6-6 follow from this equation.

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)

When demand is elastic, quantity changes by a greater percentage than price, so revenue will rise following a price decrease and fall following a price increase.

On the other hand, if you increase price when demand is elastic, revenue will go down (top row of Table 6-5). To illustrate, let's look at Mayor Marion Barry's tax increase on gasoline sales in the District of Columbia. Before the tax was put into law, D.C. gas station owners argued against it, predicting that the 6% price increase would reduce quantity by 40%. Indirectly, the gas station owners were arguing that the price elasticity of demand for gasoline sold in the District was –6.7. Because of this very elastic demand, the gas station owners predicted that gasoline revenue, and the taxes collected out of revenue, would decline.

In fact, after the tax was instituted, quantity fell by 38%, very close to what gas station owners had predicted. Sure enough, tax revenue fell, as would be predicted in the top row of Table 6-5.

The exact numerical relationship between marginal revenue (change in revenue) and elasticity is $MR = P(1 - 1/|e|)$.[9] We can use this formula to express the marginal analysis rule—reduce price if MR > MC, and increase price if MR < MC—using price elasticity in place of marginal revenue:

MR > MC means that $(P - MC)/P > 1/|e|$.

This expression has an intuitive interpretation. The left side of the expression is the *current margin* of price over marginal cost, (P – MC)/P, whereas the right side is the *desired margin,* which is the inverse elasticity, 1/|*e*|. If the current margin is greater than the desired margin, reduce price because MR > MC, and vice versa. Intuitively, the more elastic demand becomes (1/|*e*| becomes smaller), the less you can raise 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 margin over marginal cost was 2.7%, which is much less than the desired margin 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 gain an understanding for what would make demand more or less elastic. In this section, we list five factors that affect demand elasticity and optimal pricing.

Products with close substitutes have more 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. This is why revenues fell when Mayor Barry raised the price of gasoline by 6%. Since D.C. has many commuters, they began purchasing gasoline in nearby Virginia and Maryland.

In a similar vein, we see that individual brands, such as Nike, have closer substitutes (other brands) than do aggregate product categories that include the brands, such as shoes. This leads to our next factor.

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/.20) = –2. Using our optimal pricing formula, this would give Nike a desired margin of 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 too 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. This becomes an important consideration for goods that are typically purchased with other goods, like computers, operating systems,

and applications. One of the reasons that the demand for iPhones is less elastic is due to the number of applications that run on them. If the price of an iPhone increases, you are less likely to substitute to another product, due to the complementary apps.

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 fourth factor:

In the long run, demand curves become more elastic.

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 (short run) but avoided the higher-priced ATMs in the future (long run).

Our final factor 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.

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 less elastic. 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:

$$\%\Delta Quantity \approx e(\%\Delta Price)^{10}$$

For example, if the price elasticity of demand is –2, and price goes up by 10%, then quantity is forecast to decrease 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:

Factor elasticity of demand = (% change in quantity) ÷ (% 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, Wal-Mart'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. For example, two-liter Coke is a good substitute for one-liter Coke

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 which 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 breakeven 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.

Let's go back to the Mattel's pricing question from the beginning of this chapter: Should they double the price of their Hot Wheels cars? Imagine that it costs Mattel 50 cents

to manufacture, package, and distribute a car, which it currently sells to retailers for 75 cents. If Mattel were to double the wholesale price to $1.50, the profit per car would increase *fourfold* from 25 cents to $1.25. This means that Mattel could lose three-fourths of its customers and still earn the same profit that it earned prior to the price increase. Thus, Mattel's stay-even quantity for a 100% increase in price is a 75% decrease in quantity. Since quantity fell by less than 75%, the price increase was profitable.

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 margin = $(P - MC)/P$.[11] If you are considering a price increase, and the predicted quantity decrease is smaller than the stay-even quantity decrease, the price increase is profitable. Stay-even analysis tells us what quantity changes support a change in price. Our elasticity estimates tell us what quantity changes are likely to be.

COST-BASED PRICING

Our expressions for optimal pricing, MR = MC or $(P - MC)/P = 1/|e|$, take into account both a firm's cost structure and its consumers' demand to obtain the optimal price. Yet, many companies set prices based only on the cost component, ignoring consumer demand entirely. For example, cost-plus pricing arrives at a price by adding a fixed dollar margin to the cost of each product, while mark-up pricing multiples the cost by a fixed number greater than 1. It doesn't take much analysis to see that ignoring consumer demand leads to suboptimal pricing—just imagine cost-based pricing applied to diamonds, wine, movie tickets, or bottled water. Without comparing costs to demand, we cannot know if goods are priced optimally.

To understand why cost-based pricing persists, we apply the second question in our problem-solving paradigm: Does the decision maker have enough information to make a good decision? In one survey of managers, most reported that they are well informed about their own costs, but much fewer than half reported being well-informed about demand.[12] Part of the reason for this is historical accident. Tax compliance required firms to have cost accountants, and since these cost data were there anyway (though using accounting—not economic—costs), pricing managers used them. A firm that takes its profitability (and pricing) seriously needs a "demand accounting" (market research) division, too.

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 MR > MC. Increase price (reduce quantity) if MR < MC. The optimal price is where MR = MC.
- **Price elasticity of demand,** e = (% change in quantity demanded) ÷ (% change in price)
  1. Estimated price elasticity = $[(Q_t - Q_2)/(Q_1 + Q_2)] \div i(P_1 - P_2)/(P_1 + P_2)]$ is used to estimate demand from a price and quantity change.
  2. 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.

	ΔRevenue
Price ↑	–
Price ↓.	+

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

	ΔRevenue
Price ↑	+
Price ↓.	–

- MR > MC implies that (P – MC)/P > 1/|e|; that is, the more elastic is demand, the lower the optimal price.
- Five factors that affect elasticity:
  1. Products with close **substitutes** have more elastic demand.
  2. Products with may **complements** have less elastic demand.
  3. Demand for brands is more elastic than industry demand.
  4. In the long run, demand becomes more elastic.
  5. 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.
- %ΔQuantity = (factor elasticity)(%ΔFactor).
- **Stay-even analysis** can be used to determine the quantity change required to offset a price change. The stay-even quantity is %ΔQ = %ΔP/(%ΔP + margin).
- A proposed price increase is profitable if the predicted quantity loss is less than the stay-even quantity.

Multiple-Choice Questions

Individual Problems

1. Jim has estimated elasticity of demand for gasoline to be –0.7 in the short run and –1.8 in the long run. A decrease in taxes on gasoline would
   a. lower tax revenue in both the short and long run.
   b. raise tax revenue in both the short and long run.
   c. raise tax revenue in the short run but lower tax revenue in the long run.
   d. lower tax revenue in the short run but raise tax revenue in the long run.
2. Which one of the following is true?
   a. Nike has a less elastic demand curve than shoes.
   b. The demand curve for gas is more elastic in the short-run than in the long run.
   c. Cigarettes have a more elastic demand than televisions.
   d. Salt has a less elastic demand than ice cream.
3. Jim recently graduated from college. His income increased tremendously from $5,000 a year to $60,000 a year. Jim decided that instead of renting he will buy a house. This implies that
   a. houses are normal goods for Jim.
   b. houses are inferior goods for Jim.
   c. renting and owning are complementary for Jim.
   d. Need information on the price of houses
4. Which of the following goods has a negative income elasticity of demand?
   a. Cars
   b. Items from Dollar stores
   c. Shoes
   d. Bread
5. An economist estimated the cross-price elasticity for peanut butter and jelly to be 1.5. Based on this information, we know the goods are
   a. inferior goods.
   b. complements.
   c. inelastic.
   d. substitutes.
6. Christine has purchased five bananas and is considering the purchase of a sixth. It is likely she will purchase the sixth banana if
   a. the marginal value she gets from the sixth banana is lower than its price.
   b. the marginal benefit of the sixth banana exceeds the price.
   c. the average value of the sixth banana exceeds the price.
   d. the total personal value of six bananas exceeds the total expenditure to purchase six bananas.

7. Buyers consider Marlboro cigarettes and Budweiser beer to be complements. If Marlboro just increased its prices, what would you expect to occur in the Budweiser market?
   a. Demand would rise, and Budweiser would reduce price.
   b. Demand would fall, and Budweiser would reduce price.
   c. Demand would fall, and Budweiser would increase price.
   d. Demand would rise, and Budweiser would increase supply.
8. Which of the following is the reason for the existence of consumer surplus?
   a. Consumers can purchase goods that they "want" in addition to what they "need."
   b. Consumers can occasionally purchase products for less than their production cost.
   c. Some consumers receive temporary discounts that result in below-market prices.
   d. Some consumers are willing to pay more than the price.
9. A bakery currently sells chocolate chip cookies at a price of $16 per dozen. The marginal cost per dozen is $8. The cookies are becoming more popular with customers, and so the bakery owner is considering raising the price to $20/dozen. What percentage of customers must be retained to ensure that the price increase is profitable?
   a. 28.0%
   b. 33.3%
   c. 66.6%
   d. 72.0%
10. Suppose your firm adopts a technology that allows you to increase your output by 15%. If the elasticity of demand is –3, how should you adjust price if you want to sell all of your output?
   a. 5% lower.
   b. 0.5% lower.
   c. 15% higher.
   d. 15% lower.

Individual Problems

6-1 Elasticity of T-shirt Sales

George has been selling 5,000 T-shirts per month for $8.50. When he increased the price to $9.50 he sold only 4,000 T-shirts. What is the demand elasticity? If his marginal cost is $4 per shirt, what is his desired markup and what is his initial actual markup? Was raising the price profitable?

6-2 Demand Curves with Same Values

Suppose there are 10 individuals with values as follows: {10, 8, 8, 8, 8, 8, 8, 4, 0, 0}.

Construct a demand schedule (table), and calculate the marginal revenue of the second unit sold.

6-3 Increasing Movie Ticket Prices

To conduct an experiment, AMC increased movie ticket prices from $9.00 to $10.00 and measured the change in ticket sales. Using the data over the following month, they concluded that the increase was profitable. However, over the subsequent months, they changed their minds and discontinued the experiment. How did the timing affect their conclusion about the profitability of increasing prices?

6-4 Nike Demand (inelastic)

If demand for Nike running shoes is inelastic, should Nike raise or lower price?

6-5 Promotional Pricing

An end-of-aisle price promotions changes the price elasticity of a good from –2 to –3. If the normal price is $10, what should the promotional price be?

6-6 Bar Nuts

Why do bars offer free peanuts?

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.

END NOTES

1. Matt Townsend, "Mattel Surges Most Since 2009 as Prices Fuel Profit," *Bloomberg*, July 17, 2012, http://www.bloomberg.com/news/2012-07-17/mattel-surges-most-since-2009-as-prices-fuel-profit.html.
2. See Roger Brinner, "Pricing: The Neglected Orphan," *Parthenon Perspectives*.
3. Don'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.
4. Marginal profit = $MR - MC$ and is the extra profit from selling one more unit.
5. Profit = Revenue – Cost = $Q^*(P - AC)$, where AC is average cost.
6. 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.
7. Note that if we used the initial price and quantity to compute the percentage changes, the calculation would be [(210 – 420)/210]/[($1.79 – $1.50)/$1.79] or –100%/16.2%; that is, –6.2.
8. This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.
9. MR = ΔRevenue/ΔQ = Δ(PQ)/ΔQ = (ΔPQ + ΔQP)/ΔQ = $P(1 - 1/|e|)$. The symbol Δ means "change in."
10. This is a first-order approximation and will work well for small changes. The approximation does not work well for large changes.
11. This is just one of many equivalent formulas. The important thing to note is that any stay-even formula ensures that the profit before and after the price change is the same.
12. Robert J. Doan and Hermann Simon, *Power Pricing* (New York: Simon & Schuster, 1996).

CHAPTER 7

Economies of Scale and Scope

In 1906, three entrepreneurs launched the French Battery Company in Madison, Wisconsin. Its early growth was driven by the demand for radio batteries, and its most successful product was the Ray-O-Vac battery, leading the firm to change its name to Rayovac Company in 1930. Over the next 60 years, it grew to become one of the top three battery producers in the United States along with Duracell and Energizer.

In 1996, the company was acquired by the Thomas H. Lee Company, a Boston-based private equity firm. After making an initial public offering the following year, the company took advantage of easy credit availability to expand via acquisition. It purchased battery manufacturers BRISCO G.M.B.H., ROV Limited, VARTA AG, Direct Power Plus, and Ningbo Baowang. Part of the motivation for acquiring the other battery manufacturers was to increase the company's size to take advantage of "efficiencies and economies of scale" according to Rayovac's CEO. Company managers expected that as they produced more of the same good, average costs would fall.

The company also purchased a variety of unrelated companies. In 2003, Rayovac purchased Remington Products (electric razors); in 2005, it bought United Industries Corporation (lawn and garden care, household insect control, and pet supplies); in 2005, it purchased Tetra Holding G.M.B.H., a German supplier of fish and aquatic supplies. To reflect its position as a provider of a broad portfolio of products, the company changed its name to Spectrum Brands in 2005. Managers often justified their expansions into these unrelated areas with claims of cost savings. For example, as part of its acquisition of United Industries, company executives announced that they anticipated "synergies" of around $75 million. By synergies, they meant that the cost of producing the different products offered by the separate companies would be less expensive when produced by one company. According to the former CEO of United who became head of North American operations after the acquisition, "we believed that there would be synergies, better performance, and all that." Unfortunately, it is much easier to describe synergies than it is to capture them, and too often they are used to justify acquisitions that enrich management at the expense of shareholders. In February 2009, Spectrum entered bankruptcy.[1]

In this chapter, we examine the two types of synergies described in the above story, economies of scale and scope, and show you how to exploit them. This is especially important if your company is following a cost leadership strategy, but managers should

always be looking for ways to cut costs, regardless of whether it is their explicit strategy. A reduction in average cost translates to an immediate increase in profit (recall that Profit = (Price – Average Cost)*Quantity). If marginal cost (MC) goes down as well, you get an "extra" increase in profit from the increase in output; recall that if MC falls below marginal revenue (MR), it becomes profitable to increase output.

Many business decisions, like breakeven analysis, can be made using very simple characterizations of cost (like a fixed cost plus a constant per-unit cost). With economies of scale or scope, however, decision making may require more complex (and realistic) cost functions. In this section, we will examine decision making in the presence of economies of scale and scope.

INCREASING MARGINAL COST

Most firms will eventually face increasing average costs as they try to increase output. The firm finds that each extra unit of output requires more inputs to produce than previous units. This phenomenon arises from a variety of factors collectively called the *law of diminishing marginal returns*.

> *The* ***law of diminishing marginal returns*** *states that as you try to expand output, your marginal productivity (the extra output associated with extra inputs) eventually declines.*

Diminishing marginal returns occur for a variety of reasons, among them the difficulty of monitoring and motivating larger workforces, the increasing complexity of larger systems, or the "fixity" of some factor. In popular jargon, these are known as "bottlenecks." More generally, bottlenecks arise when more workers, or any variable input, must share a fixed amount of a complementary input. When productivity falls from bottlenecks, costs increase.

> *Diminishing marginal productivity implies increasing marginal cost.*

If more inputs are needed to produce each extra unit of output, then the cost of producing these extra units—the marginal cost—must increase. And once the marginal cost rises above the average cost, the average will rise as well.

> *Increasing marginal costs eventually lead to increasing average costs.*

Just as a baseball player's season batting average will rise if his game batting average is above his season batting average, so too does average cost rise if marginal cost is above the average.

In Figure 7-1, the rising average cost of production implies that marginal cost is above average cost.

In the presence of fixed costs, increasing marginal cost gives you a U-shaped average cost curve (shown in Figure 7-2). The curve initially falls due to the presence of fixed costs, but then it rises due to increasing marginal costs.

Knowing what your average costs look like will help you make better decisions. In 1955, Akio Morita brought his newly invented $29.95 transistor radio to New York. He shopped it around, and after turning down an original equipment manufacturer (OEM) deal from Bulova, he eventually found a retailer that would sell it under his "Sony" brand name. The problem was that the retailer had a chain of around 150 stores and wanted to buy 100,000 radios, 10 times more than Mr. Morita's capacity. Mr. Morita turned the offer down. He knew that he would lose money producing 100,000 units because increasing output would require hiring and training more workers and an expansion of facilities, raising his average cost or breakeven price.

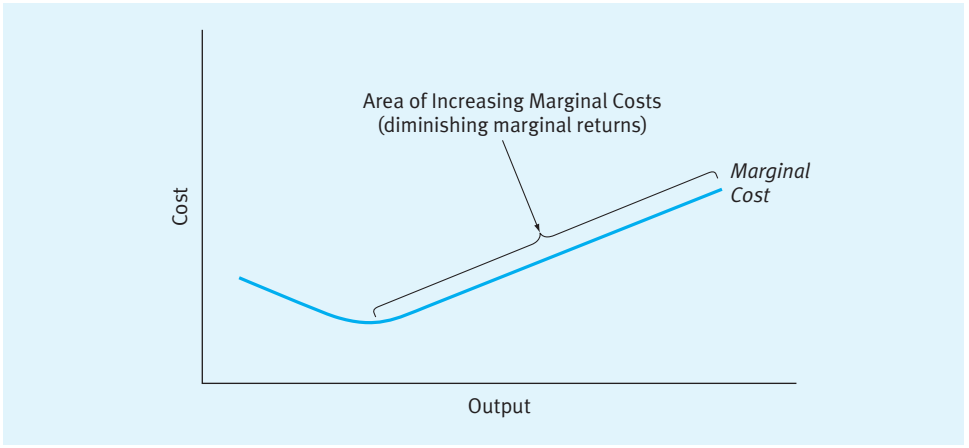


FIGURE **7.1 Diminishing Marginal Returns**

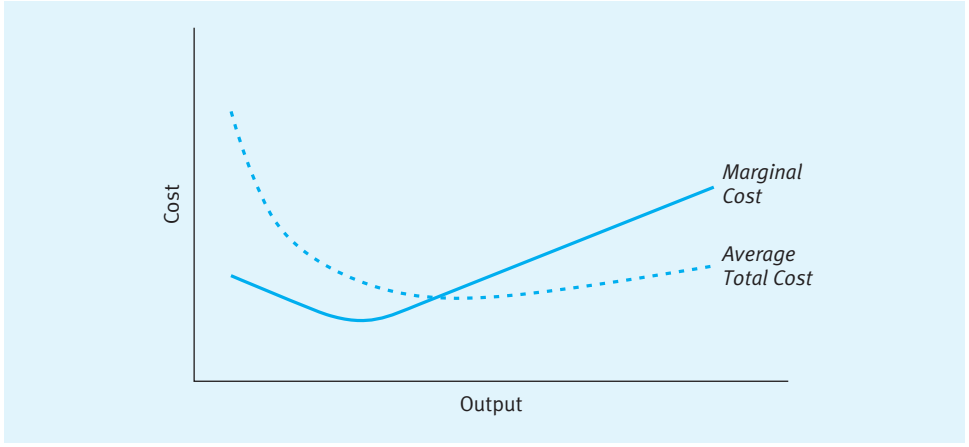


FIGURE **7.2 U-Shaped Average Cost Curve**

After being turned down, the retailer agreed to settle for 10,000 units at the lowest unit price, and the rest is history. The Sony brand radios became very popular, and the company evolved into the giant electronics firm it is today. The moral of the story is know what your costs look like—otherwise, you could end up making unprofitable deals. In this case, using a more realistic cost function, Morita was able to compute his breakeven prices, allowing him to bargain effectively with the retail chain.[2]

ECONOMIES OF SCALE

The law of diminishing marginal returns is primarily a short-run phenomenon arising from the fixity of at least one factor of production, like capital or plant size. In the long run, however, you can increase the size of the plant, hire more workers, buy more machines,

and remove production bottlenecks. In other words, your "fixed" costs become "variable" in the long run.

If long-run average costs are constant with respect to output, then you have ***constant returns to scale.***
If long-run average costs rise with output, you have ***decreasing returns to scale*** *or* ***diseconomies of scale.***
If long-run average costs fall with output, you have ***increasing returns to scale*** *or* ***economies of scale.***

One of the reasons the "big-box" retail stores, like Staples and Office Depot, are successful is that they sell so many units that their suppliers enjoy scale economies. Competition among the suppliers for the right to supply these office superstores allows the superstores to capture most of profit emanating from these scale economies in the form of lower input prices. Big-box retailers are able to offer the supplier all of its demand (e.g., in an exclusive arrangement), which in turn allows the supplier to realize economies of scale.

Economies of scale have had a dramatic effect on the structure of the poultry industry in the United States.[3] In 1967, a total of 2.6 billion chickens and turkeys were processed in the United States. By 1992, that number had increased to nearly seven billion. Despite this large increase, the number of processing facilities dropped from 215 to 174. The share of shipments of plants with over 400 employees grew from 29% to 88% for chicken production and from 16% to 83% for turkey production over the same period. The shift in the structure of the industry was due largely to changes in technology, which reduced costs of processing poultry in larger plants.

It is important to realize, however, that the same factors (i.e., the fixity of some input) that cause diminishing marginal returns in the short run can also cause decreasing returns to scale in the long run. Often, the managerial structure of the company does not scale beyond a certain point. Management is an important input into the production processes; and as the company grows, so do the problems of coordination, control, and monitoring. Managers often behave as if they have a fixed amount of decision-making capability, so giving them more decisions often leads to managerial bottlenecks that raise costs.

Knowing whether your long-run costs exhibit constant, decreasing, or increasing returns to scale can help you make better long-run decisions. If your long-run costs exhibit increasing returns to scale, securing big orders allows you to reduce average costs.

LEARNING CURVES

Learning curves are characteristic of many processes. That is, when you produce more, you learn from the experience; then, in the future, you are able to produce at a lower cost. Learning curves mean that current production lowers future costs, which has important strategic consequences. Here the maxim "Look ahead and reason back" is particularly important.

For example, every time an airplane manufacturer doubles production, marginal cost decreases by 20%. If the first plane costs $100 million, then the second will cost $80 million, the fourth will cost $64 million, the eighth will cost $51.2 million, and so on. In Table 7-1, we illustrate such a learning curve.[4]

To see how learning curves affect decision making, put yourself in American Airlines' place, when they were negotiating with Boeing to purchase airplanes. From Boeing's point of view, a big order from the world's largest airline would allow it to "walk down

TABLE **7.1**

Airplane Manufacturing Costs

Quantity	Marginal Cost ($M)	Total Cost ($M)	Average Cost ($M)
1	100.0	100.0	100.0
2	80.0	180.0	90.0
3	70.2	250.2	83.4
4	64.0	314.2	78.6
5	59.6	373.8	74.8
6	56.2	429.9	71.7
7	53.4	483.4	69.1
8	51.2	534.6	66.8
9	49.3	583.9	64.9
10	47.7	631.5	63.2

its learning curve," as shown in Figure 7-3, and reduce the costs of future production. However, American knows that its order will allow Boeing to reduce costs for future sales and wants to capture some of Boeing's increased profit.

If American knew exactly how many planes Boeing would make over the lifetime of the airplane, they could offer a price at Boeing's average cost. For example, if Boeing expected to produce eight units, American could offer $66.8 million per plane, and Boeing would break even on the order over the lifetime of the model. But if the lifetime production is not known, then American must pursue other strategies. For example, American could ask for "kickbacks" on sales of future Boeing planes; however, this request may violate European

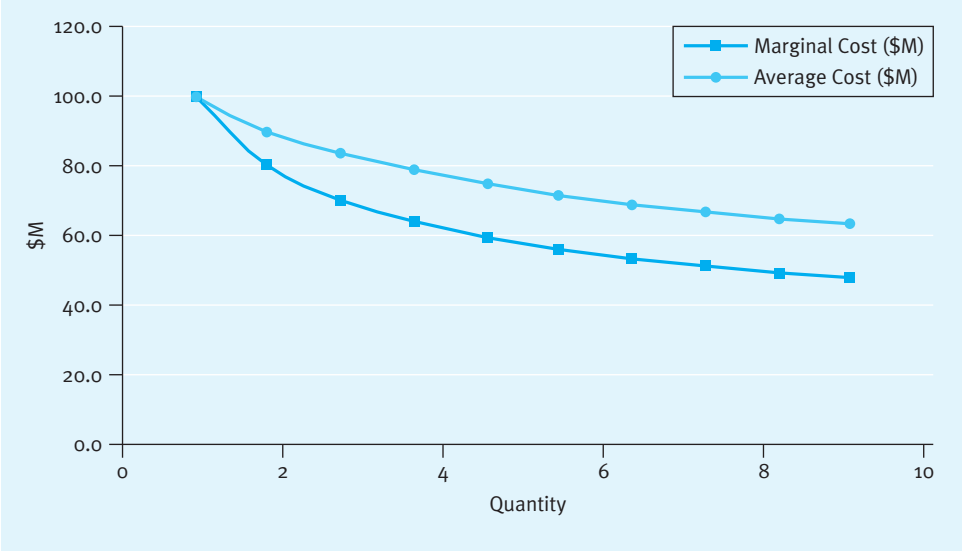


FIGURE **7.3 Airplane Manufacturing Learning Curve**

or U.S. antitrust laws. Alternatively, since stock prices reflect future earnings, American could ask for a percentage of the increase in Boeing's stock market value following announcement of the deal; such a request would be equivalent to buying call options to purchase Boeing stock before beginning negotiations. When Boeing's stock value increased because of the order, the value of the call options would also increase. These strategies may violate securities laws on insider trading, so be sure to get legal advice before trying something like this.

Instead, American offered to purchase planes exclusively from Boeing over the next 30 years in exchange for a very favorable price. Note the similarity of this solution to those of the big-box retailers. By offering exclusivity, American guaranteed Boeing a big chunk of demand that would lower costs. Boeing was willing to give American a very good deal in exchange for such a guarantee.

As a strange footnote to this story, in 1998, Boeing tried to acquire rival McDonnell-Douglas. The European Commission antitrust authority objected because Boeing's large European competitor, Airbus, objected to the long-term exclusive contracts as anticompetitive. Airbus claimed Boeing's exclusive contracts prevented it from competing for American's business. To complete its purchase of McDonnell-Douglas, Boeing agreed not to enforce its exclusive contracts with American, leaving American free to purchase from Airbus if it so chose.

ECONOMIES OF SCOPE

Gibson Guitar traditionally used rosewood for fingerboards on its less expensive Epiphone guitars and reserved ebony for its high-end Gibson brand. Both rosewood and ebony are excellent tone woods, but ebony is preferred for its distinct sound and pure black appearance. A significant number of ebony fingerboard blanks are rejected for use on the Gibson brand guitars because carving of the fingerboard reveals brown streaks in the otherwise pure black wood. The percentage of fingerboards rejected has increased steadily over the past 10 years as the world supply of streak-free ebony has shrunk.

Gibson Guitar began installing these streaked blanks on its lower-end instruments. The buyers perceive the streaked ebony fingerboard as an upgrade over rosewood. Their ability to use discarded ebony in its Epiphone guitars gives Gibson both a cost and quality advantage over rivals that produce only high-end or only low-end instruments. In this case, we say there are economies of scope between production of high-end and low-end guitars.

If the cost of producing two products jointly is less than the cost of producing those two products separately—that is,

$$\text{Cost}(Q_1, Q_2) < \text{Cost}(Q_1) + \text{Cost}(Q_2)$$

—then there are **economies of scope** between the two products.

Obviously, you want to exploit economies of scope by producing both Q_1 and Q_2. This is a major cause of mergers. For example, about eight years ago, we saw a consolidation in the food distribution business. Companies like Kraft, Sara Lee, and ConAgra sell a variety of meat products, hot dogs, sausage, and lunchmeats because they can derive economies of scope by distributing these products together. Once you set up a distribution network, you can easily pump more products through the network without incurring additional costs.

These low costs were putting pressure on their competitors, in particular, a regional breakfast sausage manufacturer in 1997. The firm used 18 trucks and a single distribution center serving retail customers located in 21 southern and midwestern states. Unfortunately, the demand for breakfast sausage is seasonal, with a peak in November and December. During the heavy winter months, the firm must pay outside carriers a premium to handle excess product, but for the other eight months, it must idle half of its trucking fleet.

Because the firm sells only a single product—breakfast sausage—it cannot exploit the scope economies associated with distributing a full product line. The firm has several choices. It could acquire other companies so that it has a full product line to distribute. It could sell out to one of the larger, full-line companies, like ConAgra. Such a company could exploit the scope economies associated with distribution, thus placing a higher value on the firm. Or it could outsource its distribution function. Several regional and nationwide distribution companies distribute a variety of food products, and these companies could take advantage of scope economies by distributing a full portfolio of meat products.

Our sausage maker eventually decided to outsource its distribution. However, after it sold its trucking fleet, it was held up by the distributor. Outsourcing was a good idea, but poorly executed.

DISECONOMIES OF SCOPE

Production can also exhibit diseconomies of scope if the cost of producing two products together is higher than the cost of producing them separately. In this case, you reduce costs by paring down the product line. AnimalSnax, Inc., makes pet food on extruder lines in 23 plants. This manufacturer has a variety of customers, from large retailers like Wal-Mart to small mom-and-pop pet stores. Currently, the firm produces 2,500 different products, or stock-keeping units (SKUs), using 200 different formulas. All customers pay about the same price per ton. Recently, however, some of the large customers have demanded price concessions.

These requests worry the firm because of the so-called *80-20 rule*: According to this rule of thumb, 80% of a firm's profit comes from 20% of its customers. Because big customers (the 20%) order in bulk, the manufacturer can set up its extruders for long production runs. These big orders are much more profitable than smaller orders because all orders require the same setup time regardless of the amount produced and packaged.

To reduce the costs associated with smaller orders, AnimalSnax reduced the variety of its product offerings to 70 SKUs, using only 13 different formulas. The firm also began offering price discounts for larger orders. Although some smaller customers were upset about being forced to use new formulas, most were willing to switch. This allowed the company to consolidate small orders into large ones to reduce setup costs.

Typical savings for one extruder line are illustrated in Figure 7-4. Under the new approach, the same amount of pet food that had been produced in one 8-hour shift could now be produced in just six hours. This dramatic increase in productivity (25%) also allowed the company to close several of its 23 plants.

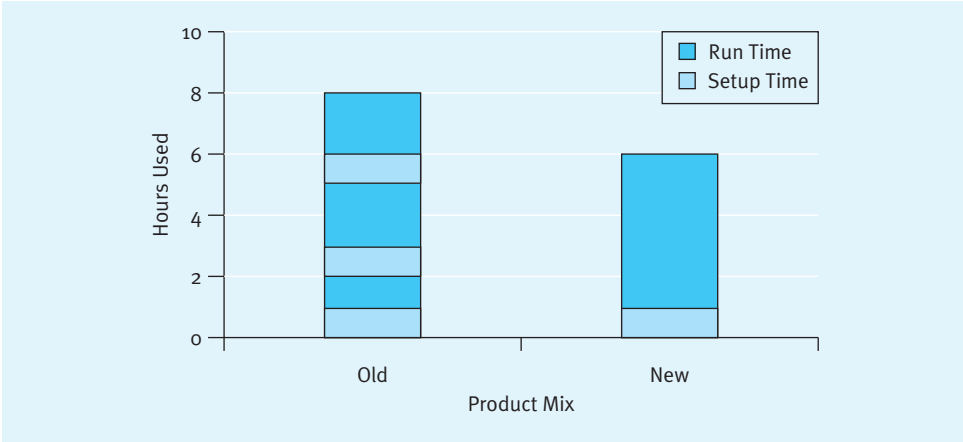


FIGURE **7.4 Pet Food Extruder Line Operation Times**

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- The **law of diminishing marginal returns** states that as you try to expand output, your marginal productivity (the extra output associated with extra inputs) eventually declines.
- **Increasing marginal costs** eventually cause increasing average costs and make it more difficult to compute breakeven prices. When negotiating contracts, it is important to know what your cost curves look like; otherwise, you could agree to unprofitable deals.
- If average cost falls with output, then you have **increasing returns to scale.** In this case you want to focus strategy on securing sales that enable you to realize lower costs. Alternatively, if you offer suppliers big orders that allow them to realize **economies of scale,** try to share in their profit by demanding lower prices.
- If your average costs are constant with respect to output, then you have **constant returns to scale.** If average costs rise with output, you have **decreasing returns to scale** or **diseconomies of scale.**
- **Learning curves** mean that current production lowers future costs. It's important to look over the life cycle of a product when working with products characterized by learning curves.
- If the cost of producing two outputs jointly is less than the cost of producing them separately—that is, $\text{Cost}(Q_1, Q_2) < \text{Cost}(Q_1) + \text{Cost}(Q_2)$—then there are **economies of scope** between the two products. This can be an important source of competitive advantage and can shape acquisition strategy.

Multiple-Choice Questions

1. Microsoft found that instead of producing a DVD player and a gaming system separately, it is cheaper to incorporate DVD playing capabilities in their new version of the gaming system. Microsoft is taking advantage of
   a. economies of scale.
   b. learning curve.
   c. economies of scope.
   d. decreasing marginal costs.
2. As a golf club production company produces more clubs, the average total cost of each club produced decreases. This is because
   a. total fixed costs are decreasing as more clubs are produced.
   b. average variable cost is decreasing as more clubs are produced.
   c. there are scale economies.
   d. total variable cost is decreasing as more clubs are produced.

3. Average costs curves initially fall
   a. due to declining average fixed costs.
   b. due to rising average fixed costs.
   c. due to declining accounting costs.
   d. due to rising marginal costs.
4. What might you reasonably expect of an industry in which firms tend to have economies of scale?
   a. Exceptional competition among firms
   b. A large number of firms
   c. Highly diversified firms
   d. A small number of firms
5. A security system company's total production costs depend on the number of systems produced according to the following equation: Total Costs = $10,000,000 + $2000 * quantity produced. Given these data, which of the following is a false statement?
   a. There are economies of scale.
   b. There are fixed costs associated with this business.
   c. There are diseconomies of scale.
   d. A firm that produces a larger output has a cost advantage over a smaller firm.
6. Following are the costs to produce Product A, Product B, and Products A and B together. Which of the following exhibits economies of scope?
   a. 50, 75, 120
   b. 50, 75, 125
   c. 50, 75, 130
   d. All of the above
7. According to the law of diminishing marginal returns, marginal returns
   a. diminish always prior to increasing.
   b. diminish always.
   c. diminish sometimes.
   d. diminish eventually.
8. It costs a firm $80 per unit to produce product A and $50 per unit to produce B individually. If the firm can produce both products together at $140 per unit of product A and B, this exhibits signs of
   a. economies of scale.
   b. economies of scope.
   c. diseconomies of scale.
   d. diseconomies of scope.
9. Once marginal cost rises above the average cost,
   a. average costs will increase.
   b. average costs are unaffected.
   c. average costs will decrease.
   d. None of the above.
10. A company faces the following costs at the respective production levels in addition to its fixed costs of $50,000:

Quantity	Marginal Cost	Sale Price	Marginal Return
1	$10,000	$20,000	$10,000
2	$11,000	$20,000	$9,000
3	$12,000	$20,000	$8,000
4	$13,000	$20,000	$7,000
5	$14,000	$20,000	$6,000

How would you describe the returns to scale for this company?
   a. Increasing
   b. Decreasing
   c. Constant
   d. Marginal

Individual Problems

7-1 Scale and Scope

What is the difference between economies of scale and economies of scope?

7-2 Rangers' T-shirts

The variety of Riverside Ranger logo T-shirts includes 12 different designs. Setup between designs takes one hour (and $18,000), and, after setting up, you can produce 1,000 units of a particular design per hour (at a cost of $8,000). Does this production exhibit scale economies or scope economies?

7-3 Brand Extensions

Suppose Nike's managers were considering expanding into producing sports beverages. Why might the company decide to do this under the Nike brand name?

7-4 Average and Marginal Costs

Describe the change in average costs and the relationship between marginal and average costs under the following three conditions as quantities produced increase:

	Average Cost	Marginal Cost versus Average Cost
Constant returns to scale	Rising Falling Flat	Higher Lower Equal
Decreasing returns to scale	Rising Falling Flat	Higher Lower Equal
Increasing returns to scale	Rising Falling Flat	Higher Lower Equal

7-5 Learning Curves

Suppose you have a production technology that can be characterized by a learning curve. Every time you increase production by one unit, your costs decrease by $6. The first unit costs you $64 to produce. If you receive a request for proposal (RFP) on a project for four units, what is your breakeven price? Suppose that if you get the contract, you estimate that you can win another project for two more units. Now what is your breakeven price for those two units?

7-6 Multiconcept Restaurants Are a Growing Trend

A multiconcept restaurant incorporates two or more restaurants, typically chains, under one roof. Sharing facilities reduces costs of both real estate and labor. The multiconcept restaurants typically offer a limited menu, compared with full-sized, stand-alone restaurants. For example, KMAC operates a combination Kentucky Fried Chicken (KFC)/Taco Bell restaurant. The food preparation areas are separate, but orders are taken at shared point-of-sale (POS) stations. If Taco Bell and KFC share facilities, they reduce fixed costs by 30%; however, sales in joint facilities are 20% lower than sales in two separate facilities. What do these numbers imply for the decision of when to open a shared facility versus two separate facilities?

Group Problems

G7-1 Economies of Scale

Describe an activity or process or product of your company that exhibits economies or diseconomies of scale. Describe the source of the scale economy. How could your organization exploit the scale economy or diseconomy? Compute the profit consequences of the advice.

G7-2 Learning Curves

Describe an activity or process or product of your company characterized by learning curves. Describe the source of the learning curve. How could your organization exploit the learning curve? Compute the profit consequences of the advice.

G7-3 Economies of Scope

Describe two activities inside your organization, or one inside and one outside your organization, that exhibit economies (or diseconomies) of scope. Describe the source of the scope economies. How could your organization exploit the scope economy or diseconomy? Compute the profit consequences of the advice.

END NOTES

1. For more on Spectrum Brands' difficulties, see Elizabeth Woyke and David Henry, "The Buyout Boom's Dark Side," *Business Week*, August 13, 2007.

2. Akio Morita with Edwin M. Reingold and Mitsuko Shimomura, *Made in Japan: Akio Morita and Sony* (New York: Penguin, 1988).
3. Michael Ollinger, James M. McDonald, and Milton Madison. "Technological Change and Economies of Scale in U.S. Poultry Processing," *American Journal of Agricultural Economics* 87 (February 2005): 116–129.
4. Marginal cost = 100*0.8^ (Log(# planes)/Log(2)).

CHAPTER 8

Understanding Markets and Industry Changes

In 1997, the portable electric generator industry was a mildly profitable but not particularly exciting industry. For over a decade, consumption of portable electric generators had been pretty stable with average annual growth of around 2%. But this all changed pretty dramatically as the century drew to a close. Many consumers feared that the power grid would collapse because the computer programs that controlled it would not be able to adapt to the change from 1999 to 2000. Anticipating a big increase in demand for portable generators, managers at Akers, MacMillan, and Parlow (AMP) implemented a Y2K (year 2000) strategy that involved doubling their production capacity. Other firms in the industry made similar investments.

In 1999, demand for portable generators boomed as expected; industry shipments increased by 87%, and prices increased by 21%. But the following year was a bust. Demand fell back to 1998 levels, and prices tumbled to below-1998 levels. Industry profit declined dramatically, along with capacity utilization rates. AMP's Y2K strategy to increase production capacity turned out to be its undoing. Along with half the firms in the industry, it declared bankruptcy in 2000.

AMP's managers would have benefited from a better understanding of the changes affecting its industry. In particular, everything that happened to AMP was perfectly predictable. If AMP had been able to forecast and interpret these industry-level changes, the topic of this chapter, they would have been able to survive, if not prosper. In this chapter, we show you how to do this using aggregate demand and aggregate supply curves.

WHICH INDUSTRY OR MARKET?

In Chapter 6, we showed you how to set a single price if you are a single firm, selling a single product, facing a group of consumers whose behavior can be described by a demand curve. In economics textbooks this is often referred to as a "monopoly" model of pricing because it involves only a single firm. In this chapter, we show you how prices are determined in an

industry where many sellers and many buyers come together in a "market" setting. In economics textbooks this is referred to as "perfect competition" because sellers must compete with one another in order to sell to buyers. We characterize the behavior of sellers with what is called a "supply" curve in much the same way that we characterized the behavior of buyers with a demand curve.

One note of caution before we begin the chapter: do not use demand and supply analysis to describe changes facing an individual firm. For example, it makes no sense to talk about the "demand and supply of iPhones" because there is only one seller of iPhones. Rather you use demand and supply to talk about the changes in the "smart phone" industry.

Before you begin analyzing an industry, you must carefully consider what you want to learn from the analysis. Perhaps you want to forecast future changes or to understand past ones. In our example, you might want to know "Why did the price for portable generators in the United States increase in 1999 and decrease in 2000?" Usually the question will suggest a particular *market definition*. The current question suggests that you should examine the *annual market for portable generators in the United States*. Notice that this market has a time (annual), a product (portable generators), and a geographic (the United States) dimension. Different questions will suggest different markets to study. Although this point may seem obvious, people often overlook it. Avoid confusion by first defining your market or industry.

Demand and supply analysis is especially important if your firm's success or profitability is closely linked to the profitability of your primary industry. If you know how the industry is going to change, it will help you recognize opportunities. For example, many towns are changing zoning laws to make it more difficult to build apartment buildings. This has led some entrepreneurs to anticipate a reduction in future supply that will drive up the price of apartments. To position themselves to take advantage of these changes, they are building new apartments or buying and renovating existing ones.

SHIFTS IN DEMAND

As we've seen, changes in price lead to changes in quantity demanded. In an example from Chapter 6, we showed that when we increase price from $6 to $7, one fewer consumer decides to purchase, so quantity demanded decreases from two units to one unit. This change is called a **movement along the demand curve.**

But price is only one factor that affects demand. In general it helps to catalog the factors that affect demand into controllable and uncontrollable factors.

***A controllable factor** is something that affects demand that a company can control.*

Price, advertising, warranties, product quality, distribution speed, service quality, and prices of substitute or complementary products also owned by the company are all examples of controllable factors.

A firm can manipulate controllable factors to increase demand for its products. In the late 1970s, for example, Microsoft developed the DOS operating system to control IBM personal computers. Demand for the DOS operating system depended on its own price but also on the price and availability of the computers that ran it, as well as on the applications that ran under it, like spreadsheets and word processors.

To increase demand for its DOS operating system, Microsoft manipulated the following controllable factors:

- Microsoft licensed its operating system to other computer manufacturers. The resulting competition between IBM and these new licensees lowered the price of computers—a complementary product.
- Microsoft developed its own versions of word processing and spreadsheet software—Word and Excel—two important complementary products in almost any office.
- Microsoft kept the price for its DOS product relatively low. As more consumers purchased DOS computers, more companies made applications that ran on DOS computers, increasing future demand for DOS software.

*An **uncontrollable factor** is something that affects demand that a company cannot control.*

In contrast, *uncontrollable factors* include things like income, weather, interest rates, and prices of substitute and complementary products owned by other companies. And as is illustrated by the story in the introduction, *expectations* of future changes can also affect current demand. Consumer expectation of a massive power outage in 2000 was an uncontrollable factor that affected 1999 demand for portable electric generators.

Even though you may not be able to control a factor affecting demand, you need to understand how it affects the industry in which you compete because it can affect your own profitability. This requires that you learn how to manipulate demand and supply curves, our next topic.

Because we only have two variables on our demand graph—price and quantity—the only way to represent a change in a third variable is with a ***shift of the demand curve***. For example, if the price of a substitute product increases, then industry demand for a product will increase. We represent this as a rightward shift in the demand curve, as shown in Figure 8-1.

In this case, at every price, demand shifts rightward, or increases, by four units. In contrast, a decrease in a substitute's price would decrease demand.

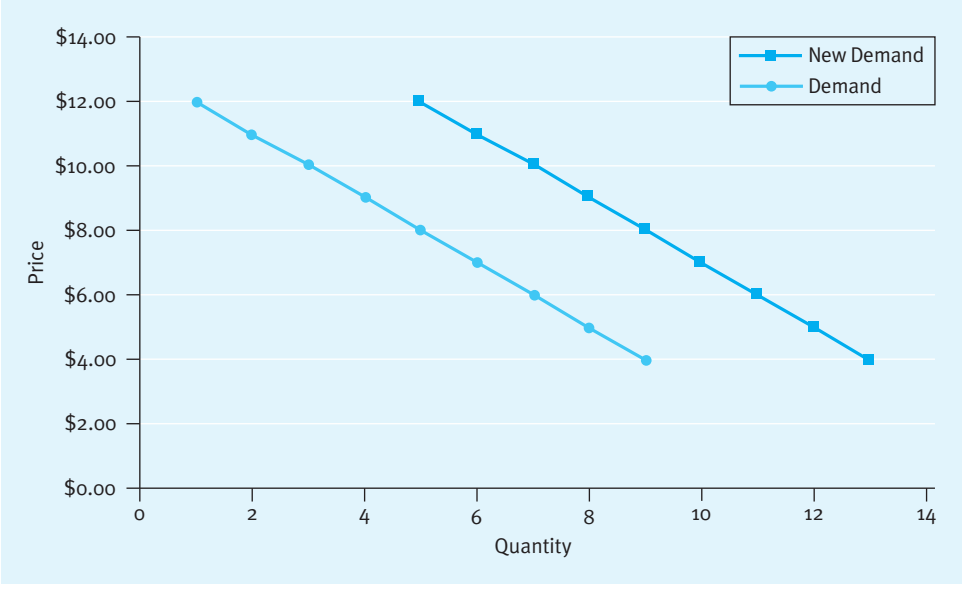


FIGURE **8.1 Demand Increase**

SHIFTS IN SUPPLY

Supply curves *describe the behavior of a group of sellers and tell you how much will be sold at a given price.*

The construction of supply curves is similar to that of demand curves; we arrange sellers by the prices at which they are willing to sell. Every person willing to sell at or below the given price "supplies" product to the market. For example, suppose we have nine sellers, with values of {$4, $5, $6, $7, $8, $9, $10, $11, $12}; at a price of $4, one seller would be willing to sell; at a price of $5, two sellers; and so on, until, at a price of $12, all nine sellers would be willing to sell. This supply curve describes the aggregate behavior of these nine sellers.

Note that a supply curve requires competition among sellers. As we have seen in Chapter 5, a single firm will produce where MR = MC. In contrast, multiple firms facing competition will behave as if they produce where P = MC. In this case, price will determine how much is supplied to the market: high prices lead to big supply; low prices to smaller supply.

Supply curves differ from demand curves in one very important way.

Supply curves slope upward; that is, the higher the price, the higher the quantity supplied.

In other words, at higher prices, more suppliers are willing to sell. We plot our aggregate supply curve in Figure 8-2.

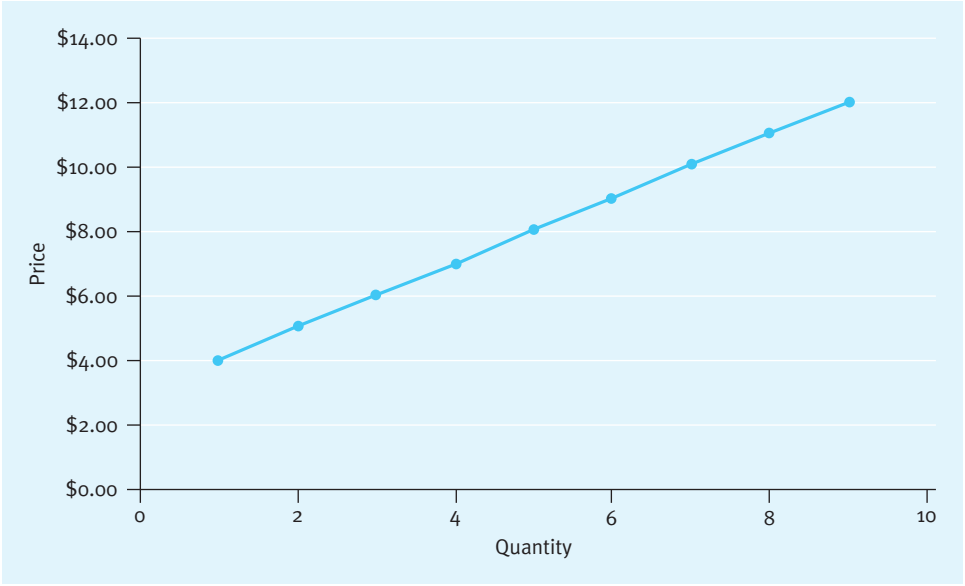


FIGURE **8.2 Supply Curve**

As with demand curves, we plot supply curves with price on the vertical axis and quantity on the horizontal axis. Also, like demand curves, supply curves shift when a variable other than price changes. Changes in costs, technological change, and entry or exit of new capacity or firms will shift supply. Consider the effect of increased costs. How would that

shift the supply curve? Think about an individual seller first—if that producer now has to pay more to produce the same quantity, he or she will require a higher price to cover those increased costs. If other sellers are similarly situated, the aggregate supply curve will *decrease*, or shift upward (and to the left). This means that higher prices are necessary to induce sellers to supply the same quantities. Alternatively, you could say that a smaller quantity will be made available at the previous price.

MARKET EQUILIBRIUM

Market equilibrium *is the price at which quantity supplied equals quantity demanded.*

In other words, at the equilibrium price, the numbers of buyers and sellers are equal, so there's no pressure for prices to change. That's why we call it an "equilibrium." You can see an illustration of market equilibrium in Figure 8-3, where, at a price of $8, five units are demanded and five units supplied.

To understand why this is an equilibrium, consider what happens at prices higher or lower than $8. For example, at a price of $11, the quantity demanded (2) is less than the quantity supplied (8), meaning that eight sellers are trying to sell to only two buyers. The sellers will compete with one another by offering to sell at a lower price. We say that *excess supply* exerts downward pressure on price.

At a price of $6, the quantity demanded (7) is greater than the quantity supplied (3)—seven buyers are chasing just three sellers, a case of *excess demand*. In this case, we say that *excess demand* exerts upward pressure on price. Only at a price of $8 are the numbers of buyers and sellers equal, exerting no pressure on price to change. This is why we call $8 an *equilibrium price*.

At the equilibrium price, only buyers with values above $8 buy, and only sellers with values below $8 sell. No one else wants to buy or sell.

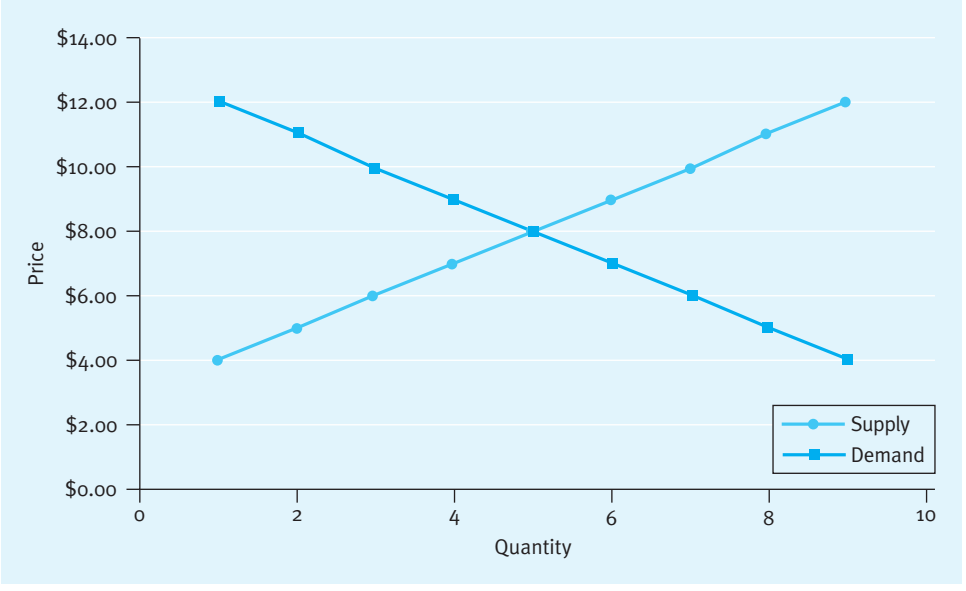


FIGURE **8.3 Market Equilibrium**

In market equilibrium, there are no unconsummated wealth-creating transactions.

Another way of thinking about this is that the market has identified the high-value buyers and the low-value sellers, brought them together, and set a price at which they can exchange goods. The market moves goods from lower- to higher-valued uses and thus creates wealth. Economists often personify market forces by saying that the market works with an "invisible hand."[1]

RIDDLE: How many economists does it take to change a light bulb?

ANSWER: None. The market will do it.

PREDICTING INDUSTRY CHANGES USING SUPPLY AND DEMAND

We can use supply and demand curves to describe changes that occur at the industry level. In Table 8-1 and Figure 8-4, we begin with a simple example of how an increase in demand changes price and quantity. This increase in demand could arise from an increase in income, a decrease in the price of a complement, or an increase in price of a substitute.

We see the initial equilibrium of $8, where quantity demanded equals quantity supplied (5 units) in the first three columns of Table 8-1, as indicated by the shaded numbers in the fifth row. After the demand shift, the new equilibrium is $10, where quantity demanded equals quantity supplied (7 units). The shaded numbers in columns 1, 3, and 4 of the third row show this new equilibrium.

TABLE 8.1

Market Equilibrium Analysis

	Price	Demand	Supply	New Demand
	$12	1	9	5
	$11	2	8	6
Equilibrium 2	$10	3	7	7
	$9	4	6	8
Equilibrium 1	$8	5	5	9
	$7	6	4	10
	$6	7	3	11
	$5	8	2	12
	$4	9	1	13

Again, the mechanism driving price to the new equilibrium is competition among buyers to buy and competition among sellers to sell. At the old price of $8, there is excess demand—more buyers than sellers. This imbalance puts upward pressure on price until it settles at the new equilibrium price of $10. Notice that price increases from $8 to $10, while quantity increases from 5 to 7 units.

To illustrate the usefulness of demand and supply, let's return to the changes in the electric generator industry that occurred around 1999. Using demand-supply analysis, we can explain exactly what happened. We can see this analysis in Figure 8-5.

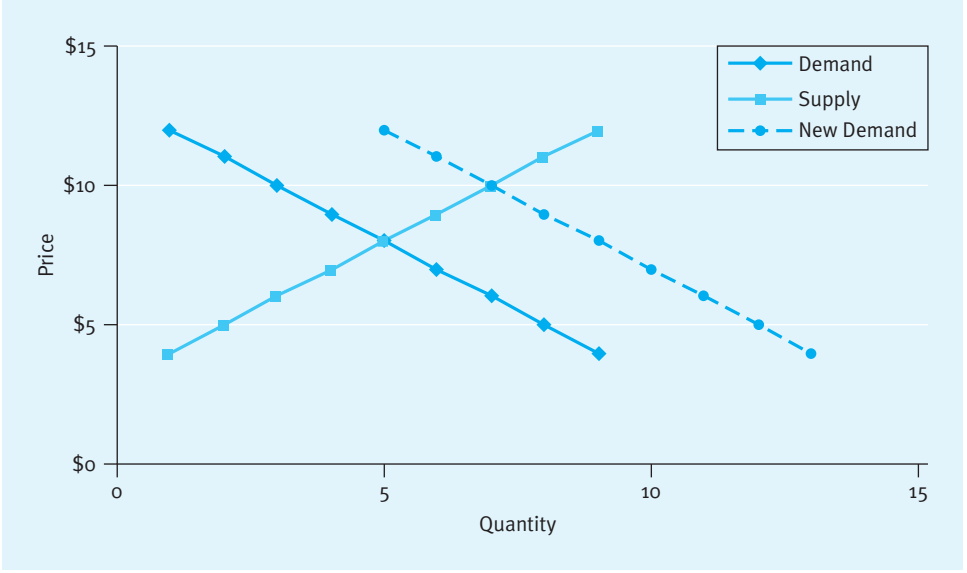


FIGURE **8.4 Market Equilibrium Following Demand Shift**

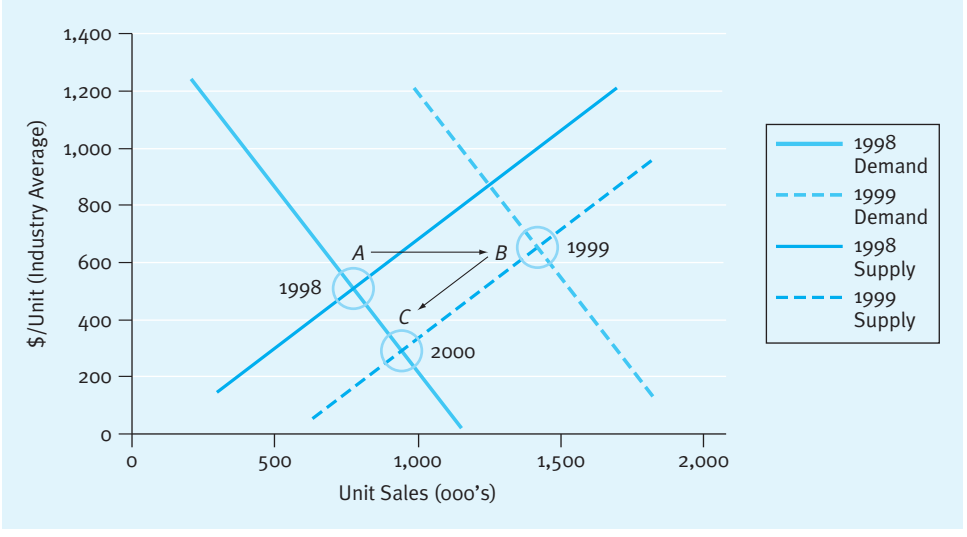


FIGURE **8.5 Demand-Supply in U.S. Generator Business**

In the graph, we see the change from 1998 to 1999 as the change from A to B (denoted A→B) when both demand and supply increased. Supply shifted outward as firms invested in capacity increases, while demand increased due to anticipation of power outages. Because price increased by 21%, we know that the increase in demand must have been bigger than the increase in supply. Both shifts contributed to the quantity increase of 87%.

In 2000, when demand returned to its 1998 level (denoted B→C), prices dropped below the 1998 level, but quantity stayed above the 1998 level because of the supply increase. Although it is relatively easy to predict these kinds of *qualitative* changes, predicting exact *quantitative* changes is much more difficult. For accurate quantitative predictions, you'd need information about the exact magnitudes of the supply and demand shifts, and information about the slopes of the supply and demand curves, information that is very hard to get. In fact, you should be very suspicious of consultants who claim they can provide accurate quantitative forecasts because it is difficult to precisely estimate the parameters necessary to construct a forecast.

Nevertheless, we can learn a lot from simple qualitative analysis. AMP's managers should have been able to predict the movement in price and quantity A→B→C, as shown in Figure 8-5; and they could have taken steps to prepare for the changes. For example, because the demand shift was temporary, they should have hired temporary workers, or even outsourced the extra production, instead of investing in their own capacity expansion. Alternatively, like John Deere's managers in Chapter 5, they could have chosen a low-fixed-cost technology, thereby better positioning themselves to make money once price dropped below its 1998 levels.

EXPLAINING INDUSTRY CHANGES USING SUPPLY AND DEMAND

The preceding analysis has asked you to predict what happens to price and quantity following increases or decreases in supply and demand, or both. This kind of analysis is relatively simple, as there are only four changes that can occur: an increase or decrease in supply; and an increase or decrease in demand. A slightly more difficult, but still very useful, analysis involves using supply and demand to explain industry changes. You look at a change in price and quantity, and then describe what must have happened to either supply and demand or both.

For example, the price of soybeans increased by 50% from mid-2007 to early 2008. From what we've learned so far, you should know that an increase in price could have been driven by an increase in demand, a decrease in supply, or both. In this case, both factors appear to have been influencing price. Demand has increased thanks to rising world population and incomes. Supply has contracted because many farmers decided to switch production to substitute products, like corn, that can be turned into biofuels. Both an increase in demand and a decrease in supply caused the dramatic price increases.

Let's test our understanding of the analysis thus far. Try to explain the increase in the quantity of mobile phones and the decline in price over the past decade using shifts in the demand or supply curves.

-------TAKE A MOMENT AND TRY TO COME UP WITH THE ANSWER-------

To answer this question, you have to explain two points in time. On a graph, the initial point has a high price and small quantity. The final point has low price and large quantity. You can explain these data with a simple increase (rightward shift) in the supply curve. In Figure 8-6, as supply increases, the equilibrium price falls from P_0 to P_1 and the equilibrium quantity increases from Q_0 to Q_1.[2]

We end this section by asking you to explain a very significant increase in price and decline in quantity of commercial paper that occurred during September 2008. Commercial paper is a short-term security (e.g., 30-day loans supplied by companies with cash on hand

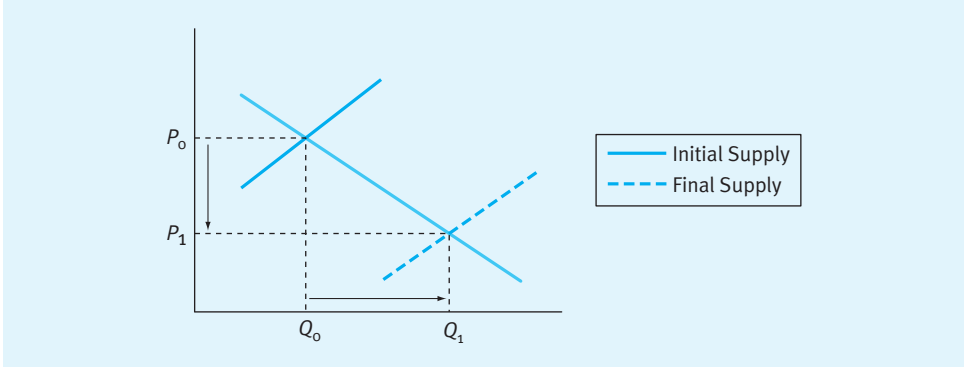


FIGURE **8.6 Demand-Supply Shifts in the Mobile Phone Industry**

to companies who have short-run borrowing demands). Think of them as IOUs. These loans are used by virtually every major business to balance the inflows of revenue with the outflows of costs, and are behind many major transactions. This kind of borrowing is typically cheaper than borrowing from a bank, at least for the companies that buy and sell these securities.

There are two equivalent ways to define this product: 30-day commercial paper or 30-day commercial loans. The difference is that the "supply" of commercial paper is equal to the "demand" for loans; and the "demand" for commercial paper is the "supply" of loans. The only difference is the price you put on the vertical axis. In what follows we are going to talk about the 30-day U.S. commercial loan market, where the "price" of a loan is the annualized interest rate on the loan, for instance, 0.5%.

In the second week of September 2008, the quantity of these loans declined dramatically (Figure 8-7), and the price (interest rate) on these loans shot up from 3% to 5%

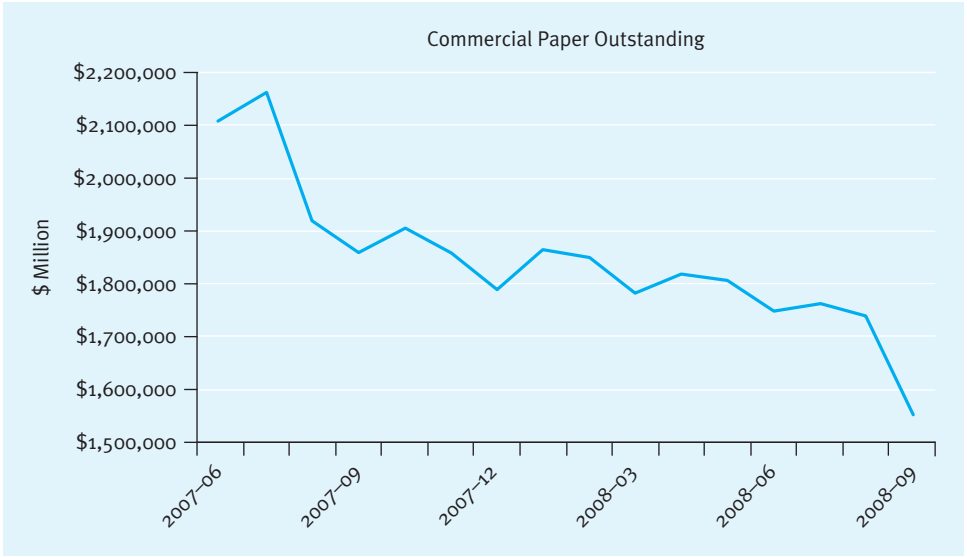


FIGURE **8.7 Shrinking Commercial Paper Market**

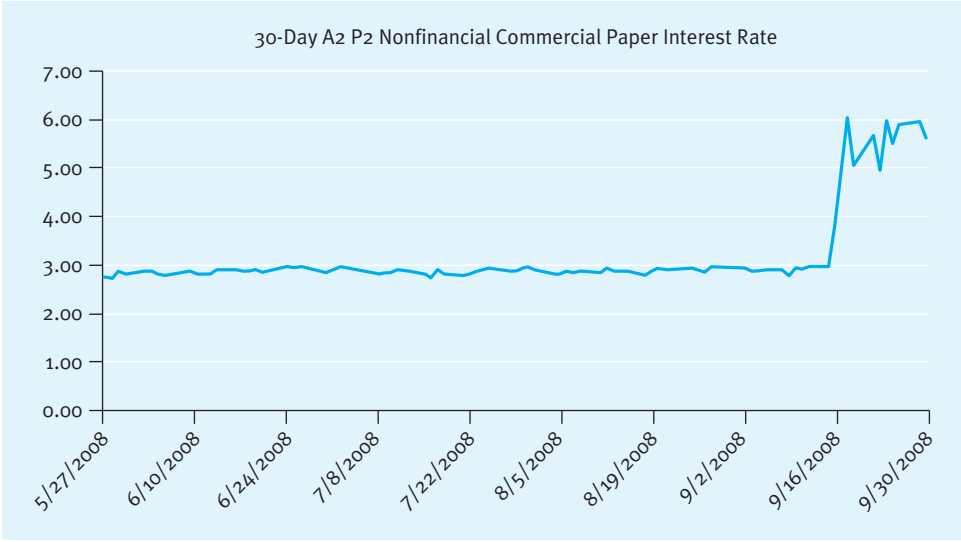


FIGURE 8.8 Prices in the Commercial Paper Market

(Figure 8-8). These changes spooked Treasury Secretary Paulson and Federal Reserve Chairman Ben Bernanke, and they were characterized as a "freeze" in the market for short-term lending. What could have accounted for these changes?

-------TAKE A MOMENT AND TRY TO COME UP WITH THE ANSWER-------

The changes could be explained by a simple decrease in the supply of loans. In fact, following the bankruptcy of Lehman Brothers, the troubles at Fannie Mae and Freddie Mac,

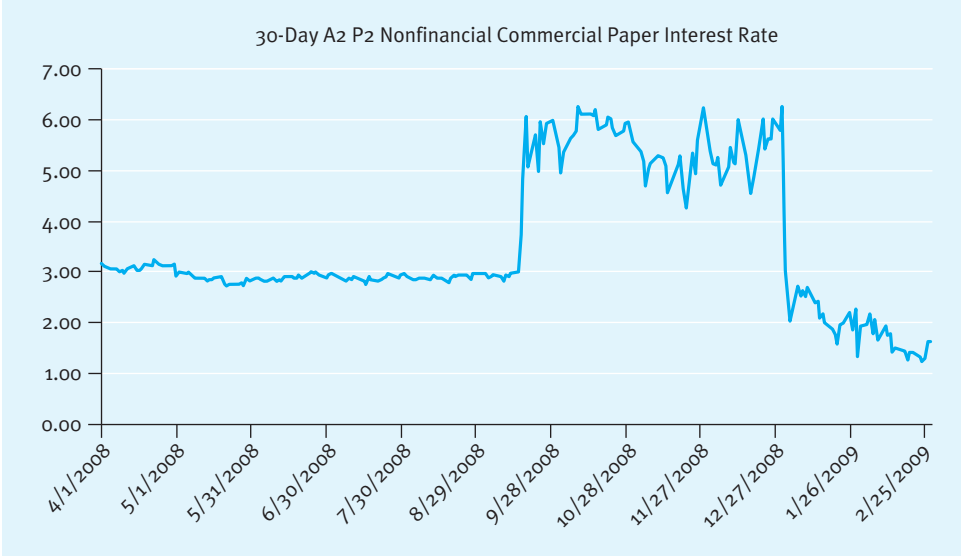


FIGURE 8.9 Price Recovery in the Commercial Paper Market

and the first bailout of AIG, commercial lenders became increasingly worried that borrowers would not be able to repay these loans. In other words, lenders became less willing to lend, and the resulting decrease in supply caused both an increase in the price of borrowing (the interest rate) and a decline in the amount of lending. As a footnote to this story, the Federal Reserve guaranteed these short-run financial transactions to remove the fear of default, which increased supply, and the interest rates came back down as shown in Figure 8-9.

Many students report that demand and supply analysis is especially useful in job interviews as it gives them a way to show off their analytical expertise by explaining industry changes.

PRICES CONVEY VALUABLE INFORMATION

Markets play a significant role in collecting and transmitting information between buyers and sellers. In a sense, prices are the primary mechanism that market participants use to communicate with one another. Buyers signal their willingness to pay, and sellers signal their willingness to sell, with prices.

To illustrate how this communication occurs, let's examine the changes that occurred when a pipeline carrying gasoline to Phoenix broke.[3] The break could have been disastrous because Arizona has no refineries of its own; it receives gasoline primarily through two pipelines. One pipeline starts in Los Angeles and supplies gasoline from West Coast refineries to the Phoenix gasoline terminals. The other pipeline starts in El Paso and supplies

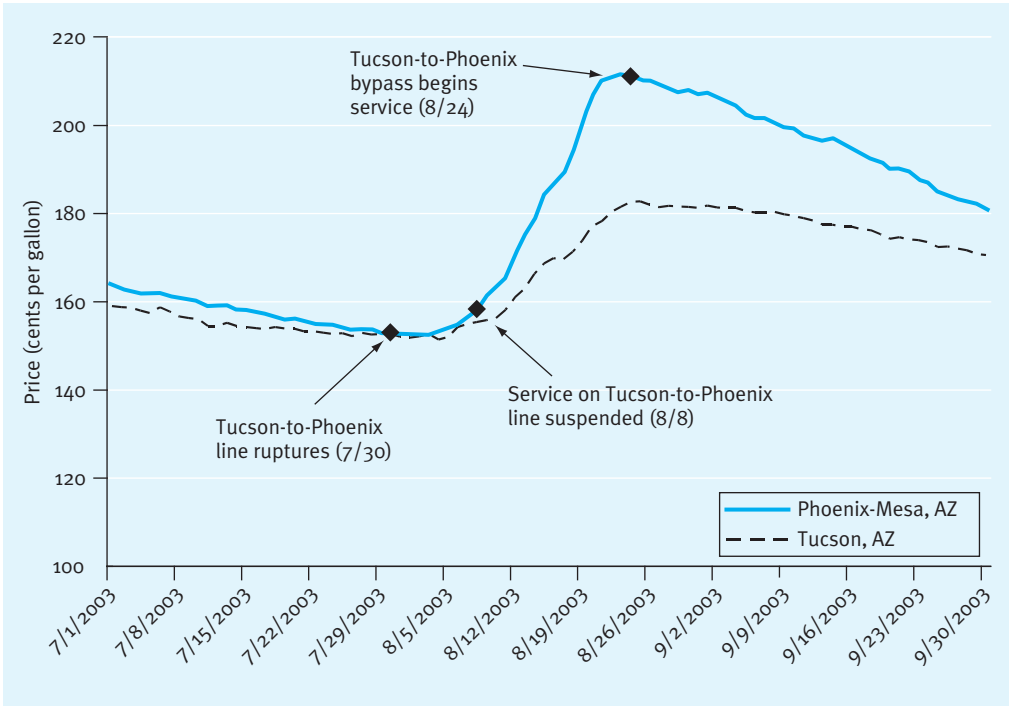


FIGURE **8.10 Phoenix and Tuscon Gas Prices**

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gasoline from refineries in Texas and New Mexico. Upon entering Arizona, that pipeline travels first to terminals in Tucson and then to terminals in Phoenix.

On July 30, 2003, the Tucson-to-Phoenix section of the pipeline from El Paso ruptured, closing that section of the line from August 8 until August 23, when partial service resumed.

Using supply-demand analysis, you should now be able to analyze what happened in the daily market for gasoline in Phoenix. Following a decrease in supply to Phoenix, the price should go up and quantity should go down. Indeed, the Phoenix price went from less than $1.60 to over $2.10 per gallon. What is less obvious is why the *Tucson* price also increased as shown in Figure 8-10. Given the location of the pipeline break, it would seem that Tucson should now have an excess supply, which would reduce Tucson prices. Instead, Tucson prices increased from about $1.60 to $1.80 per gallon.

What happened? The tank wagon owners who normally deliver gas from the Tucson terminal to Tucson gas stations discovered that delivering gas to Phoenix was more profitable than delivering it to Tucson. Tucson and Phoenix tank wagons waited for as much as six hours at the terminal in Tucson to buy gasoline to deliver to Phoenix. The high prices in Phoenix conveyed information to sellers in Tucson that it was more profitable to sell in Phoenix. So the supply actually decreased in Tucson—resulting in a price increase in that city. Similarly, supply decreased in Los Angeles as sellers found it more profitable to divert some of their gasoline to Phoenix, leading to a price increase in that city as well.

Next time you hear a politician complaining about the "high price of gas," tell her that without those high prices, consumers would consume too much, and suppliers would supply too little. If politicians set prices instead of markets, prices would not convey the information that provides incentives for buyers to conserve and for sellers to increase supply. Without higher prices, shortages would occur, and gasoline would not move from lower- to higher-valued uses.

The information conveyed by prices is especially important in financial markets, where each market participant possesses a little piece of information about the prospects for a traded security. By trading, they reveal their information to the market. For example, the price of a stock is a good predictor of the discounted flow of profit that will accrue to the stockholder. Likewise, prices of S&P futures are good predictors of the future level of the S&P 500 Stock Market Index, and foreign exchange futures are good predictors of future exchange rates. The information contained in these prices has obvious uses to companies and individuals trying to make decisions based on an uncertain future.

In fact, market prices are so good at forecasting the future that companies like Hewlett Packard, Eli Lilly, and Microsoft are setting up internal markets to help forecast demand for their products.[4] They set up an automated trading platform and let employees buy and sell contracts that pay off according to how much the company will earn or sell in the future. The prices of the contracts tend to be much more accurate predictors than traditional forecasting methods and are being used to plan production. The accuracy of these prices in forecasting future sales can also help firms design compensation schemes for salespeople; for example, sales people could be rewarded for increasing sales above the forecast quantity.

MARKET MAKING

In the supply-demand analyses in this chapter, we've been ignoring the costs of making a market. Buyers and sellers don't simply appear in a trading pit and begin transacting with one another. Instead, someone has to incur costs to identify high-value buyers and low-value

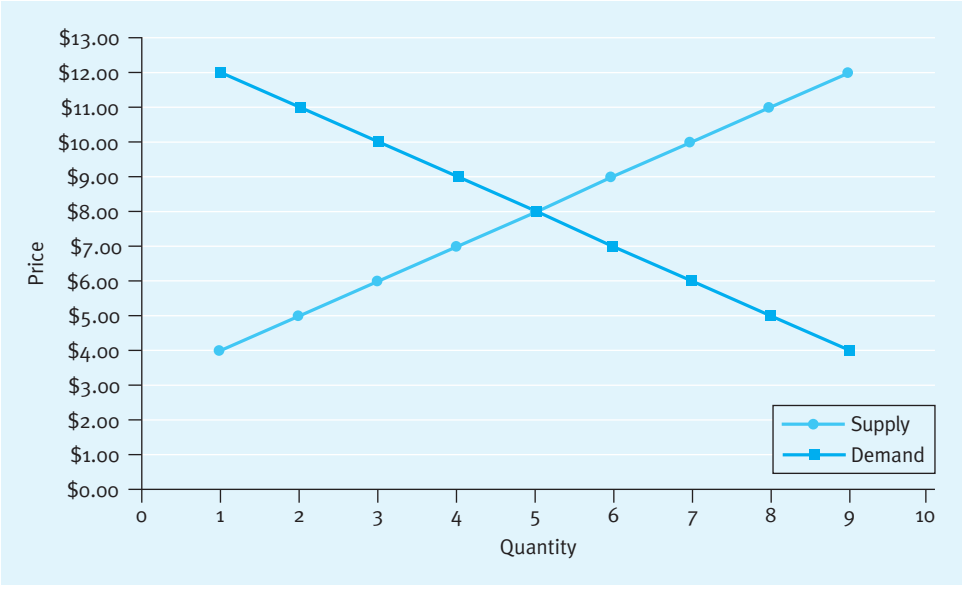


FIGURE **8.11 Market-Making Supply and Demand Curves**

sellers, bring them together, and devise ways of profitably facilitating transactions among them. The economies of Chicago, New York, London, and Tokyo depend largely on the profit earned from making markets. These profits are the "costs" of making a market that, when significant, can prevent prices from moving to equalize demand and supply.

In this section, we show exactly how a "market maker" makes a market—by buying low and selling high. Consider a market maker facing the demand and supply curves shown in Figure 8-11: nine buyers have values {$12, $11, $10, $9, $8, $7, $6, $5, $4}, and nine sellers are willing to sell at the same prices. If there were but a single (monopoly) market maker, how much would she offer the sellers (the bid), and how much would she charge the buyers (the ask)? How many transactions would occur?

If the market maker does not want to be left in either a long (holding inventory) or short (owing inventory) position, then she has to pick prices (the bid and the ask) that equalize quantity supplied and quantity demanded. Note that if the market maker bought and sold at the competitive price ($8), she would earn zero profit. To earn profit, the market maker must buy low (at the bid) and sell high (at the ask). For example, if the market maker were going to engage in, say, three transactions, she would offer sellers $6 (from the supply curve, we see that three sellers will sell if the price is at least $6) and charge buyers $10 (from the demand curve, we see that three buyers are willing to pay at least $10). Consequently, there are five obvious bid-ask price combinations:[5]

- Buy at $8 and sell at $8 (five transactions).
- Buy at $7 and sell at $9 (four transactions).
- Buy at $6 and sell at $10 (three transactions).
- Buy at $5 and sell at $11 (two transactions).
- Buy at $4 and sell at $12 (one transaction).

Note that the market maker faces a familiar trade-off. She can consummate fewer transactions but earn more on each transaction; or she can consummate more transactions but earn less on each transaction. In Table 8-2, we calculate the optimal bid-ask spread for the market maker: Either buy at $6 and sell at $10, or buy at $5 and sell at $11. Both earn profit of $12.

TABLE 8.2

Optimal Spread in Market Making

	Ask	Quantity	Profit
$8	$8	5	$0
$7	$9	4	$8
$6	$10	3	$12
$5	$11	2	$12
$4	$12	1	$8

Now suppose that competition among several market makers forces the bid-ask spread—the price of a transaction—down to the costs of market making, which we suppose to be $2 per transaction. Now what is the competitive bid and ask?

In this case, each market maker would buy at $7 and sell at $9. Those offering worse prices wouldn't make any sales, and those offering better prices wouldn't cover costs. In this case, competition forces price down to cost, thereby raising the number of transactions from three to four.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- A market has a product, geographic, and time dimension. Define the market before using supply-demand analysis.
- *Market demand* describes buyer behavior; *market supply* describes seller behavior in a competitive market.
- If price changes, *quantity demanded* increases or decreases (represented by a ***movement along* the demand curve**).
- If a factor other than price (like income) changes, we say that demand curve increases or decreases (a ***shift* of demand curve**).
- **Supply curves** describe the behavior of sellers and tell you how much will be sold at a given price.
- **Market equilibrium** is the price at which quantity supplied equals quantity demanded. If price is above the equilibrium price, there are too many sellers, forcing price down, and vice versa.
- Prices convey valuable information; high prices tell buyers to conserve and sellers to increase supply.
- Making a market is costly, and competition between market makers forces the bid-ask spread down to the costs of making a market. If the costs of making a market are large, then the equilibrium price may be better viewed as a spread rather than a single price.

Multiple-Choice Questions

1. Changes in prices of a good causes
   a. movement along the demand curve.
   b. movement along the supply curve.
   c. no effect to either curve.
   d. Both a and b

2. If the market for a certain product experiences an increase in supply and a decrease in demand, which of the following results is expected to occur?
   a. Both equilibrium price and the equilibrium quantity could rise or fall.
   b. Equilibrium price would rise, and the equilibrium quantity could rise or fall.
   c. Equilibrium price would fall, and the equilibrium quantity could rise or fall.
   d. Equilibrium price would fall, and the equilibrium quantity would fall.
3. When demand for a product falls, which of the following events would you NOT necessarily expect to occur?
   a. A decrease in the quantity of the product supplied
   b. A decrease in its price
   c. A decrease in the supply of the product
   d. A leftward shift of the demand curve
4. Suppose recent and widely circulated medical article reports new benefits of cycling exercise. Simultaneously, the price of the parts needed to make bikes falls. If the change in supply is greater than the change in demand, the price will _____ and the quantity will _____.
   a. rise, rise
   b. rise, fall
   c. fall, rise
   d. fall, fall
5. Suppose there are nine sellers and nine buyers, each willing to buy or sell one unit of a good, with values {$10, $9, $8, $7, $6, $5, $4, $3, $2}. Assuming no transactions costs and a competitive market, what is the equilibrium price in this market?
   a. $5
   b. $6
   c. $7
   d. $8
6. If the government imposes a price floor at $9 (i.e., price must be $9 or higher) in the above market, how many goods will be traded?
   a. Five
   b. Four
   c. Three
   d. Two
7. Suppose there is a single market maker in this market. What is the optimal bid-ask spread?
   a. $2 bid; $10 ask
   b. $4 bid; $8 ask
   c. $5 bid; $7 ask
   d. $6 bid; $6 ask
8. Now suppose that competition among several market makers forces the spread down to $2. How many goods are traded?
   a. Five
   b. Four
   c. Three
   d. Two
9. The price of peanuts increases. At the same time, we see the price for Jelly rise. How does this affect the market for peanut butter?
   a. The demand curve will shift to the left; the supply curve will shift to the left.
   b. The demand curve will shift to the left; the supply curve will shift to the right.
   c. The demand curve will shift to the right; the supply curve will shift to the left.
   d. The demand curve will shift to the right; the supply curve will shift to the right.
10. Holding other factors constant, a decrease in the tax for producing coffee causes
    a. the supply curve to shift to the left, causing the prices of coffee to rise.
    b. the supply curve to shift to the right, causing the prices of coffee to rise.
    c. the supply curve to shift to the left, causing the prices of coffee to fall.
    d. the supply curve to shift to the right, causing the prices of coffee to fall.

Individual Problems

8-1 Widget Market

The widget market is competitive and includes no transaction costs. Five suppliers are willing to sell one widget at the following prices: $30, $29, $20, $16, and $12. Five buyers are willing to buy one widget at the following prices: $10, $12, $20, $24, and $29. What is the equilibrium price and quantity in this market?

8-2 Demand and Supply of Syndicated Bank Loans

In 1998, the Syndicated Bank Loan market (defined as loans having more than two bank lenders) was a vast and cheap source of debt financing for U.S. corporations. This market was characterized by a large number of financial institutions that aggressively committed capital to debt issuers as a way to build market share and increase earnings.

Over the next three years, however, syndicated loan prices increased dramatically while the quantity of these loans declined. The price increase, measured as a markup over the cost of funds or LIBOR (London Interbank Offered Rate), is illustrated in the figure labeled "All-In Drawn Pricing." For example, the price to BBB-rated companies rose from 37.5 basis points in 1998 to approximately 129 basis points in 2002. This is a 244% increase in the price or spread. Explain these changes using shifts in demand and/or supply.

Over the same time period, in a related lending market, asset-backed commercial paper, we see a huge quantity increase as shown in the "Asset-Backed Commercial Paper" graph. Did prices for these loans increase or decrease? Justify your answer using shifts in supply and demand curves.

8-3 Hand Sanitizer

Due to the H1N1 flu outbreak, the demand for hand sanitizer has tripled. Should Johnson & Johnson increase production of their Purell hand sanitizer? Should it invest in doubling production capacity?

8-4 Candy Bars Market

a. In the accompanying diagram (which represents the market for chocolate candy bars), the initial equilibrium is at the intersection of S_1 and D_1. Circle the new equilibrium if there is an increase in cocoa prices.
b. In the same diagram, the initial equilibrium is at the intersection of S_1 and D_1. Circle the new equilibrium if there is rapid economic growth.

8-5 Demand Shifts

Indicate whether the following changes would cause a shift in the demand curve for Product A and, if so, the direction of the shift.

Change	Demand Curve Shift?		Direction of Shift?		
Increase in price of complementary product	Yes	No	Increase	Decrease	N/A
Increase in the price of the Product A	Yes	No	Increase	Decrease	N/A
Launch of effective advertising campaign for Product A	Yes	No	Increase	Decrease	N/A

8-6 Valentine's Day

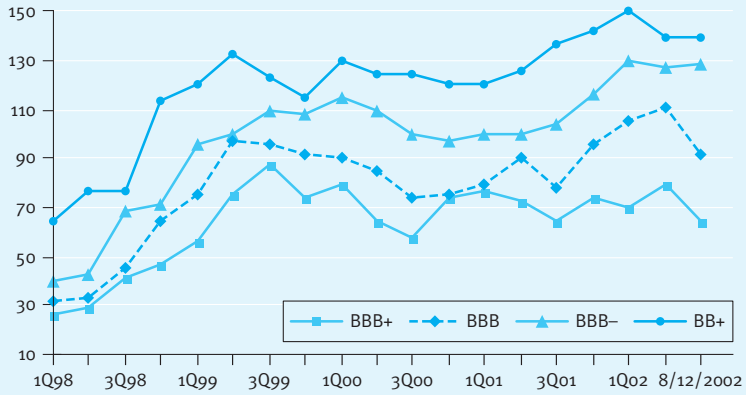
On Valentine's Day, the price of roses increases by more than the price of greeting cards. Why? (*Hint*: Consider what makes roses and cards different and how that difference might affect supply's responsiveness to price.)

Group Problem

G8–1 Supply and Demand

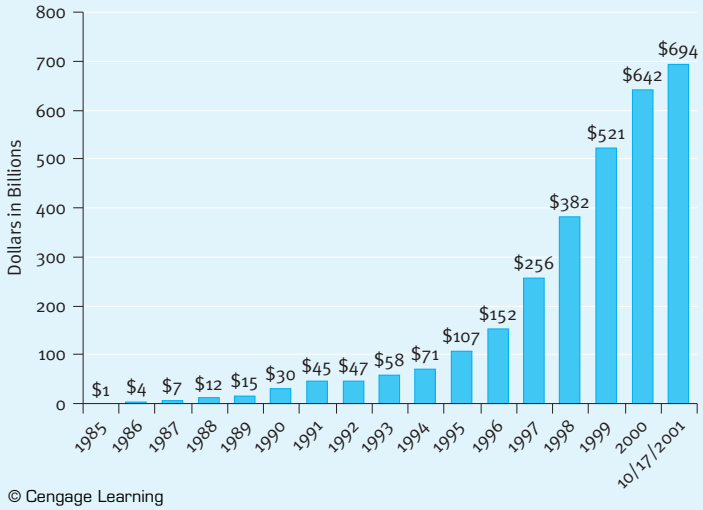
Using shifts in supply and demand curves, describe a change in the industry in which your firm operates. The change may arise from a change in costs, entry/exit of firms, a change in consumer tastes, a change in the macroeconomy, a change in interest rates, or a change in exchange rates. Label the axes, and state the geographic, product, and time dimensions of the demand and supply curves you are drawing. Explain what happened to industry price and quantity by making specific references to the demand and supply curves. If more than one change occurred, then decompose the change into smaller pieces so that your explanation has a step-by-step character to it. (*Hint and warning:* Demand and supply curves are used at the industry level, not at the firm level.) Describe how your company could profitably use the analysis.

Graph A for Problem 8-2
All-In Drawn Pricing (Including Usage Fees)

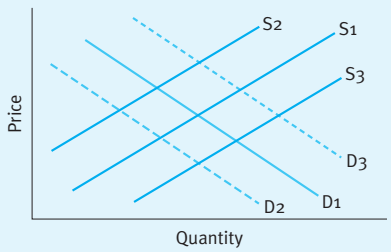


For Broadly Syndicated Loans Maturing in 2–5 Years Based on S&P Senior Debt Ratings

Graph B for Problem 8-2
Asset-Backed Commercial Paper



Graph for Problem 8-4
Chocolate Candy Bars Market



END NOTES

1. Credit for the invisible hand metaphor goes to Adam Smith and his renowned *The Wealth of Nations*.
2. Note that an increase in demand could explain the increase in quantity but not the decrease in price.
3. Federal Trade Commission, *Gasoline Price Changes: The Dynamics of Industry Supply and Demand* (Washington, D.C.: U.S. Government Printing Office, 2005).
4. Barbara Kiviat, "The End of Management?" *Time,* July 12, 2004, "Inside Business" section.
5. Note that it makes sense to make this market only for five transactions or fewer. For quantities greater than this, the demand curve lies below the supply curve. So to complete seven transactions, for example, the market maker would have to offer sellers $10 (see the supply curve) and charge buyers $6 (see the demand curve) for a net loss of $4 per transaction.

CHAPTER 9

Relationships Between Industries: The Forces Moving Us Toward Long-Run Equilibrium

One of the most successful business advice books of all time is Jim Collins' *Good to Great*. Since it was published in 2001, the book has sold over three million copies. It has been translated into 35 languages and has appeared on the best-seller lists of the *New York Times*, *Wall Street Journal*, and *Business Week*. Collins and his research team examined over 1,000 established companies and found 11 that made the jump from average or below-average performance to great results. These companies earned returns substantially in excess of average market returns over a 15-year period. From the experiences of these 11 "good to great" companies, Collins created a list of general management principles that he argued would help other companies make similar leaps.

Anyone familiar with the 2008 mortgage crisis should easily recognize one of the good-to-great companies, Fannie Mae. Shares of Fannie Mae were valued at around $70 per share in mid-2001, the year Collins' book was published. By 2009, government regulators had seized the company, and its shares were trading below $1. Another one of the companies, Circuit City, declared bankruptcy in 2008 and was liquidated. Overall, the 11 good-to-great companies failed to outperform the market over the years following the book's publication.

So where did the analysis go wrong?

The book made two fatal errors. The first is called the "fundamental error of attribution," which you may have heard described in your statistics class as "confusing correlation with causality." Just because you observe successful firms behaving in a particular way does not mean that the behavior caused the success. We will return to this theme in Chapter 17 when we examine decision making under uncertainty. Until we do, beware of consultants peddling such "best practices."

The second error of *Good to Great* was to ignore the long-run forces that tend to erode profit. High profit draws attention to the value that a firm creates, and customers, suppliers, competitors, substitutes, and new entrants will take actions that try to capture some of the value. How and why this occurs is the topic of this chapter.

In contrast to Chapter 8, where we analyzed short-run industry-level changes within a single market or industry, in this chapter, we analyze how changes in one industry affect other industries. In particular, the ability of capital and labor to move between two industries implies that the prices and profits of one industry are related to prices and profits in another.

COMPETITIVE INDUSTRIES

To understand the relationship between industries, we first consider the extreme case of a **competitive industry** where:

- Firms produce a product or service with very close substitutes so that they have very elastic demand.
- Firms have many rivals and no cost advantages.
- The industry has no barriers to entry or exit.

A competitive firm cannot affect price, so there is little a competitive firm can do except react to industry price. If price is above MC, it sells more; if price is below MC, it sells less. In sum, a competitive firm's fortunes are closely tied to those of the industry in which it competes.

Several industries come close to being "perfectly" competitive, like formal stock exchanges or agricultural commodities. But no industry is perfectly competitive because it is a theoretical benchmark. We use the benchmark because it helps us see the long-run forces that determine long-run industry performance.

Here's an example. Suppose industry demand suddenly increases for a product in a competitive industry. From Chapter 8, you should know that following the increase in demand, price goes up. At the higher price, firms in the industry enjoy above-average profit—but only for a while. This "for a while" is the period that economists call the "short run." Above-average profit lasts only for a while because profit attracts capital to the industry; existing firms expand capacity, or new entrants come into the industry. This increases industry supply, which leads to a decrease in price. Entry and capacity expansion continue, and price keeps falling until firms in the industry are no longer earning above-average profit. At this point, capital flow into the industry stops, and we say that the industry has reached **long-run equilibrium.** The length of the short run depends on how quickly assets can move into or out of the industry. It could be as short as a few seconds in highly liquid financial markets or as long as several years in industries where it takes a lot of time and effort to move assets.

In the long run, no competitive industry earns more than an average rate of return. If it does, firms will enter the industry or expand, increasing supply until the profit rate returns to average. To a business student trying to make money, this seems like terrible news. But it's not all bad news: In the long run, no competitive industry can earn less than an average rate of return. If it does, firms will exit the industry or shrink, decreasing supply until the profit rate returns to average.

A competitive firm can earn positive or negative profit in the short run but only until entry or exit occurs. In the long run, competitive firms earn only an average rate of return.

When firms are in long-run equilibrium, economic profit is zero (including the opportunity cost of capital), firms break even, and price equals average cost. Recall that profit is

equal to $(P - AC)*Q$; so if Price equals Average Cost, and cost includes a capital charge for the opportunity cost of capital, there's no reason for capital to move because it cannot earn a higher rate of return elsewhere.

Competitive industries will experience demand and supply shocks that result in short-run price increases and decreases, but economic profit tends to revert to zero. Another way to say this is that profit exhibits **mean reversion** where the mean is zero economic profit. According to reported estimates, the speed at which profit moves back toward an average rate of return is 38% per year.[1] That is, if profit is 20% above the mean one year, it will be only 12.4% above the mean in the following year.[2] A separate analysis of more than 700 business units found that 90% of both above-average and below-average profitability differentials disappeared over a 10-year period. Return on investment, as shown in Figure 9-1, revealed a strong tendency to revert to the mean level of approximately 20% for both over- and underperformers.

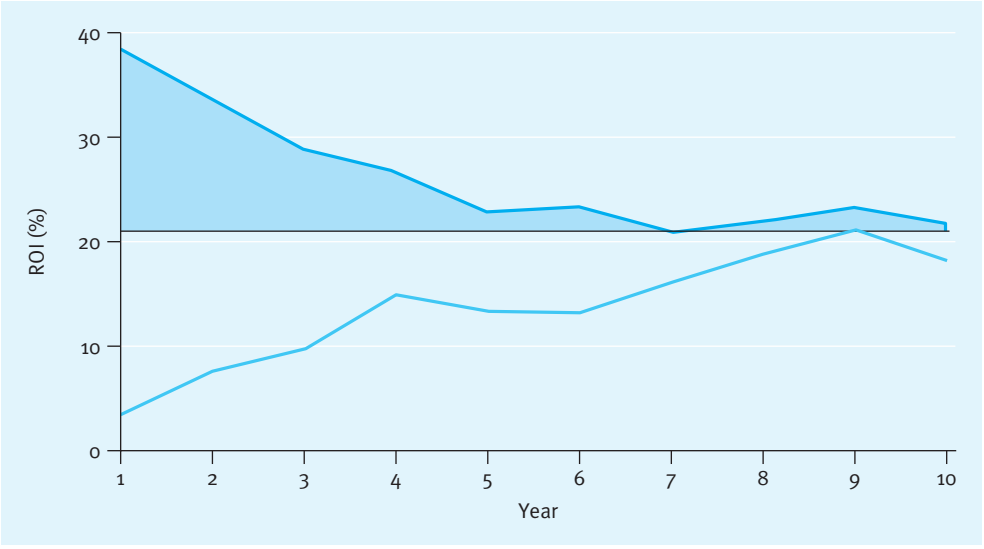


FIGURE **9.1 Mean Reversion of Profitability**

Students have a tendency to confuse short- and long-run analysis. If we are analyzing an increase in demand in an industry, price and quantity will increase in the short run, and firms will earn above-average profit. In the long run, these above-average profits will attract new assets into the industry, which will increase supply until profits fall back to the average. Do not confuse the short run with the long run. For example, do not say things like "demand creates its own supply." Instead, analyze the changes more precisely by separating them into short- and long-run changes.

THE INDIFFERENCE PRINCIPLE

We have begun to see the role of entry and exit, or *asset mobility,* as the major competitive force driving profit to zero (remember that economic profit includes a cost of capital, so economic profit is normally zero). Positive profit attracts entry, and negative profit leads to

exit. The ability of assets to move from lower- to higher-valued uses is the force that moves an industry toward long-run equilibrium. Such asset mobility leads to what Steven Landsburg[3] calls the **indifference principle:**

> *If an asset is mobile, then in long-run equilibrium, the asset will be indifferent about where it is used; that is, it will make the same profit no matter where it goes.*

Labor and capital are generally highly mobile assets. They flow into an industry when profits are high and out of an industry when profits are negative. Once this long-run equilibrium is reached, capital is indifferent about where it goes because it earns the same return (its opportunity cost) regardless of the industry.

To show you how the forces of asset mobility link markets together, let's apply long-run equilibrium analysis to the problem of deciding where to live. Suppose that San Diego, California, is more attractive than Nashville, Tennessee. What do you think will happen?

If labor is mobile, people will move from Nashville to San Diego. This migration will increase the demand for housing in San Diego, driving up San Diego house prices while simultaneously reducing Nashville house prices. The process will continue until the higher price of housing makes San Diego just as unattractive as Nashville. At that point, migration will stop, and we say that the two cities are in long-run equilibrium. Both places are now equally attractive, meaning consumers are indifferent between them. The lower housing costs in Nashville compensate Nashvillians for the less attractive living conditions like the hot and humid summers.

Wages also adjust to restore equilibrium. The indifference principle tells us that in long-run equilibrium, all professions should be equally attractive, provided labor is mobile. If school teaching is more attractive than truck driving, for example, some truck drivers will become school teachers, increasing supply and reducing the wage for school teachers, but decreasing supply and increasing the wage for truck drivers. When all professions are equally attractive, the migration stops, and the wages stop moving. It may take a long time for entry to move wages to an equilibrium level, especially in professions that require a long period of training. In these industries, the long run might be very long.

Once equilibrium is reached, differences in wages, called **compensating wage differentials,** reflect differences in the *inherent* attractiveness of various professions. Why do embalmers make 30% more than rehabilitation counselors?[4] Assuming the two industries are in long-run equilibrium, the higher wages compensate embalmers for working in a relatively unattractive profession. In the same way that lower-cost housing compensates Nashvillians for living in Nashville, embalmers' higher wages compensate them for working with dead bodies.

As demand and supply shocks change price in one industry, region, or profession, assets move in and out of industries, regions, and professions, until a new equilibrium is reached. In this way, the forces of competition allocate resources to where they are most highly valued and allow our economy to adapt rapidly to shocks. For example, when Jose Peralta came to the United States in 2001, he worked as a field hand picking strawberries. In 2003, he found a better job in construction, building condos in Newport Beach for $11/hour. Following the decline in demand for construction in the summer of 2007, when wages fell to $9/hour and work became harder to find, Mr. Peralta went back to picking strawberries.[5]

One of the concerns following the housing meltdown has been its potential impact on labor mobility. In previous recessions, there was a relatively rapid migration from locations where the jobs were disappearing (e.g., the Rust Belt) to areas where they were being created (e.g., the Sun Belt). But this time, the decline in housing values has made it difficult for people to move (unless they walk away from their mortgages) because they are reluctant

to sell houses at a loss. This has reduced the flexibility of the U.S. economy and slowed down the adjustment to a new long-run equilibrium. This is worrisome because this flexibility is one of the factors that has limited the duration and size of previous downturns.

We can apply the same long-run analysis to gain insight into some fundamental relationships in finance. We start with the common sense observation that investors prefer higher returns and lower risk. If one investment earns the same return as another but is less risky, investors will move capital from the more risky investment to the less risky investment and bid up the price of the less risky investment. The higher price decreases its expected rate of return[6]—its expected price change—until the higher-risk investment is just as attractive as the less risky investment. In equilibrium, the risky investment will earn a higher rate of return than the less risky investment to compensate investors for bearing risk.

We can illustrate this relationship with a simple example. Suppose that two stocks are trading at the same $100 price. Research analysts tell us that in a year, the first stock will either increase in value to $120 with probability 0.5 or maintain its current value of $100 with probability 0.5. The expected price of the stock next year is $110, and the expected return is 10%. Likewise, a similarly priced second stock will either increase in value to $130 with probability 0.5 or decrease in value to $90 with probability 0.5. Although the second stock has the same expected price ($110) and expected return (10%), it is more risky because the return has a higher variance (next year value of $90 or $130). Investors will sell the risky stock and buy the less risky stock. This increases the price of the first stock, reducing its expected return; it also decreases the price of the second stock, increasing its expected return.

The higher return on a risky stock is called a **risk premium**, and this premium is analogous to a compensating wage differential. Just as higher wages compensate embalmers for preserving cadavers, higher expected rates of return compensate investors for bearing risk.

In equilibrium, differences in the rate of return reflect differences in the riskiness of an investment.

We can see this relationship in Figure 9-2, which plots the CBOE Volatility Index (VIX) against the price of the S&P 500 stock index (GSPC). The VIX measures the implied

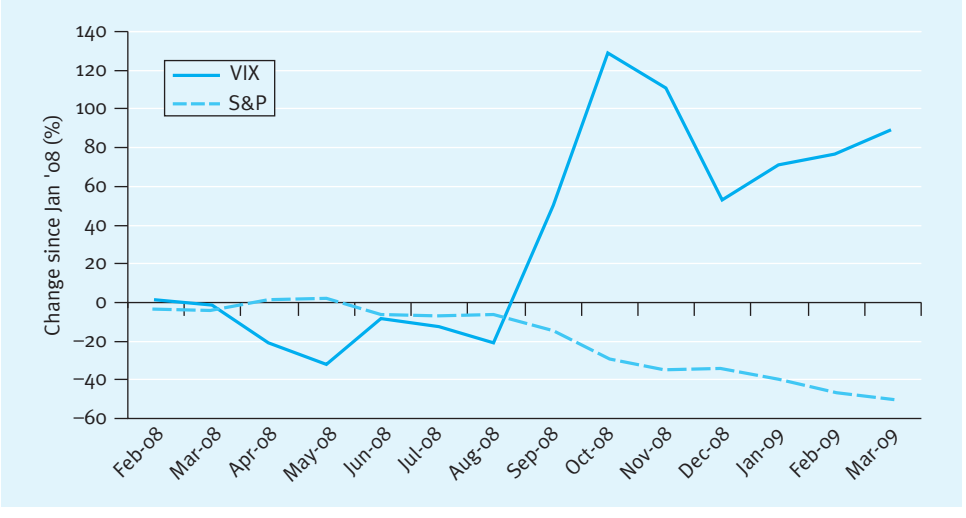


FIGURE **9.2 Stock Volatility and Returns**

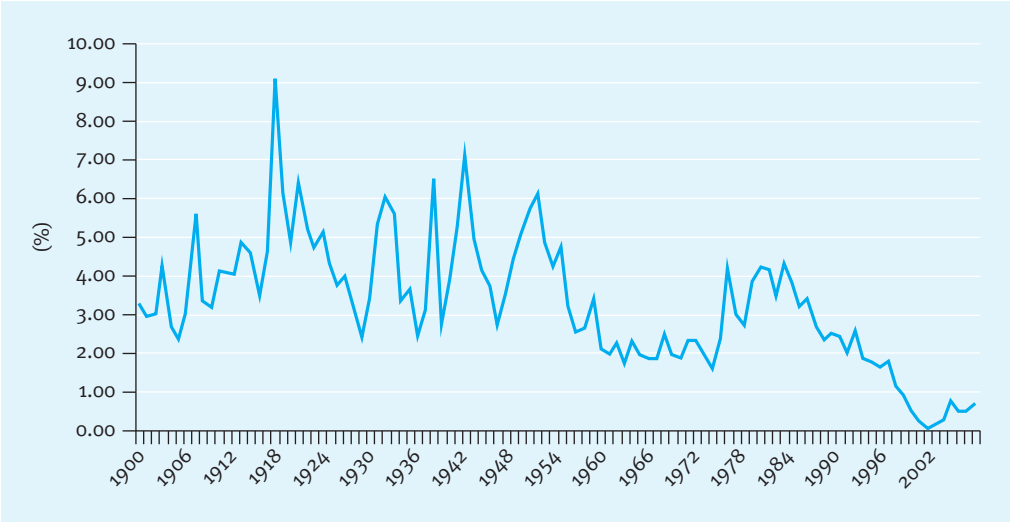


FIGURE **9.3 Historical Equity Risk Premium**

riskiness of the index, as computed from options prices. From the Fall of 2008 through the Spring of 2009, the stock market declined by about 50% while the volatility index increased by about 100%. Whatever was making stocks more volatile was also reducing the stock prices, thereby increasing expected returns in order to compensate investors for bearing more risk.

Since government bonds are thought to be risk-free, investors often benchmark expected stock returns against the returns from holding government bonds. Over the last 80 years, bonds have returned 1.7% whereas stocks have returned 6.9%. The difference is a risk premium that compensates investors for holding risky stocks. The equity risk premium (of stocks over bonds) has varied over time, from 0% to 9%, as shown in Figure 9-3.[7]

If you can predict how risk changes, you can make a lot of money by anticipating asset price changes. In late 2006, for example, risk premia became very small. Not only was the difference between expected returns on stocks versus bonds small, so were the differences between expected returns on low- versus high-quality stocks and between emerging market debt versus U.S. debt. Small spreads between risky and less risky assets meant either that the world had become less risky or that investors were simply ignoring risk in search of higher returns. In hindsight, it looks as if it was the latter. If you had been smart enough to recognize this, you would have moved out of risky assets and into less risky assets, like bonds. When risk returned in late 2007, the stock market began a 50% decline, and you would have earned a lot of money.

In fact, today's volatile stock market has given rise to new jargon, the so-called risk-on and risk-off investing, where investors attempt to profit by increasing their risk exposure when they expect favorable macro developments, and decreasing it when they foresee unfavorable developments. This can be easily understood as an application of the idea of long-run equilibrium. If you expect a reduction (or increase) in the risk that, for example, the European Union will dissolve, it makes sense to buy (or sell) assets with exposure to this risk.

MONOPOLY

If competitive firms live in the worst of all possible economic worlds, **monopoly** firms live in the best. Monopolies have attributes that protect them from the forces of competition.

- Monopolies produce a product or service with no close substitutes,
- Monopolies have no rivals, and
- Barriers to entry prevent other firms from entering the industry.

An example of a monopoly firm is a biotechnology company that develops and then patents a new variety of crop plant without any substitutes. Without rivals and with patent protection preventing others from entering, the firm will enjoy a period of protection from the forces of competition.

Unlike a competitive firm, a monopoly firm[8] can earn positive profit—an above-average rate of return—for a relatively long time. This profit is a reward for doing something unique, innovative, or creative—something that gives the firm less elastic demand.

But even monopolies are not permanently protected from the forces of entry and imitation. No barrier to entry lasts forever. Eventually other firms develop substitutes or invent new products that compete with the monopoly's products and erode monopoly profit. The main difference between a competitive firm and a monopoly is the length of time that a firm can earn above-average profit.

In the long run, even monopoly profit is driven to zero.

To see why this is so, recall from Chapter 6 that a firm will price at the point where $(P - MC)/P = 1/|\text{elasticity}|$. In the very long run, the forces of entry and imitation (the development of close substitutes) make the monopolist's demand more elastic. The elastic demand will push price down toward marginal cost and will eventually drive economic profit to zero.

Here is a well-known example from the portable music player industry. In October of 2001, Apple released the company's first portable music player, the iPod. The iPod's stylish design, straightforward user interface, and generous storage space gave Apple a unique, user-friendly product. The elasticity of demand for the iPod was very low, and the margins for the product were very high. Over the next several years, however, rivals like SanDisk, Samsung, and Microsoft released competing music players. The development of these rival products made demand for iPods more elastic. The higher elasticity reduced the iPod's price-cost margin, and Apple's profit eroded.

Of course, Apple didn't stand still. Its managers keep improving the product, keeping it innovative and different from rival products—in a word, unique. The fact that Apple is still making iPods is testament to the company's ability to innovate.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- A competitive firm can earn positive or negative profit in the short run until entry or exit occurs. In the long run, competitive firms earn only an average rate of return.
- Profit exhibits what is called **mean reversion**, or "regression toward the mean."
- If an asset is mobile, then in equilibrium the asset will be indifferent about where it is used (i.e., it will make the same profit no matter where it goes). This implies that unattractive jobs will pay **compensating wage differentials**, and risky investments will pay compensating risk differentials (or a risk premium).
- The difference between stock returns and bond yields is a compensating risk premium. When risk premia become too small, some investors view this as a time to get out of

risky assets because the market may be ignoring risk in pursuit of higher returns.
- **Monopoly** firms can earn positive profit for a longer period of time than competitive firms, but entry and imitation eventually erode their profit as well.

Multiple-Choice Questions

1. In the long run, which of the following outcomes is most likely for a firm?
   a. Zero accounting profits but positive economic profits
   b. Zero accounting profits
   c. Positive accounting profits and positive economic profits
   d. Zero economic profits but positive accounting profits
2. At the individual firm level, which of the following types of firms faces a downward-sloping demand curve?
   a. Both a perfectly competitive firm and a monopoly
   b. Neither a perfectly competitive firm nor a monopoly
   c. A perfectly competitive firm but not a monopoly
   d. A monopoly but not a perfectly competitive firm
3. Which of the following types of firms are guaranteed to make positive economic profit?
   a. Both a perfectly competitive firm and a monopoly
   b. Neither a perfectly competitive firm nor a monopoly
   c. A perfectly competitive firm but not a monopoly
   d. A monopoly but not a perfectly competitive firm
4. What is the main difference between a competitive firm and a monopoly firm?
   a. The number of customers served by the firm.
   b. Monopoly firms are more efficient and therefore have lower costs.
   c. Monopoly firms can generally earn positive profits over a longer period of time.
   d. Monopoly firms enjoy government protection from competition.
5. Which of the products below is closest to operating in a perfectly competitive industry?
   a. Nike shoes
   b. Eggs
   c. Perdue Chicken
   d. Restaurants
6. A firm in a perfectly competitive market (a price taker) faces what type of demand curve?
   a. Unit elastic
   b. Perfectly inelastic
   c. Perfectly elastic
   d. None of the above
7. A perfectly competitive firm's profit-maximizing price is $15. At MC = MR, the output is 100 units. At this level of production, average total costs are $12. The firm's profits are
   a. $300 in the short run and long run
   b. $300 in the short run
   c. $500 in the short run and long run
   d. $500 in the short run
8. What would happen to revenues if a competitive firm raised price?
   a. They would increase.
   b. They would increase but profit would decrease.
   c. They would increase along with profit.
   d. They would fall to zero.
9. If a firm in a perfectly competitive industry is experiencing average revenues greater than average costs, in the long run
   a. some firms will leave the industry and price will rise.
   b. some firms will enter the industry and price will rise.
   c. some firms will leave the industry and price will fall.
   d. some firms will enter the industry and price will fall.
10. A sudden decrease in the market demand in a competitive industry leads to
    a. losses in the short run and average profits in the long run.

b. above-average profits in the short run and average profits in the long run.
c. new firms being attracted to the industry.
d. demand creating supply.

Individual Problems

9-1 Faculty Housing Benefits

At a university faculty meeting in 2000, a proposal was made to increase the housing benefits for new faculty to keep pace with the high cost of housing. What will likely be the long-run effect of this proposal? (*Hint*: Think indifference principle.)

9-2 Entry and Elasticity

Suppose that new entry decreased your demand elasticity from –2 to –3 (made demand more elastic). By how much should you adjust your price of $10?

9-3 Snacks, Beer, and Marijuana

Snack food venders and beer distributers earn some monopoly profits in their local markets but see them slowly erode from various new substitutes. When California voted on legalizing marijuana, which side would you think that California beer distributors were on? What about snack food venders? Why?

9-4 Competitive Industries

Relative to managers in more monopolistic industries, are managers in more competitive industries more likely to spend their time on reducing costs or on pricing strategies?

9-5 Economic Profit

Describe the difference in economic profit between a competitive firm and a monopolist in both the short and long run. Which should take longer to reach the long-run equilibrium?

9-6 Economics versus Business

Describe an important difference in the way an economist and a businessperson might view a monopoly.

Group Problem

G9-1 Compensating Wage Differential

Give an example of a compensating wage differential, a risk premium, or some kind of long-run equilibrium price difference your company faces. How can your company profitably exploit this difference?

END NOTES

1. Eugene Fama and Kenneth French, "Forecasting Profitability and Earnings," *Journal of Business,* April 2000.
2. Profitability at time $t + 1$ = Profitability at time t – (0.38 x Profitability at time t); 12.4% = 20% – 7.6%.
3. Steven Landsburg, *The Armchair Economist: Economics and Everyday Life* (New York: Free Press, 1993).
4. Median salary of embalmers equals $43,800, and median salary of rehabilitation counselors equals $33,740 according to May 2011 National Occupational Employment and Wage Estimates from the Bureau of Labor Statistics.
5. Miriam Jordan, "Immigrants Turn to Farm Work Amid Building Bust," *Wall Street Journal,* June 13, 2008, available at http://online.wsj.com/article/SB121331595868170069.html.
6. The percentage return on an investment that is held for one period is equal to $(P_{t+1} - P_t)/P_t$, where P_t is the initial price of the investment. P_{t+1} is the expected price next period, so the difference is the expected return. If the current price increases (i.e., P_t increases), then the expected return decreases.
7. Adapted from information provided by William Spitz in October 18, 2006, presentation at Vanderbilt University.
8. In contrast to price takers (competitive firms), monopoly firms are price searchers. These firms face a downward-sloping demand curve; as price increases, quantity sold drops and vice versa. A price searcher "searches" for the optimal price—quantity combination.

CHAPTER 10

Strategy: The Quest to Keep Profit from Eroding

In 1971, three partners opened a coffee shop in Seattle's Pike Place Market. Two of the partners wanted to name the store after the ship *Pequod* from *Moby Dick*, but the third disagreed. Eventually they agreed to name the store after the *Pequod's* first mate. The company enjoyed mild growth until 1988 when the partners agreed to sell the company to their former director of retail operations and marketing. Over the following 20-plus years, that director has overseen the expansion of the company to over 17,000 worldwide stores as of 2012 and revenues of over 11 billion dollars. And in case you haven't put it all together yet—Starbuck was the first mate on the *Pequod* and that former director of retail operations is Howard Schultz, the current CEO of the world's largest coffee retailer, Starbuck's.

What has been the key to the company's success? According to Schultz:[1] "Starbucks is the quintessential experience brand and the experience comes to life by our people. The only competitive advantage we have is the relationship we have with our people and the relationship they have built with our customers." The ability to create this unique experience draws on distinctive capabilities the company has developed in both producing high-quality coffee and establishing a relationship-oriented culture among its employees and customers. In a 2012 study of U.S. consumer sentiments expressed through social media outlets, Starbucks ranked as the most loved restaurant-related brand,[2] and the company generated over $1.5 billion in 2011 operating income despite operating in a very competitive industry.

Succeeding in the face of competition requires that you first find a way to create an advantage and then figure out how to protect that advantage. How important is creating and sustaining advantage? Consider this story about the one of the most respected investors of our time:

> *Warren Buffett was once asked what is the most important thing he looks for when evaluating a company. Without hesitation, he replied, "Sustainable competitive advantage."*
>
> *I agree. While valuation matters, it is the future growth and prosperity of the company underlying a stock, not its current price that is most important. A company's prosperity, in turn, is driven by how powerful and enduring its competitive advantages are.*

> *Powerful competitive advantages (obvious examples are Coke's brand and Microsoft's control of the personal computer operating system) create a moat around a business such that it can keep competitors at bay and reap extraordinary growth and profit. Like Buffett, I seek to identify—and then hopefully purchase at an attractive price—the rare companies with wide, deep moats that are getting wider and deeper over time. When a company is able to achieve this, its shareholders can be well rewarded for decades. Take a look at some of the big pharmaceutical companies for great examples of this….*
>
> *It is extremely difficult for a company to be able to sustain, much less expand, its moat over time. Moats are rarely enduring for many reasons: High profit[s] can lead to complacency and are almost certain to attract competitors, and new technologies, customer preferences, and ways of doing business emerge. Numerous studies confirm that there is a very powerful trend of regression toward the mean for high-return-on-capital companies. In short, the fierce competitiveness of our capitalist system is generally wonderful for consumers and the country as a whole, but bad news for companies that seek to make extraordinary profit over long periods of time.*[3]

In the previous chapter, we discussed how the forces of competition tend to erode high profit; in this chapter, we show you what to do about it. This material will help you formulate long-run strategies to slow your firm's competitive erosion of profit—in essence how to build a moat around your company so that you can sustain profitability. We'll also evaluate Buffett's investment strategy.

STRATEGY IS SIMPLE

From the last chapter, you should now know that firms would rather be monopolists than competitors. In fact, if you hire management consultants, they should advise you to figure out how to become a monopolist (assuming they're worth the money you are paying them). To keep one step ahead of the forces that erode profit, firms develop strategies to

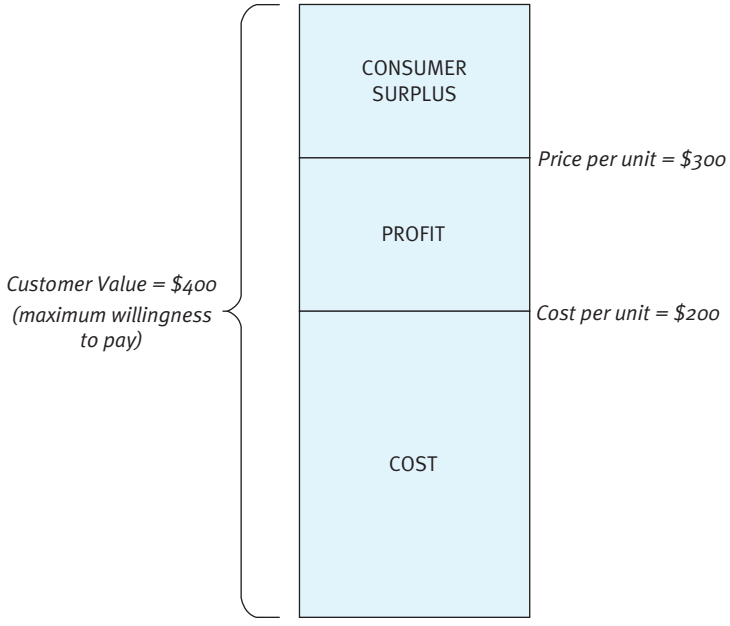


FIGURE **10.1 Allocation of Value**

gain *sustainable competitive advantage*. Firms have a competitive advantage when they can a) deliver the same product or service benefits as their competitors but at a lower cost or b) deliver superior product or service benefits at a similar cost. Firms with a competitive advantage are able to earn positive economic profits.

Teaching students to do this is probably among the most difficult things in business to teach, but it's also the most important to learn.

In some respects, strategy is very simple. Figure 10-1 shows the allocation of economic value for a particular product. Say a representative consumer values the product at $400, it's priced at $300, and it costs $200 per unit to produce. The box between $300 and $200 (price minus cost) represents $100 of profit to the firm. Strategy is all about how to increase the size of the profit box. The box gets bigger if the firm can lower its costs or raise its price. At a very high level, it's really that simple. Strategy is about raising price or reducing cost. Really successful firms manage to do both. Extremely successful firms like Starbucks do it over a long period of time, reflecting a *sustainable competitive advantage*.

SOURCES OF ECONOMIC PROFIT

So what are the keys to competitive advantage and generating sustainable economic profit? Two schools of thought offer differing points of view. The first—the industrial organization (IO) economics perspective—locates the source of advantage at the *industry* level. The second—the resource-based view (RBV)—locates it at the *individual firm* level.

The Industry (External) View

In the IO perspective, the focus is on the industry. According to Michael Porter, "The essence of this paradigm is that a firm's performance in the marketplace depends critically on the characteristics of the industry environment in which it competes."[4] Certain industries, due to their structural characteristics, are more attractive than other industries, and companies in those industries possess market power, which allows them to keep prices above the competitive level and to earn economic profit (above the opportunity cost of capital). Here is the logic behind this point of view: Industry structure determines firm conduct, and that conduct, in turn, determines the firms' performance. Industry structure includes factors such as barriers to entry, product differentiation among firms, and the number and size distribution of firms. For example, industries with high barriers to entry are more attractive because competitors find it more difficult to enter the industry and thus cannot drive profit down to competitive levels; firms in industries with differentiated products have less elastic demand and therefore higher profit; and industries with a small number of firms of different sizes are less likely to compete vigorously.

If industry structure is the most important determinant of long-run profitability, then the key to generating economic profit is to enter the right industry. According to Michael Porter's Five Forces model,[5] the best industries are characterized by

- high barriers to entry,
- low buyer power,
- low supplier power,
- low threat from substitutes, and
- low levels of rivalry between existing firms.

A key first step in applying the Five Forces model is defining what exactly we mean by "industry." An industry is comprised of a group of firms producing products that are close

substitutes to each other. For multiproduct companies, the analysis may need to be done on a product-by-product basis. Also, when you think about the Five Forces model, think about "value capture." Just because you are in an industry that creates value doesn't mean that you are going to capture it. Value can also be captured by suppliers, industry rivals, and buyers. Each of the participants wants to capture as much of the value created as possible: suppliers want to charge as much as possible, and buyers want to pay as little as possible. The Five Forces model helps you think about how much of the industry value your firm is likely to capture given the characteristics of the industry. Here's how.

Suppliers are the providers of any input to the product or service. Examples include labor, capital, and providers of raw/partially finished materials. Supplier power tends to be higher when the inputs they provide are critical inputs or highly differentiated. Concentration among suppliers also contributes to supplier power because a firm will have fewer bargaining options. Even if many suppliers exist, power may still be high if there are significant costs to switching between suppliers. The story on buyer power is similar. If buyers are concentrated (consider if your firm were an automotive supplier and your buyers were the major auto manufacturers) or if it is easy for buyers to switch from firm to firm, buyer power will tend to be higher. More power means these buyers will find it easier to capture value, taking it away from your firm.

As we discussed in the last chapter, economic profits tend to draw new entrants. These entrants will quickly erode the profit of an industry unless barriers prevent or slow their entry. Examples of entry barriers include government protection (e.g., patents or licensing requirements), proprietary products, strong brands, high capital requirements for entry, and lower costs driven by economies of scale. Substitute products can still erode a firm's ability to capture value even if barriers to entry are high. If close substitutes to a product are available and buyers find it inexpensive to switch to them, it will be hard for a firm to build and maintain high profits.

The final force concerns the rivalry among existing firms, the force most directly related to our typical view of "competition." If a large number of similarly situated firms compete in an industry with high fixed costs and slow industry growth, rivalry is likely to be quite high. Rivalry also tends to be higher when products are not very well differentiated and buyers find it easy to switch back and forth.

The wide differences in profitability across industries in Figure 10-2 support the IO view.[6] The most profitable industry, pharmaceuticals, exhibits relatively high barriers to entry, arising from significant investments in personnel and technology; moreover, successful products enjoy extended periods of patent protection (legal barriers to entry).

Overall, the IO view suggests that the way to earn economic profits is to choose an attractive industry and then develop the resources that will allow you to successfully compete in the industry. But, what about managers who don't have the luxury of choosing a new industry? The tools of industry analysis can still be helpful. First, move beyond a historical analysis of your industry to think about how the five forces might change in the future. Second, and more importantly, think about what actions you can take to make your current industry position more attractive. For example, how can you reduce supplier power? The answer is to increase rivalry among your suppliers. One way you can do this by using an online procurement auction to purchase raw materials and semifinished inputs. Auctions are the topic of Chapter 17. Steps that you take to decrease rivalry with your competitors, reduce buyer power, and build entry barriers will all help improve the attractiveness of your industry position.

It's also important to realize the limitations of tools like the Five Forces. This view portrays an industry as a zero-sum game; that is, the way you get a bigger piece of the pie is to

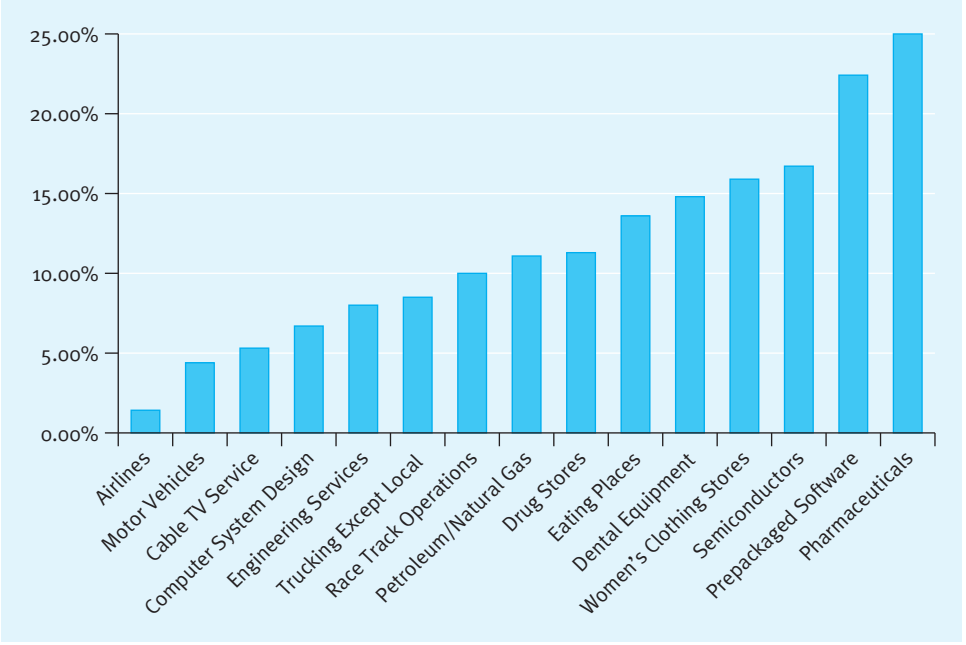


FIGURE **10.2 Profitability Differences Between Industries**

take it from one of the other participants in the industry. Although this is one way to view competition (and one that is often correct), companies can also work with other industry participants to try to build a larger pie. With a larger pie, everyone's slice grows bigger. Cooperative efforts with rivals, buyers, and suppliers feature prominently in a book by Adam Brandenberger and Barry Nalebuff called *Coopetition* (cooperative competition). The authors remind us that to look beyond the threats to firm profitability, emphasized by Porter's Five Forces analysis, to *opportunities* for cooperation that can enhance firm profitability. Annabelle Gawer and Michael A. Cusumano offer a similar idea for thinking about strategy in industries like telecommunications where success requires creating an "ecosystem" of complementary products.[7] A company must first decide whether to pursue a "product" or a "platform" strategy; a "product" is proprietary and controlled by one company whereas a "platform" needs a set of complementary innovations to reach its full potential. One of the biggest mistakes a company can make is to pursue a product strategy and fail to recognize the platform value of their product. The best example of this is perhaps the Macintosh computer, which, due to its early technological lead, could have become the dominant platform for personal computing. Instead they priced high, failed to encourage complementary innovation, and let Microsoft become the dominant platform.

The Resource (Internal) View

If industry structure told the whole story about strategy, we wouldn't expect to find performance differences across firms within industries. These differences do exist, however, and the resource-based view (RBV) gained favor in the 1990s as an explanation for these interfirm differences.

The RBV explains that individual firms may exhibit sustained performance advantages due to their superior resources, where resources are defined as "the tangible and intangible assets firms use to conceive of and implement their strategies."[8] Resources can include tangible resources like equipment, real estate, and financial capital as well as intangible resources like brand, knowledge, and organizational culture.

Two primary assumptions underlie the RBV: resource heterogeneity and resource immobility. Essentially, the RBV views firms as possessing different bundles of resources that are immobile (resist transfer or copying). These immobile resources give rise to differences in firm profitability within an industry.

Given the assumption of resource heterogeneity, the RBV[9] provides further guidance on when resources may lead to superior performance, where superior performance is defined as the firm's ability to earn above-average profit. If a resource is both valuable and rare, it can generate at least a temporary competitive advantage over rivals. A valuable resource must allow a business to conceive of and implement strategies that improve its efficiency or effectiveness. Examples include resources that let a firm operate at lower costs than its rivals or charge higher prices to its customers. For a resource to be rare, it must not be simultaneously available to a large number of competitors.

Resources that generate temporary competitive advantage do not necessarily lead to a sustainable competitive advantage. For such resources to deliver a sustainable advantage, they must be difficult to substitute for or imitate. Otherwise, any advantages that those resources deliver will be competed away. Imitation and substitution both erode firm profit. In the first, a competitor matches the resource by exactly duplicating it; in the second, a competitor matches the resources by deploying a different but strategically equivalent resource. We can list several conditions that make resources hard to imitate *(inimitability)*:

1. Resources that flow from a firm's unique historical conditions will be difficult for competitors to match.
2. If the link between resources and advantage is ambiguous, then competitors will have a hard time trying to re-create the particular resources that deliver the advantage.
3. If a resource is socially complex (e.g., organizational culture), rivals will find it difficult to duplicate the resource.

Be wary of any advice you read that claims to identify critical resources or capabilities that successful companies have to develop in order to gain a competitive advantage. You should be skeptical of such advice for two reasons. First, explanations such as these often mistakenly conclude a causal relationship when only a correlation exists. Remember the *Good to Great* companies that we mentioned in the last chapter. They all had five management principles in common that supposedly drove their success. Their subsequent less-than-great performance raises serious doubts about whether these "best practices" caused their prior superior performance. As a general rule, be wary of consultants claiming that they can identify "best practices."

The second reason you should question such advice has to do with the nature of competition in general. Publicly available knowledge is *not* going to help you create a competitive advantage. Let's say an author discovers that having a CMEO (Chief Managerial Economics Officer) in your company always leads to a competitive advantage in companies and publishes this advice in a new book. You read the book and decide to hire a CMEO for your business and no competitive advantage follows. What happened? Well, your competitor probably read about the CMEO "secret" as well and hired one, too. Now that

everyone knows about it, no advantage is possible. Competitive advantage flows from having something that competitors can't easily duplicate, such as an extremely valuable brand like Starbucks. You're not likely to find these on the shelves of your local bookstore. Nor are you likely to find it from a consultant who is selling the same advice that he or she sells to your competitors.

THE THREE BASIC STRATEGIES

A firm looking to generate superior economic performance, given its industry and resource base, has three basic strategies it can follow to keep one step ahead of the forces of competition:

1. cost reduction,
2. product differentiation, or
3. reduction in competitive intensity.

Most strategies fall into one of these three categories. The first strategy, cost reduction, is pretty self-explanatory. Low-cost strategies are usually found in industries where products are not particularly differentiated and price competition tends to be fierce. Note, however, that cost reductions generate increases in long-run profitability *only* if the cost reduction is difficult to imitate. If others can easily duplicate your actions, cost reduction will not give you sustainable competitive advantage.

The third strategy, reducing competitive intensity, is also self-evident. If you can reduce the level of competition within an industry and keep new competitors from entering, you may be able to slow the erosion of profitability. (In the chapter on strategic interaction, we'll use game theory to develop strategies that reduce the intensity of competition.) One easy way to reduce rivalry is to ask the government to do it for you. This is what the bookselling industry in Germany does. Discounting of new books by German booksellers is illegal, essentially making price competition a crime. U.S. washing machine manufacturers have benefited from regulation as well. A 2000 Department of Energy regulation banned the sale of low-priced washing machines under the guise of increasing energy efficiency. Who were the biggest supporters of the ban? It was not the consumers, who by a margin of six-to-one preferred to purchase lower-priced machines. It was the washing machine manufacturers—because now they would be able to sell expensive "front-loading" models at an average price of $240 more than the banned machines.[10]

We can interpret the second strategy, product differentiation, as a reduction in the elasticity of demand for the product. Less elastic demand leads to an increase in price because the optimal margin of price over marginal cost is related to the elasticity of demand; that is, $(P - MC)/P = 1/|e|$. The more unique your product is relative to other products, the less elastic is your demand and the higher is the margin of price over marginal cost. Starbucks is an excellent example of a company that has successfully pursued a differentiation strategy for over 40 years. And they have pursued differentiation in both the product (coffee) and the overall experience as well.

Another successful example of a product differentiation strategy is Perdue Chicken. Frank Perdue took an essentially homogeneous product—chicken—and turned it into a branded product, Perdue Chicken. He did this by exercising quality control over the entire supply chain, from the feed to the final product. Consumers perceive his branded chickens

to be of higher quality. Thus, they have less elastic demand, allowing Perdue to charge a higher price. Economies of scale (cost reduction) also have played a part in Perdue's success.

Prelude Lobster's[11] managers tried a product differentiation strategy similar to Perdue's. Although they advertised their superior after-catch handling of the lobsters, customers correctly perceived that, for lobsters, unlike chicken, the supply chain is largely uncontrollable. Prelude was eventually forced out of business by lower-cost competitors who did not advertise.

With the benefit of hindsight, it is easy to identify successful strategies (and the reasons for their success) or failed strategies (and the reason for their failures). It's much more difficult to identify successful or failed strategies before they succeed or fail. But this is what you have to do in order to invest successfully, or to build successful strategies.

To illustrate the importance of this idea, let's return to the wisdom of investing in companies with a sustainable competitive advantage. This strategy leads to sustained, above-average profitability for the company, but remember that the stock price also determines the return from investing. If the stock price is high relative to its discounted future earnings, the investment is a bad one, regardless of whether the company has a sustainable competitive advantage. Warren Buffett, for instance, makes money by acquiring companies whose potential future earnings are high relative to their current stock price. He then helps develop strategies to help them realize their high potential earnings by creating a sustainable competitive advantage. He doesn't make money simply by investing in companies with a current competitive advantage. Instead, his success is due to his ability to help these companies craft successful long-run strategies.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Strategy is simple—to increase economic performance, figure out a way to increase P (price) or reduce C (cost).
- The industrial organization economics (IO) perspective assumes that the industry structure is the most important determinant of long-run profitability.
- The Five Forces model is a framework for analyzing the attractiveness of an industry. Attractive industries have low supplier power, low buyer power, high entry barriers, low threat of substitutes, and low rivalry.
- According to the resource-based view (RBV), individual firms may exhibit sustained performance advantages due to their superior resources. To be the source of sustainable competitive advantage, those resources should be valuable, rare, and difficult to imitate/substitute.
- Strategy is the art of matching the resources and capabilities of a firm to the opportunities and risks in its external environment for the purpose of developing a sustainable competitive advantage.
- Be wary of any advice you read that claims to identify critical resources or capabilities that successful companies have to develop in order to gain a competitive advantage.
- To stay one step ahead of the forces of competition, a firm can adopt one of three strategies: cost reduction, product differentiation, or reduction in the intensity of competition.

Multiple-Choice Questions

1. An industry is defined as
   a. a group of firms producing the exact same products and services.
   b. firms producing items that sell through the same distribution channels.

c. firms that have the same resources and capabilities.
d. a group of firms producing products that are close substitutes.

2. Attractive industries have all the following, except
a. high supplier power.
b. low buyer power.
c. high entry barriers.
d. low rivalry.

3. Buyers have higher power when
a. firms sell a highly differentiated product.
b. they are not a significant purchaser of the supplier's output.
c. switching costs are low.
d. the buyer industry is highly fragmented (buyers are not concentrated).

4. All of the following are example of entry barriers, except
a. government protection through patents or licensing requirements.
b. strong brands.
c. low capital requirements for entry.
d. lower costs driven by economies of scale.

5. The forces that create high rivalry within an industry include all of the following except
a. numerous competitors.
b. high fixed costs.
c. fast industry growth.
d. low switching costs for buyers.

6. The concept that explains firms possessing different bundles of resources is
a. resource heterogeneity.
b. resource immobility.
c. barriers to entry.
d. imitability.

7. If a firm successfully adopts a product differentiation strategy, what should happen to the elasticity of demand for its product?
a. Increase
b. Decrease
c. Become unit elastic
d. Is unaffected

8. When a resource or capability is valuable and rare, a firm may gain a
a. sustainable competitive advantage.
b. competitive parity.
c. cost advantage.
d. temporary competitive advantage.

9. Which of the following is critical for a firm adopting a cost-reduction strategy?
a. The firm must be the first to adopt the cost-reduction strategy.
b. The strategy reduces costs by at least 10%.
c. The strategy is focused on reducing internal production costs.
d. The methods of achieving cost reductions are difficult to imitate.

10. When a resource or capability is valuable, rare, hard to imitate, and nonsubstitutable firms may gain
a. a temporary competitive advantage.
b. a complex competitive advantage.
c. competitive parity.
d. a sustainable competitive advantage

Individual Problems

10-1 High Rivalry

For each category, indicate which condition is associated with higher rivalry among competitors.

Number of firms	High	Low
Fixed costs	High	Low
Level of product differentiation	High	Low
Industry growth	High	Low
Buyer switching costs	High	Low

10-2 Increasing Customer Value

To increase a company's performance, a manager suggests that the company needs to increase the value of its product to customers. Describe three ways in which this advice might be incorrect (*Hint*: Think about what else might or might not change that affects profit.)

10-3 Intangible Resources

Why might intangible resources like human capital and intellectual assets be a more likely source of sustainable competitive advantage than tangible resources?

10-4 Five Forces and the Airline Industry

Examine the U.S. passenger airline industry using the Five Forces. Is this an attractive industry? Why or why not?

10-5 Smart Phone Market

The smart phone market has been dominated by Apple, but recently the Droid has been able to leverage Google's information services into market gains while Blackberry, known for its secure business oriented network, has attempted to become more attractive with a "friendlier" interface. At the same time, a number of less capable fringe firms are emerging. How do these features fit into an Industrial Organization (IO) view of the market versus a Resource-Based View (RBV)?

10-6 Salons and Teeth Whitening

Salon owners have recently started offering teeth whitening services to clients in addition to their more standard services. In a number of states, regulators have ordered the salon owners to stop, claiming that this service constitutes the practice of illegal dentistry. What group would you expect to be behind the state's efforts to ban salons from providing teeth whitening services? Why?

Group Problems

G10-1 Strategy

What strategy is your company following (try to classify it into one of the three strategies in the text)? How is your strategy working—how long will it allow you to maintain a competitive advantage?

G10-2 Resources

What are your firm's key resources and/or capabilities? How do these translate into a competitive advantage?

END NOTES

1. See http://www.forbes.com/sites/carminegallo/2011/03/25/starbucks-ceo-lesson-in-communication-skills/.
2. See http://www.digitalcoco3.com/brand-love-infographic/.
3. Whitney Tilson, "Boring Portfolio" column on the Motley Fool site, February 28, 2000, http://www.fool.com/boringport/2000/boringport000228.htm.
4. Michael Porter, "The Contributions of Industrial Organization to Strategic Management," *Academy of Management Review* 6 (1981): 609–620.
5. Michael Porter, *Competitive Strategy* (New York: Free Press, 1980).
6. Profitability measured by operating income divided by assets over the period 1988–1995. Adapted from Pankaj Ghemawat and Jan W. Rivkin. "Creating Competitive Advantage." Harvard Business School Background Note 798-062, February 2006 (revised from original January 1998 version).
7. A. Gawer and M. A. Cusumano, "How Companies Become Platform Leaders," *Sloan Management Review* 49 (2008): 28–35. Michael Porter also recognizes the importance of considering complements in an industry although he argues that the presence of complements is not necessarily bad or good for an industry. He suggests that complements affect industry profitability through the way they influence the other five forces.
8. Definition from J. B. Barney and A. M. Arikan, "The Resource-Based View: Origins and Implications," in *The Blackwell Handbook of Strategic Management,* eds. M. E. Hitt, R. E. Freeman, and J. S. Harrison (Oxford: Oxford University Press, 2001), 138.
9. For an overview of the resource-based view, see Jay Barney, "Firm Resources and Sustained Competitive Advantage," *Journal of Management* 17 (1991): 99–120. The explanation contained here draws from that description.

10. For more on how companies use the legal and regulatory process to further their competitive strategies, see Richard Shell's book, *Make the Rules or Your Rivals Will*. For more on regulation, see S. E. Dudley, *Primer on Regulation* (Mercatus Policy Series, George Mason University, November 2005), available at http://mercatus.org/publication/primer-regulation.
11. Harvard Business School case number 9-373-052, "Prelude Corp."

CHAPTER 11

Foreign Exchange, Trade, and Bubbles

When the business plan for the new Nissan Rogue was developed in September 2005, the exchange rate was 115 USD/JPY. At this exchange rate, the contribution margin for cars sold in the United States was projected to be 18%.

When the Rogue was launched 21 months later, the dollar had *appreciated* to 124 USD/JPY. For the U.S. division of Nissan this was good news because the Rogue was produced in Japan, but sold in the United States. Consequently, the costs Nissan incurred (in yen) had gone down relative to the revenue they earned (in dollars). The contribution margin jumped to 20%. We illustrate this change in Figure 11-1 below.

As you can see in the figure, Nissan's good fortune did not last long. In 2008, the dollar started falling in value. By June 2011, the dollar had fallen to 77 USD/JPY and this caused the Rogue's margin to fall to 12%. The exchange rate movements, which initially raised profit at the U.S. Division, were now hurting it.

To insulate itself against future exchange rate movements, Nissan is increasing the "localization rate" of vehicles sold in the United States. By 2015, 85% of value-added to Nissan vehicles sold in the United States will be from the United States, up from today's rate of 70%. Greater localization means that costs, and profit, are affected less by exchange rate movements.

In this chapter, we give you the tools to analyze events like this. First, we show you how exchange rates are determined. Second, we show you how changes in exchange rates affect firms and consumers. And finally, we tell you what economists know about "bubbles," prices that are not determined by the usual forces of supply and demand. The bursting of asset bubbles had a big effect on exchange rates, so we put them in this chapter.

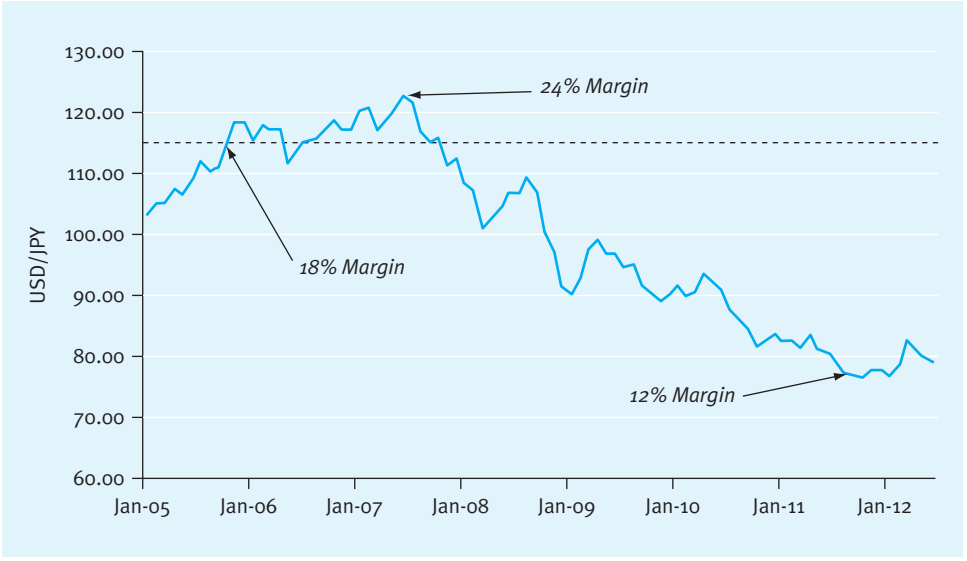


FIGURE **11.1 USD/JPY Exchange Rate**

THE MARKET FOR FOREIGN EXCHANGE

To understand how exchange rates are determined, we are going to examine the curious case of Iceland. It began in 2001 when all three of Iceland's recently privatized banks decided to enter the high-risk world of investment banking. They borrowed from other banks, and bought Beverly Hills condos, British soccer teams, and Danish airlines.

Buoyed by the belief that asset prices would keep rising, the banks borrowed as much as they could, as quickly as they could, and bought as much as they could. But by 2006, the Icelandic banks were finding it difficult to borrow from other banks, so they started taking deposits through the Internet, mainly from the UK. In just two years, the number of depositors outnumbered the population of Iceland, and the amounts in just those accounts was more than Iceland's national income.

In 2008, the entire process began to unravel. In response to declining asset prices, the rating agencies downgraded Iceland's banks, and foreign depositors rushed to withdraw their money. Iceland's currency, the krona, plunged in value, and prices of imported goods soared.[1]

Although this adjustment caused a lot of pain, there is an upside to a weak currency—Iceland's exports started looking a lot less expensive. Today, Iceland's economy is growing again. It is easy to contrast the crash and recovery in Iceland with the slow crash still going on in Greece. Because Greece does not have its own currency (it abandoned the drachma when it joined the Eurozone in 2001), it cannot devalue its currency. Unemployment has soared. Because their exchange rate is "fixed" with respect to the rest of the Eurozone, the path to recovery taken by Iceland is not open to Greece.

To understand the determinants of exchange rates, we begin by asking a simple question "why do people want to trade one currency for another?" If an Icelander, for example,

buys a Land Rover (built in the UK) and pays the manufacturer in krona, the manufacturer changes krona (ISK) into pounds (GBP) because Land Rover's workers and suppliers are in the UK, and want to be paid in pounds. For ease of exposition, we are going to adopt the convention that to buy the Land Rover, the Icelandic consumer "sells krona to buy pounds" and pays for the car in pounds. This is not literally true, but someone in the supply chain, the manufacturer, the exporter, or the local car dealer must exchange krona for pounds. To simplify the explanation, we assume that it is the consumer who pays for the car in pounds.

In other words, Icelandic consumers who want to buy British goods "demand" pounds. The aggregate demand for the British pound includes everyone in Iceland who wants to purchase British goods and services, or who wants to invest in Britain. To do so, they have to "sell" krona to "buy" pounds. Every time you see the word "buy," think of demand, and every time you read the word "sell," think of supply.

On the other side of the transaction are those who want to "sell" pounds to "buy" krona. The "supply" of pounds includes everyone in Great Britain who wants to buy Icelandic goods and services or who wants to invest in Iceland. The market for foreign exchange brings together the demanders of pounds and the suppliers of pounds, and the equilibrium price is the exchange rate, or the price of a pound measured in krona.[2]

We plot the price of a pound measured in krona in Figure 11-2. The financial symbol for this exchange rate is GPB/ISK. We see that the price of a pound went from 125 krona in 2008 to about 200 in 2012. We say that the pound *appreciated*, or that that krona *depreciated*.

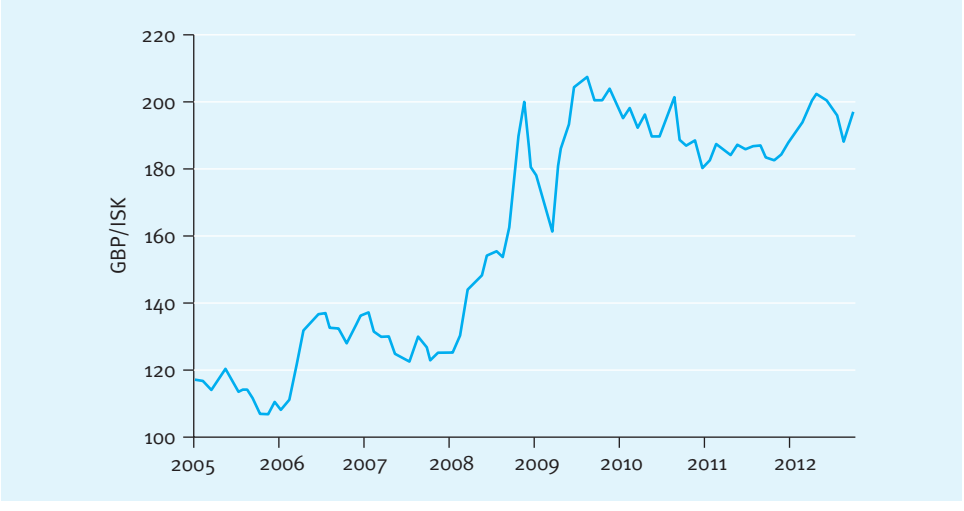


FIGURE **11.2 GBP/ISK Exchange Rate**

To figure out why these changes occurred, we are going to apply the tools of Chapter 8 to the market for foreign exchange. Think of the demand and supply of pounds as determining the price of a pound (the exchange rate). You can also analyze these movements by using the supply and demand for krona. The trick is realizing that the supply of pounds—those who sell pounds to buy krona—is also the demand for krona. Likewise, the demand

for pounds—those who sell krona to buy pounds—is also the supply of krona. And the price of a krona, measured in pounds, is the inverse of the price of a pound. So if the price of a pound went up from 125 to 200 krona, we could instead say that the price of a krona declined from 0.008 pounds, to about 0.005 pounds, or about half a penny.

Now that you understand who is behind the demand and supply of foreign exchange, try to analyze the effect of the bust in Iceland, when the UK depositors withdrew their deposits from Icelandic banks.

Here is how to do it. Since they receive deposits in krona but live in the UK, when the UK depositors withdrew their krona deposits, they *sold krona to buy pounds*. This is an increase in the demand for pounds which makes the pound *appreciate* against the krona.

The only difficult part of exchange rate analysis is keeping track of your frame of reference. If you are looking at it from the point of view pounds, it is a demand increase, but if you are looking at it from the point of view of krona, it is a supply increase. Both frames give you the same answer (a pound appreciation or a krona depreciation), but a different curve will shift.

Now let's test your understanding of this kind of analysis: Try to figure out how a decrease in U.S. interest rates affects the dollar exchange rate against a foreign currency, like the yen. This is the kind of question you might get in a job interview for a job at Nissan.

To answer it, think of how a lower U.S. interest rate would affect a foreign borrower or a foreign investor. A foreign borrower would increase borrowing in dollars in response to the lower U.S. interest rate. She would borrow dollars from a U.S. bank, and then sell the dollars to buy yen to invest in Japan. This is sometimes referred to as the "carry trade." You should recognize this as an increase in the supply of dollars ("selling" dollars), which makes the dollar depreciate against the foreign currency.

Notice that we get the same answer when we look at the carry trade from the point of view of a foreign investor, looking to earn a high interest rate. A reduction in U.S. rates makes U.S. investments less attractive to Japanese investors. Japanese investors shift some investment dollars out of the United States by "selling" dollars to "buy" yen. As above, this is an increase in the supply of dollars, which reduces the price of a dollar. So from the point of view of both foreign investors and foreign borrowers, a decrease in U.S. interest rates will cause a dollar devaluation.

In fact, this is one of the mechanisms by which the U.S. Federal Reserve is trying to stimulate the U.S. economy. Lower interest rates lead to a weaker dollar, which makes our exports look cheaper. To see this, consider a Japanese consumer thinking about the purchase of a $60,000 U.S.-produced Chevrolet Corvette. At an exchange rate of 1 USD = 115 JPY, the car costs 6.9 million yen. If the dollar depreciates to 1 USD = 105 JPY, the car now only costs the Japanese buyer 6.3 million yen. At this lower price, the Corvette looks a lot more attractive.

THE EFFECTS OF A CURRENCY DEVALUATION

Now that we understand how exchange rates are determined, the next topic is how exchange rates affect the domestic economy. For example, when the peso falls in value relative to the dollar (a peso devaluation), what happens to the demand and supply of golf in Tijuana and in San Diego, "sister" towns on either side of the Mexico-U.S. border? The golf courses represent Mexican and U.S. firms, located on either side of the border, and the golfers represent Mexican and U.S. consumers, who can cross the border to play golf in either country.

Let's first look at the effects on Mexican golf courses. There are two types of consumers who play golf in Mexico: Mexicans and Americans. Recall that in order to play golf in Mexico, an American golfer must sell dollars to buy pesos. Because a dollar buys more pesos, the peso devaluation makes Mexican golf look less expensive to the American golfer.

Similarly, U.S. golf starts looking more expensive to the Mexican golfer. Both U.S. golfers and Mexican golfers substitute away from more expensive U.S. golf toward cheaper Mexican golf. In other words, a weaker peso *increases* demand for Mexican golf and decreases demand for U.S. golf. Domestic supply does not change.

We represent these changes graphically in Figure 11-3. As above, the key to understanding the two changes is to keep track of the frame of reference. Let's begin with Mexico. A peso devaluation increases the demand for golf in Mexico but does not affect supply. As a result, the price of Mexican golf goes up, where the price is measured in pesos. The higher price helps the Mexican golf course owners (producers), but hurts the Mexican golfers (consumers).

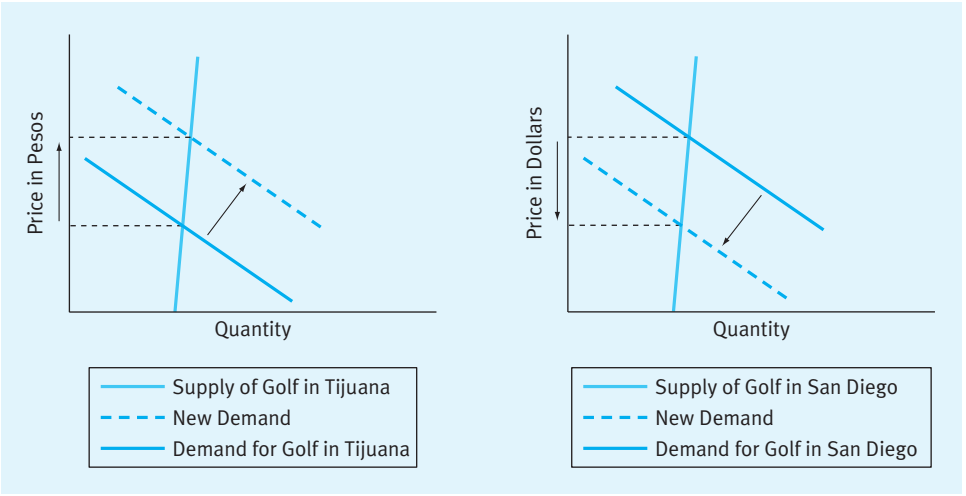


FIGURE **11.3 Demand-Supply Analysis of a Peso Devaluation**

Now let's look at the change from the point of view of U.S. golf courses. In the United States, the devaluation makes Mexican golf look cheaper, which is a substitute product. This reduces demand for U.S. golf courses and results in a reduction in price, measured in dollars. In general, one country's devaluation helps suppliers and harms consumers but it also harms foreign producers and benefits foreign consumers.

Currency devaluations help producers because they make exports less expensive, but they hurt consumers because they make imports more expensive.

Let's use this intuition to examine the effects of an appreciation in the pound (or a devaluation of the krona) on Iceland producers and consumers. Iceland producers (e.g., fishermen) have two sets of consumers who demand their product: domestic consumers and foreign consumers who buy exported fish. An appreciation of the pound, like that which

occurred in 2008, would increase export demand for fish in Iceland, and the price of fish (in krona) would increase. These changes would help Icelandic producers but hurt Icelandic consumers.

Similarly, foreign car producers have two sets of consumers, domestic and foreign, who buy their product. In England, an appreciation of the pound decreases foreign or export demand and causes a drop in price (in pounds). These changes would hurt British producers but help British consumers.

BUBBLES

From 1980 to about 2007, the economies of the developed world experienced steady growth, low unemployment, and mild inflation. Things were so good, for so long, that this period has been called the "great moderation." When it ended, it was sudden, dramatic, and unexpected. Very few economists predicted the crash, but since it happened, many have tried to come up with explanations for it. With this chapter, we include ourselves among them.

Our explanation has to do with the self-fulfilling role of expectations. During the great moderation, people began to expect that things would continue as they had for so long. To see how this could affect price, imagine that buyers and sellers see a price increase in one year and expect a similar price increase in the following year. How do these expectations about the future affect price today?

If buyers expect a future price increase, they will accelerate buying to avoid it just as sellers will delay selling to take advantage of it. We illustrate these changes in Figure 11-4, which shows an increase in demand and a decrease in supply. Both changes tend to increase price. If consumers expect prices to increase, they change behavior in ways that tend to increase the current price. In other words, once people form expectations about future price increases, these expectations become self-fulfilling. This is often what economist mean when they talk about "bubbles."

In addition, if buyers expect prices to increase faster than the interest rate, it makes sense to borrow as much money as possible to buy now in order to sell in the future. This will also tend to increase demand. In fact, an increase in leverage, or borrowing, often accompanies bubbles.

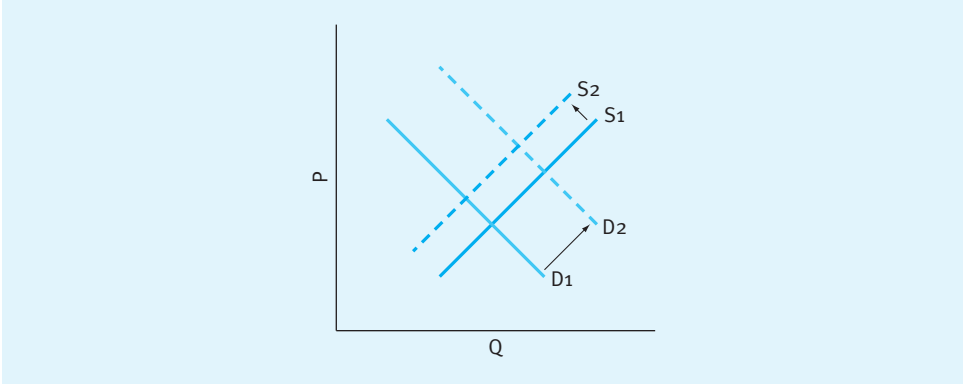


FIGURE **11.4 Effects of Expectations on Demand and Supply**

There are certain features, or empirical regularities, of bubbles that economists have documented.[3]

1. Bubbles emerge when investors have disagreements about the importance of particular economic events. Given the greater cost of betting on prices decreasing rather than increasing, more optimistic investors dominate.
2. Bubbles involve very large increases in trading volume.
3. Bubbles may continue even when many suspect a bubble. The bubble won't pop, however, until a sufficient number of skeptical investors act simultaneously. So far, no one has figured out how to predict when this is likely to occur.

To illustrate these phenomena, let's look at the recent housing market in the United States. The increase in prices began in 1993 when the government enacted policies designed to encourage low-income homeowners to buy houses. The government reduced qualifications for home borrowing from government-sponsored lenders like Fannie Mae. This led to an increase in demand for houses and a dramatic increase in rates of home ownership, from 64% to 69%, as shown in Figure 11-5.[4] This is the "big economic development" that started the bubble.

Especially in areas where the supply was limited by strict zoning laws (e.g., East Coast, California, and Florida), prices increased dramatically. Because many market participants expected housing prices to continue to increase, they borrowed heavily to buy bigger and sometimes even second houses. The bankers who lent them money thought that the loans were "safe" because the price of the underlying asset had always gone up in the past. As a consequence, banks were willing to lend on very favorable terms.[5]

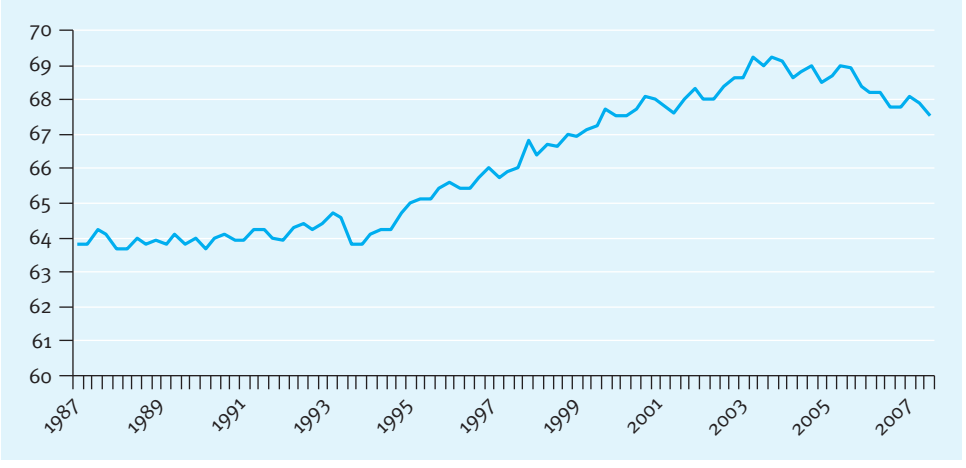


FIGURE **11.5 U.S. Home Ownership Rate**

HOW CAN WE RECOGNIZE BUBBLES?

In 2006, David Lereah, chief economist of the National Association of Realtors, published a book titled *Are You Missing the Real Estate Boom? Why Home Values and Other Real Estate Investments Will Climb Through the End of the Decade—And How to Profit from Them.* He thought that the increase in housing prices was entirely rational and could be

easily explained by economic fundamentals: low inventories, low mortgage rates, and favorable demographics caused by a big increase in boomers and retirees, who often buy second homes. He predicted that the price increase would continue at least through the end of the decade.

In contrast to Lereah, Yale economist Robert Shiller warned of an irrational housing bubble in 2005.[6] He identified the bubble by noting that house prices were becoming very expensive relative to rents. In long-run equilibrium, homeowners should be indifferent between renting and buying. If we plot the relationship between the rents and prices, we see a dramatic increase in prices. It turns out that Professor Shiller was right, although he had to wait a couple of years to be proven so. In Figure 11-6, we see the dramatic decline in house prices beginning in 2006.

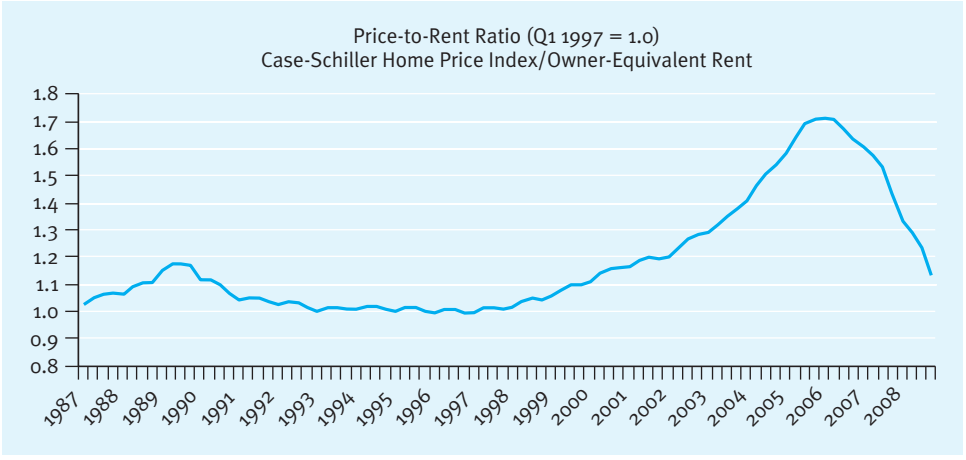


FIGURE **11.6 Renting versus Owning**

So why did the bubble pop? If you believe the bubble-ologists, it must have been because there were enough skeptical investors who, like Professor Shiller, started betting on house prices to fall. But the truth is that we don't know. If we did, we probably wouldn't tell you (we would trade on the information instead); and we certainly wouldn't spend our time writing textbooks (instead we would sell investment advice).

Interestingly, this was not Professor Shiller's first good call on a price bubble. In 2000, he made what is perhaps the best prediction in stock market history when his book *Irrational Exuberance* was released at the same time that the "Internet" or "tech" bubble began to burst. He identified the bubble by looking at the long-run equilibrium relationship between stock prices and earnings or profit. If prices are rational, then they should equal the discounted flow of future earnings. Obviously, we cannot observe future earnings, so Professor Shiller plotted current stock prices against a 10-year trailing average of past earnings.

In Figure 11-7, we update Professor Shiller's analysis and plot the Price/Earnings ratio of the S&P 500 index (and comparable predecessor indices) going back to 1882. The average of the ratio is about 16, which means that, on average, a stock's price is about 16 times its trailing earnings. Equivalently, if you hold a typical stock for 16 years, earnings will just cover the purchase price, on average.

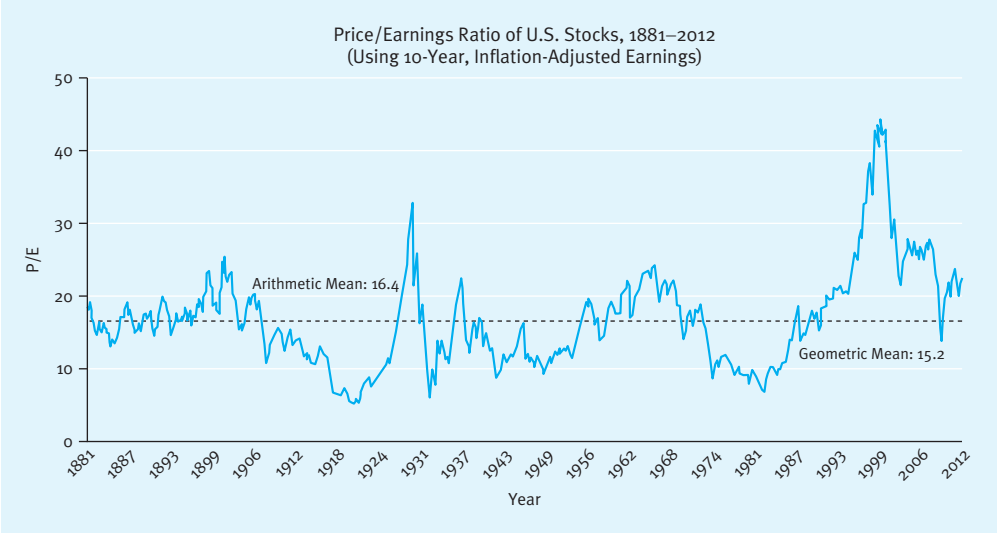


FIGURE **11.7 Stock Price/Earnings Ratio**

So what do bubbles have to do with Iceland exchange rates? Looking at Shiller's graph, we see that from 2003 to 2007, the stock market was very expensive. In fact, there are only two other episodes in history where stock prices have been this high, 1929 and 2000. In both of these cases, prices crashed after reaching these heights. Shiller's methodology tells us that Icelandic banks began borrowing and investing at a time when asset prices were very expensive. Once the asset prices began to come down, depositors lost faith in the banks' ability to pay them back, which precipitated the run on Icelandic banks. And this led to a depreciation of the krona.

PURCHASING POWER PARITY

So what are the long-run relationships that tell us when a currency is overvalued, relative to its "intrinsic" value? The answer is called *purchasing power parity*, the idea that exchange rates and/or prices should adjust so that tradable goods cost just as much no matter where you buy them. If they didn't, there would be a higher-valued use for the good. Exporters could make money by buying the good in one country and selling it in another. This is sometimes referred to *arbitrage*.

In July 2007, the *Economist* reported that a Big Mac cost $7.61 in Iceland, $3.41 in the United States, and only $1.45 in China. The theory of purchasing power parity says that arbitrage should push these prices together. The idea is that if goods are cheaper in China, exporters can buy them in China, ship them to the United States, and then sell them to U.S. consumers. If enough exporters do this, then the exchange rate adjusts to bring the prices closer together.

Here's how the prices converge. An increase in exports of Chinese Big Macs to the United States means the U.S. consumers sell dollars to buy yuan, increasing demand for yuan. This appreciates the yuan relative to the dollar, which causes an increase in the dollar price of a Big Mac. Used in this way, the *Economist*'s "Big Mac Index"[7] can tell you which currencies are overvalued (Iceland) or undervalued (China) relative to the dollar.

Now there are some problems with the theory linking these foreign exchange markets together. The obvious one is that Big Macs are not traded goods and cannot be shipped thousands of miles. However, many of the constituent ingredients in a Big Mac are actively traded, and the Big Mac Index turned out to be a very good predictor of the bubble in Iceland.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- In the market for foreign exchange between England and Iceland, the supply of pounds includes everyone in Britain who wants to sell pounds to buy krona in order to buy Icelandic goods, or invest in Iceland. The supply of pounds is also equal to the demand for krona.
- In the market for foreign exchange between England and Iceland, the demand for pounds includes everyone in Iceland who wants to sell krona to buy pounds in order to buy British goods, or invest in Britain. The demand for pounds is also equal to the supply of krona.
- A decline in dollar-denominated interest rates will induce foreign investors to borrow in dollars, sell the dollars to buy a foreign currency, and then invest in the foreign country (the so-called carry trade). This causes a dollar depreciation.
- Currency devaluations increase domestic demand by making exports cheaper and imports more expensive. Devaluations help domestic firms but hurt domestic consumers. Foreign firms are hurt, but foreign consumers are helped.
- Expectations about the future play a role in price bubbles. If buyers expect a future price increase, they will accelerate their purchases to avoid it. Similarly, sellers will delay selling to take advantage of it.
- You can potentially identify bubbles by using the "indifference principle" of Chapter 9 to tell you when market prices move away from their long-run equilibrium relationships.

Multiple-Choice Questions

1. The intersection between demand for U.S. dollars and the supply of U.S. dollars is known as the
   a. inflation rate.
   b. exchange rate.
   c. price.
   d. quantity.
2. An individual in the United States wants to buy office equipment from England that costs 2,800 pounds. If the exchange rate is $1.92/pound, how much will it cost him in dollar terms?
   a. $2,800
   b. $5,376
   c. $1,458
   d. Need more information
3. If the Chinese currency devalues compared to the U.S. dollar, then
   a. U.S. producers will benefit; Chinese consumers will benefit.
   b. U.S. producers will benefit; Chinese consumers will be hurt.
   c. U.S. producers will be hurt; Chinese consumers will benefit.
   d. U.S. producers will be hurt; Chinese consumers will be hurt.
4. Following a peso appreciation relative to the dollar, which of the following results is expected to occur?
   a. Prices in the United States would rise, and prices in Mexico would rise.
   b. Prices in the United States would rise, and prices in Mexico would fall.
   c. Prices in the United States would fall, and prices in Mexico would rise.
   d. Prices in the United States would fall, and prices in Mexico would fall.

5. Following a peso appreciation relative to the dollar, which of the following results is expected to occur?
   a. U.S. consumers would benefit, and Mexican producers would benefit.
   b. U.S. consumers would be hurt, and Mexican producers would benefit.
   c. U.S. consumers would benefit, and Mexican producers would be hurt.
   d. U.S. consumers would be hurt, and Mexican producers would be hurt.
6. Following an increase in Mexican interest rates relative to U.S. interest rates (which causes Mexican consumers to borrow abroad to consume domestically), which of the following is expected to occur?
   a. The dollar would appreciate relative to the peso, and Mexican prices would increase.
   b. The dollar would appreciate relative to the peso, and Mexican prices would decrease.
   c. The dollar would depreciate relative to the peso, and Mexican prices would increase.
   d. The dollar would depreciate relative to the peso, and Mexican prices would decrease.
7. Following an increase in Mexican interest rates relative to U.S. interest rates, which caused Mexican investors to borrow abroad to invest domestically, which of the following would occur?
   a. The dollar would appreciate relative to the peso, and Mexican prices would increase.
   b. The dollar would depreciate relative to the peso, and Mexican prices would decrease.
   c. The dollar would depreciate relative to the peso, and Mexican prices would increase.
   d. The exchange rate would not be affected, and neither would Mexican prices.
8. How does domestic inflation in China affect the Big Mac Index?
   a. The price of a Chinese Big Mac would increase relative to the U.S. price.
   b. The price of a Chinese Big Mac would decrease relative to the U.S. price.
   c. The Big Mac Index is not affected by inflation.
   d. No effect
9. Holding other things constant, a decrease in the inflation rate in the U.S. economy compared to the Canadian economy may cause the demand for (U.S.) dollars to _____ and the supply for dollars to _____.
   a. increase; decrease
   b. increase, increase
   c. decrease; increase
   d. decrease; decrease
10. If buyers expect future price increase, they will _____ their purchases to avoid it. Similarly, sellers will _____ selling to take advantage of it.
   a. accelerate; accelerate
   b. accelerate; delay
   c. delay; accelerate
   d. delay; delay

Individual Problems

11-1 Explain the Peso Devaluation

In August 2008, Mexican pesos were trading at $0.10 on the foreign exchange market. By November, they were down to $0.07, a decline of 30%. Explain the fall in the price of a peso using supply and demand curves. In words, explain the equivalent rise in the price of a dollar.

E11-2 Flight to Safety

As stock markets have crashed, and uncertainty has increased, consumers move their money to the safest currencies and countries in the world. Predict the effects of an increase in uncertainty on GBP/USD exchange rates.

11-3 Evaluating Appreciation

Explain how both Japanese consumers and producers would view an appreciation of the Japanese yen versus the U.S. dollar.

11-4 The Carry Trade

How does a decrease in U.S. interest rates affect the EU/U.S. exchange rate?

11-5 Dollar Devaluation

How will a dollar devaluation affect businesses and consumers in the twin cities of El Paso, United States, and Juarez, Mexico?

11-6 Effect of Expectations on the Exchange Rate

If market participants expect the krona to appreciate relative to the dollar, what will happen?

Group Problems

G11-1 Exchange Rate Effects on Industry

Using shifts in supply and demand curves, describe how a change in the exchange rate affected your industry. Label the axes, and state the geographic, product, and time dimensions of the demand and supply curves you are drawing. Explain what happened to industry price and quantity by making specific references to the demand and supply curves. How can you profit from future shifts in the exchange rate? How do you predict future changes in the exchange rate?

G11-2 Exchange Rate Effects on Your Firm

Describe how a change in the exchange rate affected your firm. Explain what happened to your price and quantity. How can you profit from future shifts in the exchange rate? How do you predict future changes in the exchange rate?

END NOTES

1. We are very grateful to Olafur Arnarson for his guidance and feedback on our discussion of the financial crisis in Iceland. We recommend his book on the subject to anyone who reads Icelandic.
2. To analyze these changes, we assume that there are only two countries (Iceland and Great Britain) trading goods and investing in each other's countries. Trade is easier to explain with a two-country example, so we ignore trade that runs through third-party countries.
3. Justin Lahart, "Bernanke's Bubble Laboratory," *Wall Street Journal,* May 16, 2008.
4. David Streitfeld and Gretchen Morgenson, "Building Flawed American Dreams," *New York Times,* October 18, 2008, http://www.nytimes.com/2008/10/19/business/19cisneros.html.
5. Edward L. Glaeser, Joseph Gyourko, and Albert Saiz, "Housing Supply and Housing Bubbles," NBER Working Paper 14193, July 2008, http://www.nber.org/papers/w14193
6. Jonathan R. Laing, "The Bubble's New Home," *Barron's,* June 20, 2005, http://online.barrons.com/article/SB111905372884363176.html.
7. See "Big Mac Index," *Economist.com,* http://www.economist.com/markets/bigmac/about.cfm.

SECTION 3

Pricing for Greater Profit

CHAPTER 12

More Realistic and Complex Pricing

In July of 2007, Scholastic Publishing released *Harry Potter and the Deathly Hallows,* the final installment in the smash Harry Potter book series. Sales expectations were high, as the previous book in the series had sold over seven million copies in the first 24 hours. Scholastic set a suggested retail price of $34.99 and was rumored to be selling the book to retailers at a wholesale price of $18.99.[1] From Chapter 6 you would expect retailers to set the price somewhere above $18.99—specifically, at the point where the markup equals the inverse demand elasticity, $(P - MC)/P = 1/|e|$.

Instead, Barnes and Noble set a price of $20.99 with an extra 10% discount for its book club members. Likewise, Costco and Wal-Mart offered the book for $18.18 and $17.87, respectively. Online retailer Amazon was even more aggressive. Those who preordered the book paid only $17.99, along with a $5 gift certificate and free shipping.

At this point, three conclusions about pricing might occur to you: (1) book retailers aren't interested in maximizing profit; (2) we gave you bad advice with the $(P - MC)/P = 1/|\text{elasticity}|$ pricing rule; or (3) real-world pricing is more complex than we have let on. In fact, there are a lot of times when you want to move beyond the simple pricing rule of Chapter 6 because you can make more money by doing so.

We have seen this kind of pricing before, when the grocery store in Chapter 6 put a low price on three-liter Coke to generate additional foot traffic. Whatever the grocery store lost on three-liter Coke, it made up in sales on other items. Amazon was following a similar tactic. By pricing low, Amazon sold over two million copies of *The Deathly Hallows*. Some were new customers, who would purchase books from Amazon in the future; and some purchased additional items at the same time they purchased *The Deathly Hallows*. In fact, Amazon estimated that about 1% of its $2.89 billion second-quarter revenue was due to this effect.

Both the grocery store and the bookstore were pricing where $MR < MC$, or equivalently where $(P - MC)/P < 1/|e|$. They did so because they were trying to maximize total profit, not profit on their individual product lines.

In this chapter, we show you how to move beyond the simple, single-product analysis of Chapter 6 to more complex and realistic settings, like those involving commonly owned products. In fact, the MR = MC pricing rule applies only to a single-product firm setting a single price on a single product. In more complex settings, the rule does not apply.

PRICING COMMONLY OWNED PRODUCTS

Commonly Owned Substitutes

Commonly owned products add a level of complexity to pricing that we can easily understand by using marginal analysis. To see this, let's examine the 2009 acquisition by InBev, which owned the Labatt's brand, of Anheuser-Busch, which owned the Budweiser brand. How would this acquisition change the pricing of the two brands in areas, like upstate New York, where consumers considered them to be close substitutes?

With just one brand, the pricing decision is simple. You trade off the benefits of a lower price (more units sold) against the costs of a lower price (less earned on each unit). Marginal analysis balances these two effects and suggests a price at the point where MR = MC to maximize profit.

Common ownership of two substitutes changes this simple pricing calculus. Now, an increase in sales of one brand (through a price reduction) will "steal" some sales from the other. Before you owned the rival brand, you didn't care where your additional sales came from, but now that you own both brands, you don't want to steal sales from a brand that you already own. This is sometimes called "cannibalizing" the sales of one product with increased sales of the other. After the acquisition, you will find it profitable to eliminate such cannibalization. You do this by raising price on each brand.

Formally, common ownership of two substitute products reduces the marginal revenue of each product, since some of the revenue gain for one product comes at the expense of the other. With a single product, you price at MR = MC. After acquiring a substitute product, MR falls below MC. As a consequence, the post-acquisition firm finds it profitable to cut back output or, equivalently, increase prices. We summarize this intuition in the following maxim:

After acquiring a substitute good, raise price on both goods.

Because the Antitrust Division of the U.S. Department of Justice thought that InBev would raise the price of both Labatt's and Budweiser in upstate New York, they challenged the acquisition. Only after InBev sold the Labatt's brand to a private equity firm—where it would stay under separate ownership—did the government allow the merger to go through.

Another way to see why acquisitions raise price is to focus on the change in perspective that joint ownership confers. Your concern changes from earning profit on an individual good to earning profit on both goods. Remember from Chapter 6 that aggregate demand (for both goods) is less elastic than the individual demands that comprise the aggregate. With less elastic demand, prices should increase.

So far we haven't said anything about which price to raise more; but here, again, marginal analysis can give us some guidance. Recall that the optimal price for a single product is set so that the margin is lower on more elastic products because consumers are more sensitive to the price of these products. If you could somehow switch these consumers to the higher-margin product, you'd increase profit. You can do this by raising the price on the low-margin good.

After acquiring a substitute product, raise price on both, but raise price more on the more elastic (low-margin) product.

As you raise price on the low-margin product, some consumers switch to the higher-margin substitute, thereby increasing profit.

Recall that marginal analysis tells you which direction to go (raise price on both and raise it more on the low-margin product), but it doesn't tell you by how much. So you get there by taking steps. After raising price, recalculate MR and MC—or simply check to make sure that profit increases—to see if further change is profitable.

After acquiring a substitute product, you can also try to reduce cannibalization by *repositioning* the products so they don't directly compete with each other—provided that repositioning isn't too expensive. For example, post-merger, InBev could reposition Labatt's as a higher end "imported" beer, so that it doesn't directly compete with Budweiser.

Commonly Owned Complements

Common ownership of complementary products leads to the opposite advice. Suppose a grocery store purchases the parking lot next to the store. Before the purchase, both parking lot and grocery store set prices without considering the effect of their prices on each other's demand.

But after the acquisition, an increase in output at grocery store (through a price reduction) will increase demand at the parking lot. In other words, common ownership of the grocery store and parking lot increases MR at each because increasing sales of one product (by reducing price) increases demand for the other. And when MR rises above MC, output should increase, or, equivalently, optimal price should fall. We summarize this intuition in the following maxim:

After acquiring a complementary product, reduce price on both products to increase profit.

REVENUE OR YIELD MANAGEMENT

Products like cruise ships, parking lots, hotels, and stadiums have several characteristics that affect their pricing. First, the costs of building capacity are mostly fixed or sunk. Second, these costs are large relative to marginal costs. Third, firms in these industries typically face capacity constraints; that is, they can increase output only up to capacity, but no further.

To understand how prices are set in these industries, let's begin with the decision of how much capacity to build. This is an extent decision, so we use marginal analysis. The owners have an incentive to keep adding capacity (more parking spaces, more hotel rooms, more cruise ship cabins, more seats in a stadium) as long as *long-run* marginal revenue is greater than *long-run* marginal cost, LRMR > LRMC. The owners stop building additional capacity when LRMR = LRMC. Here, the term *long-run marginal revenue* refers to the expected additional revenue that another parking space, hotel room, ship cabin, or stadium seat would earn over the life of the capacity. Likewise, long-run marginal cost is the expected additional cost of building, maintaining, selling, and using another unit of capacity over the life of the capacity.

Once construction is finished, we know from Chapter 3 that we should ignore sunk or fixed costs when setting price to avoid committing the sunk-cost fallacy. The relevant costs

and benefits of setting price are the *short-run* marginal revenue (MR) and *short-run* marginal costs (MC). Since short-run marginal cost is likely to be much smaller than long-run marginal cost, while short-run marginal revenue is likely to be close to long-run marginal revenue, you want to price to fill capacity. This leads to the rather obvious advice:

If MR > MC at capacity, then price to fill available capacity.

Because MR > MC, the firm's managers would like to reduce price in order to sell more, but cannot because the firm is limited by capacity. So the firm sells as much as it can, or prices to fill capacity.

If demand is known, this is relatively easy to do. For example, to set price for a parking lot in a downtown business district, you look to see what time the lot fills up. If the lot fills up before 9 A.M., then raise price; if the lot is still empty at 9 A.M., then reduce price. If the lot fills up near 9 A.M., the price is just right.

In contrast, if demand is hard to predict, pricing to fill capacity becomes much more difficult. For example, each time a cruise ship sails, no one knows what demand will be. To determine optimal price, the cruise line's managers balance the costs of over-pricing (lost profit on unfilled rooms) against the cost of under-pricing (lower margins on all the rooms).

In this case, an optimal price would minimize the expected costs of these two errors. If the lost profit from these two pricing errors is symmetric, then the firm should price so that expected (predicted) demand is just equal to capacity. We call this the "target price." However, if the lost profit from over-pricing is less than the lost profit from under-pricing, then the firm should over-price, or price above the target price, and vice versa. This will lead, on average, to more over-pricing errors than underpricing errors, but the cost of these errors is lower.

If the cost of overpricing (unused capacity) is smaller than the cost of underpricing (lower margins), then price higher than would fill capacity, and vice versa.

The precise degree of under- or over-pricing depends not only on the costs of under- and over-pricing, but also on the probability of under- and over-pricing. In the chapter on uncertainty we will illustrate this difference more clearly.

Obviously, with better demand forecasts, you will make fewer errors—which will raise profit because the ship is filled as close to capacity as possible and at the best possible price. To better match demand to available capacity, cruise ship managers often adjust prices up until the time the ship sails. If it looks like capacity is going unused, they reduce price; and if it looks like capacity will be more than filled, they raise price.

But charging different prices to passengers who purchase at different times raises other problems. First, if consumers realize that they may get a lower price if they wait to purchase, then you create an incentive for them to wait. And this phenomenon makes it more difficult to match demand to capacity—the whole point of adjusting price. To eliminate the late-booking incentive, many cruise line managers reduce price only slightly or reduce price only by offering cabin upgrades, so that consumers don't realize they're paying less. Second, once some passengers realize they paid more than their fellow passengers who booked at different times, they may become angry and demand a refund or disparage the cruise line to future customers. We discuss this phenomenon in a section of the chapter on price discrimination titled "Only Schmucks Pay Retail." No one wants to be a schmuck.

ADVERTISING AND PROMOTIONAL PRICING

In this section, we use marginal analysis to show you how to price in conjunction with advertising or promotional expenditures. The most important thing to realize is that different types of promotional expenditures affect demand in different ways. For pricing, it is most important to know whether promotional expenditures make demand more or less price elastic.[2]

If promotional expenditures make demand more (less) price elastic, then you should reduce (increase) price when you promote the product.

Consider the simplest kind of advertising—information about the price of your product relative to substitute products. Coupons, end-of-aisle displays in grocery stores, and weekly advertising inserts in the newspaper fall into this category. By focusing consumers on prices, you make them more sensitive to price differences, which makes demand more elastic. When you make demand more elastic, you want to reduce price to attract more customers. When you see this kind of promotion, you also typically see a reduction in the price of the promoted good.

On the other hand, advertising designed to increase the attractiveness of the product makes demand less elastic. Advertising high product quality or associating the product with a celebrity or desirable activity falls into this category. These promotional campaigns are trying to reduce the customer's sensitivity to price. In this case, it makes sense to *increase* price.

A final cautionary note about pricing and quality: A higher price may influence consumer perceptions about the quality of the product. If you know nothing else about the product except its high price, you may infer that it is of high quality. In this case, you'd want to price high to signal quality. Many wines are priced high for this reason.

PSYCHOLOGICAL PRICING

Many pricing strategies are built on the assumption that consumers behave in a rational, calculating way. But, sometimes they don't. Consider Coca-Cola's failed attempt to have vending machines adjust price with the temperature. Because people are willing to pay more for a cold drink when it is hot, the Coca-Cola CEO pronounced that "it is fair that it [a can of Coke] should be more expensive" when heat drives up demand.[3] A consumer outcry (and opportunistic advertising by rival Pepsi) led the company to reverse course. However, the CEO could have easily gained consumer acceptance by explaining that the vending machines will be providing discounts when colder temperature suppresses demand. Even though both statements—higher prices when temperatures are high and lower prices when temperatures are low—are equivalent, they are quite different, behaviorally.

The relatively new field of behavioral economics adds psychological insights to standard economic models. Prospect theory, developed by Nobel Prize winner Daniel Kahneman and long-time colleague Amos Tversky, identifies several behavioral regularities that are useful in formulating pricing strategy.

First, people perceive how good a price is based on its distance from a "reference price." A reference price is simply how much we expect something to cost, given the environment, and explains why we might see $4 for a bottle of beer as both unreasonably expensive (at a grocery store) and reasonably cheap (at a restaurant). This means that

altering a consumer's price expectation upwards can have the same effect on the demand as altering the actual price downwards, though without sacrificing profit. For example, first presenting a consumer with higher-priced options can drive up price expectations and make later, lower-priced options appear less expensive in comparison.

Managing price expectations is as important as managing price.

Prospect theory implies that consumers are motivated not by the actual price level, but rather by a comparison of the price level to the reference price. The idea is that a consumer will perceive a "win," and is more likely to buy, if price is below his reference price. It follows that firms should try to "frame" decisions so that consumers perceive them as gains, not losses. By describing its policy as higher prices during warmer weather, Coca-Cola implicitly set a low reference price, during the colder weather. Instead, Coca-Cola should have emphasized the lower prices during cold weather, which would have set higher reference price, during the warm weather. Similarly, retailers should focus on "cash discounts" rather than "credit card surcharges" and airlines on "discounts for not checking bags" rather than "checked bag fees."

A second behavioral insight is that multiple losses or multiple gains do not obey simple arithmetic. Consider an example. How would you feel if, on your way home today, you lost $20? Now imagine instead you lost $10 and then, minutes later, you lost another $10. Which of these scenarios made you feel worse? To most people, the two losses feel worse even though they amount to the same $20. Similarly, finding two $10 bills makes most people happier than finding one $20 bill. For most of us, losses and gains are super-additive (the happiness from $10 + $10 is greater than the happiness from $20). This has clear implications for pricing:

Integrate losses but separate gains.

Let's reverse the example involving losing $20. If I *have* to lose $20, I'd rather do it all at once than lose a little each step of the way. This is why you rarely see charges for "shipping and handling" quoted separately. This also may account for the popularity of all-inclusive vacations. On the other hand, consider the decision by some airlines in 2008 to begin charging passengers for snacks on flights. At first glance, it seems like a sensible strategy. With a snack charge, only those who really value a snack buy, and the rest of the passengers aren't forced to subsidize their fellow passengers' snacking habits with slightly higher fares. Unfortunately for these airlines, the average consumer did not view it this way. First, the charge was seen as a loss simply because it was new. Second, having passengers face these small charges on top of the ticket price made many feel nickel-and-dimed, with the result that some switched airlines.

Also beware of consumer concerns with fairness. One reason Home Depot would rather face shortages than raise price for snow shovels when it snows is not to be perceived as "unfair." Consumers often have a notion of what they believe to be fair behavior by sellers. If you cross this line, the reaction can be quite strong. You only need to recall the increase in gas prices in 2012 that led to outraged calls for price controls and "windfall profit" taxes from infuriated consumers (although nobody seemed to call for price supports and "insufficient profit" subsidies when prices fell dramatically).

Companies that want to set prices that could be viewed as "unfair" must come up with creative solutions to overcome this concern. One example comes from the music industry. Performers don't want to be perceived as greedy, so they set concert prices well below

the market-clearing price. For example, a 2009 Britney Spears concert sold out almost immediately because tickets were priced at $125. Minutes later, a large number of the tickets appeared on secondary sites, like Craigslist, at prices of over $1,000. The secondary market prices aren't viewed as unfair because most people think that fans are reselling tickets. But often, the artists or promoters hold back a number of tickets from the initial sale and then resell them on the secondary market. The artist may share in the proceeds from these secondary sales but avoids blame for the high prices.[4] Of course, this works only as long as consumers don't figure out what's going on.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- After acquiring a substitute product,
  - raise price on both products to eliminate price competition between them.
  - raise price more on the low-margin (more price elastic demand) product.
  - reposition the products so that there is less substitutability between them.
- After acquiring a complementary product, reduce price on both products to increase demand for both products.
- If fixed costs are large relative to marginal costs, capacity is fixed, and MR > MC at capacity, then set price to fill available capacity.
- If demand is hard to forecast and the costs of under-pricing are smaller than the costs of over-pricing, then under-price, on average, and vice versa.
- If promotional expenditures make demand more elastic, then reduce price when you promote the product, and vice versa.
- Psychological biases suggests "framing" price changes as gains rather than as losses.

Multiple-Choice Questions

1. After massive promotion of Justin Bieber's latest music album, the producers reacted by raising prices for his albums. This implies that promotion expenditures made the album demand
   a. more elastic.
   b. unitary elastic.
   c. the change is due to psychological pricing.
   d. less elastic.
2. All the below choices are examples of promoting a firm's product, except
   a. advertising.
   b. pricing.
   c. discount coupons.
   d. end-of-aisle displays.
3. A firm that acquires a substitute product can reduce inter-product cannibalization by
   a. doing nothing.
   b. repositioning its product or the substitute so that they do not directly compete with each other.
   c. pricing each product at the same level.
   d. raising prices on the low-margin products.
4. A shoe-producing firm decides to acquire a firm that produces shoe laces. This implies that the firm's aggregate demand (shoes + laces) will be:
   a. less elastic than the individual demands.
   b. more elastic than the individual demands.
   c. same elasticity as the individual demands.
   d. None of the above
5. After firm A producing one good acquired another firm B producing another good, it raised the prices for the bundle of goods. One can conclude that the goods were
   a. substitutes.
   b. complements.
   c. not related.
   d. None of the above
6. Firms tend to raise the price of their goods after acquiring a firm that sells a substitute good because
   a. they lose market power.
   b. there is an increase in the overall demand for their products.

c. the bundle has a more elastic demand than individual goods.
d. the bundle has a less elastic demand than individual goods.

7. For products like parking lots and hotels, costs of building capacity are mostly fixed or sunk and firms in this industry typically face capacity constraints. Therefore,
   a. if SRMR > SRMC at capacity, then the firms should price to fill capacity.
   b. if SRMR < SRMC at capacity, then the firms should price to fill capacity.
   c. if LRMR > LRMC at capacity, then the firms should price to fill capacity.
   d. if LRMR > LRMC at capacity, then the firms should price to fill capacity.
8. A firm started advertising its product and this changed the product's elasticity from –2 to –1.5. The firm should
   a. raise price from $10 to $15.
   b. reduce price from $15 to $10.
   c. raise price from $7.5 to $10.
   d. reduce price from $10 to $7.5
9. After running a promotional campaign, the owners of a local shoe store decided to decrease the prices for the shoes sold in their store. One can infer that
   a. the promotional expenditures made the demand for their shoes more elastic.
   b. the promotional expenditures made the demand for their shoes less elastic.
   c. the promotional expenditures has no effect on the shoe demand elasticity.
   d. the owners got it wrong. To cover the promotional expenses, they should have raised the prices.
10. On average, if demand is unknown and costs of underpricing are _____ than the costs of overpricing, then _____.
    a. smaller; overprice
    b. smaller; underprice
    c. larger; underprice
    d. None of the above

Individual Problems

12-1 Parking Lot Optimization

Suppose your elasticity of demand for your parking lot spaces is –2, and price is $8 per day. If your MC is zero, and your capacity is 80% full at 9 A.M. over the last month, are you optimizing?

12-2 Parking at Cowboys Stadium

What would efficient revenue management imply for the pricing of the Cowboys Stadium parking lot on typical game days? How about for the Super Bowl? How about for the many smaller events that fill less than half the lot?

12-3 App Pricing for Droids

Every week, more and more apps (applications) are available for Droid-based smart phones. How does this affect the optimal price for Droid-based smart phones?

12-4 Macintosh versus iPhone

When the Macintosh computer was introduced in 1982, Apple made it difficult for third party software developers to develop software for the platform. In contrast, Apple made it relatively easy for third party developers to make applications that ran on the iPhone when it was introduced in 2007. Compare and contrast these two strategies.

12-5 Concert Prices

Concert prices have increased coincidentally with illegal downloading of music off the Internet. Why?

12-6 Radio Stations and Rock Concerts

Clear channel, an owner of multiple radio stations with the Top 40 format, recently bought rock concert promoter Live Nation. How would this affect prices for concert tickets or rates for radio programming?

Group Problems

G12-1 Pricing Commonly Owned Products

Evaluate a pricing decision your company made involving commonly owned products. Was it optimal? If not, why not? How would you adjust price? Compute the profit consequences of the change.

G12-2 Yield or Revenue Management

Evaluate a pricing decision your company made that involved a product or service with fixed capacity. Was price set optimally? If not, why not? How would you adjust price? Compute the profit consequences of the change.

G12-3 Promotional Pricing

Evaluate a pricing decision of your company that coincided with a promotional or advertising campaign. Was price set optimally? If not, why not? How would you adjust price? Compute the profit consequences of the change.

G12-4 Psychological Pricing

Evaluate a pricing decision of your company based on psychological pricing. Was price set optimally? If not, why not? How would you adjust price? Compute the profit consequences of the change.

END NOTES

1. Story adapted from Joe Nocera, "Harry and the Strange Logic of Book Discounters," *New York Times,* July 28, 2007, http://select.nytimes.com/2007/07/28/business/28nocera.html?r=l&fta=y.
2. Luke M. Froeb, Steven Tenn, and Steven T. Tschantz, "Mergers when Firms Compete by Choosing Both Price and Promotion," *International Journal of Industrial Organization* 28 (2010): 695–707.
3. Constance L. Hays, "Variable-Price Coke Machine Being Tested," *New York Times*, October 28, 1999, C1.
4. Mark Hefflinger, "Top Artists 'Scalping' Own Tickets on Resale Sites," *Wall Street Journal,* March 12, 2009.

CHAPTER 13

Direct Price Discrimination

INTRODUCTION

Pricing Laptops

Dell, Inc., sells over 100,000 computer systems per day, more than one every second. The company sells to individual home users, small businesses, and to every Fortune 100 company. Some of these customers are less price sensitive than others. If Dell could identify these customers and figure out a way to charge them higher prices, they could increase profit.

Pricing Museum Entry

Once the home of Peter the Great, the enormous green and white Winter Palace in Saint Petersburg, Russia, now houses one of the world's most famous art collections. Tourists who fly many miles to Saint Petersburg are unlikely to miss visiting The Hermitage Museum, home to three million works of art. Locals, on the other hand, are poorer than the international tourists who visit their country and have hundreds of other nearby options competing for their expenditures. Charging a single price for admission would require either charging tourists much less than the profit-maximizing price or making the museum prohibitively expensive for many locals.

Potentially, both Dell and The Hermitage could benefit by charging different prices to different consumer groups. Dell could increase profit by charging lower prices to more price-sensitive home and small business users while the Hermitage could increase profit by offering price discounts to locals.

However, such discriminatory pricing is risky, and sometimes illegal. In this chapter, we discuss ways of profitably designing and implementing price discrimination schemes, in which sellers charge different prices to different consumers, not on the basis of differences in costs but, rather, on differences in consumer demand. We move beyond the simple pricing of Chapter 6, where a single firm set a single price on a single product by allowing a firm to set multiple prices for the same product.

WHY (PRICE) DISCRIMINATE?

To see how price discrimination increases profit, let's look at the simple aggregate demand curve from Chapter 6 (Table 6-4), where seven consumers are willing to pay ($7, $6, $5, $4, $3, $2, $1) for a good that costs $1.50 to make. There, we saw that the profit-maximizing price is $5. At this price, the company sells three units. We calculate total profit ($10.50) as revenue ($15) minus cost ($4.50).

At the optimal price of $5, low-value consumers—those willing to pay $4, $3, and $2—don't purchase, even though they're willing to pay more than the cost of producing the good. These three consumers represent unconsummated wealth-creating transactions. The one lesson of business tells us to find a way to profitably consummate these transactions.

Suppose you could identify these customers because they live in a certain part of town, because they are older, or because they have children. You could offer each a price reduction, respectively, by sending discount coupons to residents who live in certain ZIP codes (as Victoria's Secret has done with its catalogs), by offering discounts to senior citizens (as do many restaurants and grocery stores), or by offering discounts for families with children (as airlines do when allowing lap children to fly for free).

TABLE 13.1

Optimal Price for High-Value Consumers

Price	Quantity	Revenue	MR	MC	Total Profit
$7	1	$7	$7	$1.50	$5.50
$6	2	$12	$5	$1.50	$9
$5	3	$15	$3	$1.50	$10.50

TABLE 13.2

Optimal Price for Low-Value Consumers

Price	Quantity	Revenue	MR	MC	Total Profit
$4	1	$4	$4	$1.50	$2.50
$3	2	$6	$2	$1.50	$3
$2	3	$6	$0	$1.50	$1.50
$1	4	$4	($2)	$1.50	($2)

To see how this would affect profit, we split the consumers into two different groups and compute the profit-maximizing prices for each group. We do this in Tables 13-1 and 13-2 for the high- and low-value consumers, respectively. In Table 13-1, we compute the profit-maximizing price for the high-value consumers. The profit-maximizing price is $5, the company sells three units, and total profit ($10.50) is revenue ($15) minus cost ($4.50), the same as computed in Table 6-4 in Chapter 6.

If we could charge a separate price to the low-value consumers—those willing to pay \$4, \$3, \$2, and \$1—we would face a second demand curve, illustrated in Figure 13-1. We could price at \$4 and sell one unit, price at \$3 and sell two units, price at \$2 and sell three units, or price at \$1 and sell four units. Marginal analysis tells us to set a price of \$3, sell two units to the low-value group, and earn an extra \$3.

This is the motivation for price discrimination: It allows a firm to sell items to low-value customers who otherwise would not purchase because the price is too high.

> ***Price discrimination*** *is the practice of charging different prices to different buyers or groups of buyers based on differences in demand.*

For products with relatively low marginal costs or with less elastic demand, like software, music, drugs, and books, the gap between price and marginal cost is largest. For these products, price discrimination schemes are most profitable because there are more consumers whose values are above the marginal cost of production but below the profit-maximizing price.

Charging lower prices to low-value consumers also means that you charge high-value customers higher prices, making the practice controversial. For example, drug manufacturers sell patented drugs, like Lipitor, Viagra, Zoloft, or Claritin, to different countries at different prices. Drugs sold in Canada and Mexico are less expensive than drugs sold in the United States, at least early in the life cycle of the drug. This has created incentives for U.S. consumers to drive to Mexico and Canada, buy drugs, and bring them back into the United States. It has also created incentives for pharmacies in Mexico and Canada to offer drugs for sale to U.S. consumers. This so-called drug reimportation emerged as an issue in the 2008 U.S. presidential campaign. If we allow reimportation, what do you think will happen?

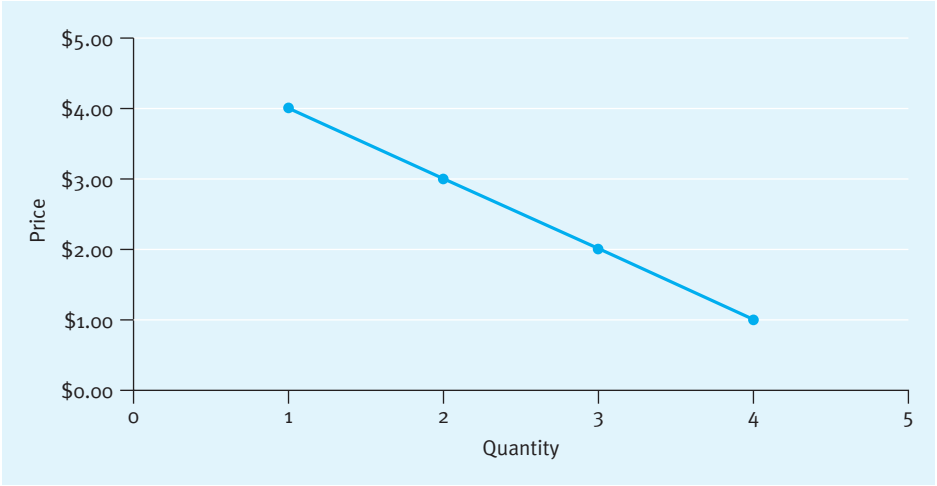


FIGURE **13.1 Demand Curve for Low-Value Consumers**

We can use our simple example to figure this out. Think of the low-value consumers (those in Table 13-2) as foreign pharmacies. Drug reimportation means that they buy drugs

at $3 and then resell them for $5 to U.S. consumers (the high-value group in Table 13-1). Once U.S. drug manufacturers realize that they are losing money by discriminating, they would go back to setting a single price of $5. The policy implication is that if we allow drug reimportation, profits of U.S. drug manufacturers would fall, and foreign buyers would face higher prices.

Often, pricing that looks discriminatory (based on demand differences) results instead from the different costs of serving different consumers. Small drugstores, small grocery stores, and small bookstores pay higher prices than do large chains like Wal-Mart because supplying big customers costs less. Big customers order full truckloads, reducing transportation costs; they also invest in information technology that reduces ordering and inventory costs and simplifies ordering, distribution, and sales. If the higher prices arise from the higher costs of serving small mom-and-pop shops, then the higher prices are not discriminatory.

DIRECT PRICE DISCRIMINATION

We can draw a distinction between *direct* and *indirect* discrimination schemes. In a **direct price discrimination scheme**, we can identify members of the low-value group, charge them a lower price, and prevent them from reselling their lower-priced goods to the higher-value group (arbitrage). In an indirect discrimination scheme, we cannot perfectly identify the two groups or cannot prevent arbitrage, so we must find indirect methods of setting different prices to the two different groups. This distinction will become clearer in the next chapter when we describe various indirect discrimination schemes.

To discriminate directly, you must be able to identify different customer groups with different elasticities. Then, you set an optimal price for each group. Obviously, charge a lower price to the group with the more elastic demand, and a higher price to the group with the less elastic demand, according to the pricing formula we derived in Chapter 6

$$(P_1 - MC_1)/P_1 = 1/|elasticity_1|$$

and

$$(P_2 - MC_2)/P_2 = 1/|elasticity_2|$$

Once you implement this discrimination scheme, you simultaneously create an incentive for members of the low-elasticity group to try to purchase at the lower prices offered to the high-elasticity group. If too many customers are able to do this, then they can make the price discrimination scheme unprofitable.

Note that the marginal cost of selling to the two different groups can be different—that is, $MC_1 \neq MC_2$. But as long as the price elasticities differ, pricing is still going to be determined, in part, by differences in elasticity.

For example, senior citizens have more price-elastic demand for a variety of reasons (lower incomes, lower opportunity cost of time, etc.). As a result, older people often pay lower prices in movie theaters than do younger people. The theater managers are able to recognize low-value customers by the age indicated on an ID card. Theater managers prevent arbitrage by making sure that those admitted on a senior citizen's ticket do not resell their tickets to younger customers.

Likewise, colleges discriminate between students of different incomes and wealth levels. At America's top universities, fewer than half of all undergraduates pay full price while a

majority receive some degree of financial aid. To award scholarships, colleges do not need to identify groups with different elasticities. Instead, colleges tailor prices to incomes directly by examining families' tax returns and bank statements. For example, Harvard and Yale universities both announced that, for middle-class families, college education is priced at 10% of annual income.

ROBINSON-PATMAN ACT

There is a tension in the law about the effects of price discrimination. On the one hand, if a firm offers an array of different prices to consumers, it consummates more transactions and thus creates more wealth. On the other hand, if it charges prices closer to what consumers are willing to pay for a good, it reduces consumer surplus (the difference between what consumers are willing to pay and what they have to pay).

The **Robinson-Patman Act** is part of a group of laws collectively called the *antitrust laws* governing competition in the United States. Under the Robinson-Patman Act, it's illegal to give or receive a price discount on a good sold to another business. This law does not cover services or sales to final consumers. The U.S. Congress passed the Robinson-Patman Act in 1936 in response to complaints from small grocery stores facing competition from lower-cost competitors, like A&P, the first grocery store chain. Sometimes called the Anti-Chain-Store Act, Robinson-Patman tries to protect independent retailers from chain-store competition by preventing the chains from receiving supplier discounts. Small retailers have sued book publishers, large book retailers, large drugstore chains, Wal-Mart, and other large retailers (together with their suppliers) for giving or receiving price discounts.[1] There are two ways to defend yourself from a Robinson-Patman lawsuit: You can claim that the price discount was cost-justified or that the price discount was given to meet the competition. This leads to the following legal advice on how to comply with the antitrust laws:

> *Charge all customers the same price, unless the cost of serving them varies. But feel free to cut price to any customer to meet the lower price of a competitor.*[2]

Antitrust economists have long recognized that the Robinson-Patman Act discourages discounting. If companies have to offer the same price to every customer, they are less likely to reduce price to their most price-elastic customers. Fortunately, many practices, such as offering promotional allowances to large retailers, are similar to discounts, making it relatively easy to comply with the law without risking the loss of your best customers.

IMPLEMENTING PRICE DISCRIMINATION SCHEMES

Now that we know how price discrimination works and how legal constraints limit the actual practice, we can discuss how to do it. We focus on the two price discrimination opportunities described in the introduction.

Pricing for Laptops

How does Dell identify customers who are less price sensitive and charge them more? The company simply asks them. On the company's home page, one selects whether shopping for Home, Home Office, Small & Medium Business, or Large Enterprise. Prices for identical products will vary depending on which category you click. In October of 2012, you could purchase a 2.6 GHz Dell Precision M6600 laptop for $3,208 as a large enterprise

customer. If instead you click on "Home Office," you can buy the exact same laptop for 40% less. Offering these different prices to different customer groups allows Dell to increase the overall profitability of selling computers. What's a bit confusing is why large business customers don't simply order using the "Home Office" or "Small Business" links.

Pricing for Museums

Most mornings there is a long line of customers outside the Hermitage museum standing in front of a window signed TICKETS. Nearby, another line also proclaims TICKETS—but in Russian and at prices that are 75% less. While proof of citizenship is not required to obtain the "local" tickets, only those asking for tickets in unaccented Russian can get the lower prices. This creates incentives for arbitrage, and many locals have set up small enterprises that buy tickets at local prices and then resell them at a profit. To combat this, the museum staff monitors low-priced ticket holders upon entry into the museum. It has become a game for some foreign visitors to see if they can feign language and mannerisms to pass for a local. Very few succeed.

Foreign tour operators have complained about the discriminatory nature of the pricing at The Hermitage, leading the Russian Travel Industry Union to petition for an end to discriminatory pricing. While The Hermitage initially agreed in 2010, it quickly backed out of the idea, noting that an end to such discriminatory pricing would only lead to everyone paying the higher price.

ONLY SCHMUCKS PAY RETAIL

Consumers don't like knowing that they're paying a higher price than other consumers. This is summed up in popular sayings like "Only schmucks[3] pay retail [prices]." If low-elasticity consumers know they're being discriminated against, they may even refuse to purchase. A study[4] of online pricing showed that when shoppers are asked whether they have any discount coupons (thus revealing the existence of a price discrimination scheme), a large number of customers abandon their virtual shopping carts, which can make the price discrimination scheme unprofitable.

So, if you're price discriminating, it's important to keep the scheme secret if you can. Otherwise, you may lose your high-value customers to rivals who don't price discriminate (or who hide it better).

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- If a seller can identify two groups of consumers with different demand elasticities, and can prevent arbitrage between the groups, it can increase profit by charging a higher price to the low-elasticity group.
- **Price discrimination** is the practice of charging different people or groups of people different prices based on differences in demand. Typically more people are served under price discrimination than under a uniform price.
- **Arbitrage** can defeat a price discrimination scheme if enough of those who purchase at low prices resell to high-value consumers. This can force a seller to go back to a uniform price.
- A **direct price discrimination scheme** requires that you be able to identify members of the low-value group, charge them a lower price, and prevent them from reselling their lower-priced goods to the higher-value group.

- It can be illegal for business to price discriminate when selling goods (not services) to other businesses unless
  - price discounts are cost-justified, or
  - discounts are offered to meet competitors' prices.
- Price discrimination schemes may annoy customers who know they're paying more than others and can make them less willing to buy because they know someone else is getting a better price. If you can, keep price discrimination schemes secret.

Multiple-Choice Questions

See the end of the next chapter for multiple-choice questions.

Individual Problems

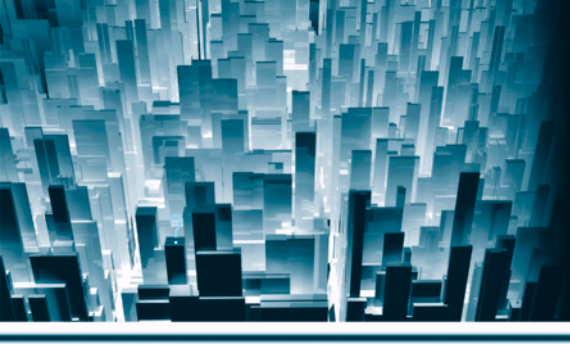
See the end of the next chapter for individual homework problems.

Group Problems

See the end of the next chapter for group homework problems.

END NOTES

1. European and many other countries have laws with similar prohibitions to Robinson-Patman.
2. John H. Shenefield and Irwin M. Stelzer, "Common Sense Guidelines," *The Antitrust Laws: A Primer,* 3rd ed. (Washington, D.C.: AEI Press, 1998), 123–126.
3. Schmuck also shmuck: n. Slang; a clumsy or stupid person; an oaf.
4. Mikhael Shor and Richard L. Oliver, "Price Discrimination through Online Couponing: Impact on Purchase Intention and Profitability," *Journal of Economic Psychology* 27, no. 3 (2006): 423–440.



CHAPTER 14

Indirect Price Discrimination

INTRODUCTION

Express Lanes

State Route 91 connects the residents of Riverside County, California, to their workplaces in nearby Orange County, on the other side of the Santa Ana Mountains. The twelve-lane freeway is one of the most congested in the United States. Two-hour commutes for a ten-mile stretch are not uncommon. In 1995, a privately funded company opened express lanes in the median of Route 91. Now drivers face a choice between the four free public lanes and the two express lanes. The express lanes vary in price from around a dollar in the middle of the night to nearly $10 on a Friday afternoon.

You might suspect that the express lanes would be popular among impatient drivers. While somewhat true, the express lanes save only a few minutes on an average day. What they do offer is predictability, as delays on the free lanes can vary greatly from day to day. Motorists who value reliability pay the tolls, while those who can afford to be late every now and then, don't.[1] The challenge is pricing the toll lanes just right—too high, and even high-value travelers will choose the free lanes; too low, and the "express" lanes will be too popular and congested, decreasing their value.

Airline Travel

Business travelers have less elastic demand than do leisure travelers, both because they don't pay for their own tickets and because they have fewer alternatives due to very specific time and geographic demands for a flight ("I have to be in Dallas, Texas, at 8:00 A.M. on Tuesday"). Unfortunately for airlines, business and leisure travelers are not easy to identify, making direct price discrimination difficult. Instead, airlines identify leisure travelers by their willingness to plan vacations months in advance. In contrast, business travelers often have to plan trips on very short notice. A ticket purchased a month in advance can often be had for half the price of one purchased closer to the flight.

However, if too many business travelers take advantage of such advance-purchase discounts, they can render the price discrimination scheme unprofitable. For example, one manufacturing company found that its 60 regional managers purchased tickets for their biweekly travel just days before takeoff. By standardizing its meeting dates (and purchasing tickets three weeks in advance), the company saved nearly half a million

dollars in travel expenses. This, of course, means that the airline lost half a million dollars in revenues.

INDIRECT PRICE DISCRIMINATION

When a seller cannot directly identify who has a low or high value, the seller can still discriminate by designing products or services that appeal to different consumer groups. For example, grocery stores use coupons to price discriminate. High-income shoppers are typically less price sensitive than are low-income consumers, at least for low-priced items. This gives them a high opportunity cost of time, which means they are less likely to clip coupons out of a newspaper or circulars. The grocery store essentially asks low-value consumers to identify themselves by their coupon-clipping behavior.

This **indirect price discrimination scheme** differs from the direct schemes of the previous chapter because high-value customers *could* clip coupons if they wanted. If too many high-value customers (those with a low elasticity of demand) clip coupons, then the scheme becomes unprofitable. Fear of such "cannibalization" is characteristic of most indirect price discrimination schemes.

Unlike direct price discrimination, where the seller can identify different groups, indirect price discrimination requires identifying some *feature* that is correlated with value, and then designing products that differ along this feature. The express lanes on State Route 91 differentiate consumer groups based on their value of reliability. Airlines differentiate business customers from leisure customers by their willingness to plan ahead.

Software manufacturers discriminate between high-value and low-value consumers by designing different versions of software to appeal to each group. For example, Adobe sells its flagship Photoshop product (the leading software for the graphic design industry) for $700. Its low-end product, Photoshop Elements, retails for $100. Here, the cannibalization threat is obvious—Adobe must design and price the two versions so that high-value business consumers prefer the full-featured version to the much cheaper disabled version. Adobe does this by omitting some features essential for professional graphic designers from the consumer version.

TABLE **14.1**

Demand for Software

Software Version	Home Users	Commercial Users
Full-featured version	$175	$500
Disabled version	$150	$200

To make this concrete, let's go through a numerical example. Suppose your marketing department does a survey (see Table 14-1) of potential users that reveals that commercial users are willing to pay $500 for a full-featured version whereas home users are willing to pay only $175. This kind of heterogeneity leaves you with the usual trade-off: You can price high ($500) but sell only to the high-value consumers, or price low ($175) and sell to both high- and low-value consumers. Assuming equal numbers of each type of consumer, the profitability of these two strategies is reported in the first two rows of Table 14-2.

Now consider an indirect price discrimination strategy in which we offer both a full-featured version to commercial users and a disabled version to home users. The most we

TABLE 14.2
Potential Software Pricing Schemes

Strategy	Implementation	Total Profit
1. Sell only to commercial users at a single high price.	Price full-featured version at $500; do not sell home version.	$500
2. Sell to all users at a single low price.	Price full-featured version at $175.	$175 + $175 = $350
3. Price discriminate: Price high to the commercial users; price low to the home users.	Price disabled version at $150; price full-featured version at $449.	$150 + $449 = $599

can charge the home users for the disabled version is $150. The difficult part of implementing an indirect price discrimination scheme is pricing the full-featured version to make sure that the high-value customers do not purchase the disabled, and cheaper, software.

Note that if we tried to charge commercial users $500 for the full-featured version, none of them would buy it. This is because they would get more surplus from buying the disabled version ($50 = $200 [value] – $150 [price]) than the full-featured version ($0 = $500 [value] – $500 [price]). But if we charge $150 for the disabled version and $449 for the full-featured version, high-value consumers gain more surplus by buying the full-featured version ($51 = $500[value] – $449[price]) than they do by buying the disabled version. Put another way, you have to price the full-featured version low enough so commercial users get at least as much consumer surplus (value minus price) as they do from the disabled version. Note that we are implicitly assuming that consumers will buy the version of the software that gives them more consumer surplus. The effect of this price discrimination scheme is shown in the third row of Table 14-2.

This example illustrates the threat of what marketers call *cannibalization*. You could charge $500 for the full-featured software if you did not offer a disabled version. But if you do offer a disabled version of a good, you have to be careful that you do not cannibalize sales of the high-priced version. Specifically, since our commercial users see the full-featured version as $300 better than the disabled version ($500 [full featured value] – $200 [disabled value]), the difference in price between the two versions must be less than $300.

TABLE 14.3
Demand for Software

Software Version	Home Users	Commercial Users
Full-featured version	$175	$500
Disabled version	$150	$400

Price discrimination is not always profitable. Sometimes, it is better to offer only a single product as the risk of cannibalization is too great. Consider a slight change to our previous example, given in Table 14-3. The only difference is that the commercial users now value even the disabled version highly. As before (Table 14-2), we can sell only to commercial users at a profit of $500, or to all users for a profit of $350. But what if we tried to sell two versions? To attract the home users, the disabled version can be priced no higher

than $150. This disabled version gives our commercial users $250 of surplus. Since our commercial user sees only a $100 value difference between the two versions, it cannot be priced higher than $249. But selling the home version at $150 and the commercial version at $249 provides lower profit than selling only the commercial version at $500.

These examples show that indirect price discrimination is not only a pricing issue, but also a product design issue. We avoid cannibalization by making the discount version as unattractive as possible to commercial users by disabling the features most important to them. For example, only the full-featured Photoshop supports CMYK colors. If you're a home user, you probably don't even know what that is. If you're a professional graphic designer, you probably find CMYK indispensible.

In one of the more infamous examples, IBM released the LaserPrinter E in May 1990, a lower-price alternative to its popular LaserPrinter. The LaserPrinter E printed at a speed of 5 pages per minute compared to 10 pages per minute for the higher-priced LaserPrinter. IBM actually *added* chips to the LaserPrinter E (at an additional cost) to insert wait states to slow the print speed. This is known as a "damaged goods" strategy.[2] Similarly, Microsoft sold both "server" and "client" versions of its Windows NT operating system, at a price difference of $800. It was later revealed that two easily changed lines of code were responsible for the technical differences between the two products.

HP Printers

Hewlett-Packard uses a different strategy to sort consumers into high- and low-value groups. High-value consumers identify themselves by how many ink cartridges they buy. To charge higher prices to the high-value group, HP prices its printers at near cost, but sells cartridges at a 50% markup over marginal cost.

To make sure you understand how this works, let's use a numerical example. In particular, suppose that HP's low-value customers consume one cartridge each year and are willing to pay $100 for printing services (printer plus one cartridge), and their high-value customers consume two cartridges each year and are willing to pay $200. What price should HP charge?

We compute the revenue of two different pricing strategies in Table 14-4. In row 1, we compute the revenue from pricing printers at $50 and cartridges at $50. We see that low-value consumers would pay $100, whereas high-value consumers would pay $150. In row 2, we see that the firm could do better by giving away the printer and charging $100 for each cartridge. In this case, the low-value consumers pay $100 and the high-value consumers pay $200.

TABLE 14.4
Pricing Strategies

	Low-Value Consumers $100 value, 1 cartridge	High-Value Consumers $200 value, 2 cartridges	Total Revenue
Strategy 1: $50 printer + $50 cartridge	$100	$150	$250
Strategy 2: $0 printer + $100 cartridge	$100	$200	$300

This pricing strategy works only because the high-value consumers use more cartridges than low-value consumers. Since HP charges a relatively high price for the cartridges, high-value customers end up paying a higher margin on printing services (printer + cartridges) than do low-value consumers.

This kind of "metering" scheme is used to sell razor blades at higher margins than razors, and famously for the marketing of Barbie products: you give away the dolls and sell the dresses at very high markups. High-value shavers use more razor blades (replacing them more frequently as they become dull), and high-value doll users purchase more Barbie outfits. Lower-value consumers buy fewer razors and fewer doll accessories.

As we described in Chapter 9, profits like those that flow from successful price discrimination are likely to attract competition. In the case of printer manufacturers, for example, the high markups on ink cartridges create profitable entry for toner refill kits. Printer manufacturers may be tempted to prevent rivals from selling lower-priced cartridges, say, by "tying" the sales of new cartridges to sales of printers. But such ties can run afoul of the antitrust laws. Here is some advice from a former antitrust prosecutor:[3]

> *Do not tie the sale of one product to another. Such arrangements are only legal in a few rare instances—to ensure effective functioning of complicated equipment, to name one. But they are generally against the law.*

Instead, HP spends over one billion dollars per year on ink research and development, in part to stay a step ahead of generic ink manufacturers.

VOLUME DISCOUNTS AS DISCRIMINATION

So far, we've been discussing ways of price discriminating between different customers—that is, setting different prices to different people or groups of people. Here, we consider the case of a single customer who demands more than one unit of a good. To price discriminate in this case, we have to find a way to set different prices for each unit consumed.

Consider a single customer who's willing to pay $7 for the first unit, $6 for the second, $5 for the third, and so on, as in our earlier demand curve example. If the price is set at $7, this consumer will purchase one unit; if the price is set at $6, two units; $5, three units; and so on. Each price represents the value that the consumer places on each unit consumed; that is, the consumer values the first item at $7, the second at $6, and so on. This is an **individual demand curve**.

Note the difference between an individual and an aggregate demand curve. With an aggregate demand curve, each point represents a different consumer with a different value for a single unit of the good. For an individual demand curve, each point represents the value that a single consumer is willing to pay for an additional unit.

Individual demand curves slope downward because the marginal value, the value placed on extra units, declines with each purchase. For example, a retailer who purchases from a manufacturer may find that the first few items are relatively easy to sell, but to sell more, she may have to lower the price, "hold" the item in inventory for a longer period of time, or spend money promoting the item. All of these activities reduce the value that the customer (here, the retailer) is willing to pay for additional units.

If a seller is setting a single price, it doesn't matter whether she faces an aggregate or an individual demand—the profit calculus is the same. She'll sell all items where MR > MC, which in this case is three units at a price of $5. And, just as in the aggregate demand curve, we see

unconsummated wealth-creating transactions at the optimal price—those units worth $4, $3, and $2—are not purchased even though the consumer places a value on these extra units that is higher than the marginal cost ($1.50) of producing them. These three extra units represent unconsummated wealth-creating transactions.

The trick to profitably selling more is to find a way to sell additional units without dropping the prices of the earlier units. There are several ways to do this:

- Offer volume discounts; for example, price the first good at $7, the second at $6, the third at $5, and so on.
- Use two-part pricing (fixed price plus a per-unit price). Charge a per-unit price low enough to consummate all wealth-creating transactions (set it at MC = $1.50); then bargain over how to split the resulting surplus. The consumer's total value for six units is $27 (= $7 + $6 + $5 + $4 + $3 + $2), and six units cost just $9 (= 6*$1.50) to produce. Bargain over how to split the remaining surplus ($18 = $27 – $9) created by the transaction. This is the "fixed price" part of the transaction.
- Bundle the goods. As we have just seen, the consumer's total value for six units is $27. If you have enough bargaining power, you can capture the entire consumer surplus by pricing a bundle of six goods at just below $27. If not, then bargain over how to split it.

This example illustrates a very important lesson for pricing:

> *When bargaining with a customer, do not bargain over unit price; instead, bargain over the bundled price.*

First, figure out how much the consumer would demand if price were set at marginal cost; then bargain over the bundled price for this amount. This strategy ensures that you're bargaining over how to split the largest possible pie.

BUNDLING DIFFERENT GOODS TOGETHER

We can also use bundling in a slightly different context—when consumers have different demands for different items. Consider a movie theater with two groups of customers whose preferences for two films—a horror film and an adventure film—are different.[4] The theater owners cannot engage in direct price discrimination because they cannot identify the movie preferences of particular consumers ahead of time. But they can bundle the films together in a double feature and accomplish the same thing.

Suppose the theater has 100 potential customers: One-half would be willing to pay $6 to see the horror film and $4 to see the adventure film; the other half would pay $4 to see the horror film and $6 to see the adventure film.

If the theater sets a single price for both films, it faces the usual trade-off. It can sell to all the consumers at a price of $4 (revenue = $4 × 100 = $400 per film), or it can sell to half of the moviegoers at a price of $6 (revenue = $6 × 50 = $300 per film). In this case, pricing low is more profitable, so each film would be sold at a price of $4 and the theater owner would earn $800 on the two films.

But look what happens when the theater bundles both films together in a double feature. Each customer values the bundle at $10, so the theater can sell to all customers at the bundled price of $10 (revenue = $10 × 100 = $1,000).

In this case, bundling makes customers more homogeneous (they're willing to pay the same amount for the bundle), so the seller doesn't have to reduce the price of the bundle

to sell more tickets. Intuitively, bundling makes it easier for the theater to extract consumer surplus with a single price for the bundle.

Bundled pricing[5] allows a seller to extract more consumer surplus if willingness to pay for the bundle is more homogeneous than willingness to pay for the separate items in the bundle. For example, the bundling of channels allows cable TV providers to extract *65%* more consumer surplus than if the channels were priced separately.[6]

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- When a seller cannot identify low- and high-value consumers or cannot prevent arbitrage between two groups, it can still discriminate indirectly by designing products or services that appeal to groups with different price elasticities of demand.
- Metering is a type of indirect discrimination that identifies high-value consumers by how intensely they use a product (e.g., by how many cartridges they buy). In this case, charge a big markup on the cartridges and a lower markup on the printer.
- If you offer a low-value product that is attractive to high-value consumers, you may cannibalize sales of your high-price product.
- When pricing for an individual customer, do not bargain over unit price. Instead, you should
  - offer volume discounts;
  - use two-part pricing; or
  - offer a bundle containing a number of units.
- Bundling different goods together can allow a seller to extract more consumer surplus if willingness to pay for the bundle is more homogeneous than willingness to pay for the separate items in the bundle.

Multiple-Choice Questions

1. A software firm can offer a high-feature version of its software or a stripped-down low-value version, each with similar production costs. Which of the following cannot be an optimal strategy?
   a. Offer only the high-feature version aimed only at a high-value market segment.
   b. Offer only the low-value version aimed at all market segments.
   c. Offer both versions targeted to different value segments.
   d. Offer only the high-feature version aimed at all market segments.
2. Which of the following conditions must be satisfied by a successful price discrimination scheme?
   a. The seller must have market power.
   b. The seller must be able to identify different customer groups with different demand elasticities.
   c. The seller must be able to prevent arbitrage between the two groups.
   d. All of the above
3. When a firm practices perfect price discrimination, that is, by charging each customer exactly what they are willing to pay, then,
   a. the demand curve is very inelastic.
   b. the marginal revenue is the demand curve.
   c. the demand curve is very elastic.
   d. the marginal cost curve is the average cost curve.

Use the following table to answer Questions 4–6. Assume the cost of producing the goods is zero and that each consumer will purchase each good as long as the price is less than or equal to value. Consumer values are the entries in the table

	Consumer A	Consumer B
Good 1	$2,300	$2,800
Good 2	$1,700	$1,200

4. Suppose the monopolist only sold the goods separately. What price will the monopolist

charge for good 1 to maximize revenues for good 1?
   a. $2,300
   b. $2,800
   c. $1,200
   d. $1,700
5. What is the total profit to the monopolist from selling the goods separately?
   a. $4,500
   b. $6,300
   c. $7,000
   d. $6,000
6. What is a better pricing strategy for the monopolist? At this price, what are the total profits to the monopolist?
   a. Bundle the goods at $2,800; Profits = $5,600
   b. Bundle the goods at $4,000; Profits = $8,000
   c. Charge $2,800 for good 1 and charge $1,700 for good 2; Profits = $4,500
   d. Charging the lowest price for each good individually is the best pricing strategy; Profits = $7,000
7. Assume that the price elasticity of demand for movie theatres is –0.85 during all evening shows but for all afternoon shows the price elasticity of demand is –2.28. For the theater to maximize total revenue, it should
   a. charge the same price for both shows, holding other things constant.
   b. charge a higher price for the afternoon shows and lower price for the evening shows, holding other things constant.
   c. charge a lower price for the afternoon shows and higher price for the evening shows, holding other things constant.
   d. Need more information
8. Arbitrage
   a. is the act of buying low in one market and selling high in another market.
   b. can force a seller to go back to uniform pricing.
   c. can defeat direct price discrimination.
   d. All of the above
9. Airlines charge a _____ price to business travelers compared to leisure travelers because business travelers have a _____ demand than leisure travelers.
   a. higher; more elastic
   b. higher; less elastic
   c. lower; more elastic
   d. lower; less elastic
10. Metering is
   a. a type of indirect price discrimination.
   b. a type of direct price discrimination.
   c. an evaluation of a product.
   d. an example of bundling.

Individual Problems

14-1 Barbie Dolls and Accessories

Why might Mattel set a much lower contribution margin on its Barbie dolls than on the accessories for the dolls?

14-2 German Brothels

German brothels recently began offering a monthly subscription service for multiple purchasers. If you thought that the brothels' encouragement of prostitution was immoral to begin with, would you consider this pricing plan to be even more immoral?

14-3 Selling Salsa

Your family business produces a secret recipe salsa and distributes it through both smaller specialty stores and chain supermarkets. The chains have been demanding sizable discounts but you do not want to drop your prices to the specialty stores. How can you legally accommodate the chains without losing profits from the specialty stores?

14-4 Microwave Ovens

A manufacturer of microwaves has discovered that male shoppers have little value for microwaves and attribute almost no extra value to an auto-defrost feature. Female shoppers generally value microwaves more than men and attribute greater value to the auto-defrost feature. There is little additional cost to incorporating an auto-defrost feature. Since men and women cannot be charged different prices for the same product, the manufacturer is considering introducing two different models. The manufacturer has determined

that men value a simple microwave at $70 and one with auto-defrost at $80 while women value a simple microwave at $80 and one with auto-defrost at $150.

If there is an equal number of men and women, what pricing strategy will yield the greatest revenue? What if women compromise the bulk of microwave shoppers?

14-5 Music Pricing

The pricing model for iTunes has been to price songs individually. Instead, Pandora opted to offer unlimited song playing for a monthly fee. Would Pandora's pricing model likely yield more profit than pricing songs individually?

14-6 Bundling

At a student café, there are equal numbers of two types of customers with the following values. The café owner cannot distinguish between the two types of students because many students without early classes arrive early anyway (i.e., she cannot price discriminate).

	Students with Early Classes	Students without Early Classes
Coffee	70	60
Banana	50	100

The MC of coffee is 10. The MC of a banana is 40. Is bundling more profitable than selling separately? If so, what price should be charged for the bundle?

Group Problems

G14-1 Price Discrimination

Does your company price discriminate? Explain how the practice works (direct or indirect) and estimate the profit consequences of price discrimination relative to a uniform price. If your company doesn't currently price discriminate, are there opportunities to do so? How would you design the scheme? Estimate the profit consequences.

G14-2 Price Discrimination Data[7]

Collect a set of price quotes for no fewer than 30 airplane tickets. Examine how these price quotes change as you vary the tickets—one characteristic at time.

For instance, suppose you get a price quote for a ticket on United Airlines from Raleigh-Durham to Chicago, departing on May 17 and returning on May 19. Change the following characteristics, one at time, and get a new price quote:

- Change the time of departure within the same day.
- Change the source of your quote (e.g., from Travelocity to the airline's Web site).
- Change the pre-departure interval date (e.g., compare flights bought a couple of days in advance to months in advance).
- Change the class of the ticket and travel restrictions.
- Change the return date to include a Saturday stay-over.
- Change anything else you can think of.

Make sure you get price quotes from airports where one airline has a dominant presence (e.g., Northwest in Minneapolis) and a route presenting stiff competition from a "no-frills" carrier such as Southwest or JetBlue.

Describe some of the important differences in pricing you observe. Are the pricing differences consistent with the patterns of indirect or direct price discrimination, or are there other explanations? Original, novel, and thoughtful interpretations of the patterns you see in the data are particularly welcome.

END NOTES

1. Kenneth A. Small, Clifford Winston, and Jia Yan, "Uncovering the Distribution of Motorists' Preferences for Travel Time and Reliability," *Econometrica* 73, no. 4 (2005): 1367–1382.
2. Raymond J. Deneckere and R. Preston McAfee, "Damaged Goods," *Journal of Economics and Management Strategy* 5, no. 2 (1996): 149–174.
3. See John H. Shenefield and Irwin M. Stelzer, "Common Sense Guidelines," *The Antitrust Laws: A Primer,* 3rd ed. (Washington, D.C.: AEI Press, 1998), 123–126.
4. Adapted from Hal R. Varian, "Sorting Out Bundling and Antitrust Law," *New York Times*, July 26, 2001, available at http://www.nytimes.com/2001/07/26/business/26SCEN.html.
5. Bundling can be accomplished in different ways. *Pure* bundling describes a situation where the commodities in a bundle are not offered for sale separately, whereas *mixed* bundling refers to a pricing strategy where the bundled goods can also be purchased separately.
6. Gregory S. Crawford and Joseph Cullen, "Bundling, Product Choice, and Efficiency: Should Cable Television Networks Be Offered a la Carte?" *Information Economics and Policy* 19 (2007): 379–404.
7. Adapted from Pat Bajari's economics class.

SECTION 4

Strategic Decision Making

CHAPTER 15

Strategic Games

On the island of Bermuda, the Cooper & Sons chain of department stores has been in the same family since 1897. Its largest rival, Gibbons, has been in the hands of another family for nearly as long. Lately, business has not been good. Since 2008, revenues have declined by 30%, and several competing department stores have shut their doors.

Competition for the remaining dollars has become fierce. Cooper lowered its prices to try to steal some of Gibbons' customers. Gibbons responded with price cuts of its own. Then Cooper cut prices even more and expanded its store hours.

Short of starting a land war in Asia, few moves are as dumb as starting a price war with a close competitor. Each firm mistakenly believes that it can somehow "win" the war. When this doesn't happen, they find themselves with low profits, consumers who have grown accustomed to low prices, and the problem of how to end hostilities.

In October of 2012, Gibbons announced that it would not be undercut. On its face, the announcement—"You find a better price, we'll match it"—seemed to promise even lower prices, but in fact, it ended the war. Cooper no longer had an incentive to undercut Gibbons' prices because it couldn't gain customers by doing so. Gibbons' customers would stay with Gibbons and demand a price match instead. Quite counter-intuitively, the price-matching announcement can end the price war.

In this chapter, we show you how to use game theory to analyze situations like these, where the profit of one firm depends critically on the actions of others. Studying game theory will give you insight into not only where competition with rivals is likely to lead, but also how to change the rules of the game to your advantage.

This chapter can be thought of as a complement to Chapter 10, where we introduced three basic strategies for slowing profit erosion: (i) reducing costs, (ii) differentiating your product, and (iii) reducing competitive intensity. Game theory will help you better understand the third strategy. In what follows, we distinguish between two different types of games: sequential-move games and simultaneous-move games.

In both types of games, the likely outcome is a **Nash equilibrium**, named for John Nash, the mathematician (and Nobel laureate in economics) profiled in Sylvia Nasar's 1998 book and the Academy Award–winning 2001 movie, *A Beautiful Mind*.

A Nash equilibrium is a pair of strategies, one for each player, in which each strategy is a best response to the other.

In equilibrium, each player is doing the best that he or she can given what the other player is doing. In what follows, we show how to compute equilibria in each type of game, and how to change the rules of the game to your advantage.

SEQUENTIAL-MOVE GAMES

In **sequential-move games**, players take turns, and each player observes what his or her rival did before having to move. To compute the likely outcome of a sequential game, we *look ahead and reason back*, or predict what will happen tomorrow in response to each of our possible actions today. Consider a simple two-move game: By anticipating how the second player will react, the first player can accurately forecast the consequences of her own moves. We represent sequential games using the *extensive* or *tree form* of a game, familiar to anyone who has ever used a decision tree.

In the simple game illustrated in Figure 15-1, an entrant is deciding whether to enter an industry in competition with an incumbent firm. Beginning on the bottom of the left branch of the tree, we see that if the entrant enters, the incumbent has two choices: accommodate entry ("Acc") or "Fight" it. Accommodation (e.g., by keeping prices high), results in a payoff of $5 for each player whereas fighting (e.g., by pricing low), results in a loss of $5 for each player. So, if the entrant decides to enter, the incumbent does better by accommodating. In Figure 15-2, we denote the best response of the monopolist by crossing out the suboptimal strategy.

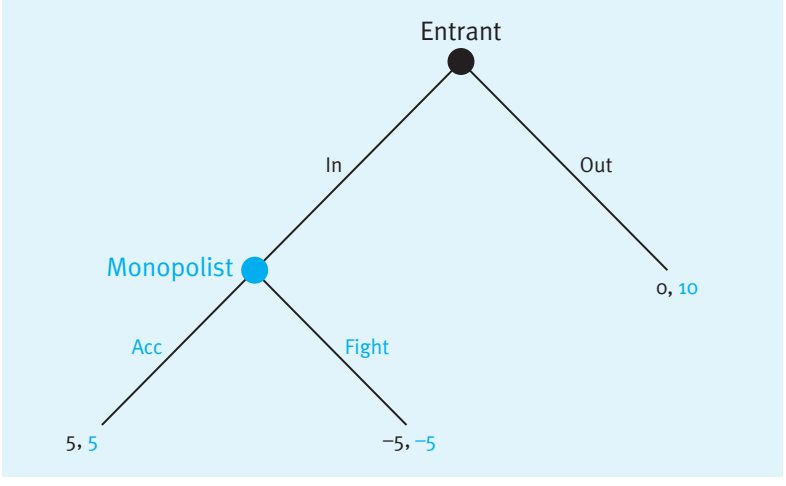


FIGURE **15.1 Entry Game**

Once the entrant knows how the incumbent will react, she can compute the profit for both options. If she enters, the incumbent will accommodate, and the entrant earns $5. If she stays out, it doesn't matter what the incumbent does—the entrant earns nothing. Comparing $5 to $0, the entrant will enter. We denote the best strategy of the entrant in Figure 15-2 by crossing out the suboptimal strategy. What remains is the *equilibrium path* of the game, {In, Accommodate}, where each player is maximizing her payoff when taking the actions of subsequent players into account.[1]

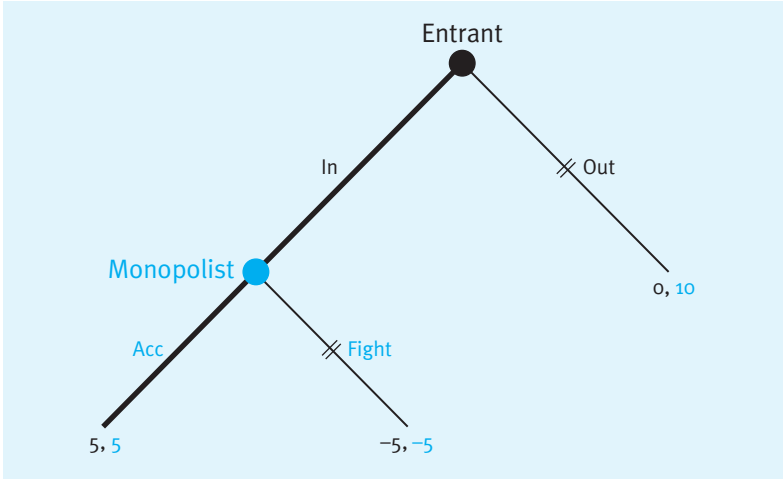


FIGURE **15.2 Entry Accommodation**

The analysis doesn't stop here, however. We don't just want to figure out what's likely to happen; we also want some guidance about how to change the game to our advantage. For example, in this game, if the incumbent could figure out how to deter entry, he could end up on the right branch of the tree and earn $10 instead of $5.

One way to deter entry is to threaten to fight (by slashing prices) if the entrant should enter. We diagram the threat by eliminating one of the branches of the tree in Figure 15-3. If the entrant believes the threat, she'll stay out because entry, combined with an incumbent's low price, would yield a loss of $5 for the entrant. By eliminating one of his own options, the incumbent has changed the equilibrium of the game. This highlights one of the interesting conclusions of this type of analysis—you can make yourself better off by eliminating one of your options. The new equilibrium {Out, Fight} is highlighted in Figure 15-3.

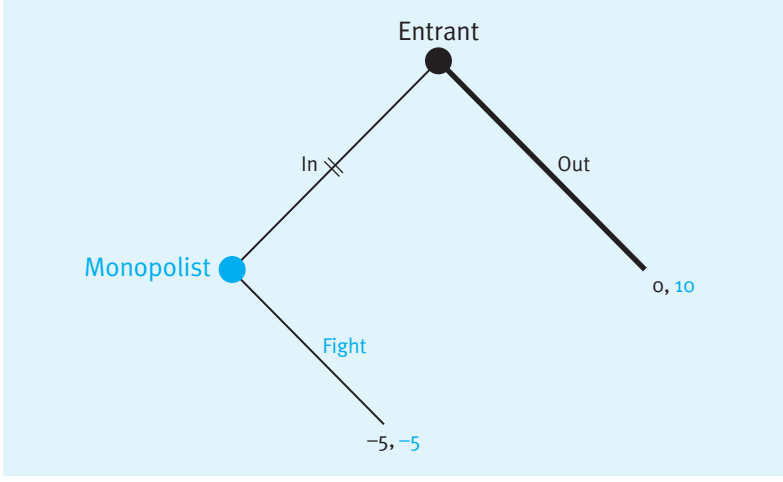


FIGURE **15.3 Entry Deterrence with Commitment**

The difficult part for the incumbent is convincing the entrant it will price low following entry. Every incumbent would want to claim that he'll fight entry, but this threat, on its own, isn't *credible*. This is because fighting by pricing low is less profitable for the incumbent than pricing high if entry does occur. The incumbent is threatening to act against his own self-interest.

To make a threat credible, you have to change the game. One way to do this is to adopt a low-marginal-cost technology so that it becomes credible to carry through on the policy of pricing low should entry occur. The incumbent could also promise customers that any competitive offer will be beat by 10%. These promises are legally binding contracts in most jurisdictions. This would credibly signal to potential entrants that the incumbent will reduce its prices if they enter, which would hopefully deter entry. This is the whole point of studying game theory. Being able to compute the equilibrium tells you where you are likely to end up. But this depends on the payoffs and the rules of the game, neither of which is fixed. While games like Monopoly and checkers have rigid rules, the rules governing business interactions are often more flexible, often dictated by little more than history or inertia. After you compute the equilibrium, try to figure out if you can change it to your advantage.

SIMULTANEOUS-MOVE GAMES

In **simultaneous-move games**, each player decides on her strategy before knowing the decisions of other players. To analyze these games, we use the *matrix* or *strategic form* of a game. The likely outcomes of such games are Nash equilibria, in which all players are doing the best they can, given other players' strategies.

How to Find Nash Equilibria

In a two-player game, we can represent the game in a matrix, as in Table 15-1. The matrix represents a game between two parolees, Frank and Jesse, who are caught driving together shortly after a nearby bank robbery. The police suspect Frank and Jesse but have no direct evidence tying them to the crime. However, association with other felons is a violation of parole, so the district attorney can send them both back to jail to serve the remaining sentences on their previous crimes. The DA puts Frank and Jesse in separate cells and offers to go lighter on the one who confesses.

TABLE **15.1**

Frank and Jesse

		Frank	
		Confess	Stay Mum
Jesse	Confess	–5, –5	–3, –10
	Stay Mum	–10, –3	–2, –2

Jesse (termed the row player because he selects rows of the matrix) has two strategies, Confess and Stay Mum. Frank chooses among the same strategies in the columns of the matrix. The payoff to each (reflecting number of years in jail) is the two-element entry (row, column) in the

corresponding cell. For example, if Jesse chooses "Confess" and Frank chooses "Stay Mum," then Jesse's payoff is –3 (three years in jail) and Frank's payoff is –10.

The game in Table 15-1 describes the three components of a game: the players, their available strategies, and the resulting payoffs. This particular game is about as simple as they come with just two players with two strategies each. To find Nash equilibria, we ask, "Are both players playing a best response to what their rivals are playing?" If so, you have found a pair of strategies that is a Nash equilibrium. Let's start from Jesse's perspective. For each of Frank's possible strategies, select the row strategy that maximizes Jesse's payoff. If Frank chooses the "Confess" column, Jesse's best row response is to play "Confess," earning a payoff of –5. Underline this payoff in the game box because it is bigger (less negative) then his "Stay Mum" payoff (–10). If Frank plays "Stay Mum," Jesse's best response is also to play "Stay Mum," earning a payoff of –2. In general, you would continue through all of the column player's strategies underlining the best row response, as shown in Table 15-2. In more complex games, best responses might not be unique if two strategies have the same payoff. If two strategies are tied for best response, simply underline both.

TABLE **15.2**

Identifying the Row Player's Best Responses

		Frank	
		Confess	Stay Mum
Jesse	Confess	–5, –5	–3, –10
	Stay Mum	–10, –3	–2, –2

We can do the same thing for Frank's best column responses to each row. If Jesse plays "Confess," Frank chooses "Confess" (because –5 is better than –10) and if Jesse plays "Stay Mum," Frank chooses "Stay Mum." This is depicted in Table 15-3.

TABLE **15.3**

Identifying the Column Player's Best Responses

		Frank	
		Confess	Stay Mum
Jesse	Confess	–5, –5	–3, –10
	Stay Mum	–10, –3	–2, –2

Recall that a pair of strategies is in equilibrium if both players are playing their best responses. Since we underlined best responses, an equilibrium occurs whenever both payoffs in a box are underlined. In this case, the game has two equilibria, {Confess, Confess} and {Stay Mum, Stay Mum}.

The fact that there are two equilibria (including one in which both stay mum) is a problem for the DA. If she could, the DA would like to change the game to get Frank and Jesse to confess. She does this by increasing the reward to confessing. The DA promises Jesse that if he confesses while Frank stays mum, she will let Jesse go free. She makes the same offer to Frank. Table 15-4 shows how this slight alteration in the payoffs changes the players' best responses.

TABLE 15.4
Prisoners' Dilemma

		Frank	
		Confess	Stay Mum
Jesse	Confess	–5, –5	0, –10
	Stay Mum	–10, 0	–2, –2

Now there is only one equilibrium. Even if Jesse thinks Frank will stay mum, Jesse's best response is still to confess.[2] The only Nash equilibrium is in the upper-left corner.

Prisoners' Dilemma

The situation depicted in Table 15-4 illustrates a tension between conflict (self-interest) and cooperation (group interest). If Frank and Jesse cooperate by both staying mum (lower right), the group would be better off. However, this is not an equilibrium. By following their self-interests, the players both confess and end up in the upper left box.

The **prisoners' dilemma** is perhaps the oldest and most studied game in economics, and reflects many business situations. For example, the pricing dilemma in the introduction of this chapter and illustrated in Table 15-5 has the same logical structure as the prisoners' dilemma. Even though Gibbons' profits are higher than Cooper's due to its larger size, both Cooper and Gibbons could make more money if both priced high, but both pricing high is not a Nash equilibrium. Cooper does better by pricing low regardless of what Gibbons does, and Gibbons does better by pricing low regardless of what Cooper does. The only Nash equilibrium is for both to price low, in the upper-left corner.

TABLE 15.5
Pricing Dilemma

		Gibbons	
		Price Low	Price High
Cooper	Price Low	100, 120	400, 0
	Price High	0, 480	300, 360

If the department stores can find a way to coordinate their pricing, they can get out of this dilemma. However, explicit price coordination is a violation of the antitrust laws, as summed up in the following advice from a former antitrust prosecutor:[3]

> Do not discuss prices with your competitors. That is one of those black-and-white areas. The enforcement authorities can be counted on to bring a criminal prosecution if they learn that you have met with your competitors to fix prices or any other terms of sale. Jail time is increasingly common.

Another way out of this dilemma is to allocate customers, divide up territories, and agree not to compete in each other's areas. However, these agreements are also illegal:[4]

> Do not agree with your competitor to stay out of each other's markets. It may be tempting to seek freedom of action in one part of the country by agreeing with a competitor not to go west if he will not come east. Avoid that temptation. The consequences of the discovery of such behavior by the enforcement authorities are likely to be the same as the unearthing of a price-fixing conspiracy.

Price Discrimination Dilemma

You learned in Chapters 13 and 14 that you can always raise profit by price discriminating, provided different consumers have different demand elasticities and you can prevent arbitrage. But when you're competing against other firms, price discrimination may provoke your rivals to retaliate in a way that could make you both worse off. If your rivals begin discriminating in reaction to your decision to discriminate, then everyone's profit can fall below what it would have been had no one price discriminated. For example, firms often discriminate by offering discounts to customers based on where they live. Supermarkets may circulate discount coupons to customers who live close to their rivals.[5] Domino's Pizza reportedly targets promotions to customers who live closer to its rivals' stores, a strategy consistent with discrimination based on consumer location.[6] A similar kind of discrimination occurs when companies offer coupons at supermarket checkouts to customers who have purchased competing brands.[7] In each of these cases, we would expect rivals to react by offering lower prices to these targeted customers as well. The result is that equilibrium prices are lower than they would be without targeted discounts.

In Table 15-6, we see an illustrative game involving two grocery stores. These stores (Kroger and Safeway) are considering whether to offer discount coupons to customers who live farther away—and nearer to a competitor's store. These customers have more elastic demand than customers living closer to the store.

TABLE **15.6**

Oligopoly Price Discrimination Dilemma

		Kroger	
		Price Discriminate	Uniform Prices
Safeway	Price Discriminate	0, 0	4, –2
	Uniform Prices	–2, 4	2, 2

If just one grocery store offers such coupons, then its profit increases. However, if its competitor does the same thing, then all the stores wind up with about the same overall sale volume, but at lower prices. In equilibrium, both stores price discriminate, and both

are worse off. Intuitively, with a uniform price, the stores compete vigorously for customers only on the boundaries of their market areas. When they discriminate, they compete vigorously for all customers, no matter where they live, and industry profit suffers.

Advertising Dilemma

Table 15-7 exhibits an advertising dilemma that has the same logical structure as the prisoners' dilemma. Rival tobacco manufacturers RJR and Phillip Morris both used to advertise quite heavily on television. Cigarette advertising is predatory; it serves mainly to steal market share from rivals without increasing market size. Thus, both companies could make more money by not advertising, but the lower-right corner in Table 15-7 is not an equilibrium. If the rival doesn't advertise, each firm can do better by advertising and stealing the rival's customers. The only Nash equilibrium is for both to advertise and earn lower profits.

When the government banned over-the-air cigarette advertising in the early 1970s, the profitability of the cigarette industry increased by nearly 40%.[8] The ban moved the industry from the upper-left corner to the lower-right corner of the payoff matrix. Ordinarily, however, you can't count on the government to help you out of a prisoners' dilemma.

TABLE 15.7
Advertising Dilemma

		Phillip Morris	
		Advertise	Don't Advertise
RJR	Advertise	30, 30	50, 20
	Don't Advertise	20, 50	40, 40

Free-Riding Dilemma

The game in Table 15-8 illustrates the strategic interdependence typical of an MBA study group. It's also typical of the kinds of payoffs you'd expect in any group or team-based activity. Each player has the option of working hard or shirking. The benefit of working hard is that you raise your grade, but the downside is that you sacrifice leisure time. If both work, they will earn an A, if only one works, they earn a B, and if both shirk, they earn a C.

To determine the Nash equilibrium of the game, you need to know how study group members rank various outcomes. Assume that students value leisure time more than a

TABLE 15.8
Free-Riding Dilemma

		Joe	
		Shirk	Work
Sally	Shirk	C+Leisure (2), C+Leisure (2)	B+Leisure (4), B (1)
	Work	B (1), B+Leisure (4)	A (3), A (3)

one-letter grade improvement, but less than a two-letter grade improvement. Thus, both students rank the outcomes as follows:

- A grade of B, with leisure time (payoff of 4) is better than
- a grade of A and no leisure time (payoff of 3), which is better than
- a grade of C, with leisure time (payoff of 2), which is better than
- a grade of B and no leisure time (payoff of 1).

With this set of preferences, the Nash equilibrium is {Shirk, Shirk}, where each player receives a C plus leisure time. This outcome is inefficient because students in the group would jointly prefer the A that comes from hard work. However, this outcome is not an equilibrium because once the other group members are working hard, the best response is to shirk. As in the other prisoners' dilemma games, there is a tension between conflict and cooperation. Successful study groups figure out how to manage this tension, and get out of the low-grade equilibrium.

WHAT CAN I LEARN FROM STUDYING GAMES LIKE THE PRISONERS' DILEMMA?

The Nash equilibrium of a prisoners' dilemma represents an unconsummated wealth-creating transaction between players. In the pricing dilemma, both players would like to price high. In the advertising dilemma, both would like to advertise less. In the free-riding game, both would like to work harder. However, none of these outcomes is a Nash equilibrium.

The point of studying the prisoners' dilemma is to learn to avoid these bad outcomes or, alternatively, to learn how to consummate these unconsummated wealth-creating transactions among players.

Change the Payoff Structure of the Game

The implication of the prisoners' dilemma for long-run strategy is clear: Try to *avoid* games with the logical structure of a prisoners' dilemma. Instead, work on developing long-run strategies that change the structure of the game to make your own payoffs less dependent on your rivals' actions. If possible, try to differentiate your product or figure out a way to lower your costs.

If you have no other option, try to reduce the intensity of competition without running afoul of the antitrust laws. For example, when Cooper and Gibbons department stores introduced price matching, they reduced the strategic benefits of lowering prices.

As a general matter, it is easier to get out of a prisoners' dilemma when the game is repeated. Only a fool (or someone who hasn't read this book) would stay stuck in a bad equilibrium. For example, suppose our MBA group members were not just playing the free riding game in Table 15-8 once, but, as is more likely, they were playing it over and over. In the initial game, they would like to coordinate on work but each has an incentive to "cheat" and shirk instead. But with repeated games, you can condition your future behavior on your opponent's past behavior with a *trigger* strategy. For example, both could agree to cooperate by working in each period, but adopt the following strategy: if my classmate worked last time, I will work too, but if my classmate shirked, it will trigger me to shirk from now on.

Is this agreement a Nash equilibrium? By working, each player receives an A in each period, but without leisure time, for a payoff of 3. If one of the players shirks, that player receives a higher payoff of 4 in *that* period. But the player knows that his colleague will shirk forever after, leading to a payoff of 2. Thus, cooperating leads to a payoff of 3 in

each period, while cheating leads to a one-time gain of 4, followed by a payoff of 2 in all future periods. The comparison between these depends on the discount rate and on the expected length of the future relationship between MBA students. Low discount rates (where future payoffs are more valuable) and long relationships both make cooperation more likely.

Similarly, the hold-up problem between a supplier and a customer from Chapter 5 can be described as a prisoners' dilemma in which both parties benefit from the transaction but one party cannot help himself from holding up the counter-party once relationship-specific costs are sunk. In a repeated-game context, the likelihood of hold-up is decreased because such action sacrifices the future value of the relationship. When cooperation is important, devise ways to make the interaction more like a repeated game so as to avoid "cheating."

How Best to Get Out of a Repeated Prisoners' Dilemma

To determine the best way to play a repeated prisoners' dilemma, economist Robert Axelrod had a novel idea—he ran a tournament with a cash prize. He asked professors of political science, mathematics, psychology, computer science, and economics to submit strategies as programmable functions, and then he ran simulated tournaments among the programs. Axelrod was able to characterize the features of the strategies that earned the highest profit:

- *Be nice*: Start by cooperating, and don't strike first.
- *Be easily provoked*: Respond immediately to rivals.
- *Be forgiving*: Don't try to punish competitors too much if they defect from the cooperative outcome.
- *Don't be envious*: Focus on your own slice of the profit pie, not on your competitor's.
- *Be clear*: Make sure your competitors can easily interpret your actions.

The tit-for-tat strategy—doing what your opponent did last period—won the tournament. It exhibits all of the characteristics of a successful strategy. Tit-for-tat never strikes first and responds immediately to defection, but limits punishment to only a single period. It is focused on maximizing your own profit, and not on limiting your competitor's profits. And finally, it is easily understood by rivals.

OTHER GAMES

Game of Chicken

In the classic game of chicken, two teenage boys—say, James and Dean—drive their cars straight toward each other. If both go straight, they crash and die. If one goes straight while the other swerves, the one who goes straight gets the girl whereas the one who swerves suffers the humiliation of "chickening out." If both swerve, neither gets the girl, and each suffers humiliation.[9]

Intuitively, you should realize that there are two equilibria to this game. If James is going straight and Dean swerves, then each player is doing the best he can given what the other is doing. James cannot improve his payoff by swerving and Dean cannot improve his by going straight. In Table 15-9, we have attached numerical values to each of the outcomes, and you can verify for yourself that the game of chicken has two equilibria in the off-diagonal entries of the matrix.

TABLE **15.9**
Game of Chicken

		James	
		Go Straight	Swerve
Dean	Go Straight	–10, –10	3, 0
	Swerve	0, 3	0, 0

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Now that we have analyzed the game and the likely outcomes, the next step is to figure out how to change the game to your advantage. Note that each party prefers one of the equilibria. This implies an obvious strategy: Commit to a position, and make sure your rival understands your commitment. Coordination here is important so that the players don't end up killing each other.

Commitment changes what is essentially a simultaneous-move game into a sequential-move game with what is known as a "first-mover" advantage. We illustrate this in Figure 15-4. The equilibrium is easy to compute. Dean does better by doing the opposite of whatever James does before him. So if James goes straight, Dean swerves, and vice versa. Once James knows what Dean is going to do, he sees that {Straight, Swerve} gives him a higher payoff than {Swerve, Straight}. The difficult part is convincing the other player that you are committed. One way to do this is to lock the steering wheel in place using an anti-theft device, like the Club, and throw away the key. Make sure that the other player sees you do this. Otherwise, he may also commit to going straight, and you could both end up dead.

The game of chicken has business applications as well. Table 15-10 represents the choices faced by competing biotechnology companies who were developing hybrid (disease-resistant) grapes. Each company could afford to tailor the grape variety to only

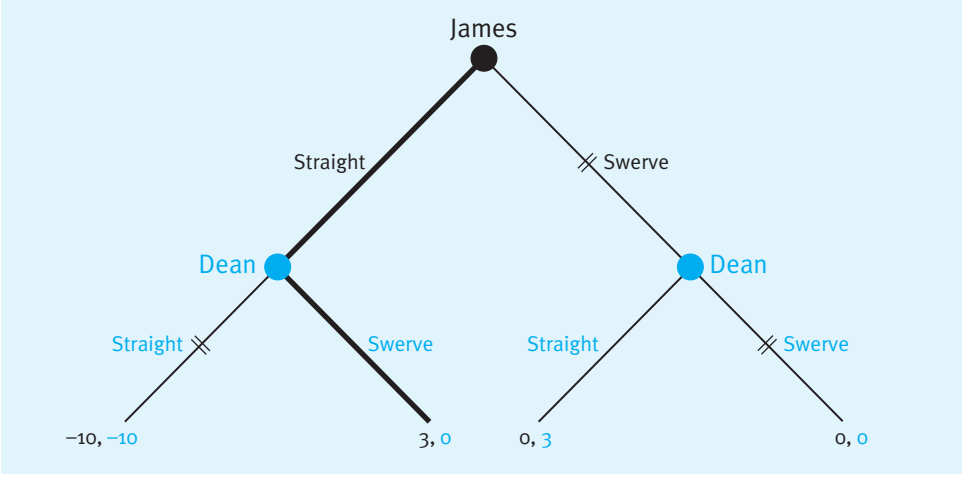

FIGURE **15.4 First-Mover Advantage in a Game of Chicken**
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TABLE 15.10
Market Entry Game of Chicken

		Firm B	
		Italy	South Africa
Firm A	Italy	0, 0	100, 50
	South Africa	50, 100	−50, −50

one country, either Italy or South Africa. Both prefer to be the sole entrant in a market, and both prefer Italy—a larger market—to South Africa. This game has the same logical structure as the game of chicken, with two equilibria: {South Africa, Italy} and {Italy, South Africa}.

If A can move first or commit to going into Italy, it will force B into South Africa. By moving first, A turns the simultaneous-move game into a sequential-move game in which it "chooses" the favorable equilibrium. We graph this outcome in Figure 15-5.

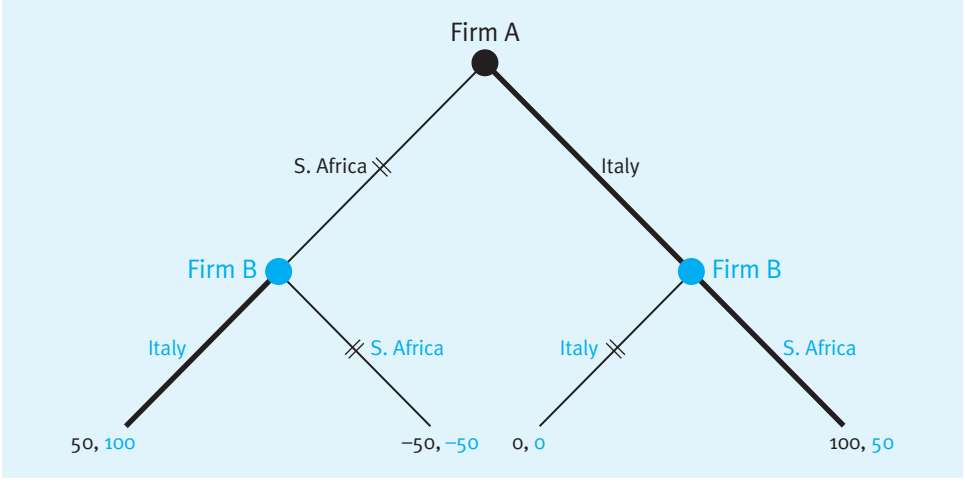


FIGURE 15.5 Sequential Market Entry

Dating Game

The dating game shares the tension between group interest (cooperation) and self-interest (conflict) inherent in a prisoners' dilemma. The game in Table 15-11 is about a couple with different interests—Sally likes ballet and Joe likes wrestling. But each likes the other's company and would prefer attending events together. The two would be best served if Sally and Joe could agree to attend an event together (total payoff of 5), but neither coordination possibility—both attend the ballet or both attend wrestling match—is a Nash equilibrium. The only Nash equilibrium is the lower left, where Joe goes to the wrestling match and Sally goes to the ballet. As in the prisoners' dilemma, the idea is to find a way to change the rules of the game so both players can earn higher payoffs.

TABLE 15.11
Dating Game

		Joe	
		Wrestling	Ballet
Sally	Wrestling	1, 4	0, 0
	Ballet	2, 2	4, 1

One easy way to increase the joint payoffs is to take turns by attending a different event together each week. This solution gives a higher group payoff (5) than the Nash equilibrium (4). Note the similarity of this solution to the repeated prisoners' dilemma—if you repeat the game, you'll find it relatively easy to figure a way out of the dilemma.

The dating game also gives you a way to analyze the tension between divisions within a corporation. Suppose Chevrolet and Cadillac—two divisions of General Motors (GM)—receive a volume discount if they purchase tires from a single supplier. However, Chevrolet and Cadillac cannot agree on a common supplier because each has its own preference: Chevrolet wants Goodyear Tires, but Cadillac wants Michelin. This interdivision conflict negatively affects company-wide profit (see Table 15-12). We will return to this topic in Chapter 22, "How to Get Divisions to Work in the Firm's Best Interests."

TABLE 15.12
Corporate Division Dating Game

		Chevrolet	
		Goodyear Tires	Michelin Tires
Cadillac	Goodyear Tires	1, 4	0, 0
	Michelin Tires	2, 2	4, 1

Interdivision conflict is more likely to arise when the parent company runs each division as a separate profit center. Finding a way to create cooperation for the good of the parent company is management's problem. In this case, GM might offer some kind of profit sharing or subsidization, such as Cadillac paying Chevrolet to use Michelin tires.

Shirking/Monitoring Game

We can consider the problem of how to manage workers efficiently as a game between an employer and an employee. Using game theory helps us understand how best to manage self-interested employees.

Consider the most basic situation: A self-interested employee would prefer to work less (shirk), but shirking is profitable only if his manager is not monitoring what he does. His employer wants him to work hard, but must incur costs to monitor the employee's behavior. Table 15-13 represents the game. Try to find an equilibrium before reading on. If the manager monitors, then the employee does better by working. If the employee works, the

TABLE 15.13
Shirking/Monitoring Game

		Employee	
		Shirk	Work
Manager	Monitor	−1, 0	5, 5
	Don't Monitor	−10, 10	10, 5

manager does better by not spending resources on monitoring. But if the manager doesn't monitor, then the employee does better by shirking. And so on. This game has no "pure strategy" equilibrium.

In these kinds of games, the players play mixed strategies; that is, they choose which strategy to play randomly. An easy way to understand the concept of mixed strategies is to think about a sports contest. Should an American football team run or pass? If the team always runs, the defense will always prepare a good run defense, and the same will happen if the team always passes. The best strategy is to mix between runs and passes to try to keep the defense guessing. The exact mix—the probability of running—will vary from team to team, depending on its players' abilities, and from game to game, depending on the abilities of rival players.

The idea is to use the element of surprise to keep your opponent from taking advantage of your strategy. By choosing actions randomly, neither player can take advantage of the other. In our monitoring/shirking game, managers randomly monitor employees' behavior, and employees randomly shirk. It turns out that the probability of monitoring depends on how much the employee gains by shirking, and the probability of shirking depends on how much it costs the employer to monitor the employee's behavior. If the employer's monitoring expenses are great, the probability of shirking will be higher.

Now that we understand behavior in this game, let's try to figure out how to change the outcome to our advantage. The employer can reduce shirking by combining monitoring with an incentive compensation scheme. When the employer monitors and finds the employee is working hard, the employer can reward the employee with a bonus; or, equivalently, when the employer monitors and finds the employee is shirking, the employer can punish him with a fine, like demotion or dismissal. This combination of monitoring and incentive compensation can reduce the costs of controlling self-interested employees. We'll return to this problem in a future chapter when we discuss aligning employee incentives with the goals of the firm.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- In **sequential-move games**, players take turns, and each player observes what his or her rival did before having to move.
- In **simultaneous-move games,** players do not observe the rival's decision before making their own.
- A **Nash equilibrium** is a pair of strategies, one for each player, in which each strategy is a best response against the other. These represent the likely outcomes of games.
- When the rules of the game are flexible, change them to your advantage.

- In sequential games, players can change the outcome by committing to a future course of action. Credible commitments are difficult to make because they require that players threaten to act against their own self-interest.
- In the **prisoners' dilemma**, conflict and cooperation are in tension—self-interest leads the players to outcomes that no one likes. Studying the games can help you figure a way to avoid these bad outcomes.
- In repeated games, it is much easier to get out of bad situations. Here are some general rules of thumb:
  - Be nice: No first strikes.
  - Be easily provoked: Respond immediately to rivals.
  - Be forgiving: Don't try to punish competitors too much.
  - Don't be envious: Focus on your own slice of the profit pie, not on your competitor's.
  - Be clear: Make sure your competitors can easily interpret your actions.

Multiple-Choice Questions

1. The prisoners' dilemma is an example of
   a. a sequential game.
   b. a simultaneous game.
   c. a shirking game.
   d. a dating game
2. Nash equilibrium
   a. is where one player maximizes his payoff and the other doesn't.
   b. is where each player maximizes his own payoff given the action of the other player.
   c. is where both players are maximizing their total payoff.
   d. is a unique prediction of the likely outcome of a game.

Use the following to answer Questions 3–5: Consider the following information for a simultaneous move game: Two discount stores (megastore and superstore) are interested in expanding their market share through advertising. The table below depicts the strategic outcomes (profits) of both stores with and without advertising. Payoffs for Megastore are in blue.

		Superstore	
		Advertise	Don't Advertise
Megastore	Advertise	\$95, \$80	\$305, \$55
	Don't Advertise	\$65, \$285	\$165, \$115

3. The Nash equilibrium for both stores is
   a. for Megastore to advertise and for Superstore to advertise.
   b. for Megastore to advertise and for Superstore not to advertise.
   c. for Megastore not to advertise and for Superstore to advertise.
   d. for Megastore not to advertise and for Superstore not to advertise.
4. When the game does reach the Nash Equilibrium, the payoffs for both stores will be
   a. Megastore \$95 and Superstore \$80.
   b. Megastore \$305 and Superstore \$55.
   c. Megastore \$65 and Superstore \$285.
   d. Megastore \$165 and Superstore \$115.
5. If collusion were not illegal, then it would be more optimal
   a. for Megastore to advertise and for Superstore to advertise.
   b. for Megastore to advertise and for Superstore not to advertise.
   c. for Megastore not to advertise and for Superstore to advertise.
   d. for Megastore not to advertise and for Superstore not to advertise.
6. Prisoners' dilemmas show that
   a. rational choices can lead to bad outcomes.
   b. rational choices can lead to good outcomes.
   c. there are no ways to learn where the pitfalls lie.
   d. None of the above
7. In repeated games, all of the below make it easier to get out of bad situations except
   a. be nice, no first strikes.
   b. respond immediately to rivals.
   c. punish competitors as much as you can when they don't cooperate.
   d. make sure your competitors can easily interpret your actions.

Refer to the following strategic form game of price competition for Questions 8 and 9.

		Firm B	
		Low Price	High Price
Firm A	Low Price	0, 0	50, –10
	High Price	–10, 50	25, 25

8. If this game is played once, then
   a. firm A will charge a low price, and firm B will charge a low price.
   b. firm A will charge a high price, and firm B will charge a low price.
   c. firm A will charge a low price, and firm B will charge a high price.
   d. firm A will charge a high price, and firm B will charge a high price.
9. Suppose the game is infinitely repeated. What strategies will each firm likely utilize?
   a. Firm A will charge a low price, and firm B will charge a low price.
   b. Firm A will charge a high price, and firm B will charge a low price.
   c. Firm A will charge a low price, and firm B will charge a high price.
   d. Firm A will charge a high price, and firm B will charge a high price.
10. You, a real-estate developer, own a piece of land in Nassau, Bahamas, next to an equal-size piece of land owned by a competitor. Both of you have the choice of building a casino or a hotel. Your payoffs are as follows:

		You	
		Casino	Hotel
Your Competitor	Casino	3, 3	20, 5
	Hotel	5, 20	2, 2

How much is it worth to you to get your casino building permit first?
   a. $2 million
   b. $3 million
   c. $15 million
   d. $17 million

Individual Problems

15-1 To Vote or Not to Vote

Mr. and Mrs. Ward typically vote oppositely in elections and so their votes "cancel each other out." They each gain two units of utility from a vote for their positions (and lose two units of utility from a vote against their positions). However, the bother of actually voting costs each one unit of utility. Diagram a game in which they choose whether to vote or not to vote.

15-2 To Vote or Not to Vote Part II

Suppose Mr. and Mrs. Ward agreed not to vote in tomorrow's election. Would such an agreement improve utility? Would such an agreement be an equilibrium?

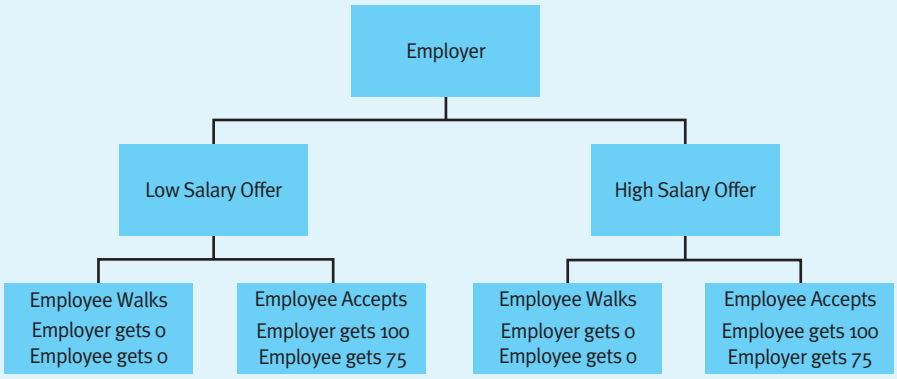
15-3 Shirk or Work

Microsoft and a smaller rival often have to select from one of two competing technologies. The rival always prefers to select the same technology as Microsoft (because compatibility is important), while Microsoft always wants to select a different technology from its rival. Describe the equilibrium of this game.

15-4 Salary Negotiation

The following represents the potential outcomes of your first salary negotiation after graduation:

Assuming this is a sequential move game with the employer moving first, indicate the most likely outcome. Does the ability to move first give the employer an advantage? If so, how? As the employee, is there anything you could do to realize a higher payoff?



15-5 Renegotiating Employment Contracts

Every year, management and labor renegotiate a new employment contract by sending their proposals to an arbitrator who chooses the best proposal (effectively giving one side or the other $1 million). Each side can choose to hire, or not hire, an expensive labor lawyer (at a cost of $200,000) who is effective at preparing the proposal in the best light. If neither hires lawyers or if both hire lawyers, each side can expect to win about half the time. If only one side hires a lawyer, it can expect to win three-quarters of the time.

a. Diagram this simultaneous move game.
b. What is the Nash Equilibrium of the game?
c. Would the sides want to ban lawyers?

15-6 Entry Game with Withdrawal

In the text, we considered a sequential move game in which an entrant was considering entering an industry in competition with an incumbent firm (Figure 15-1). Consider now that the entrant, if fought, has the possibility of withdrawing from the industry (at a loss of 1 for the entrant and a gain of 8 for the incumbent), or staying (at a loss of 5 for each player). What is the equilibrium of this game? Discuss if the entrant is better off with or without the ability to withdraw.

Group Problems

G15-1 Strategic Game

Describe some interaction your company has with another entity (firms producing complementary or substitute products, upstream suppliers, or downstream customers), or between internal divisions within your firm that can be described as a sequential or simultaneous game. Diagram the strategies, players, and compute payoffs as best you can. Compute the Nash equilibria. What can you do to change the rules of the game to your advantage? Compute the profit consequences of your advice.

END NOTES

1. For sequential games, this is a specific type of Nash equilibrium called a *subgame-perfect* or *rollback* equilibrium.
2. When a player has the same best response to anything other players might do, it is called a *dominant strategy*. Here, "Confess" is dominant for both Jesse and Frank.
3. John H. Shenefield and Irwin M. Stelzer, "Common Sense Guidelines," *The Antitrust Laws: A Primer,* 3rd ed. (Washington, D.C.: AEI Press, 1998), 123–126.
4. Ibid.
5. Retail scanner data and company loyalty programs sometimes make such discrimination possible. For a detailed analysis of these

strategies, see Greg Shaffer and Z. John Zhang, "Competitive Coupon Targeting," *Marketing Science* 14 (1995): 395–416.

6. See Greg Shaffer and Z. John Zhang, "Pay to Switch or Pay to Stay: Preference-Based Price Discrimination in Markets with Switching Costs," *Journal of Economics and Management Strategy* 9 (2000): 397–424.
7. Examples of these so-called pay-to-switch strategies include Coca-Cola's giving a discount on Diet Coke to purchasers of Diet Pepsi and Chesebrough-Pond's giving a discount on Mentadent Toothpaste to purchasers of PeroxiCare. See *ibid*.
8. For more on how the pricing ban actually benefitted the tobacco companies, see James L. Hamilton, "The Demand for Cigarettes: Advertising, the Health Scare, and the Cigarette Advertising Ban," *Review of Economics and Statistics* 54, no. 4 (1972): 401–411.
9. Actually, the classic version of the game of chicken involved two cars driving toward the edge of a cliff, with the winner being the one who jumped out of the car last. Our updated version preserves the cars as well as the drivers.

CHAPTER 16

Bargaining

In the summer of 2011, the owners of the National Basketball Association (NBA) were negotiating with the players' union over how to split revenue. The union wanted 57%, equal to its previous contract, but the owners were offering only 50%. The owners locked out the players, cancelling the beginning of the season. After months of finger-pointing and legal threats, the players settled for what the owners had offered.

In contrast to the players' union, public sector employee unions have been able to bargain much more successfully. In places like California, with strong unions, public sector workers earn 30% more than their private sector counterparts. In Central Falls, Rhode Island, the city workers were able to win retirement benefits so generous that they bankrupted the city.

A similar contrast appears in the bargaining over drug prices. Hospitals and HMOs are able to buy drugs at prices that are 10–40% less than drugstores pay. What accounts for these differences?

In this chapter, we answer these question from two different, but complementary, points of view. We begin with a strategic view that characterizes bargaining as a formal *game of chicken* where the ability to commit to a position gives one player bargaining power over its rivals.

The other view of bargaining begins with the observation that real negotiations rarely have rules like the ones that characterize formal games. Under this view of bargaining, it is the alternatives to agreement that determine the terms of agreement, regardless of the precise form of the negotiations. If you can increase your opponent's gain to reaching agreement (or decrease your own), you make your opponent more eager to reach agreement, and this allows you to capture a bigger share of the proverbial pie.

STRATEGIC VIEW OF BARGAINING

In this section, we model bargaining as a *game of chicken* where the ability to commit to a position gives one player bargaining power over rivals. To make this concrete, imagine that a company's managers are bargaining with a labor union over a fixed sum and that each

player has just two possible strategies: *bargain hard* or *accommodate*. If both bargain hard, they'll reach no deal, and each earns nothing; if both accommodate, they split the gains from trade. If one player bargains hard and the other accommodates, the player who bargains hard takes 75% of the gains from agreement.

In Table 16-1 we see that this game has the same logical structure as a game of chicken. If both players accommodate each other, they split the gains from trade (lower right), but this is not an equilibrium because either player can do better by bargaining hard. If both bargain hard, then each earns nothing (upper left), but this is not an equilibrium because either player can do better by accommodating the other. The two equilibria, {Bargain Hard, Accommodate} in the upper-right quadrant, and {Accommodate, Bargain Hard} in the lower-left quadrant, are where each party is playing optimally against its rival.

At this point, you should know what to expect in a game of chicken—both parties will try to steer the game to their preferred equilibrium by committing to a position. If you can convince your rival that you're going to bargain hard, regardless of what your rival does, he will do better by accommodating, and you will get a bigger share of the gains from trade.

TABLE 16.1

Labor Negotiation Game

		Management	
		Bargain Hard	Accommodate
Labor	Bargain Hard	0, 0	75, 25
	Accommodate	25, 75	50, 50

To see the value of commitment, we recharacterize the game as a sequential-move game where the party able to make a commitment gets to move first. In this case, imagine that the Union makes either a generous offer or a low offer; and then Management must either accept or reject the offer. If Management accepts the offer, it earns what the Union offered; if not, Management locks out the Union, and each party earns nothing.

We diagram the offers and payoffs in Figure 16-1. To analyze the game, we begin at the second stage, and notice that Management does better by accepting whatever is offered in the first stage. Regardless of whether the Union makes a generous offer or a low offer, accepting the offer gives Management a higher payout than rejecting it. Realizing this, the Union makes a low offer at the first stage and earns 75% instead of 25%. We identify the equilibrium by putting two lines through all the suboptimal options in Figure 16-1.

This game illustrates a classic *first-mover advantage*—by moving first, or equivalently, by committing to bargain hard, the Union can capture most of the gains from trade.

By now you should be able to recognize that the simultaneous move game is symmetric, which means that if Management can commit to lock out the Union if it receives a low offer, it can change the outcome of the game. If the Union believes Management's threat, it will make a generous offer instead of a low one.

As in the entry deterrence game in Chapter 15, by committing to a position, Management changes the equilibrium of the game by eliminating an option. We illustrate the new equilibrium in Figure 16-2.

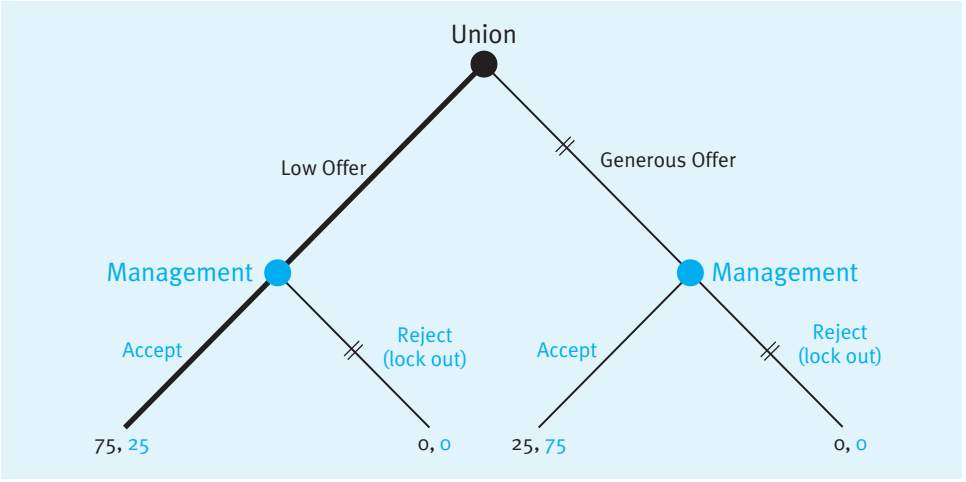


FIGURE **16.1 Management versus Labor Union Game**

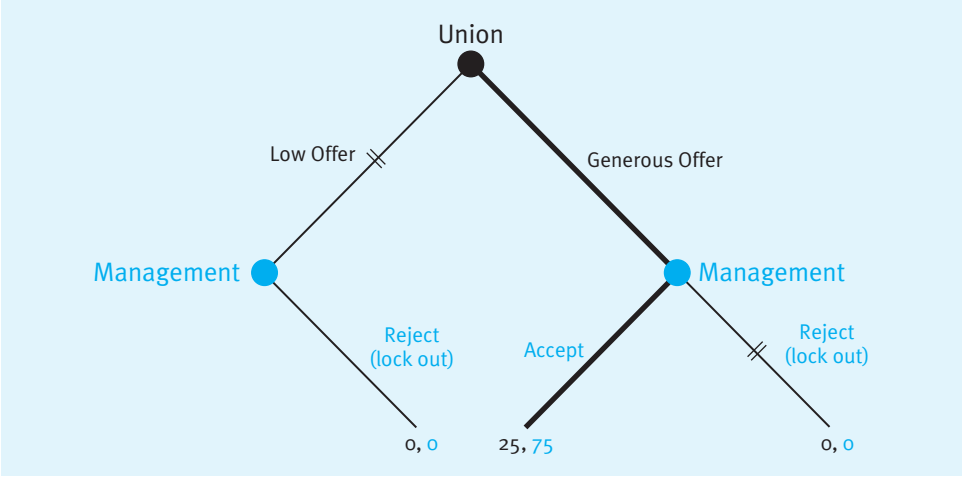


FIGURE **16.2 Negotiation with Management Commitment to Lock Out**

Although committing to a lockout sounds simple, it's difficult for Management to persuade the Union that it will pursue an otherwise unprofitable strategy. If the threat is not credible, Management might actually have to carry through on the threat, leading to the following maxim:

The best threat is one you never have to use.

Lockouts (and strikes) occur because the Union doesn't believe Management's threat. In these cases, the only way for Management to convince the Union that it's committed to a lockout is to actually lock the Union out.

To summarize: the strategic view of bargaining suggests that if you can commit to a position, you can capture a bigger share of the gains from agreement. But committing to

a position is difficult because it requires you to act against your self-interest. If you rival doesn't believe your commitment, she will test you and you may go through a period of no agreement.

To see the practical implications of the strategic view, imagine that you are buying a new car. To get a better price, try to put the car dealer in a position where he is forced to either accept or reject your offer. First, figure out which car you want to buy, exactly which features you want (like floor mats), and offer a price where the dealer can make some, but not too much, money, say 5% above his cost. Do some research to find out what the dealer's cost really is. Take only one check, preferably a cashier check that cannot be modified, made out for a specific amount. Go late in the day so that the car dealer doesn't have time to make you a counter-offer, and threaten to leave if she says anything but "yes" to your offer. If the car dealer believes you, then your offer is likely to be accepted.

NONSTRATEGIC VIEW OF BARGAINING

The games just described take a **strategic view of bargaining**, in which the outcome depends on who moves first and who can commit to a position, as well as whether the other player can make a counteroffer. The dependence of the bargaining outcome on the precise rules of the bargaining game is a little disturbing because real-world bargaining rarely has such well-defined rules. To address this shortcoming, John Nash, the same mathematician responsible for Nash equilibrium, proved that any reasonable bargaining outcome would split the gains from trade.[1] We call this an "axiomatic" or "nonstrategic" view of bargaining because it does not depend on the rules of the bargaining game or whether players can commit to a position.

To understand this result, imagine two players bargaining with each other. Without agreement, Player 1 earns D_1 and Player 2 earns D_2. These are sometimes called each the players' "outside options" or "disagreement values." If they reach an agreement, they earn A. If the gains to trade are positive, $A - (D_1 + D_2) > 0$, then they are split evenly by the parties. In this case, Player A earns $D_1 + (A - (D_1 + D_2))/2 = (A + D_1 - D_2)/2$, and Player 2 earns $D_2 + (A - (D_1 + D_2))/2 = (A + D_2 - D_1)/2$. Notice that each player's split depends not only on how much the agreement is worth (A), but also on the players' outside options, or disagreement values (D_1 and D_2). Player 1 receives more if his outside option is better or if Player 2's outside option is worse. This leads immediately to the following advice:

> *To improve your own bargaining position, improve your outside option, or decrease that of your opponent.*

This nonstrategic view of bargaining tells you that if you can *decrease* your own gain to reaching agreement by *improving* your outside option, you become a tougher bargainer—because you have less to gain by reaching agreement. For example, the best time to ask for a raise is when you already have an attractive offer from another company (D_1 is big). Because you have a good alternative, your gain to reaching agreement is small, which makes you less eager to reach agreement. Note the similarity of the disagreement value to the idea of *opportunity cost*. The cost of staying in your current job is the offer you give up if you stay. If you have a good alternative offer, the opportunity cost of staying in your job is high, putting you in a stronger bargaining position.

The result also tells us how bargaining is likely to change as circumstances change. Suppose, for example, that Player 1 receives a bonus B for reaching agreement. The total gain

to reaching agreement has now risen from A to A + B. The nonstrategic view of bargaining tells us that this bonus will be split between the two parties. In essence, Player 1 "gives" away half of his bonus to Player 2. If you increase the first player's gain to reaching an agreement, you make him more eager to reach agreement, and this puts him in a weaker bargaining position.

Bonuses like this are similar to incentive compensation schemes that companies adopt to induce salespeople to increase sales. Offering salespeople bonuses increases their eagerness to reach agreement, and this inducement makes them weaker bargainers. So, if you give your salespeople an incentive like this, you can expect lower prices when they negotiate with customers. We will come back to this theme in Chapter 21 when we talk about how to align the incentives of salespeople, who typically prefer lower prices so they can make more sales, with the profitability goals of the company.

To understand how advice gleaned from Nash's bargaining outcome differs from advice gleaned from analyzing bargaining as a strategic game, let's return to the Union/Management game. The strategic view of bargaining emphasized the role of commitment and timing in affecting the outcome of a game. For example, Management's commitment to lock out the Union in the event of a low offer changes the equilibrium of the game. But strategies play no role in the nonstrategic view of bargaining. Only a strike that hurts Management more than it hurts the Union can improve the bargaining position of labor. This is why strike threats are more common during seasonal peaks in demand, when it would hurt the firm more than it would hurt the union. By changing the alternatives to agreement for Management (bigger loss during a strike), the Union can increase Management's willingness to reach agreement.

The next time you shop for a car, keep in mind that salespeople typically get paid commissions at the end of the month. So buying a car near the end of the month means that the salesperson earns an immediate commission. This immediacy raises the gain to reaching agreement (remember that current dollars are worth more than future dollars due to the time value of money), increasing the likelihood that you'll receive a better offer. You can also shop for cars at unpopular times, like Black Friday or Christmas Eve, when demand is low. Look at it from the salesperson's point of view: The cost of selling to you is the forgone opportunity to sell to someone else. If there is no one else around, the cost of selling to you is essentially zero; or equivalently, the salesperson's outside alternative is very poor.

Mergers or acquisitions of rivals can also strengthen your bargaining position. Suppose a managed care organization (MCO) or insurance company puts together a network of hospitals to serve its client base. The MCO bargains with individual hospitals over whether to include them in the network and what price they'll charge if included in the network. To get better prices, the MCO threatens to exclude one hospital in favor of a nearby substitute hospital. But if the two hospitals merge and bargain together, the MCO's bargaining alternatives become much worse. If the MCO fails to reach agreement with the merged hospitals, then its managers must go to the third-best alternative, which might be farther away from its client base. This would reduce the attractiveness—and profitability—of the network, and make the MCO more eager to reach agreement with the merged hospital.

To make this concrete, let's use a numerical example. Suppose an MCO can market its network to an employer for $100 if the network contains one of two hospitals and for $120 if it contains both, but the MCO cannot market the plan at all without at least one of the hospitals. The MCO goes to the first hospital and tells them that they are going to reach agreement with the second. This makes the gain from adding the first hospital to its

network that already has the second hospital in it only $20. Under the nonstrategic view of bargaining, this $20 is evenly split between the hospital and the MCO. The MCO does the same thing to the second hospital. Thus, before a merger, the MCO plays each hospital off against the other, and each hospital gets only $10 for joining the MCO network.[2]

Now suppose the two hospitals merge and bargain together. The MCO can no longer threaten to drop one of the hospitals in favor of the other, so the gain from striking a bargain with the merged hospital is the full $120, which is also evenly split in the Nash bargaining solution. The merger of the hospitals increases the total payment to the hospitals from $20 to $60.

CONCLUSION

Let's close this chapter by applying the nonstrategic view of bargaining to the different negotiations in the introduction. To do this, we focus on the outside alternatives of each of the parties. Let's begin with the NBA lockout. If the players don't play, they lose not only their salaries (half of the revenue), but they also lose a year of longevity (the average player plays for only five years). In contrast, the owners lose only the contribution margin (half of the revenue minus the variable cost), which is much smaller than what the players lose. Because they have less to gain from reaching agreement, the owners were less eager to reach agreement, and this allowed them to get most of what they asked for.

Public employee unions are particularly good bargainers because they help elect (and defeat) the politicians they bargain against. If a politician fails to reach agreement with the union, she knows that the union can help put her out of a job. This makes the politician more eager to reach agreement and a weaker bargainer. The end result is that public sector unions earn more than private sector workers who have to bargain against bosses whose compensation is typically tied to the profitability of the company.

Finally, let's look at the bargaining between drug companies and two different types of customers, retail drugstores and hospitals. Drugstores typically carry all the competing brands because this is what their customers want. If they fail to stock a drug, the customer will go to a competing drug store that carries the drug. The drug store will lose not only the profit on sale of the drug, but also the profit on sales of other items that the customer would have bought when buying the drug. For the reason, drug stores are eager to reach agreement on all brands, so they don't get very good prices.

The greater bargaining power of hospitals and HMOs is due to their ability to "steer" patients toward a particular drug. To do this, they use formularies, which limit the number of brands in each class. For example, they will carry only one non-drowsy allergy drug. This creates price competition among the non-drowsy allergy drug brands to get onto the formulary. As a result, hospitals and MCOs are able to get better prices.

In this chapter, we have described two different ways of thinking about bargaining. This raises the obvious question, which is better? The answer is that "it depends" on the particular setting in which you find yourself. If you can credibly commit to a position by, for example, making a take-it-or-leave-it offer, then go ahead. If, as is more likely, commitment is costly or not credible, then try to change the alternatives to agreement, as they determine the terms of agreement.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Bargaining can be viewed strategically, as a game of chicken where the ability to commit to a position allows a player to capture the lion's share of the gains from trade.
- However, credible commitments are difficult to make because they require players to commit to a course of action against their self-interest.
- The **nonstrategic view of bargaining** does not focus on the explicit rules of the game to understand the likely outcome of the bargaining. Rather, it is the alternatives to agreement that determine the terms of any agreement.
- Anything you can do to increase your opponent's gains from reaching agreement or to decrease your own will improve your bargaining position.

Multiple-Choice Questions

1. For threats or commitments to be effective, they must be
   a. irrational.
   b. rational.
   c. credible.
   d. None of the above
2. Fred is a salesman who can sell enough to generate $200,000/year worth of profit for his company. He earns only $110,000 in compensation. What is the value of his outside or next best alternative?
   a. $0
   b. $5,000
   c. $10,000
   d. $20,000
3. How many pure strategy equilibria does the following game have?
   a. 0
   b. 1
   c. 2
   d. 3

		Labor	
		Bargain Hard	Be Nice
Management	Bargain Hard	0, 0	20, 10
	Be Nice	12, 18	15, 15

4. In the game above, how much does Labor earn if they can move first?
   a. 10
   b. 15
   c. 18
   d. 20
5. Consider a vendor–buyer relationship. Which of the following conditions would lead to the buyer having more bargaining power?
   a. Lots of substitutes for the vendor's product are available.
   b. There are relatively few buyers and many vendors.
   c. It costs little for buyers to switch vendors.
   d. All of the above
6. In the following game, how many pure strategy equilibria are there?
   a. 0
   b. 1
   c. 2
   d. 3

		Labor	
		Bargain Hard	Be Nice
Management	Bargain Hard	15, 0	20, 10
	Be Nice	10, 20	30, 15

7. Pete and Lisa are entering into a bargaining situation in which Pete stands to gain up to $5,000 and Lisa stands to gain up to $1,000, provided they reach agreement. Who is likely to be the better bargainer?
   a. Pete
   b. Lisa
   c. They will be equally effective.
   d. These potential gains will have no impact on bargaining.
8. George and KC have been working jobs that pay $20,000 and $30,000/year, respectively. They are trying to decide whether to quit their jobs and jointly open up a taco stand on the beach, which they estimate can earn $60,000/year. How will the taco stand proceeds be split?
   a. They won't quit their jobs.

b. George gets $25,000, and KC gets $35,000.
c. George gets $30,000, and KC gets $30,000.
d. George gets $35,000, and KC gets $25,000.

9. The game of chicken has
a. a second-mover advantage.
b. a first-mover advantage.
c. no sequential-move advantage.
d. potential sequential-move advantages, depending on the players.

10. Two hospitals are bargaining with an MCO to get into its provider network. The MCO can earn $100 if it puts one of the hospitals in its network; and $200 if it puts both hospitals in its network. If both hospitals merge, and bargain jointly, how much more will they earn?
a. $0
b. $50
c. $100
d. It depends on the ability of the merged hospital to credibly commit to a take-it-or-leave-it offer.

Individual Problems

16-1 Newspaper Bargaining

Two equal-sized newspapers have overlap circulation of 10% (10% of the subscribers subscribe to both newspapers). Advertisers are willing to pay $10 to advertise in one newspaper but only $19 to advertise in both, because they're unwilling to pay twice to reach the same subscriber. What's the likely bargaining negotiation outcome if the advertisers bargain by telling each newspaper that they're going to reach agreement with the other newspaper, so the gains to reaching agreement are only $9? Suppose the two newspapers merge. What is the likely post-merger bargaining outcome?

16-2 Airline Merger

American Airlines and British Airways are proposing to merge. If different unions represent British pilots and American pilots how would this merger affect airline costs?

16-3 House Closing

You've entered into a contract to purchase a new house, and the closing is scheduled for next week. It's typical for some last-minute bargaining to occur at the closing table, where sellers often try to tack on extra fees. You have three options for the closing: (1) attend yourself, (2) send an attorney authorized to close only per the previously negotiated terms, or (3) pre-sign all the closing documents per the current terms and not attend the closing. Which of these would be most advantageous from a bargaining position?

16-4 A City and Its Unions

Robert G. Flanders Jr., the state-appointed receiver for Central Falls, RI, said his city's declaration of bankruptcy had proved invaluable in helping it cut costs. Before the city declared bankruptcy, he said, he had found it impossible to wring meaningful concessions out of the city's unions and retirees—who were being asked to give up roughly half of the pensions they had earned as the city ran out of cash. Why does bankruptcy give the city bargaining power against its unions?

16-5 Entering International Markets

Your pharmaceutical firm is seeking to open up new international markets by partnering with various local distributors. The different distributors within a country are stronger with different market segments (hospitals, retail pharmacies, etc.) but also have substantial overlap.

a. In Egypt, you calculate that the annual value created by one distributor is $60 million per year, but would be $80 million if two distributors carried your product line. How much of the value can you expect to capture?
b. Argentina also has two distributors with values similar to those in Egypt, but both are run by the government. How does this affect the amount you could capture?
c. In Argentina, if you do not reach an agreement with the government distributors, you can set up a less efficient Internet-based distribution system that you would generate $20 million in value to you. How does this affect the amount you could capture?

16-6 PBM's

Pharmaceutical Benefits Managers or PBM's are intermediaries between upstream drug manufacturers and downstream insurance companies. They design formularies (list of drugs that insurance will cover) and negotiate prices with drug companies. PBM's want a wider variety of drugs available to their insured populations, but at low prices. Suppose that they are negotiating with two non-drowsy allergy drugs, Claratin and Allegra, for inclusion on the formulary. The "value" or "surplus" created by including one non-drowsy allergy drug on the formulary is \$100, but the value of the second drug is only \$30.

a. What's the likely bargaining negotiation outcome if the PBM bargains by telling each drug company that they're going to reach agreement with the other drug company?

b. Now suppose the two drug companies merge. What is the likely post-merger bargaining outcome?

Group Problems

G16-1 Bargaining

Describe some bargaining interaction your company has with another entity (firms producing complementary or substitute products, upstream suppliers, or downstream customers), or between internal divisions within your firm. Describe the bargaining as either a strategic or nonstrategic interaction. Compute payoffs as best you can. Compute the Nash equilibria (strategic) or the likely outcome (Nash's nonstrategic) outcome. What can you do to change the bargaining to your advantage? Compute the profit consequences of your advice.

END NOTES

1. John Nash, "The Bargaining Problem," *Econometrica* 18, no. 2 (1950): 155–162.
2. This view of pre-merger bargaining treats the pre-merger competition as an auction where one hospital has to outbid the other to get into the network. In reality, the pre-merger competition is likely to be less competitive than this. In this case, the price effect of the merger is smaller because there is less pre-merger competition to lose.

SECTION 5

Uncertainty

CHAPTER 17

Making Decisions with Uncertainty

XYZ makes money by designing and developing software. They start with a number of ideas, recommend the best ones based on market demand, dig deeper into a few, create products, launch them, and then hope their products succeed. Their design process is illustrated in Figure 17-1.

At the "Recommend" phase, the marketing team provides revenue projections for five candidate products. In the "Discover" phase, the technology "department" makes estimates of the cost and complexity for the best two of the five projects.

The company has the capacity to develop only one product at a time, so it is critical that it picks the most profitable. In 2011, based on the data presented in Table 17-1, the company decided to develop product A because it looked as if it was going to earn $300K more than product B.

Unfortunately, the product was scrapped prior to launch, which put the company into a financial hole and prompted a formal review of the decision-making process by the board of directors. What the review discovered was a classic trade-off: More technically complex projects had higher potential revenue, but they were also more likely to be scrapped prior to launch, due to their inherent complexity. In fact, a review of last four years of data indicated that only 50% of the more complex products were launched, compared to a 75% launch rate for simpler products.

This mistake could have easily been avoided had XYZ known how to make decisions in the face of uncertainty, the topic of this chapter. In what follows, we show you how to quantify uncertainty by replacing known quantities with *random variables*. Specifically, we show you how to work with discrete random variables, which can assume only a limited number of values, but the same analysis can be done with continuous[1] random variables as well.

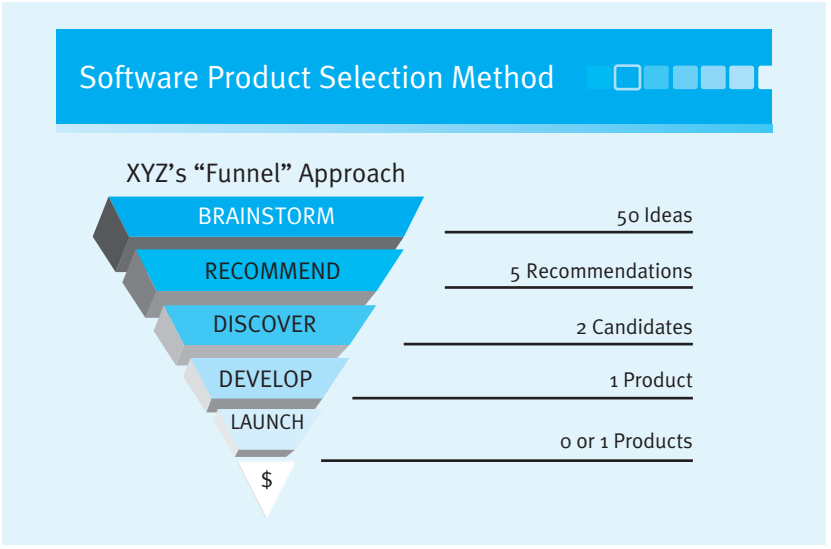


FIGURE **17.1 XYZ Design Process**

TABLE **17.1**

XYZ Profit Projections

	Product A	Product B
Technology	Complex	Simple
Projected Revenue	$1 Million	$600,000
Cost	$200,000	$100,000
Profit	**$800,000**	**$500,000**

RANDOM VARIABLES AND PROBABILITY

You'll never have as much information as you want—especially when you're faced with a significant decision. This means that you cannot simply compute the costs and benefits of a decision (as we did in Chapter 3) because costs or benefits will be uncertain. Instead, we use **random variables** to take account of what we don't know. When we're uncertain about what value a variable will take, we identify the situations in which it takes on different values, list possible values it could take, and assign a probability to each value. Usually, we are interested in expected values, or *average outcomes*, computed using a weighted average, where the weights are the probabilities.

> *The mean or expected value of a random variable that can take on two values, $\{x_1, x_2\}$, with probabilities $\{p, 1 - p\}$, is* $E[X] = p \times x_1 + (1 - p)\, x_2$. *In general, the expected value of a random variable that can take on N values is* $E[X] = p_1 \times x_1 + p_2 \times x_2 + \ldots + p_N \times x_N$.

In this chapter, we will work with discrete random variables, which can assume only a limited number of values.[2]

As a simple example of how to use random variables, suppose you go to a carnival and contemplate playing a game called The Wheel of Cash. The wheel looks like a simple roulette wheel, with three pie-like wedges. On each wedge is a number: $100, $75, and $5. If the cost to play is $50, should you take a chance on the game?

First, note that you have three possible outcomes: $100, $75, and $5. If the wheel is fair—that is, if each outcome has an equal probability of occurring—then the *expected value* of playing the game is (1/3)($100) + (l/3)($75) + (l/3)($5) = $60. So it looks like a really good deal. On average, you'll earn $10 every time you play. But before playing, you should remember this maxim:

If a deal seems too good to be true, it probably is.

If players could really earn, on average, $10 each time they played, we'd expect to see a very long line of players eager to take their chances. Likewise, we'd expect to see the carnival losing money on the game. What's more likely is that the wheel is *not* fair and that it lands on the $5 wedge more frequently than on the other two wedges. For example, if the wheel is twice as likely to land on the $5 than on the $75 or $100 wedges, then the expected value of playing is only (1/6)($100) + (l/6)($75) + (2/3)($5) = $32.50. Note that reaching a correct decision hinges on our ability to accurately assess these probabilities.

Now, let's return to the decision facing our software development company, XYZ. If the firm decides to develop the complex product (A), they incur costs of $200K, and then have a 50% chance of launching, and receiving revenue of $1 million. If the firm decides to develop the simple product (B), they incur costs of only $100K, and have a 75% chance of launching, but receiving revenue of $600K. What should XYZ do? We diagram the consequences of the decision in Figure 17-2.

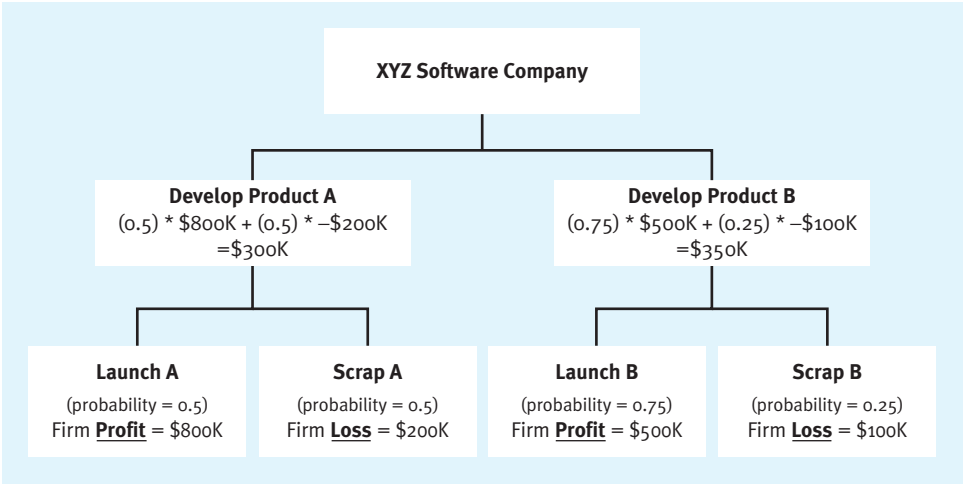


FIGURE **17.2 Modeling an Uncertain Decision**

Look first at the left branch of the decision tree in Figure 17-2. If XYZ decides to develop product A, it doesn't know whether the product will make it to the launch stage.

If it is lucky, it will end up in the first box on the bottom row, and earn \$800K (computed as \$1,000K revenue minus \$200K development cost). If it gets unlucky, the product will not be launched, and the firm will lose the \$200K development cost. The firm quantifies its uncertainty by estimating a 50% probability of landing in the first box, and a 50% probability of landing in the second. The expected profit of launching product B is the weighted average of the profit in each box, or \$300K. This is computed in the box labeled "Launch Product A."

Now look second at the right branch of the decision tree in Figure 17-2. If XYZ decides to develop product B, it doesn't know whether the product will make it to the launch stage. If it is lucky, it will end up in the third box on the bottom row, and earn \$500K (computed as \$600K revenue minus \$100K development cost). If it gets unlucky, the product will not be launched, and the firm will lose the \$100K development cost. The firm quantifies its uncertainty by estimating a 75% probability of landing in the third box, and a 25% probability of landing in the fourth. The expected profit of launching product B is the weighted average of the profit in each box, or \$350K. This is computed in the box labeled "Launch Product B."

Although more than \$50K of expected profit separates the alternatives, you want to make sure that the firm has estimated probabilities precisely enough to distinguish between the two alternatives.

Do not get lulled into a sense of false precision.

A simple way to determine if your probabilities are precise enough is to see how different they would have to be to reverse the decision. If the probability of a successful launch for product B were 67% instead of 75% or if the probability of a successful A launch were 55% instead of 50%, the decision would be reversed. In this case, XYZ Software has no more confidence in one set of probabilities than in the other, and the decision is a wash. Thus, XYZ may want to gather more information—perhaps by surveying end users or consulting with outside software engineers in hopes of estimating the probabilities more precisely.

This kind of analysis also clearly identifies the two separate risks that XYZ faces. Since the decision is so close, a next step might be to find a creative way to avoid either possible risk. Perhaps the firm could find a better way to screen potential projects. For example, XYZ may be able to evaluate the software projects sooner, which may reduce the potential loss if they do not launch.

For another example of how uncertainty could change the decision making, let's return to the entry-deterrence example in Chapter 15. Suppose that the potential entrant is uncertain about whether the incumbent will price low if it enters, and it quantifies this uncertainty by placing a 40% chance on a low price following entry. So the entrant faces a 60% chance of earning \$5, but also a 40% chance of losing \$5. The expected value of entering is $(0.4)(-\$5) + (0.6)(\$5) = \$1.00$. The expected value of staying out of the industry is \$0. So the expected benefits are \$1.00 larger than the expected costs. We illustrate this decision with a tree in Figure 17-3.

We've seen that using random variables—and their associated probability distributions—rather than exact numbers to do benefit–cost analysis identifies sources of risks and points out ways to mitigate them. But we have another good reason for doing this kind of analysis: If things don't turn out well, you have a good justification for making the wrong decision. By using a distribution that includes a worst-case scenario, you explicitly recognize these possibilities and that things went wrong because the firm was unlucky. By presenting decision

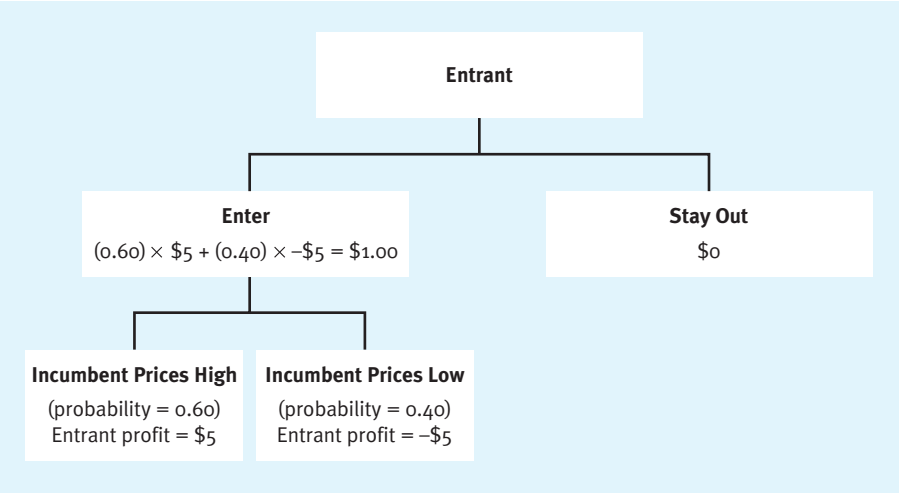


FIGURE **17.3 Entry Decision with Uncertainty**

makers with analyses that account for uncertainty, you allow them to distinguish between bad luck and bad decisions.

To illustrate the final benefit of replacing exact numbers with random variables, let's turn to another example. Suppose your Uncle Joe invites you to invest in a real estate venture. He gives you a prospectus that shows how much money you'll make if you invest. The prospectus is based on estimates of future interest rates and future housing demand in the area. How should you analyze the prospectus?

If you're uncertain about the future, you need to rework the analysis using best- and worst-case scenarios. You have two sources of risk here—both future demand and future interest rates, which may be related—so you should rework the analysis on a spreadsheet, allowing you to vary the assumptions about the future.

Uncle Joe has most likely given you a best-case scenario (low interest rates/high demand). Add other scenarios (low interest rates/low demand, high interest rates/high demand, high interest rates/low demand), and assign probabilities to each scenario. Compute profit under each possible outcome, and calculate expected profit as the weighted sum of the possible outcomes. Almost certainly, Uncle Joe will do well under all four scenarios; you, however, will do well under only one (low interest rates/high demand).

This analysis exposes an incentive conflict between you (the investor), and Uncle Joe (the entrepreneur). In this case, don't invest unless you can better align Uncle Joe's incentives with your own. For example, suggest that Uncle Joe accept a payoff that rewards him only if the venture does well. If Joe declines, then most likely he doesn't believe his own forecasts. This is a kind of *adverse selection*, a topic that we cover in Chapter 19.

UNCERTAINTY IN PRICING

If you don't know your demand, you face uncertainty in pricing. One of the easiest ways to model uncertainty is to classify the number and type of potential customers. Suppose you run a marketing survey and find you have two types of customers: high-value customers

willing to pay $8 and low-value consumers willing to pay just $5. Your survey tells you that there are equal numbers of high- and low-value customers.

Obviously, you have two possible options: price high ($8) and sell only to the high-value group, or price low ($5) and sell to everyone. Which price should you choose? The answer is "It depends." In this case, it depends on your costs, which we'll set at $3 per unit for illustrative purposes.

We plot the decision tree in Figure 17-4. If you price high, you earn $8 – $3 = $5, provided you get a high-value customer. Since such sales happen only 50% of the time, the expected profit is $2.50. If you price low, you sell all the time, and you earn $5 – $3 = $2. So price high and sell half as many goods, and earn an *expected* $0.50 more on each unit you sell.

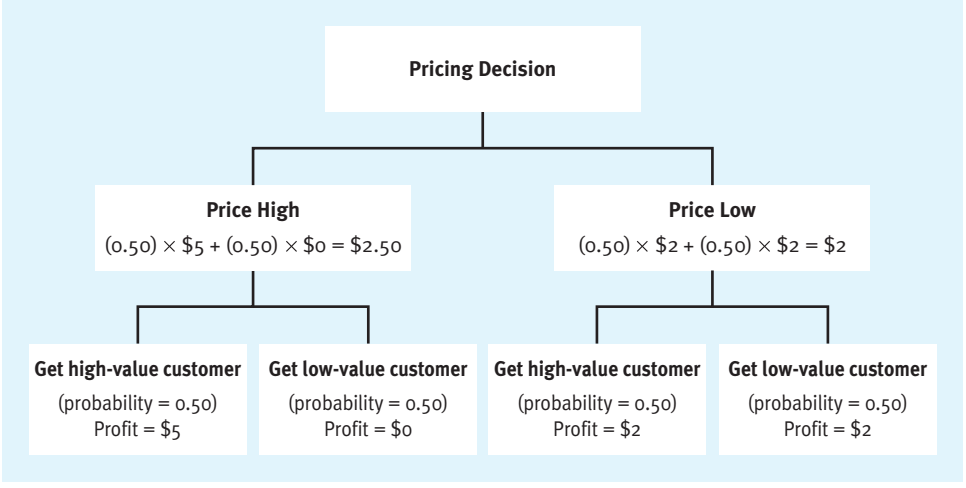


FIGURE **17.4 Pricing Decision with Uncertainty**

Note that with this high-price strategy, you're left with unconsummated wealth-creating transactions—the low-value customer is willing to pay $5 for a good that costs you $3 to produce. To consummate these transactions, we turn again to a strategy of price discrimination (see Chapters 13 and 14).

Price Discrimination

If you can identify the two types of customers, set different prices for each group, and prevent arbitrage between them, then you can price discriminate. Sell at a price of $8 to the high-value customers and at a price of $5 to the low-value customers. However, once your customers learn you're discriminating, high-value customers will try to mimic the behavior or appearance of low-value customers to get the lower prices. Figuring out how to correctly identify low- and high-value customers is critical for any price discrimination scheme.

To see how identification matters, consider car salespeople. By making customers wait at the dealership before offering them a price discount, salespeople can identify low-value customers. The longer customers are willing to wait, the bigger the price discount they receive. This discrimination scheme works because the opportunity cost of time is higher for high-value customers. Only low-value customers are willing to wait for better offers.

To defeat this kind of discrimination, try to mimic the behavior of low-value customers. If it's too difficult for you, or if you're too impatient, hire a negotiating agent who can bargain for you.

According to a 1995 article[3] in the *American Economic Review*, new-car salespeople tend to give worse offers (higher prices) to women and minority buyers. The article described a study employing "testers" who were given identical credit histories and bargaining scripts. The study found that women and minority testers received worse offers than their non-minority male counterparts.

Surprisingly, these offers did not vary with the race or gender of the salesperson—minority and female salespeople discriminated against minority and female car buyers, just as their male and non-minority counterparts did. The article concluded that the discrimination did not arise from racial or gender bias but rather, that it was a profit-maximizing price discrimination scheme. Note that this kind of scheme is still illegal.

Why, then, do salespeople think women and minority buyers are willing to pay more? It could be that non-minority men are better bargainers because they have better access to information about the costs of the car or perhaps they simply have a "taste" for bargaining.

In a study of car loans,[4] Professor Mark Cohen found that minority car buyers—African Americans and Hispanics in particular—paid about $400 more for car loans than White borrowers paid. But the prices varied across individuals. One theory consistent with these results is that some consumers do not shop for car loans and end up paying a higher price. If a bigger percentage of minorities is in the group that does not shop, it could account for the difference.

RUN EXPERIMENTS TO REDUCE UNCERTAINTY

One way to gather information about the benefits and costs of a decision is to run experiments. For example, a regional manager of a national restaurant chain decided to test the profitability of a new holiday menu by introducing it in Dallas-based restaurants in her territory. By comparing *changes* in sales at these restaurants (the treatment group) to *changes* at restaurants that did not introduce the menu (the control group), she hoped to isolate the effect of the holiday menu on sales. The manager used what economists call a *difference-in-difference estimate* of the change as depicted in Table 17-2. The first difference is before versus after introduction of the menu; the second difference is between the treatment and control groups. The difference-in-difference approach controls for other unobserved factors that might have accounted for the change.

TABLE **17.2**

Average Sales per Store

	Pre-Menu Revenue	Post-Menu Revenue	Difference
Dallas Stores (Treatment Group)	$23,600	$28,500	$4,900
Fort Worth Stores (Control Group)	$21,400	$26,000	$4,600
Difference-in-Differences			$300

She found that although sales jumped during the holidays, the increase was similar in both the control and treated restaurants. She concluded that the holiday menu's popularity came at the expense of the regular menu items. In other words, the holiday menu items cannibalized sales of regular menu items and did not attract new customers to the restaurant.

The value of conducting experiments depends on how well the control group represents what would have happened "but for" the treatment. Two important considerations are "representativeness" and "leakage." The change in the Fort Worth stores is likely to be fairly representative of what would have happened in Dallas without the menu change. Any other non-price factor affecting Dallas (e.g., state holidays, good weather) probably affected Fort Worth in the same way because of their proximity to each other. A more representative control group provides more precise estimates. However, this proximity could also have led to leakage from one city to the other if patrons in one city sought out preferred menus in the other. Leakage would lead to biased estimates. Using, say, Oklahoma City as the control group might have reduced leakage but would also reduce the representativeness of the control group. There is often a trade-off between the two.

MINIMIZING EXPECTED ERROR COSTS

Rather than making decisions that maximize *expected* profits (i.e., those whose *expected* benefits are bigger than their *expected* costs), it is sometimes useful to think instead about minimizing *expected* "error costs." This approach is useful when one of your alternatives would work well in one state of the world but not the other, and you are uncertain about which state of the world you are in. For example, XYZ's vice president for new products must decide which products to bring to market and which to pull the plug on. Formally, she wants to know whether the product launch will be profitable. She does cost and market research studies to assess the probability, p, that the product is profitable.

We illustrate this decision in Table 17-3. The two alternatives are represented by the two rows, and our uncertainty is represented by the columns. In other words, she can choose a row, but she doesn't know which column she is in. If she decides to launch the product and it is profitable, then our column matches the row, and her error cost is zero. Likewise, if she kills the project and it is unprofitable, the column again matches the row. The two errors are represented by the off-diagonal elements in the table: She can kill a profitable product (a "false positive" or "Type I error"); or she can launch an unprofitable product (a "false negative" or "Type II error").

TABLE 17.3
Error Costs of a Product

		Truth	
		Profitable (Hypothesis True)	**Not Profitable (Hypothesis False)**
Decision	Launch Product (Accept Hypothesis)	**Correct Decision**	**Type II Error**
	Do Not Launch Product (Reject Hypothesis)	**Type I Error**	**Correct Decision**

The optimal decision is to choose the row with the smaller *expected* error costs. Since p is the probability the product is profitable, decide to launch (accept the hypothesis) if p × (Error Cost I) < (1 – p) × (Error Cost II) and vice versa. She needs three pieces of information to make the decision: The size of the two error costs and the probability. Of these, there is often more uncertainty about the probability p.

You can use a type of break even analysis to determine how high p would have to be before a product launch is profitable. The probability that equates the two expected errors is $\bar{p}$ = (Error Cost II)/(Error Cost I + Error Cost II). If p is above $\bar{p}$, approve the project. But will our vice president for product introduction be too cautious? A failed product launch will become all too apparent to everyone, including her superiors. In contrast, scrubbed product launches that would have been profitable are less apparent simply because we do not observe what did not happen. Since her career advancement is likely to be hindered by noticeable mistakes, she has an incentive to set too high of a value for $\bar{p}$, or be too cautious, so as to avoid the types of mistakes that are most visible.

Another way for her to avoid mistakes is to continue to gather information that will make her more certain that her estimate of p is above $\bar{p}$ (or below it). With more and better cost studies, focus groups, and pilot studies, she becomes more certain of making the right decision. The value of this information is that the firm will benefit from smaller decision error costs. The important trade-off is usually the cost of delay. Dawdling cuts into a finite product lifecycle or allows another firm to enter first. Optimally, she would balance the value of more precise information with these costs of delay. However, the same factors that led her to set too high a standard could also lead her to require too much certainty.

This type of analysis is also useful for balancing the risks of overpricing and underpricing errors, which we discussed in Chapter 12. Suppose that a cruise ship faces an uncertain demand. To model the benefits and costs of this decision, consider two states of the world: High demand and low demand. If demand turns out to be high, it would be an error to underprice. If demand turns out to be low, overpricing is the mistake. Predict the probability of demand being high or low, and the costs of under- or overpricing mistakes. Pick the option that minimizes your expected error costs.

RISK VERSUS UNCERTAINTY

Our approach so far has described uncertainty as something that can be quantified using random variables; that is, you can list the possible outcomes and assign probabilities to each of those outcomes. Formally, this is known as "risk" not "uncertainty." *Uncertainty* refers to outcomes that we cannot foresee, or whose probabilities that we cannot estimate. In other words, *uncertainty* is a way of characterizing what we don't know about the distribution of the random variables themselves.[5]

Understanding the difference between risk and uncertainty is critical. Risk can be quantified, priced, and traded. It can even be hedged with large pools of assets. Uncertainty, in contrast, is much more difficult to deal with. And, mistaking risk for uncertainty can have devastating consequences because it leads to overconfidence.

At least part of blame for the recent financial crisis can be laid at the feet of bankers who mistakenly thought they were hedging the risk associated with complex financial instruments like CDOs. This mistaken assumption came from statistical models of risk, constructed from random variables, and tested on data from a period without any extreme events.[6] When the financial crisis hit, it was an outcome far outside the predictions of

most statistical models, and the banks found that their hedges could not prevent them from insolvency.

So, how do you deal with uncertainty? Gathering more or better information is often a good place to start. Some companies have turned to prediction markets to help them try to quantify uncertain situations.[7] For example, retailer Best Buy uses dispersed sets of non-experts to predict a variety of outcomes like holiday sales rates. Google also uses internal prediction markets mostly focused on demand and usage forecasting. Prediction markets gather broadly dispersed pieces of information from a wide group of people in order to try to turn uncertainty into risk.

Despite our best efforts, we can never be sure that the models we use to quantify risk are the right ones. In other words, uncertainty is something that we cannot eliminate. Consequently, it makes sense to design organizations that can adapt to it. We leave you with a piece of advice from an organization that is designed to succeed in the most uncertain of environments. The Warfighting Manual of the U.S. Marines advises us to design flexible, decentralized, organizations to succeed in this "intrinsically unpredictable" environment:

> *Because we can never eliminate uncertainty, we must learn to fight effectively despite it. We can do this by developing simple, flexible plans; planning for likely contingencies; developing standing operating procedures; and fostering initiative among subordinates.*

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- When you're uncertain about the costs or benefits of a decision, assign a simple probability distribution to the variable and compute expected costs and benefits.
- When customers have unknown values, you face a familiar trade-off: price high and sell only to high-value customers, or price low and sell to all customers.
- If you can identify high-value and low-value customers, you can price discriminate and avoid the trade-off. To avoid being discriminated against, high-value customers will try to mimic the behavior and appearance of low-value customers.
- Difference-in-difference experiments are a good way to gather information about the benefits and costs of a decision. The first difference is before versus after the decision or event. The second difference is the difference between a control versus experimental group. Choose controls to balance representativeness with leakage.
- If you are facing a decision where one of your alternatives would work well in one state of the world, but not in the other, and you are uncertain about which state of the world you are in, think about how to minimize expected error costs.
- Because failed initiatives are visible, but never-attempted initiatives are not, guard against employees becoming too cautious.
- Risk can be quantified, estimated, and hedged. Uncertainty cannot. Don't mistake risk for uncertainty, and try to design institutions flexible enough to deal with unforeseen contingencies.

Multiple-Choice Questions

1. You are taking a multiple-choice test that awards you one point for a correct answer and penalizes you 0.25 points for an incorrect answer. If you have to make a random guess and there are five possible answers, what is the expected value of guessing?
   a. 0.5 points
   b. 0.25 points
   c. –0.25 points
   d. 0 points
2. Your firm is considering a potential investment project, and your finance group has prepared the following estimates: an NPV of $10 million if the economy is strong (30% probability), an NPV of $4 million if the

economy is normal (50% probability), and an NPV of –$2 million if the economy is poor (20% probability). What is the expected value of NPV (to the nearest dollar) for the following situation?

a. $3.4 million
b. $4.0 million
c. $4.6 million
d. $5.2 million

3. You've just decided to add a new line to your manufacturing plant. Compute the expected loss/profit from the line addition if you estimate the following:

- There's a 70% chance that profit will increase by $100,000.
- There's a 20% chance that profit will remain the same.
- There's a 10% chance that profit will decrease by $15,000.

a. Gain of $100,000
b. Gain of $71,500
c. Loss of $15,000
d. Gain of $68,500

4. Your software development company is considering investing in a new product. If it is very well received by users (30% probability), you expect an NPV of $500,000; if users are mildly happy with the product (50% probability), you expect an NPV of $400,000; and if users are not that excited by the product (20% probability), you expect an NPV of $300,000. What is the expected NPV of the product?

a. $390,000
b. $400,000
c. $410,000
d. None of the above

5. Suppose an investment project has an NPV of $150 million if it becomes successful and an NPV of –$50 million if it is a failure. What is the minimum probability of success above which you should make the investment?

a. 0.5
b. 1/3
c. 0.25
d. 0.1

6. You want to price posters at the Poster Showcase profitably and run an experiment to estimate the demand elasticity. You raise the price of kitten posters by 10% but keep your dog poster prices unchanged. After a month, kitten poster unit sales fall by 12% but dog posters rise by 8%. What is the difference-in-difference estimate of the demand elasticity?

a. –1.2
b. –2.0
c. –0.8
d. –0.4

7. Your company has a customer list that includes 200 people. Of those 200, your market research indicates that 140 of them hate receiving coupon offers whereas the remainder really likes them. If you send a coupon mailer to one customer at random, what's the probability that he or she will value receiving the coupon?

a. 0.3
b. 0.6
c. 0.70
d. 1.4

8. Your production line has recently been producing a serious defect. One of two possible processes, A and B, could be the culprit. From past experience you know that the probability that A is causing the problem is 0.8 but investigating A costs $100,000 while investigating B costs only $20,000. What are the expected error costs of shutting down process B first?

a. $80,000
b. $20,000
c. $16,000
d. $4,000

9. You have two types of buyers for your product. The first type values your product at $10; the second values it at $6. Forty percent of buyers are of the first type ($10 value); 60% are of the second type ($6 value). What price maximizes your expected profit?

a. $10
b. $6
c. $7.60
d. $8

10. You are considering entry into a market in which there is currently only one producer (incumbent). If you enter, the incumbent can take one of two strategies, price low or price high. If they price high, then you expect a $60k profit per year. If they price low, then you expect a $20k loss per year. You should enter if:
    a. You believe demand is inelastic.
    b. You believe the probability that the incumbent will price low is greater than 0.75.
    c. You believe the probability that the incumbent will price low is less than 0.75.
    d. You believe the market-size is growing.

Individual Problems

17-1 Global Expansion

You're the manager of global opportunities for a U.S. manufacturer, who is considering expanding sales into Europe. Your market research has identified three potential market opportunities: England, France, and Germany. If you enter the English market, you have a 0.5 chance of big success (selling 100,000 units at a per-unit profit of $8), a 0.3 chance of moderate success (selling 60,000 units at a per-unit profit of $6), and a 0.2 chance of failure (selling nothing). If you enter the French market, you have a 0.4 chance of big success (selling 120,000 units at a per-unit profit of $9), a 0.4 chance of moderate success (selling 50,000 units at a per-unit profit of $6), and a 0.2 chance of failure (selling nothing). If you enter the German market, you have a 0.2 chance of huge success (selling 150,000 units at a per-unit profit of $10), a 0.5 chance of moderate success (selling 70,000 units at a per-unit profit of $6), and a 0.3 chance of failure (selling nothing). If you can enter only one market, and the cost of entering the market (regardless of which market you select) is $250,000, should you enter one of the European markets? If so, which one? If you enter, what is your expected profit?

17-2 Game Show Uncertainty

In the final round of a TV game show, contestants have a chance to increase their current winnings of 1 million dollars to 10 million dollars. If they are wrong, their prize is decreased to $100,000. To win, they have to guess the exact percentage that answered a question a certain way, and the range has already been narrowed to an 11-point range. So, for example, the contestant knows that the correct answer is between 20% and 30% and he or she must guess the correct percentage in that range. So, let's say you have no idea what the right answer is and have to make a random guess. Should you play?

17-3 Pricing Posters

You want to price posters at the Poster Showcase profitably and run an experiment to estimate the demand elasticity. You raise the price of kitten posters 10% but keep your dog poster prices unchanged. After a month, kitten poster unit sales fall by 12%, but dog posters rise by 8%. Why might the elasticity estimate from this experiment be biased?

17-4 Disposing of Used Assets

Your company has a customer who is shutting down a production line, and it is your responsibility to dispose of the extrusion machine. The company could keep it in inventory for possible future product and estimates that the reservation value is $250,000. Your dealings on the second-hand market lead you to believe that there is a 0.4 chance a random buyer will pay $300,000, a 0.25 chance the buyer will pay $350,000, a 0.1 chance the buyer will pay 400,000, and a 0.25 chance it will not sell. If you must commit to a posted price, what price maximizes profits?

17-5 Lottery Expected Value

Tennessee just instituted a state lottery. The initial jackpot is $100,000. If the first week yields no winners, the next week's jackpot goes up, depending on the number of previous players who placed the $1 lottery bets. The probability of

winning is one in a million (1.0×10^{-6}). What must the jackpot be before the expected payoff is worth your $1 bet? Assume that the state takes 60% of the jackpot in taxes, that no one else is a winner, and that you are risk neutral (i.e., you value the lottery at its expected value).

17-6 Hiring

The HR department is trying to fill a vacant position for a job with a small talent pool. Valid applications arrive every week or so, and the applicants all seem to bring different levels of expertise. For each applicant, the HR manager gathers information by trying to verify various claims on resumes, but some doubt about fit always lingers when a decision to hire or not is to be made. What are the type I and II decision error costs? Which decision error is more likely to be discovered by the CEO? How does this affect the HR manager's hiring decisions?

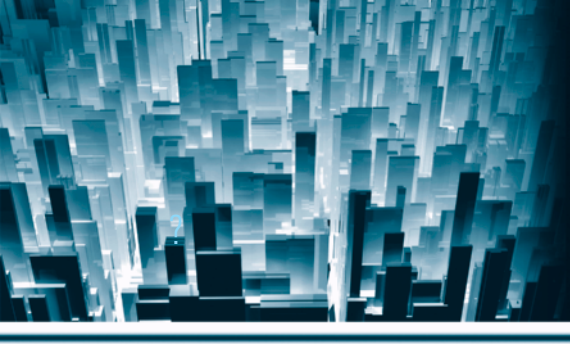
Group Problem

G17-1 Uncertainty

Describe a decision your company has made when facing uncertainty. Compute the expected costs and benefits of the decision. Offer advice on how to proceed. Compute the profit consequences of the advice.

END NOTES

1. A continuous random variable assumes an infinite number of values corresponding to the points on an interval (or more than one interval).
2. A continuous random variable assumes an infinite number of values corresponding to the points on an interval (or more than one interval).
3. Ian Ayres and Peter Siegelman, "Race and Gender Discrimination in Negotiation for the Purchase of a New Car," *American Economic Review* 84 (1995): 304. For a further discussion of the results, see http://islandia.law.yale.edu/ayers/carint.htm.
4. Mark A. Cohen, "Imperfect Competition in Auto Lending: Subjective Markup, Racial Disparity, and Class Action Litigation," December 14, 2006. Vanderbilt Law and Economics Research Paper No. 07-01. Available at SSRN: http://ssrn.com/abstract=951827
5. The distinction between risk and uncertainty traces back to the work of economist Frank Knight. See F. H. Knight, *Risk, Uncertainty and Profit* (New York: Augustus Kelley, 1921).
6. Felix Salmon, "Recipe for Disaster: The Formula That Killed Wall Street," *Wired,* February 23, 2009.
7. Renee Dye, "The Promise of Prediction Markets," *The McKinsey Quarterly,* April 2008.



CHAPTER 18

Auctions

In 1885, the Bell Telephone Company of Canada established Northern Electric to manufacture its telephone equipment. The company diversified into phonographs, televisions, and even sleigh bells (for which it was once the world's largest manufacturer). In 1976, the company changed its name to Northern Telecom (and later Nortel), announcing a shift to telecommunications. For the next three decades, the company would lead innovation in satellite, digital, fiber-optic, mobile, and Internet communication.

By early 2000, the company had a market share of over $200 billion and set its hopes on overtaking Cisco to become the world's largest communication technology company. Instead, a decade of bad investments and accounting scandals followed. The company declared bankruptcy in 2011. The bankruptcy court, uncertain of the value of Nortel's assets, approved the sale of Nortel's sizable portfolio of over 6,000 patents through an auction. Google opened the bidding at $900 million. Bidding quickly escalated, surpassing all industry estimates and pushing the final price to $4.5 billion.

Auctions are also used by CarBargains. However, instead of many buyers competing to buy a single good, the service organizes a competition among sellers—local car dealers—to sell to a single consumer. For one student, CarBargains persuaded six dealers to participate in a sealed-bid auction, and the bids ranged from $1,500 over factory invoice to $100 over invoice. Unfortunately, the dealer with the exact car (options, color, etc.) that the student wanted came in with the worst bid. But when the student showed the dealer the $100-over-invoice bid from another dealer, he matched the offer and took care of the deal himself. This cut out the salesman, which meant that the dealer didn't have to pay a sales commission. It also saved the student the time and hassle of negotiating with a salesman. She concluded that the service was well worth the $190 cost.

In previous chapters, we examined various types of competition, like price competition and bargaining. In this chapter, we examine another type of competition, auctions. Like price competition and bargaining, auctions set a price and identify the high-value buyer (for Nortel's assets) or the low-cost seller (among the car dealers). But, as the CarBargains example indicates, auctions are often used in conjunction with bargaining. In this case, the auction identified a potential negotiating partner, and the student used the outside alternative of rival bids to negotiate a deal.

ORAL AUCTIONS

A variety of auction formats are available, and we start with the most familiar.

> *In an* ***oral*** *or* ***English auction****, bidders submit increasing bids until only one bidder remains. The item is awarded to this last remaining bidder.*

Since every bidder is willing to bid up to his value, but no higher, the high-value bidder wins the item as soon as the second-highest-value bidder drops out.

For example, if five bidders have values of $8, $5, $3, $2, and $1, the bidder with the $8 value will win at a price close to $5. In auctions, it is the losing bidders who determine the price; the stronger they are, the higher the price.

Economists love auctions. Not only do auctions identify the high-value bidder (efficiency), but they also set a price for the item, thereby avoiding costly negotiation. Auctions are especially valuable for selling unique or customized items, like art, antiques, or entire companies. For such items, it's difficult to identify the high-value buyer and to set an appropriate price.

To illustrate the benefits of using an auction, we contrast a simple auction to a fixed price. Consider a retail store uncertain about whether customers would be high value ($70) or low value ($50), with respect to a unique, single item the store offers for sale. The store expects two customers and estimates that each is equally likely to have a high or a low value. The four possibilities are listed in Table 18-1. In setting a fixed price, the store faces the familiar trade-off: price high and sell only if a high-value consumer shows up, or price low and sell to everyone. A high price generates more *expected* revenue [$52.50 = (0.75)($70)] than a low price [$50 = (1.0)($50)].

Suppose instead that the store uses an oral auction among these two customers. The winning bid, listed in the last column of Table 18-1, is equal to the second-highest value. If the auctioneer is lucky, he'll get two high-value bidders, and the winning bid will be $70. However, this outcome occurs only 25% of the time. The other 75% of the time, the second-highest value is just $50. The *expected* revenue of the auction is the weighted average of these two outcomes, where the weights are the probabilities of each: (0.75)($50) + (0.25)($70) = $55. Compared to a fixed price of $70, the auction in this case gives the seller higher *expected* revenue.

Now suppose that three bidders show up at an auction. As before, they could be either high-value ($70) or low-value ($50) bidders. What is the *expected* revenue from the auction?

TABLE **18.1**

Oral Auction with Two Bidders

Bidder 1	Bidder 2	Probability	Winning Bid
$50	$50	0.25	$50
$50	$70	0.25	$50
$70	$50	0.25	$50
$70	$70	0.25	$70

TABLE **18.2**

Oral Auction with Three Bidders

Bidder 1	Bidder 2	Bidder 3	Probability	Winning Bid
$50	$50	$50	0.125	$50
$50	$50	$70	0.125	$50
$50	$70	$50	0.125	$50
$70	$50	$50	0.125	$50
$50	$70	$70	0.125	$70
$70	$50	$70	0.125	$70
$70	$70	$50	0.125	$70
$70	$70	$70	0.125	$70

The possible outcomes of the auction are listed in Table 18-2. Again, if the auctioneer is lucky, two or more high-value bidders will show up, so the winning bid is $70. But this happens only 50% of the time. The other 50% of the time, we expect at most one high-value bidder, so the winning bid is $50. *Expected* revenue is (0.5)($70) + (0.5)($50) = $60.

Comparing Tables 18-1 and 18-2, we see that more bidders raise the expected price because you are more likely to draw more strong (high-value) bidders.

Stronger losing bidders lead to higher winning bids.

For example, eBay auctions that remain open for 10 days return 42% higher prices than 3-day auctions, presumably because the 10-day auctions attract a larger number of bidders.[1]

SECOND-PRICE AUCTIONS

*A **Vickrey** or **second-price auction** is a sealed-bid auction in which the item is awarded to the highest bidder, but the winner pays the second-highest bid.*

Why would an auctioneer use an auction that seems to leave money on the table? The answer is that a second-price auction induces bidders to bid more aggressively because their bid determines only whether they win, *not* the price they pay. The optimal strategy in a second-price auction is to bid *exactly* your value. This is because a second-price auction is actually strategically equivalent to an English auction. We saw in an English auction that everyone should be willing to bid up to his value, and the highest-valued bidder wins at a price equal to the second-highest value. That's precisely the outcome that a second-price auction achieves. A second-price auction allows the auctioneer to simulate what would have happened in an English auction, but without the need to have bidders show up at the same place and time.

William Vickrey shared the 1996 Nobel Prize in Economics for inventing the Vickrey auction and establishing its equivalence to oral auctions. Recently, however, economists have discovered that second-price auctions were used to sell rare stamps as early as 1893.[2] To accommodate bidders who didn't want to travel to participate in a live auction, stamp dealers held second-price auctions through the mail. So Vickrey auctions predated Vickrey by nearly a century!

Vickrey auctions are also useful for auctioning off multiple units of the same item—say, 10 laptop computers. As in the second-price auction, the highest losing bid determines the price—in this case, the highest losing bid is the 11th-highest.[3] As in the second-price auction, it is optimal to bid your value.

Vickrey auctions are beginning to gain popularity. The U.S. Treasury has experimented with them to sell five-year bonds. Google used a Vickrey-style auction in its unconventional IPO, and now uses it to sell advertisements on the Internet. Auction sites like eBay use auctions that resemble second-price auctions by employing "bidding agents" that automatically raise bids for you up to your value but no higher than needed to outbid the next-highest bidder.

FIRST-PRICE AUCTIONS

*In a **sealed-bid first-price auction**, the highest bidder wins the item at a price equal to the highest bid.*

In contrast to a second-price auction, in a sealed-bid first-price auction, you have to pay the amount you bid. Consequently, each bidder faces a trade-off: He can bid higher and raise the probability of winning, but doing so lowers his surplus (or profit) if he does win. In equilibrium, each bidder *shades* his bid; that is, he balances these two effects by bidding below his value. In these auctions, experience is the best teacher. In general, you should bid more aggressively—shade your value less—if the competition is stronger.

BID RIGGING

Collusion among bidders is one of the biggest challenges for an auctioneer. To illustrate the effects of *collusion* or *bid rigging*, let's return to our simple oral auction in which bidders have values of \$8, \$5, \$3, \$2, and \$1. Imagine that the two high-value bidders form a *bidding ring* or *cartel*. What is the winning bid?

A cartel earns money by eliminating competition among its members. Here, the two highest-value bidders (those willing to pay \$8 and \$5) decide not to bid against each other. To win the auction, they have to outbid the highest non-cartel member, whose value is \$3. Collusion reduces the auctioneer's revenue by 40%, from \$5 (what the price would have been without the cartel) to \$3 (the price with the cartel). The cartel members typically split this \$2 profit between them.

This kind of agreement between bidders in an auction is a criminal violation of the antitrust laws in the United States and in most other developed countries. In addition, most countries offer amnesty to the first conspirator willing to testify against fellow conspirators. These amnesty schemes create a prisoners' dilemma among the conspirators. This "race to the courthouse" has led to the discovery and prosecution of a number of different cartels.

In one type of cartel, antique dealers, for example, will refrain from bidding against one another at an estate sale. They get together after the auction to "re-auction" the goods they won in the first auction. The difference between what the good sold for in the first auction and what it sold for in the second or "knockout" auction is the profit that the cartel members split among themselves. A more common type of cartel is the bid-rotation scheme where bidders refrain from bidding against one another in exchange for similar consideration when it's their "turn" to win.

The weakness of a bid-rotation scheme is that each cartel member must wait for his turn to win. And, cartel members can easily cheat by bidding slightly above the agreed-on bid. Grouping many contracts or items together into a single big auction raises the gains from cheating on the cartel. This leads to our first observation about bid rigging:

Collusion is more likely in small, frequent auctions than in big, infrequent ones.

In a sealed-bid auction, collusion requires the cooperation of *all* the cartel members; that is, the cartel members must figure a way out of the prisoners' dilemma. If any of the cartel members raises his bid above the agreed-on price, he could win the item for himself at a very low price. This temptation often leads cartel members to cheat on the cartel, which makes cartels more difficult to organize.

In an oral auction, however, cheating on the cartel offers no benefit. The cartel members know immediately if one of their own tries to bid higher than the agreed-on price. In retaliation, the other cartel members begin bidding competitively, and there is no gain to cheating. This leads to our second observation about bid rigging:

Collusion is more likely in oral and second-price auctions than in first-price sealed-bid auctions.

For bidders to collude, they must devise a way to punish cheaters. But to punish cheaters, you have to know who they are. If cheaters don't fear punishment from other cartel members, then cheating is likely, and the cartel is unlikely to survive. This leads to our third observation about bid rigging:

Collusion is more likely when winning bidders and winning bids are identified.

Collusion can be quite costly for the auctioneer. The graph in Figure 18-1 plots the average winning price of a conspiracy that collapsed when a grand jury began investigating auctions to supply the U.S. Navy with frozen fish. The investigators computed the effect of the conspiracy by *backcasting* (the opposite of forecasting) from the competitive period into the collusive period (the darker line in Figure 18-1). This allowed them to determine that prices would have been 23% lower during the collusive period had bidders behaved competitively. The judge used this information to help determine how long the conspirators would go to prison.

Among the reasons for the conspiracy was a set of "domestic content" rules, which prevented foreign suppliers from bidding on new contracts. Without foreign competition, it was quite easy for the few domestic suppliers of frozen seafood to form a cartel. Another reason was the frequent (up to 10 each week) auctions, which made the bid-rotation scheme fairly easy to organize.[4]

COMMON-VALUE AUCTIONS

*In a **common-value auction**, the value is the same for each bidder, but no one knows what it is. Each bidder has only an estimate of the unknown value.*

So far, we considered auctions in which each bidder has her own *private value* for whatever is being auctioned. Bidders for an unexplored oil field, on the other hand, have a *common value* because the amount of oil in the field determines the value of the field and it is the same for all bidders. However, no one knows for certain how much oil is in the field; each bidder has only an estimate.

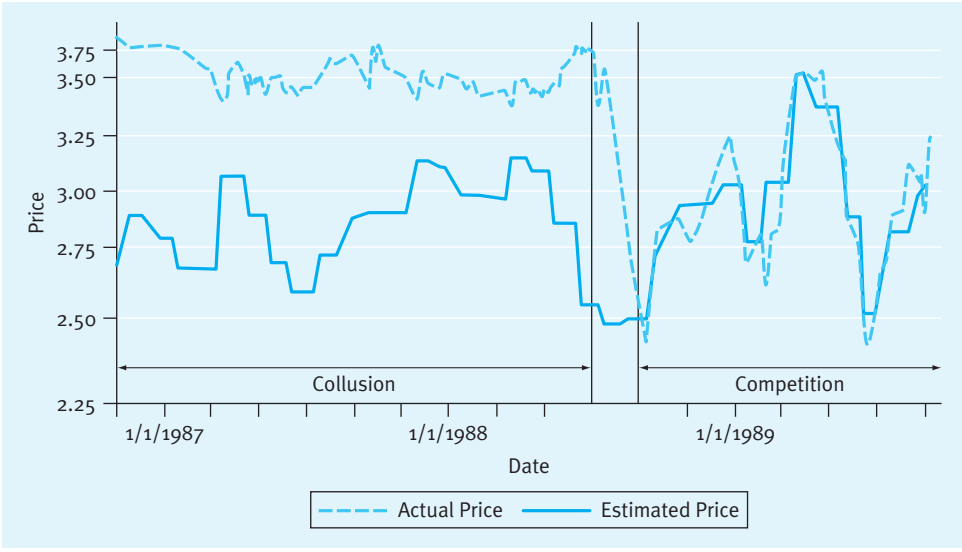


FIGURE **18.1 Collusion in Frozen Fish Bidding**

Winning in a common-value auction is bad news: It means that your estimate was the highest and most optimistic. Since the highest and most optimistic estimate is likely to exceed the actual value, the winner will lose, on average. This is known as the **winner's curse.** The winner's curse does not mean you lost money in an auction (this is called bad luck). It does mean that you bid incorrectly, and put yourself in a position to lose money, on average. To avoid the curse, you must bid as if your information is the most optimistic in the first place.

To avoid the winner's curse, you bid as if everyone else thinks the value is less than your estimate.

For example, imagine that you estimate the value of some object at $500. If I were to tell you that everyone else (including some very smart people) thinks it is worth less than $500, would you revise your own estimate downward? This revised estimate—based on the assumption that everyone else is more pessimistic than you are—should serve as the basis of your bid.

Does it matter how many other bidders there are? Which would make you doubt your estimate more: If I told you that just one other person thinks it is worth less than $500, or 50 people all think so? The more competitors there are, the more winning is "bad news," and the lower you should bid.

To avoid the winners' curse, you bid less aggressively as the number of bidders increases.

The winner's curse is especially bad when rival bidders have better information about the value than you do. For example, some bidders for oil fields own neighboring fields and have better estimates of the amount of oil than those without neighboring fields. In this case, you will win only when others think the item isn't worth much, or when you overbid. It's seldom a good idea to bid in common-value auctions when rivals have better information than you do.

If you're the auctioneer, you want to encourage aggressive bidding by releasing as much information as you can about the value of the item. By reducing uncertainty about the value of

the item, you mitigate many of the effects of the winner's curse, which encourages bidders to bid closer to their estimated values. Even if you have adverse information about an item, you should still release it. If you don't, bidders will correctly infer that the information is bad.

Oral auctions return higher prices in a common-value setting.

One way to release information in a common-value auction is to hold an oral auction. Each bidder can see how aggressively rivals are bidding, which reduces uncertainty and reduces the magnitude of the winner's curse. Oral auctions result in more aggressive bidding and higher prices in common-value auctions.

If releasing information is good for the auctioneer, it must be bad for the bidders. Since the value is the same for each bidder, everyone knowing that value leads to everyone bidding away any potential profits. The source of profit in a common-value auction is the information that you have and that others do not.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- In **oral** or **English auctions,** the highest bidder wins but only has to outbid the second-highest bidder. Losing bidders determine the price.
- **A Vickrey** or **second-price auction** is a sealed-bid auction in which the high bidder wins but pays only the second-highest bid. These auctions are strategically identical to English auctions, but easier to run and well suited for use on the Internet.
- In a **sealed-bid first-price auction,** the high bidder wins and pays his value. Bidders must balance the probability of winning against the profit they will make if they do win. Optimal bids are less than bidders' private values.
- Bidders can raise profit by agreeing not to bid against one another. If collusion is suspected,
  - do not hold open auctions;
  - do not hold small and frequent auctions;
  - do not announce the winners or the winning bids.
- In a **common-value auction,** everyone has the same value but each has only an estimate of what it is.
- To avoid the **winner's curse** in common-value auctions, bid below your estimated value. Bid as if your estimate is the most optimistic and everyone else thinks it is worth less.
- Oral auctions return higher prices in common-value auctions because they release more information.

Multiple-Choice Questions

1. You are bidding in a second-price auction for a painting that you value at $800. You estimate that other bidders are most likely to value the painting at between $200 and $600. Which of these is likely to be your best bid?
   a. $1,000
   b. $800
   c. $600
   d. $400
2. Which of the following is true about different ways of conducting a private-value auction?
   a. A first-price auction is strategically equivalent to a second-price auction.
   b. A first-price auction is strategically equivalent to an English auction.
   c. A second-price auction is strategically equivalent to an English auction.
   d. None of the above
3. Suppose that five bidders with values of $500, $400, $300, $200, and $100 attend an oral auction. Which of these is closest to the winning price?
   a. $500
   b. $400
   c. $300
   d. $200
4. In the above auction, if the bidders with the first- and third-highest values ($500 and

$300) collude, which of these is closest to the winning price?
   a. $500
   b. $400
   c. $300
   d. $200
5. In a common-value auction, you should
   a. bid more aggressively the more competitors you face.
   b. bid less aggressively the more competitors you face.
   c. bid the same regardless of the number of competitors.
   d. bid more aggressively when others have better information than you.
6. If a seller is concerned about collusion among bidders, which of the following changes to the auction should the seller make?
   a. Hold frequent, small auctions instead of infrequent large auctions.
   b. Conceal the amount of winning bids.
   c. Publically announce the name of each auction's winner.
   d. Hold a second-price instead of a first-price auction.
7. You're holding an auction to license a new technology that your company has developed. One of your assistants raises a concern that bidders' fear of the winner's curse may encourage them to shade their bids. How might you address this concern?
   a. Release your analyst's positive scenario for the technology's future profitability.
   b. Release your analyst's negative scenario for the technology's future profitability.
   c. Use an oral auction.
   d. All of the above
8. Which of the following is true about the winner's curse?
   a. The winner's curse occurs primarily in private-value auctions.
   b. You successfully avoided the winner's curse if you made money in the auction.
   c. The winner's curse means that you bid incorrectly.
   d. The winner's curse means that you lost money in an auction.
9. A bidder's value for a good may be low ($2), medium ($5), or high ($7). There is an equal number of potential bidders having each value. Suppose two bidders participate in a second-price auction. What is the best estimate of the expected revenue from the auction?
   a. $4.11
   b. $3.99
   c. $3.56
   d. $5.00
10. In a first-price auction, you bid _____ your value, and in a second-price auction you bid _____ your value.
   a. at; above
   b. below; above
   c. below; at
   d. below; below

Individual Problems

18-1 Effects of Collusion

You hold an auction among three bidders. You estimate that each bidder has a value of either $16 or $20 for the item, and you attach probabilities to each value of 50%. What is the expected price? If two of the three bidders collude, what is the price?

18-2 Reserve Prices

A reserve price is a minimum price set by the auctioneer. If no bidder is willing to pay the reserve price, the item is unsold at a profit of $0 for the auctioneer. If only one bidder values the item at or above the reserve price, that bidder pays the reserve price. An auctioneer faces two bidders, each with a value of either $30 or $80, with both values equally probable. What reserve price should the auctioneer set, and what is the expected revenue from auctioning the item with and without a reserve price?

18-3 Reserve Prices II

Consider the problem above, but now each bidder has a value of either $60 or $80. What reserve price should the auctioneer set, and what is the

expected revenue from auctioning the item with and without a reserve price?

18-4 Asset Auctions in Sweden

In Sweden, firms that fail to meet their debt obligations are immediately auctioned off to the highest bidder. (There is no reorganization through Chapter 11 bankruptcy.) The current managers are often the high bidders for the company. Why?

18-5 Art Auctions

When a famous painting becomes available for sale, it is often known which museum or collector will be the likely winner. Yet, representatives of other museums that have no chance of winning are actively wooed by the auctioneer to attend anyway. Why?

18-6 Contractor Bidding

Moe Green estimates the cost of future projects for a large contracting firm. Mr. Green uses precisely the same techniques to estimate the costs of every potential job, and formulates bids by adding a standard profit markup. For some companies to whom the firm offers its services, no competitors exist, so they are almost certain to get them as clients. For these jobs, Mr. Green finds that his cost estimates are right, on average. For jobs where competitors are also vying for the business, Mr. Green finds that they almost always end up costing more than he estimates. Why does this occur?

Group Problem

G18-1 Using Auctions in Your Business

Identify something you buy or sell that could be bought or sold using an auction. How would you run the auction? Do a benefit-cost analysis of the auction relative to how you currently buy or sell.

END NOTES

1. See David Reiley, Doug Bryan, Naghi Prasad, and Daniel Reeves, "Pennies from eBay: The Determinants of Price in Online Auctions," *Journal of Industrial Economics* 55, no. 2 (2007): 223–233.
2. David Lucking-Reiley, "Vickrey Auctions in Practice: From Nineteenth-Century Philately to Twenty-First-Century E-Commerce," *Journal of Economic Perspectives* 14, no. 3 (2000): 183–192.
3. If bidders can bid for multiple items, then the price paid by a bidder who wins n units is the sum of the n highest losing bids by other bidders.
4. The cartel and its collapse are described in Luke Froeb, Robert Koyak, and Gregory Werden, "What Is the Effect of Bid-Rigging on Prices?" *Economics Letters* 42, no. 4 (1993): 419–423.

CHAPTER 19

The Problem of Adverse Selection

With over one billion in annual sales, Zappos is the Internet's largest shoe retailer. Customer service is a key differentiator for Zappos, and its core value is to "Deliver WOW Through Service." As part of the hiring process, new recruits participate in a four-week training program to introduce them to the company's strategy, processes, and culture.

Training alone cannot teach employees how to deliver WOW. In addition, it takes the right personality and attitude. But Zappos has not been able to figure out how to measure these intangible qualities. Instead, they use a clever plan to get the WOW employees to identify themselves. After the first week of training, the company offers $4,000 to any new hire who will quit that day. About 3% take the offer. The ones who are left are the ones with the ability to deliver WOW. Zappos has discovered that the $4,000 "screen" is a relatively inexpensive way to reduce the rate of bad hires, to decrease the costs of employee turnover, and to protect the company's reputation for service.[1]

This story illustrates the problem known as **adverse selection**. It arises when one party to a transaction is better informed than another—in this case, workers know more about their work habits and WOW ability than Zappos. Because low-quality workers typically have worse outside options, they are more likely than good ones to accept an offer of employment. Unless employers can distinguish high- from low-quality workers, they are more likely to hire the wrong sort.

In this chapter we show you how to anticipate adverse selection, how to protect yourself from its consequences, and, in some cases, how to get around it.

INSURANCE AND RISK

The adverse selection problem is most easily illustrated in the market for insurance. To understand the demand for insurance, we have to return to our discussion of random variables. A lottery is a random variable with a payment attached to each outcome. If I agree to pay you $100 if a fair coin lands heads-up and $0 otherwise, you face a lottery with an

expected value of $50. Your attitude toward risk determines how you value this random payoff.

*A **risk-neutral** consumer values a lottery at its expected value. A risk-averse consumer values a lottery at less than its expected value.*

Consider the possibility of trade between a risk-averse seller and a risk-neutral buyer. For instance, a risk-averse consumer might be willing to sell the $100 coin toss lottery for $40, whereas a risk-neutral consumer would be willing to pay $50 for the same lottery. If the two of them transact, say at a price of $45, they create wealth by moving an asset—the lottery—to a higher-value use. After the transaction, the risk-averse seller has $45, a sure payout that he values more than the lottery, and the risk-neutral buyer pays only $45 for an asset that she values at $50.

Similarly, insurance is a wealth-creating transaction that transfers risk from someone who doesn't want it (the risk-averse consumer) to someone who is willing to accept it for a fee (the risk-neutral insurance company). The only difference from our lottery example is that the risk-averse sellers face a lottery over *bad* outcomes instead of *good* ones.

For example, suppose that Rachel owns a $100 bicycle that might be stolen. The possibility of theft means that the payoff from owning the bicycle is like that of a lottery: lose $100 if the bike is stolen and lose nothing if it isn't. If the probability of theft is 20%, the *expected* cost of the lottery is (0.2)($100) = $20.

If Rachel purchases insurance for $25 that reimburses her for the value of her stolen bicycle, she eliminates the risk. By voluntarily transacting, both Rachel and her insurance company are made better off. Rachel pays to eliminate the risk, and the insurance company earns $5, on average, for accepting it. Note that the insurance company never earns $5. If the bike is stolen, it loses $75; if not, it earns $25, so the expected value of offering insurance is $5 = 0.2(–$75) + 0.8($25).

Insurance is not the only way of moving risk from those who don't want it to those who don't mind it. One of the financial industry's main functions is to move risk from lower- to higher-valued uses. For example, farmers face uncertain future prices for their crops. To get rid of the risk, they sell forward contracts to grain companies or speculators. The buyer of the contract takes possession of the crop on a specified delivery date and accepts the risk that the crop may be worth less than the price. Selling crops before they are planted moves risk from risk-averse farmers to risk-neutral buyers.

ANTICIPATING ADVERSE SELECTION

To illustrate the problem of adverse selection, we modify our bicycle insurance example by assuming that there are two different types of consumers, each facing different risks. One type of consumer lives in a secure area, where the probability of theft is 20%. The other type lives in a less secure area, where the probability of theft is higher—say, 40%. Each consumer is risk-averse and would be willing to buy insurance for $5 more than its expected cost; that is, the low-risk consumer would be willing to pay $25 for insurance, and the high-risk consumer would be willing to pay $45. If the insurance company could tell them apart, it would sell different policies, at different prices, to each.

But when the insurance company cannot distinguish between the high- and low-risk consumers, it faces potential losses. If the company naively offers to sell insurance at an average price of $35, only the high-risk consumers will purchase the insurance. They think it's

a great deal because they'd be willing to pay as much as $45 for the insurance. In contrast, the low-risk consumers recognize a bad deal when they see it. They would rather face the possibility of theft than pay $35 for insurance that they value at only $25.

If only high-risk consumers purchase insurance, the insurance company's expected costs are $40, meaning it loses $5 on every policy it sells. This leads to the first important lesson of the chapter:

Anticipate adverse selection and protect yourself against it.

If the insurance company correctly anticipates that only high-risk consumers will buy, it will offer insurance at $45. At this price, only high-risk consumers buy the insurance, but the company does make money on the policies it sells.

To see what happens when you don't anticipate adverse selection, let's turn to a real example. In June of 1986, the city of Washington, D.C., passed the Prohibition of Discrimination in the Provision of Insurance Act, which outlawed HIV testing by health insurance companies. What do you think happened?

According to press reports at the time, the result was a "mass exodus of insurers from the city." Unable to distinguish low-risk from high-risk consumers, insurance companies faced the prospect of being able to sell only to high-risk purchasers. The insurance companies, if not the D.C. government, correctly anticipated adverse selection and realized they could not make money selling only to HIV-positive consumers.

When the law was repealed in 1989, the problem disappeared. Once companies were able to distinguish between consumers with HIV and those without, they offered two polices based on the costs of insuring each population. When you eliminate the information asymmetry—when the company knows who is high-risk and who is low-risk—there is no adverse selection. President Obama's signature healthcare legislation uses a different solution. Like the Washington, D.C., measure, it also prohibits insurers from distinguishing high-risk from low-risk patients, but by requiring everyone to purchase insurance, it prohibits low-risk purchasers from exiting the market.

In financial markets, adverse selection arises when owners of companies seeking to sell shares to the public know more about the prospects of the company than do potential investors. Potential investors should anticipate that companies with relatively poor prospects are the ones most likely to sell stock to the public. For example, small Initial Public Offerings[2] (IPOs) of less than $100 million lose money in the long term, on average, whereas large IPOs have "normal" returns, equal to those of comparably risky assets. Economists find it puzzling that investors don't anticipate adverse selection by reducing the price they pay for these small IPOs.

Finally, we note that the winner's curse of common-value auctions is a kind of adverse selection. Unless the winning bidder anticipates that she will win only when she has the most optimistic estimate of the item's true value, she'll end up overbidding. Only if bidders anticipate the winner's curse—by bidding as if theirs is the highest estimate—will they bid low enough to avoid overpaying.

SCREENING

If our bicycle insurance company sells at a price of $45, the low-risk consumers will not purchase insurance, even though they would be willing to pay a price, $25, which is more than the cost of the insurance. This leads to the second point of this chapter.

The low-risk consumers are not served because it is difficult to transact with them profitably.

Adverse selection represents a potentially profitable, but unconsummated, wealth-creating transaction. Screening (the subject of this section) and signaling (the subject of the next section) are two ways to overcome the obstacles to transacting with low-risk individuals.

One obvious solution to the problem of adverse selection is to gather information so you can distinguish high from low risk. If, for example, the insurance company can distinguish between high- and low-risk consumers, they can offer two different policies to the two groups—a low-price policy to the low-risk group and a high-price policy to the high-risk group.

But this isn't as easy as it sounds. Information gathering can be costly; moreover, privacy and anti-discrimination laws can prevent insurance companies from acquiring (and using) information that lets them sort customers into high- and low-risk groups. For example, your credit report is an excellent predictor of whether you'll be involved in an auto accident. If you give an insurance company permission to look at your credit report, you can get car insurance at a low price, provided your credit is good. But three states, California, Hawaii, and Massachusetts, prohibit car insurance companies from using credit scores to price insurance. This restriction reduces the amount of information available to insurance companies and raises the cost of insurance to good drivers.

Even when it's hard to gather information about individual risks directly, you can sometimes gather information indirectly. By offering consumers a menu of choices, you can get them to reveal information about themselves by the choices they make. Returning to our bicycle insurance example, suppose you offer two policies: full insurance for \$45 and partial insurance for \$15. Partial insurance would compensate the owner for just half the value of the bicycle. Typically, partial insurance involves a deductible or a copayment.[3]

If high-risk individuals prefer full insurance for \$45 to partial insurance for \$15, they will purchase the full insurance, whereas low-risk individuals will purchase partial insurance. At these prices, the insurance company can make money because the cost of insuring the high-risk group is (0.4)\$100 = \$40 and the cost of partially insuring the low-risk group is (0.2)\$50 = \$10. By offering partial insurance, the insurance company can transact (partially) with the low-risk consumers.

Screening *describes the efforts of the less informed party (the insurance company) to gather information about the more informed party (consumers). Information may be gathered indirectly by offering consumers a menu of choices. Consumers reveal information about their information (risk) by the choices they make.*

A successful screen has one critical requirement: It must *not* be profitable for high-risk consumers to mimic the choice of low-risk consumers. In our insurance example, the high-risk group must prefer full insurance at \$45 to partial insurance at \$15. If high-risk individuals purchase partial insurance, the screen fails, and the insurance company loses money.[4]

As a consumer, you can use this information to your advantage when purchasing insurance. If you're a low-risk individual, you may be able to lower your own *expected* insurance costs by purchasing a policy with a large deductible or copayment. This choice will identify you as a low-risk individual to the insurance company and allow you to purchase (partial) insurance for a lower price, albeit with a large deductible or copayment. Likewise, if you purchase insurance with a small deductible or copayment, you identify yourself as a

high-risk consumer and pay a higher expected price. Buying a policy with a small deductible signals that you expect your insurance costs to be high.

Note that the software price discrimination scheme discussed in Chapter 14 is very similar to screening. By offering consumers a choice between a less expensive, disabled version of the software and a more expensive, full-featured version, the software company induced consumers to identify themselves as either high- or low-value consumers. This allowed the company to price discriminate. The scheme was successful because it was unprofitable for business users to mimic the behavior of home users (i.e., by purchasing the disabled version).

Let's apply these ideas to the used-car market, where adverse selection is known as the *lemons problem*. Suppose there are bad cars (lemons) worth $2,000 and good cars (cherries) worth $4,000. The information asymmetry is that each seller knows whether he or she owns a lemon, but the buyer does not.

What happens when an uninformed buyer tries to buy a used car from an informed seller? If a buyer offers a price of $3,000, only lemon owners would be willing to sell, so the buyer ends up paying $3,000 for a $2,000 car. If, instead, the buyer offers to purchase at a price of $4,000, both cherry owners and lemon owners would be willing to sell, so the expected value of any purchased car will be less than $4,000. In both cases, the buyer pays too much, on average, for what he is getting.

If the buyer anticipates adverse selection, he offers to pay just $2,000. At this price, only lemon owners will sell, but at least the buyer won't overpay for the car. Owners of cherries are analogous to low-risk consumers in the insurance market because they are unable to transact. Again, adverse selection represents an unconsummated wealth-creating transaction. Put yourself in the position of a buyer who wants to buy a cherry for $4,000, and try to design a screen to solve the lemons problem.

One option is to offer $4,000 for a car, but demand a money-back guarantee. Sellers of good cars will accept the offer because they know the car won't be returned. Lemon owners would be unwilling to offer guaranties like this. Warranties on products serve a similar purpose. Manufacturers of high-quality, durable products are more willing to offer longer warranties because they don't expect to have to make many repairs.

Screening occurs in a wide variety of contexts beyond the insurance and auto markets. For example, the state of Louisiana allows couples to choose one of two marriage contracts: a covenant contract, under which divorce is very costly, and a regular contract, under which divorce is relatively cheap. What is the screening function of this menu of choices?

Suppose there are two types of prospective partners: gold-diggers (those who want only a short-term relationship) and soul mates (those who want to stay together until death). Given a choice of contracts, you learn something about your intended by the choice he or she makes. Note that this screen works only if gold-diggers prefer the regular marriage contract to the covenant marriage.

Finally, as seen in our Zappos' story, screens can solve the adverse selection problem in hiring. The $4,000 payment to quit made it profitable for low-quality workers to identify themselves as such.

Incentive compensation is another way that employers identify and avoid low-quality workers. Suppose you can hire two types of salespeople—hard workers who will sell 100 units per week in their territories, and lazy workers who will sell only 50 units per week. The asymmetric information means that workers know which type they are but you don't.

The employer could ask potential employees if they are lazy at the interview, but that is unlikely to be fully revealing.

Suppose hard and lazy workers alike expect to earn at least $800 for a week's work. If you offer a wage of $800 per month, you get a mix of lazy and hard workers. To screen out the lazy workers, offer a straight $10 commission. Hard workers will accept the offer because they know they'll earn $1,000. Lazy workers, who know they'll make only $500, will reject the offer. This is a perfect screen because the workers' own choices (accept or reject) identify their type (lazy or hardworking).

However, most incentive compensation schemes expose workers to risk. In addition to effort, there are factors beyond the salespersons' control that affect sales—like consumer income, rival prices, or interest rates. A screen that works just as well, but presents less risk, is a contract with a flat salary of $500 in combination with a $10 commission on sales beyond 50 units. This combination guarantees each worker a base salary of $500 without risk, and an expected compensation of $1,000 for good workers. If bad workers do not expect to sell at least 50 units, they will reject the offer. And the good workers get a compensation scheme that exposes them to less risk.

SIGNALING

Let's recap what we've learned so far. Even when we anticipate it and protect ourselves against it, adverse selection results in unconsummated wealth-creating transactions, such as those between

- insurance companies and low-risk consumers;
- car buyers and sellers with good cars; or
- employers and hardworking employees.

Screening is a tactic by the less informed party to consummate these transactions by getting rid of the information asymmetry. When consumers identify themselves by their choices, wealth-creating transactions can be consummated.

In this section, we discuss efforts by an informed party—the low-risk consumers, the hardworking employees, and the sellers with good cars—to get rid of the asymmetric information. This is called signaling.

> ***Signaling*** *describes the efforts of the more informed parties (consumers) to reveal information about themselves to the less informed party (the insurance company). A successful signal is one that bad types will not mimic.*

Signaling is closely related to screening. In fact, any successful screen that separates low-risk from high-risk consumers, good from bad car sellers, or lazy from hardworking employees, can also serve as a signal. To signal, the informed party could use the mechanisms just described: low-risk consumers could offer to buy insurance with a big deductible, good employees could offer to work on commission, and sellers with good cars could include a warranty with the purchase.

The crucial element of a successful signal is that it must not be profitable for the bad types to mimic the signaling behavior of the good types.

For example, much of the value of education may derive not from what it adds to students' human capital but rather from its signaling value. Students signal to potential employers that they're hardworking, quick-learning, dedicated individuals (all these qualities

are difficult to measure) by dropping out of the labor force and spending lots of money to pursue an education. Consequently, they receive high offers from employers. It's not profitable for lazy, slow-learning, or undedicated individuals to mimic this behavior because their type will be revealed before they can recoup the investment in education. Once employers realize that they are low-quality workers, they won't be promoted or retained. Further, the education itself is more arduous (expensive) for these types.

Advertising and branding can also serve as signals. By investing significant money into branding and advertising a product, firms signal to consumers that theirs is a high-quality product. Low-quality firms won't mimic this signal because even consumers who buy will soon learn of its low quality and avoid the brand in the future. For branding and advertising to serve as a signal, it must be the case that low-quality producers cannot sell enough to recover their advertising and branding expenditures. Consequently, consumers are willing to pay more for branded and advertised goods.

This type of advertising is often called "burning money" as the message of the advertisement is less important than the fact that money was spent on it. Burning money is used to signal in nature, too. The male peacock's colorful feathers serve as an expensive signal (they serve no apparent survival purpose) but reflect health and superior genes preferred by females. A less healthy peacock won't (or biologically can't) mimic this signal. For the same showy reason, before FDIC insurance, banks were often built of granite. This served to reassure depositors that the bank owners were not looking to abscond with depositors' money. Doing so would not offset the building costs of the bank.

ADVERSE SELECTION AND INTERNET SALES

In 2000, Robert and Teri La Plant paid $2,950 for a 1.41-carat marquise-cut diamond on eBay. But when the La Plants received the diamond, they noticed a visible chip and returned it. Power user Al Bagon, who does business as MrWatch, refused to refund their money, alleging that the La Plants chipped the diamond themselves to avoid paying for it. Mr. Bagon noted that an appraisal accompanied the diamond when it was shipped. The La Plants countered by noting that the appraisal was 18 months old, and that they have collected the standard $200 insurance policy that eBay offers for all its purchases. eBay refused to suspend MrWatch from the site, noting that he has had 1,800 positive responses from customers and only eight negative responses.[5]

Problems like this arise because eBay sellers have better information than buyers about the quality of goods being offered for sale. If buyers anticipate adverse selection, they offer less, making sellers less willing to sell high-quality goods. Consummated transactions are likely to leave buyers disappointed with respect to quality.

eBay tries to solve the adverse selection problem by using authentication, grading, and escrow services, and insurance against fraud. Sellers can also build good reputations as customers rate each transaction with the seller. Sellers who enjoy good reputations command higher prices on eBay for the same items. A well-rated seller earns up to 10% more than a new seller, while a single negative rating can significantly decrease price.[6] eBay's ability to address the adverse selection problem has allowed them to begin selling more expensive items, such as cars, which expose uninformed buyers to bigger potential losses.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Insurance is a wealth-creating transaction that moves risk from those who don't want it to those who are willing to bear it for a fee.
- **Adverse selection** is a problem that arises from information asymmetry, or "hidden" information. Anticipate it and, if you can, figure out how to consummate the unconsummated wealth-creating transaction.
- The adverse selection problem disappears if the information asymmetry disappears.
- **Screening** is an uninformed party's effort to learn the information that the more informed party has. Successful screens have the characteristic that it is unprofitable for bad "types" to mimic the behavior of good types.
- **Signaling** is an informed party's effort to communicate her information to the less informed party. Every successful screen can also be used as a signal.
- Online auction and sales sites, like eBay, address the adverse selection problem with authentication and escrow services, insurance, and on-line reputations.

Multiple-Choice Questions

1. An insurance company offers doctors malpractice insurance. Assume that malpractice claims against careful doctors cost $5,000 on average over the term of the policy and settling malpractice claims against reckless doctors costs $30,000. Doctors know whether they are reckless or careful, but the insurance company only knows that 10% of doctors are reckless. How much do insurance companies have to charge for malpractice insurance to break even?
   a. $5,000
   b. $7,500
   c. $27,500
   d. $30,000
2. An employer faces two types of employees. Regular workers are 70% of the population and generate $100,000 in productivity. Exceptional workers are 30% of the population, and generate $120,000 in productivity. Employees know their types, and reject salaries below their productivity. If the employer offers a salary equal to the average productivity in the population, what will be the employer's per-employee profit?
   a. –$10,000
   b. –$6,000
   c. $0
   d. $4,000
3. An all-you-can-eat buffet attracts two types of customers. Regular customers value the buffet at $20 and eat $5 of food in costs to the restaurant. Hungry customers value the buffet at $40 and eat $10 of food. If there are 100 of each type in the market for a buffet dinner, what is the restaurant's profit?
   a. $2,500
   b. $3,000
   c. $4,500
   d. $6,500
4. To combat the problem of adverse selection, _____ informed parties can employ_____ techniques.
   a. more; signaling
   b. less; signaling
   c. equally; screening
   d. equally; signaling
5. Which of the following can be an example of a signal?
   a. An air-conditioning manufacturer offers a 50-year warranty.
   b. A lawyer offers to be paid only if the client wins.
   c. A student pursues an MBA.
   d. All of the above
6. Which of the following is *not* an example of adverse selection?
   a. A business bets the proceeds of a bank loan on the next NFL game.
   b. An accident-prone driver buys auto insurance.
   c. A patient suffering from a terminal disease buys life insurance.
   d. A really hungry person decides to go to the all-you-can-eat buffet for dinner.

7. The demand for insurance arises primarily from people who are
   a. risk-seeking.
   b. risk-averse.
   c. risk-neutral.
   d. None of the above
8. Which of the following is a potential solution to the adverse selection problem faced by insurance companies?
   a. Offer plans with different deductibles so that higher-risk customers accept higher deductibles.
   b. Create a national database of customers that allows companies to look up each person's historical risk.
   c. Mandate that every person purchase insurance.
   d. All of the above
9. An insurance company suffers from adverse selection if
   a. safe customers are less likely to insure than risky customers.
   b. customers know their willingness to pay for insurance but the company does not.
   c. a customer takes on much greater risk because he is insured.
   d. its customers are risk averse.
10. Which of the following is an example of adverse selection?
   a. A safe driver taking greater risk in a rental car than his own car.
   b. A terminally ill person purchasing life insurance.
   c. An employment contract encourages little effort on the part of employees.
   d. All of the above

Individual Problems

19-1 Leasing Residuals

In the late 1990s, car leasing was very popular in the United States. A customer would lease a car from the manufacturer for a set term, usually two years, and then have the option of keeping the car. If the customer decided to keep the car, the customer would pay a price to the manufacturer, the "residual value," computed as 60% of the new car price. The manufacturer would then sell the returned cars at auction. In 1999, the manufacturer lost an average of $480 on each returned car (the auction price was, on average, $480 less than the residual value).

A. Why was the manufacturer losing money on this program?
B. What should the manufacturer do to stop losing money?

19-2 College Degrees Required for Police Officers

Many Police Officer positions being advertised today require the applicant to have a college degree even though the tasks of a police officer rarely call upon college course material. Why don't police departments increase their applicant pool by dropping this requirement?

19-3 Bicycle Insurance and Information Asymmetry

You sell bicycle theft insurance. If bicycle owners do not know whether they are high- or low-risk consumers, is there an adverse selection problem?

19-4 Job Auction[7]

When China reformed state-owned enterprises, it tried a new approach to choosing managers: it put managerial jobs up for auction. The bids for the jobs consisted of promises of future profit streams that the managers would generate and then deliver to the state. In cases where the incumbent manager was the winning bidder, firm productivity tended to increase dramatically. When outside bidders won, there was little productivity improvement. If incumbent managers were not generally more qualified, how can you explain this result?

19-5 "Soft Selling" and Adverse Selection

Soft selling occurs when a buyer is skeptical of the usefulness of a product and the seller offers to set a price that depends on realized value. For example, suppose you're trying to sell a company a new accounting system that will reduce costs by 10%. Instead of naming a price, you offer to give them the product in exchange for 50% of their cost savings. Describe the information asymmetry, the adverse selection problem, and why soft selling is a successful signal.

19-6 Hiring Employees

You need to hire some new employees to staff your start-up venture. You know that potential employees are distributed throughout the population as follows, but you can't distinguish among them:

Employee Value	Probability
$50,000	0.25
$60,000	0.25
$70,000	0.25
$80,000	0.25

What is the expected value of five employees you hire?

Group Problem

G19-1 Adverse Selection

Describe an adverse selection problem your company is facing. What is the source of the asymmetric information? Who is the less informed party? What transactions are not being consummated as a result of the information? Could you (or do you) use signaling or screening to consummate these transactions? Offer your company some sound advice, complete with computations of the attendant profit consequences.

END NOTES

1. The payment has increased from $100 in 2008 to $4,000 now. For more on Zappos' use of this hiring practice, see Keith McFarland, "Why Zappos Offers New Hires $2,000 to Quit," *Business Week,* September 16, 2008.
2. An Initial Public Offering of stock describes the sale of a company by its private owners to the public who can purchase shares in the stock.
3. A deductible is a dollar amount the consumer pays (e.g., $50) while a copayment is a percentage of the total bill (e.g., 50%). In both cases, the insurance company pays the remainder.
4. Every time the insurance company sells partial insurance for $15 to a high-risk individual, it loses $5 (its cost is 0.4 × $50 = $20).
5. Barbara Whitaker, "If a Transaction Goes Sour, Where Do You Turn?" *New York Times,* August 20, 2000, section 3, p. l.
6. Paul Resnick, Richard Zeckhauser, John Swanson, and Kate Lockwood, "The Value of Reputation on eBay: A Controlled Experiment," *Experimental Economics* 9, no. 2 (2006): 79–101.
7. Inspired by John McMillan, *Games, Strategies, and Managers: How Managers Can Use Game Theory to Make Better Business Decisions* (New York: Oxford University Press 1996).

CHAPTER 20

The Problem of Moral Hazard

INTRODUCTION

Fcc Financing

In 1993, the Federal Communications Commission began auctioning licenses to cellular frequencies for wireless communication. Congress required that small female- and minority-owned businesses be given a reasonable opportunity to win licenses. The fear was that they had less money than big players like AT&T and thus would have little chance of winning.

As it turned out, these small businesses bid two to three times higher than the big players for equivalent licenses. Why? The government believed that the biggest difference between small and big firms was access to capital. Therefore, small businesses were afforded very favorable financing: pay just 10% of the winning bid, with the balance due seven years later. While well-intentioned, this financing created some perverse incentives. The value of a license depends on future cell phone innovation and market growth. These cannot be known with any certainty and involve risks. A company like AT&T weighs the chance that a license will be of very high value against the risk that it ends up being worth very little. But the small businesses did not. If the value of the license didn't pan out, they could always default on the payment. Their situation is equivalent to a gambler who only has to pay the bet if he wins. How much would you bet if that were the case? Since they didn't have to face the full consequences of their bids, the financing created an incentive to take on much more risk.

Progressive Snapshot

In 2004, the Progressive Direct Group of Insurance Companies introduced a new car insurance product called TripSense. Now called Snapshot, the service includes a free device that plugs into a car's diagnostic port and records mileage totals, the times when the vehicle is driven, and driving style, including if you slam on your brakes. Progressive uses this information to offer renewal discounts to customers who drive fewer miles during off-peak times. New customers earn an initial discount of up to 10% just for signing up. Renewal discounts vary from 30% to reported *increases* of 9%.

At this point, you should be thinking that this is another example of an insurance company trying to solve the problem of adverse selection by gathering information about the different risks faced by consumers who purchase insurance. But there is another factor involved. Some of the risky driving behavior is caused by the insurance itself. To see this, note that the decision of how much or how fast to drive is an extent decision. The marginal benefit of driving more or at faster speeds is obvious. The marginal cost is the cost of gasoline and wear on the car and the increased risk of accident. Once you buy insurance, the cost of getting into an accident goes down, so we would expect to see more accidents. We call this change in behavior **moral hazard**. Insurance companies anticipate that insured drivers drive less carefully, and they price policies accordingly. The Federal Communications Commission did not foresee the moral hazard, and therefore had many companies default on their risky winning bids.

Moral hazard is ubiquitous. Researchers have found that improvements in risk abatement technology create incentives for consumers to take more risks. For example, improved parachute rip cords did not reduce the number of sky-diving accidents. Instead, overconfident skydivers waited too long to pull the cord. Likewise, workers who wear back-support belts try to lift heavier loads, and wilderness hikers take bigger risks if they know that a trained rescue squad is on call. Public health officials cite evidence that enhanced HIV treatment can lead to riskier sexual behavior. And children who wear protective sports equipment engage in rougher play. The analogy to insurance is obvious. All of these costly technologies reduce the costs of risk taking, which leads to more risk taking.[1]

The problem of moral hazard is closely related to the problem of adverse selection, and it has similar causes and solutions. Both problems are caused by information asymmetry: Moral hazard is caused by hidden *actions* (insurance companies cannot observe your driving behavior) whereas adverse selection is caused by hidden *information* (insurance companies cannot observe the inherent risks that you face). Both problems can be addressed by getting rid of the information asymmetry.

INSURANCE

To illustrate the problem of moral hazard, let's return to the bicycle insurance example from Chapter 19. Assume there is just one type of consumer, the high-risk consumer whose probability of theft is 40%. Now, however, suppose that consumers can bring their bikes inside, which reduces the probability of theft from 40% to 30%. If the cost of exercising care is low enough (let's say it costs \$5 worth of effort to exercise care), then it makes sense to do so. Each uninsured consumer brings the bike inside because the *expected* benefit of doing so—the reduction in the probability of theft multiplied by the price of the bike, $(0.40 - 0.30) \times \$100 = \$10$—is greater than the \$5 cost of exercising care.[2]

These owners still face the risk of theft and are willing to pay \$5 more than the *expected* cost of insurance to get rid of the risk. In this case, the *expected* loss is \$30 (or $0.3 \times \$100$), and the bicycle owner would be willing to pay the insurance company \$35 to insure against this risk. However, once consumers purchase insurance, any benefit from exercising care disappears.

> *Moral hazard means that insured customers exercise less care because they have less incentive to do so.*

In our example, the consumer stops bringing the bicycle inside, and the probability of theft increases from 30% to 40%. This leads to the first lesson of moral hazard:

> *Anticipate moral hazard and protect yourself against it.*

The insurance company should anticipate that the probability of theft will rise to 40% and price its policies accordingly; that is, it must charge at least $40 for the insurance, instead of $35.

What happens when an insurance company doesn't anticipate moral hazard? Consider what one of our students (who previously worked at an insurance company) had to say about antilock braking systems (ABS), which can be thought of as a type of insurance:

> *People with an antilock braking system (ABS) were far more likely to get into accidents because, after buying ABS, they thought they could drive on ice or in the rain. As a result, our company phased out discounts for ABS, except in those states that required such a discount.*

The second point of this chapter is that the problem of moral hazard can represent an opportunity to make money.

> *Moral hazard represents an unconsummated wealth-creating transaction.*

If the insurance company could figure out how to get insured consumers to take care, then it could make more money. For example, if the insurance company could observe whether the customer was exercising care, then it could lower the price of insurance to those taking care. This is what Progressive's Snapshot system tries to do.

MORAL HAZARD VERSUS ADVERSE SELECTION

Moral hazard and adverse selection often offer competing explanations for the same observed behavior. Consider the fact that people who drive cars equipped with air bags are more likely to get into traffic accidents. Either adverse selection or moral hazard could explain this phenomenon.

The adverse selection explanation is that bad drivers are more likely to purchase cars with air bags. If you know you're likely to get into an accident, it makes sense to purchase a car with air bags.

The moral hazard explanation is that air bags are like insurance. Once drivers have the protection of air bags, they take more risks and get into more accidents. If you don't believe that people change behavior in this way, try running a simple experiment. Next time you drive somewhere, don't wear a seatbelt. (Make this a thought experiment if a seatbelt is required by law.) See if you drive more carefully. If you do, then this also means that you drive less carefully when you wear a seatbelt. This reduces the probability of being killed or injured if you do get into an accident, but it also means that you will have more accidents.

What distinguishes adverse selection from moral hazard is the kind of knowledge that is hidden from the insurance company. Adverse selection arises from hidden *information* regarding the type of person (high vs. low risk) who is purchasing insurance. Moral hazard arises from hidden *actions* by the person purchasing insurance (taking care or not). Adverse selection is the problem of separating you from someone else. Moral hazard is the problem of separating the good you from the bad you.

More information can solve both problems. If the insurance company can distinguish between high- and low-risk consumers, it can offer a high-price policy to the high-risk group and a low-price policy to the low-risk group, thereby solving the adverse selection problem. Similarly, if the insurer can observe whether customers are exercising appropriate levels of care after purchasing insurance, it can reward people for taking care, thereby solving the problem of moral hazard. For example, insurance investigators devote a great deal

of time trying to figure out exactly what happened in accidents in order to determine whether it faces a problem of adverse selection or a problem of moral hazard.

SHIRKING

Shirking is a type of moral hazard caused by the difficulty or cost of monitoring employees' behavior *after* a firm has hired them. Without good information, ensuring high levels of effort becomes more difficult.

Suppose, for example, a commission-based salesperson can work hard or shirk. Further suppose that working hard raises the probability of making a sale from 50% to 75% but the increased effort "costs" the salesperson $100. How big does the sales commission have to be to induce hard work?

In Figure 20-1, we draw the decision tree of the salesperson who decides whether to work hard or shirk. The benefit of working hard is the increased probability of making a sale and earning a sales commission (C). The "cost" to the salesperson of expending effort is $100. The salesperson will decide to work hard if 25% × C > $100, where C is the sales commission. In other words, the commission has to be at least $400.[3]

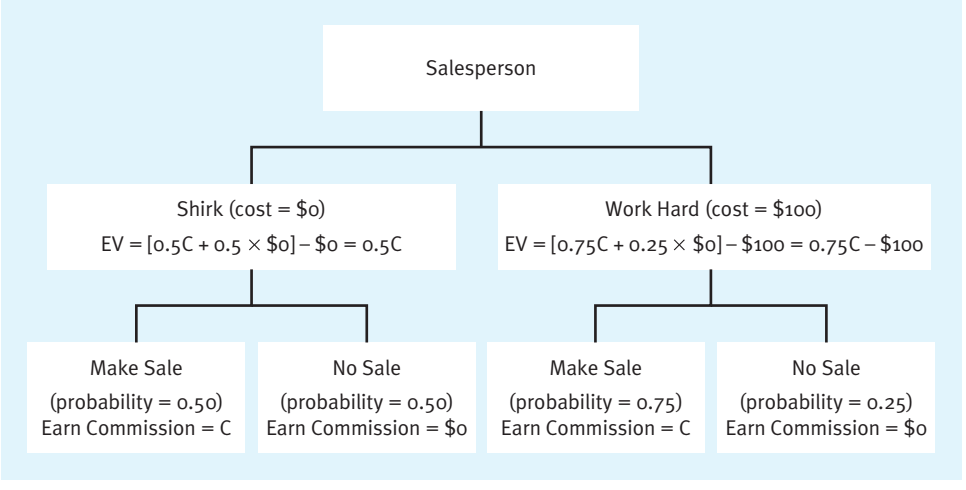


FIGURE **20.1 Choice between Shirking and Working**

Unless the company's contribution margin (P – MC) is at least $400, the company cannot afford to pay a commission that big.[4] In this case, it doesn't pay to address the moral hazard problem with a simple incentive compensation scheme. Ordinarily, it's very hard for business students to accept that sometimes solutions cost more than the problem they are supposed to address. For these students, we leave you with a simple maxim:

If there is no solution, then there is no problem.

Note that the shirking problem arises from the same lack of information that leads to moral hazard in insurance: Only the salesperson knows how hard she is working, just as only the insured driver knows whether he is driving carefully. The performance evaluation metric that the company does possess—whether or not a sale is made—is a noisy measure

of effort because too frequently (50% of the time), the salesperson earns a commission for doing nothing.

Suppose we had a better performance evaluation metric than sales. In particular, suppose we could hire someone to monitor the behavior of our salesperson to verify that she was working hard. This could be done, for example, by tracking the salesperson's movements with a GPS device. How would you design a compensation scheme with this different metric?

Think of rewarding the salesperson for effort directly, with either a stick (work hard or get fired) or a carrot (work hard and earn a reward). If you have a performance metric like this, then almost any incentive compensation scheme will work. The new performance evaluation metric allows you to put the salesperson's entire compensation or job at risk. If the benefits of keeping a job and earning a salary are bigger than the costs of exerting effort, the salesperson will exert effort.

Another solution is to find a worker who has a reputation for working hard, regardless of whether she is monitored. Having a reputation for working hard without monitoring is valuable to the company and to the worker, who should be able to command a higher wage.

This leads directly to our last point about moral hazard—it hurts both parties to a transaction. Consider, for example, the case of a consulting firm that gets paid based on an hourly rate. Given the rate structure and the inability of the client to monitor the consultant's actions, the client expects the consultant either to bill more hours than the client prefers or to spend time on projects that the consultant values but that the client does not. Clients anticipate shirking and are understandably reluctant to transact, unless the consulting firm can find a way to convince the client that it can address the moral hazard problem. The point is this: Both parties benefit if they can figure out how to solve the moral hazard problem. In this case, the consultant can try to develop a reputation for not shirking, the consultant can accept a portion of the contract on a fixed-fee basis, or the consultant can provide the client with information documenting the value of the work being done.

MORAL HAZARD IN LENDING

As a final example, let's consider the problems that banks face when making loans to borrowers. The adverse selection problem is that borrowers who are less likely to repay loans are more likely to apply for them. The moral hazard problem is that once a loan is made, the borrower is likely to invest in more risky assets. Both of these factors make repayment less likely. Again, adverse selection arises from hidden *information,* whereas moral hazard arises from hidden *actions.*

To illustrate the moral hazard problem, suppose you're considering a $30 investment opportunity with the following payoff: $100 with a probability of 0.5 and $0 with a probability of 0.5. The bank computes the expected value of the investment ($50) and decides to make a $30 loan at a 100% rate of interest. If the investment pays off, the bank gets $60. But if the investment returns zero, the bank gets nothing. The expected return to the bank ($30 = 0.5 × $60 + 0.5 × $0) is equal to the loan amount, so it breaks even, on average. The borrower's expected profit is the remainder ($20 = 0.5 × $40 + 0.5 × $0).

The moral hazard problem arises when, after receiving the loan, the borrower discovers another, riskier investment. The second investment pays off $1,000, but has only a 5% probability of success. Although the expected payoffs of the two investments are the same,

the payoffs for the parties are not. Compare the expected payoffs of the borrower and the bank in Tables 20-1 and 20-2. Because the borrower receives more of the upside gain if the investment pays off, he captures a much bigger share of the expected payoff. And if the borrower does much better, the bank does much worse. The bank's share of the expected $50 payout drops to just $3 = 0.05($60) + 0.95($0).

TABLE 20.1

Payoffs to a Less Risky Investment ($30 Loan at 100% Interest)

	Investment Returns $100 ($p$ = 0.5)	Investment Returns $0 ($p$ = 0.5)	Expected Payoff
Payoff to borrower	$40	$0	$20
Payoff to bank	$60	$0	$30

Note: p = probability.

TABLE 20.2

Payoffs to a More Risky Investment ($30 Loan at 100% Interest)

	Investment Returns $1,000 ($p$ = 0.05)	Investment Returns $0 ($p$ = 0.95)	Expected Payoff
Payoff to borrower	$940	$0	$47
Payoff to bank	$60	$0	$3

This is an example of moral hazard caused by the hidden actions of the borrower. Banks guard against moral hazard by monitoring the behavior of borrowers and by placing covenants on loans to ensure that the loans are used for their intended purpose.

We can also characterize moral hazard as an incentive conflict between a lender and a borrower. The lender prefers the less risky investment because she receives a higher expected payoff. The borrower prefers the more risky investment for the same reason.

Remember that moral hazard is a problem not only for the lender, but also for the borrower. If the lender anticipates moral hazard, it may be unwilling to lend. The incentive conflict between banks and borrowers is exacerbated when the borrower can put *other people's money* at risk.

Borrowers take bigger risks with other people's money than they would with their own.

In the early 1980s in Texas, a bust in the real estate market reduced the value of many savings and loan institutions (S&Ls). S&Ls are basically banks that borrow from depositors and lend to homeowners. When the real estate market collapsed, the value of the S&Ls' assets (the real estate loans) fell below the cost of their liabilities (the money owed to depositors). But before the regulators could shut these banks down, they borrowed more money from depositors at very high interest rates and "bet" heavily on junk bonds—the riskiest investment available to them. Just as in our loan example, this move decreased the expected payoff to the lender. Since deposits were insured by the U.S. government, U.S.

taxpayers were stuck with the $200 billion cost of repaying depositors of banks whose investments turned out poorly.

To control this kind of moral hazard, lenders must try to find ways to better align the incentives of borrowers with the goals of lenders. They do this by requiring that borrowers put some of their own money at risk. If the investments don't pay off, the lender wants to make sure that the borrowers share the downside. This is why banks are much more willing to lend to borrowers who have a great deal of their own money at risk. This has led to the complaint that banks lend money only to those who don't need it. But if banks lend to borrowers without assets, banks face a big moral hazard problem.

MORAL HAZARD AND THE 2008 FINANCIAL CRISIS

Regulators can reduce the costs of moral hazard by ensuring that banks keep an equity "cushion" of about 10% so that they can repay depositors who want their money back. For example, a bank that raises $10 million in equity can accept $100 million in deposits and make $100 million in loans. They earn money on the spread between the interest they receive from their loans and the interest they pay to depositors. The balance sheet of this bank would have $100 million in liabilities (deposits that must be paid back) and $110 million in assets (loans plus equity).

When the value of the assets fall, and the bank becomes insolvent, the risk of moral hazard increases. In late 2008, economists voiced concerns that the U.S. Treasury's plan to guarantee short-term loans would give undercapitalized banks the opportunity to make risky "heads I win, tails you lose" bets. If they pay off, then the bank gets most of the gain, but if they don't, the taxpayers absorb most of the losses. Without the guarantees, the banks would have trouble raising capital unless they could convince lenders that they had good investment opportunities.

A better alternative is to have the Treasury Department inject equity into banks. Not only does this get banks lending again but it also gives the bank owners a "stake" in the bank that mitigates some of the risk of moral hazard. In addition, it has the benefit of punishing bank owners by making them give up some of their ownership stake to the government.

Bailing out homeowners raises similar issues. Proponents of the bailout insist that only "responsible families" will benefit from a foreclosure prevention program. But it's obvious that the plan will help tens of thousands of borrowers who made risky bets that house prices would continue to rise. Responsible borrowers, who didn't buy houses they clearly could not afford, watch as their less responsible neighbors are bailed out by the government. Furthermore, the expanded rights of borrowers to renegotiate loans (which helps those with existing loans) make new loans even more expensive. So responsible borrowers are punished twice—once by sharing in the bailout and again when they face higher loan rates.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- **Moral hazard** refers to the reduced incentive to exercise care once you purchase insurance.
- Moral hazard can look very similar to adverse selection—both arise from information asymmetry. Adverse selection arises from hidden information about the type of individual you're dealing with; moral hazard arises from hidden actions.
- Anticipate moral hazard and (if you can) figure out how to consummate the implied wealth-creating transaction.
- Solutions to the problem of moral hazard center on efforts to eliminate the information asymmetry (e.g., by monitoring or by changing the incentives of individuals).
- Shirking is a form of moral hazard.
- Borrowers prefer riskier investments because they get more of the upside while the lender bears more of the downside. Borrowers who have nothing to lose exacerbate this moral hazard problem.

Multiple-Choice Questions

1. Which of the following is an example of moral hazard?
   a. Reckless drivers are the ones most likely to buy automobile insurance.
   b. Retail stores located in high-crime areas tend to buy theft insurance more often than stores located in low-crime areas.
   c. Drivers who have many accidents prefer to buy cars with air bags.
   d. Employees recently covered by the company health plan start going to the doctor every time they get a cold.
2. In a bad economy, a CEO has a 4% chance of meeting earnings estimates at regular effort, and a 5% at extraordinary effort. Extraordinary effort costs the CEO $10,000 in extra effort. How a large of a bonus should the CEO be paid for meeting estimates to encourage extraordinary effort?
   a. $100,000
   b. $200,000
   c. $250,000
   d. $1,000,000
3. A salesperson can put in regular effort (resulting in a 40% chance of sale) or high effort (60% chance of sale). If high effort costs the salesperson $20 more than regular effort, how large of a per-sale bonus is required to encourage high effort?
   a. $12
   b. $20
   c. $33.33
   d. $100
4. Which of the following is *not* an example of a process designed to combat moral hazard problems?
   a. Banks include restrictive covenants in loan agreements.
   b. Universities have students complete evaluations of professor performance at the end of a class.
   c. Insurance companies require applicants to provide medical history information as part of the application process.
   d. Employers regularly monitor employee performance.
5. Which of the following is an example of moral hazard?
   a. High-quality products being driven out of a market by low quality products.
   b. A local charity raising insufficient funds because no one contributes, expecting that their neighbors will.
   c. A bakery defaults on its loan because of a new consumer fear of carbohydrates.
   d. A corporation uses a business loan secured for one investment on another, higher-risk investment.

6. Which of the following is *not* an example of moral hazard?
   a. People are more likely to lock their own car than a rental car.
   b. Skateboarders attempt more difficult maneuvers when wearing a helmet.
   c. Bad salespeople are less drawn to commission-based jobs.
   d. People with fire insurance are less likely to install smoke alarms.
7. Which of the following is true?
   a. Moral hazard is primarily an issue prior to a transaction.
   b. Adverse selection is primarily an issue after a transaction.
   c. Moral hazard is the result of an information asymmetry.
   d. Resolving adverse selection also resolves moral hazard.
8. Restrictive covenants on loans are used to avoid
   a. moral hazard.
   b. adverse selection.
   c. free riding.
   d. None of the above
9. Loan applications require a lot of information from applicants to avoid
   a. moral hazard.
   b. adverse selection.
   c. free riding.
   d. None of the above
10. Which of the following is true about moral hazard?
   a. Moral hazard arises from actions that cannot be observed.
   b. Shirking is a form of moral hazard.
   c. Moral hazard refers to the taking of excessive risk.
   d. All of the above

Individual Problems

20-1 Extended Warranties

Your product fails about 2% of the time, on average. Some customers purchase the extended warranty you offer in which you will replace the product if it fails. Would you want to price the extended warranty at 2% of the product price? Discuss both moral hazard and adverse selection issues.

20-2 Business Loan

A colleague tells you that he can get a business loan from the bank, but the rates seem very high for what your colleague considers a low-risk loan.

a. Give an adverse selection explanation for this, and offer advice to your friend on how to solve the problem.
b. Give a moral hazard explanation for this, and offer advice to your friend on how to solve the problem.

20-3 Locator Beacons for Lost Hikers

Lightweight personal locator beacons are now available to hikers that make it easier for the Forest Service's rescue teams to locate those lost or in trouble in the wilderness. How will this affect the costs that the Forest Service incurs?

20-4 Auto Insurance

Suppose that every driver faces a 1% probability of an automobile accident every year. An accident will, on average, cost each driver $10,000. Suppose there are two types of individuals: those with $60,000 in the bank and those with $5,000 in the bank. Assume that individuals with $5,000 in the bank declare bankruptcy if they get in an accident. In bankruptcy, creditors receive only what individuals have in the bank. What is the actuarially fair price of insurance? What price are individuals with $5,000 in the bank willing to pay for the insurance? Will those with $5,000 in the bank voluntarily purchase insurance? What is the effect of state laws forcing individuals to purchase auto liability insurance?

20-5 BPO Services

BPO Services is in the business of digitizing information from forms that are filled out by

hand. In 2006, a big client gave BPO a distribution of the forms that it digitized in house last year, and BPO estimated how much it would cost to digitize each form.

FORM TYPE	Mix of Forms	Form Cost
A	25%	$0.25
B	25%	$0.10
C	25%	$0.15
D	25%	$0.50

A. Compute the average cost of filling out a form.
B. The client agreed to pay the average cost computed in A for each form that BPO processed, but BPO lost money on the contract. How much did BPO lose, on average, for each form that it processed?

20-6 Frequent Flyers

Frequent flyer programs are targeted more toward business travelers (who do not pay for their own tickets) than leisure travelers (who do). Explain their effect on each type of traveler. Why is there a difference?

Group Problem

G20-1 Moral Hazard

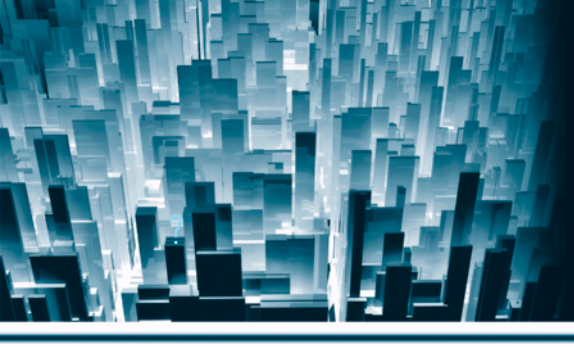
Describe a moral hazard problem your company is facing. What is the source of the asymmetric information? Who is the less informed party? Are there any wealth-creating transactions not consummated as a result of the asymmetric information? If so, could you consummate them? Compute the profit consequences of any advice.

END NOTES

1. William Ecenbarger, "Buckle Up Your Seatbelt and Behave," *Smithsonian,* April 2009, available at http://www.smithsonianmag.com/science-nature/Presence-of-Mind-Buckle-Up-And-Behave.html.
2. We thank Mark Cohen for the bicycle insurance example.
3. Work hard = 0.75C – $100 > 0.5C = shirk; equivalently, 0.25C > $100 or C > $400
4. Even if its contribution margin is greater than $400, it still may find it more profitable to settle for shirking at lower commissions.

SECTION 6

Organizational Design



CHAPTER 21

Getting Employees to Work in the Firm's Best Interests

In the late 1990s, a large auction house, Auction Services International (ASI), employed art experts to keep track of art from various "schools"—French Impressionism, American Realism, and the like. Each expert's job was to persuade art owners to use ASI's auction services to sell their art. ASI earned money by charging the art owners a percentage of the final price at auction. The art expert negotiated this rate or "price" with the art owners.

The negotiated rates were supposed to vary from 10% to 30%, depending on the art expert's assessment of the seller's willingness to pay. Instead, most of these negotiations yielded relatively low rates, much closer to 10% than 30%. Puzzled, ASI's CEO did some investigating and discovered that the art experts were discounting rates in exchange for gifts from the sellers—cases of fine wine, fur coats, even luxury cars. After she found out about these kickbacks, the CEO took away the experts' discretion to negotiate the rates.

The CEO's action ended the exchange of gifts for lower rates, but the experts had become accustomed to the kickbacks, considering them an important part of their compensation. Consequently, many of the art experts quit, leaving to set up their own independent galleries in direct competition with ASI.

To make matters worse, the CEO decided to set a 17% price by conspiring with a rival auction house. When the conspiracy was discovered, the CEO was sentenced to a year in jail, and the judge tacked on a $7.5 million fine, an amount calculated as 5% of the $150 million volume of commerce affected by the price-fixing conspiracy.

Had the CEO known how to motivate her employees to work in the firm's interest—the topic of this chapter—she wouldn't have needed to resort to price fixing to make her own firm profitable.

In this and the last two chapters, we come back to the original problem-solving framework of Chapter 1. Our goal is to show you the analytical roots of the framework, so that you understand why it works in addition to how it works. To do this, we begin with principal-agent models.

PRINCIPAL-AGENT RELATIONSHIPS

When we study the relationship between a firm and its employees, we use what economists call *principal-agent models*.

> ***A principal** wants an **agent** to act on her behalf. But agents often have different goals and preferences than do principals.*

In the ASI story, for example, the firm or the CEO is the principal, and the art expert is the agent. We adopt the linguistic convention that the principal is female and the agent male.

The problem the principal faces is that the agent has different incentives than does the principal—which we call **incentive conflict.** In our example, ASI's CEO wanted her art experts to negotiate profitable commission rates, whereas the art experts wanted to increase personal income, including kickbacks from customers. In general, incentive conflicts exist between every principal and every agent throughout the management hierarchy—for example, between shareholders and managers, between managers and subordinates, and between a firm and its various divisions.

Incentive conflict generates problems that should sound familiar:

> *The principal has to decide which agent to hire (adverse selection); once she hires an agent, she has to figure out how to motivate him (moral hazard).*

We know (from Chapters 19 and 20) that adverse selection and moral hazard problems are costly to control. In fact, the costs associated with moral hazard and adverse selection are called **agency costs** because we analyze them using principal-agent models. A well-run firm will find ways to reduce agency costs; poorly run firms often blindly incur agency costs or unwittingly make decisions that increase them.

We also know that we can reduce the costs of adverse selection or moral hazard by gathering information about the agent:

> *A principal can reduce agency costs if she gathers information about the agent's type (adverse selection) or about the agent's actions (moral hazard).*

For adverse selection, information gathering means checking the background of agents *before* they're hired; and for moral hazard, information gathering means monitoring the agents' actions *after* they're hired. This difference has led some to characterize adverse selection as a *pre*-contractual problem caused by hidden information and moral hazard as a *post*-contractual problem caused by hidden actions.

At ASI, for example, had the CEO known when agents were reducing rates in exchange for gifts, she might have devised a simple incentive compensation scheme (a reward or a punishment) to stop it. But even without this information, she should have anticipated the art experts' opportunistic behavior, especially since she was paying them flat salaries—compensation unrelated to performance. Because ASI failed to compensate the art experts to set profitable rates, the art owners found it easy to bribe them to set unprofitable ones.

When the CEO decided to take away rate-setting discretion from the art experts, she compounded her initial mistake. This solution was costly because the CEO lacked information about what rates owners were willing to pay, information that was critical to setting profitable rates. Instead, she tried her "17% solution," the collusive rate set with her rival.

A better solution would have been to leave the rate-setting authority with the art experts but change to an incentive compensation scheme—for example, to one that paid art

experts a percentage of the revenue they bring to the firm. This kind of compensation scheme better aligns the agents' incentives with the firm's goals. If the agents set profitable rates, they'll increase both the firm's profit and their own compensation. If you think of the art experts as salespeople, this incentive compensation scheme seems like an obvious solution—most salespeople are compensated with sales commissions.

This solution does have one drawback: like all incentive compensation schemes, it exposes the agents to risk. In this case, should the economy decline, the firm would sell fewer art pieces, and the art experts' compensation would fall through no fault of their own.

If you are the principal, imposing risk on the agent may not seem like your problem, but we know (from Chapter 9) that salespeople must be compensated for bearing risk. This raises the principal's cost of using an incentive compensation scheme.

Incentive compensation imposes risk on the agent for which he must be compensated.

The risk of incentive compensation reminds us that most solutions to the problems of adverse selection and moral hazard involve trade-offs. We adopt incentive compensation only if its benefits (the agent works harder) exceed its costs (we have to compensate the agent for bearing risk). We measure these costs and benefits relative to the status quo or relative to other potential solutions.

PRINCIPLES FOR CONTROLLING INCENTIVE CONFLICT

We don't have any hard and fast rules for the best way to control incentive conflicts between principals and agents, but we can identify the trade-offs associated with various solutions. Once you understand the basic trade-offs, it is easier to identify the costs and benefits of various solutions.

Let's start by describing an ideal organization whose agents always make decisions in the best interests of their principals:

In a well-run organization, decision makers have (1) the information necessary to make good decisions and (2) the incentive to do so.

To ensure that decision makers have enough information to make good decisions, there are two obvious solutions:

Either move information to those who are making decisions or move decision-making authority to those who have information.

Typically, though not always, information enters a firm from the bottom so that subordinates (who are further down in the management hierarchy) are better informed than their bosses. In the case of ASI, the art experts, but not the CEO, knew how much clients were willing to pay. When the CEO *centralized* decision-making authority to set rates, her company lost the ability to price discriminate between high- and low-value customers.

When you centralize decision-making authority, you should also figure out how to transfer information to the decision maker.

This is not so easy to do. Information comes from self-interested parties who may have an incentive to manipulate the decision maker. For example, sales agents often tell their marketing bosses that they have to reduce price in order to make a sale. They have an incentive to lie if they are paid using a sales commission or, in the case of ASI, kickbacks.

The other solution, leaving pricing discretion with the art expert, *decentralizes* decision-making authority.

When you decentralize decision-making authority, you should also strengthen incentive compensation schemes.

The logic is clear. Once you give an agent authority to make decisions, you want to make sure that he is motivated to make choices in the firm's best interest. At ASI, the weak incentives were obvious—the art experts were given no financial incentive to set profitable rates. The CEO should have adopted an incentive compensation scheme to encourage more profitable rate setting.

Recall from Chapter 1 that incentives have two parts: Before you can reward good behavior, you have to be able to measure it. You can measure performance informally, with some kind of subjective performance evaluation, or formally, using sales or profitability as performance metrics. Once you have an adequate performance measure, you create incentives by linking compensation to the performance metrics. Here, we speak very generally about compensation: Compensation can be pay, increased likelihood of promotion, bonuses, or anything else that employees value. The link between performance and compensation creates the incentive for agents to act in the firm's best interest.

Designing good incentive compensation schemes is challenging. Take a simple example of a fruit farmer trying to decide how to pay pickers. The obvious solution is to pay workers a piece rate based on the number of pieces picked. A complicating factor is that the rate has to be increased when pickings are slim to ensure that the workers earn the minimum wage required by law. Under this system, however, workers monitor each other to discourage fast picking, resulting in the piece rate being raised. This defeats the point of the incentive compensation scheme. One solution to this problem is to have managers test-pick a field to gauge the difficulty of picking and then set the piece rate based on the results of the test-pick.[1] The lesson of this story is to realize that workers have an incentive to "game" compensation schemes. First, try to anticipate the more obvious games and adjust the compensation scheme to prevent them. Second, monitor outcomes to ensure that you are getting the behaviors you really want. Monitoring gives the principal a better performance evaluation metric, which allows her to better align the incentives of the agent with the goals of the principal.

In the case of ASI, it looks like decentralization, but with stronger incentives, would have been the better solution. In general, the answer to whether centralization or decentralization is better depends on the relative cost of the two alternatives. If you want to centralize decision making, how costly will it be to transfer information from agents to principals? If you want to decentralize, how costly will it be to institute incentives that adequately compensate agents for bearing risk?

MARKETING VERSUS SALES

The conflict between the art experts and their employer is fairly typical of the general incentive conflict that arises in organizations with separate sales and marketing divisions. The two divisions rarely get along. For example, consider a large telecommunications equipment company, among whose customers are various government agencies that operate or regulate the telecommunications sector. In this company, the conflict manifests itself as a dispute over what price to charge: Sales agents want to price aggressively to ensure that they make the sales; marketing people, however, want less aggressive pricing to ensure that the sales are profitable.

The incentive conflict arises because marketing managers receive stock options or profitability bonuses as compensation, whereas salespeople receive commissions based on revenue. They disagree about what price to charge because the marketing principal wants to maximize profitability—that is, by making sales where MR > MC. In contrast, the sales agent wants to maximize revenue by making sales where MR > 0. This means that the salesperson prefers more sales or, equivalently, lower prices.

If the marketing managers *know* when salespeople are making unprofitable sales, they can easily put a stop to it. Without that information, controlling the incentive conflict becomes costly.

To see why, put yourself in the place of a marketing manager who is overseeing a salesperson who tells you that he *has* to reduce price to make a particularly tough sale. Because you don't know how much each customer is willing to pay, you can't tell whether the salesperson wants to reduce price to make a particularly tough sale (which would be reasonable from the firm's perspective) or whether he's actually reducing price because he cares only about revenue, not about profit.

Since it seems easy to design an incentive compensation scheme that rewards the salesperson for increasing profitability rather than revenue, we have to wonder why this kind of incentive compensation is not more widely used. Most salespeople will tell you they prefer performance evaluations based on revenue because revenue is what they directly control. They also may perceive a change from a sales commission to profit commission as a sneaky way for the company to cut labor costs. Remember that profit is always lower than revenue.

You should be able to persuade the sales agent to accept the change to a profit commission if you design the profit-based compensation scheme to be "revenue-neutral" to the salesperson. For example, a 20% commission on profit is equivalent to a 10% commission on revenue if the contribution margin is 50%. Agents are guaranteed to earn the same under each compensation scheme, even if their behavior does not change. But because they can earn more money if they change behavior (by pricing less aggressively), their compensation should increase under a commission based on profit, or net sales.

You often see companies trying to control incentive conflicts simply by asking sales agents to change their behavior—but actions (and paychecks) speak much louder than words. The sales agents will change behavior only when they have incentives to do so. A profit commission gives them the incentive to make sales where MR > MC.

Another common solution is to require sales agents to obtain permission to reduce price below some specific threshold. To obtain permission to reduce price, sales agents would have to provide their supervisors that the price reduction is necessary. If enough information is transferred to the marketing manager so that she can prevent sales agents from making unprofitable price reductions, then this solution can work well. It won't work well if the marketing manager has to rely on information coming from sales agents who have an incentive to manipulate her decisions.

FRANCHISING

We can understand the growth of franchising in the United States over the past 50 years as a solution to a particular principal-agent incentive conflict. The principal is the parent company that owns a popular brand, like McDonald's. As the company grows, it has a choice—it can

open up company-owned stores, or it can let franchisees open and run stores. The franchisees then pay the company a fee for the right to use the parent company's brand.

Suppose you are advising the owner of a fast-food restaurant chain. This chain's owner is trying to decide whether to sell one of its company-owned restaurants, currently run by a salaried manager, to a franchisee. If the chain sells the store, the franchisee will manage it and pay the owner a fixed franchise fee for permission to use the brand. Should the owner sell the store?

Of course, the answer is "It depends." In this case, it depends on whether the asset is moving to a higher-valued use, and this depends on whether the franchise organizational form is more profitable than the company-owned organizational form. With the company-owned structure, managers don't work as hard as they would if they owned the restaurant (moral hazard), and the salaried management job may have attracted a lazy manager (adverse selection).

These agency costs disappear once a franchisee owns the restaurant because the agent and the principal become one and the same. The franchisee works harder than a salaried manager because he gets to keep all profit after paying off his costs—including the franchise fee—and industrious franchisees will outbid lazy ones for the right to run a franchised restaurant. Running a franchised store can be thought of as a strong form of incentive compensation—you turn a manager into an owner (franchisee) when you give him the residual profit from running the store.

However, the franchisee faces more risk than does a salaried manager and, as a consequence, will demand compensation in the form of a lower franchise fee. If the franchisee demands too much for bearing risk, then the restaurant could be more valuable as a company-owned store than it is as a franchise.[2]

Jointly, the parties can split a larger profit pie if they can figure out how to balance these concerns. At one extreme, the company-owned store with a salaried manager leads to shirking on the part of the agent—a type of moral hazard. As mentioned above, it also leads to adverse selection because salaried jobs are more likely to attract lazy managers. The company may also incur costs to monitor the managers' actions.

At the other extreme, the franchise organizational form is analogous to an incentive-compensation scheme because the franchisee keeps every dollar he earns after paying off his costs. But if factors other than effort affect profit, this kind of incentive compensation also imposes extra risk on the agent for which he must be compensated.

Sharing contracts fall between these two extremes. Instead of a fixed franchise fee, the franchisor might demand a percentage of the revenue or profit of the restaurant. This arrangement reduces franchisee risk by reducing the amount the franchisee pays to the franchisor when the store does poorly. However, sharing contracts may also encourage some shirking because the franchisee no longer keeps every dollar he earns. In other words, a sharing arrangement reduces the benefit (MR) of effort.

A FRAMEWORK FOR DIAGNOSING AND SOLVING PROBLEMS

Understanding the trade-offs between information and incentives is useful, but it still doesn't tell you how to identify and fix specific problems within an organization. For that you need to be able to find the source of the incentive conflict and come up with specific alternatives to reduce the associated agency costs. Then choose the alternative that gives you the highest profit.

To analyze principal-agent problems, we return to the problem-solving framework introduced in Chapter 1. First, reduce the problem to a bad decision, and then ask three questions:

1. Who is making the (bad) decision?
2. Does the decision maker have enough information to make a good decision?
3. Does the decision maker have the incentive to do so—that is, how is the decision maker evaluated and compensated?

The first question identifies the source of the problem; the second and third examine the employee's information and incentives. Remember that incentives have two parts: The performance evaluation scheme measures whether the individual is doing a good job; the compensation scheme ties rewards to performance.

Let's answer the three questions for the ASI example:

1. *Who is making the bad decision?* The art experts. They were negotiating rates that were too low.
2. *Did the decision makers have enough information to make good decisions?* Yes—in fact, they were the only ones with enough information to set profitable rates.
3. *Did the decision makers have the incentive to make good decisions?* No. The art experts received a flat salary, making it relatively easy for art owners to bribe them with gifts.

In general, answers to the three questions will suggest alternatives for reducing agency costs in three general ways: by (1) changing decision rights, (2) transferring information, and/or (3) changing incentives. In this case, we have two obvious solutions: Leave rate-setting authority with the art experts, but adopt stronger incentive compensation; or transfer rate-setting authority to a marketing executive, and then transfer crucial information to her. The first is a *decentralization* solution, and the second is a *centralization* solution.

To see how well you understand how to use the framework, imagine that you are called in as a consultant to a large retail chain of "general stores" that target low-income customers in cities having fewer than 50,000 people. As the company has grown, the CEO and the stock analysts who follow the company have noticed that newly opened stores are not meeting sales projections. The CEO wants you to find out what's causing the problem and fix it.

In the course of your investigation, you learn that the company uses "development" agents to find new store locations and negotiate leases with property owners. The company rewards these agents with generous stock options, provided they open 50 new stores in a single year. Although agents are supposed to open new stores only if the sales potential is at least $1 million per year, this is obviously not happening. Newly opened stores earn just half that amount.

---------- *Before continuing, try to identify the problem.* ----------

Begin your analysis by asking the three questions.

1. *Who is making the bad decision?* The development agents. They are opening unprofitable stores.
2. *Do they have enough information to make a good decision?* Yes. The development agents probably have access to information about whether the new stores would be profitable.

3. *Do they have the incentive to do so?* No. The agents received stock options for opening 50 stores each year, regardless of the new stores' profitability.

The problem is not with information but rather with the incentives of the agent, who is rewarded for opening stores regardless of profitability. Before you continue, suggest at least two solutions to the problem and choose the best one.

---------- *Before continuing, try to fix the problem.* ----------

You have at least two obvious solutions:

1. (Decentralization) The company could change the incentives of the development agents by rewarding them for opening only *profitable* stores.
2. (Centralization) Alternatively, the company could oversee the decision to open stores from agents and then gather its own information about the potential profitability of new store sites.

The decentralization solution would leave decision-making authority with the agents, who have specialized knowledge about the profitability of locations for new stores. But the agents would have to wait for a year of store operation before receiving compensation (at which point, they know whether the store made $1 million in sales). In addition, this solution exposes the agents to risk beyond their control—their compensation would depend on the behavior of the store manager, as well as on the state of the economy. The agent would have to be compensated for bearing this risk in the form of higher compensation, which is the usual trade-off between incentive compensation and risk.

In this case, the general store chain chose the centralization option. It developed a forecasting model to predict the profitability of new stores based on local demographic information and the locations of rival stores. Agents were allowed to open new store locations only if the model predicted sales exceeding $1 million.

If the model is good at predicting which stores are likely to be profitable, this solution will work well. But if the model cannot identify profitable locations, it will be a poor substitute for the agents' specialized knowledge or intuition about which new store locations are likely to be profitable. It will make both type I errors (open unprofitable stores) and type II errors (fail to open profitable stores). As you should recall from our discussion of minimizing expected error costs in Chapter 17, if the error costs are asymmetric (it is more costly to open an unprofitable store), "shade" your prediction threshold to avoid the more costly error (raise the predicted thresholds for opening stores). In this case, the model predicted well, and the problem disappeared.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- **Principals** want **agents** to work in the principals' best interests, but agents typically have different goals from those of principals. This is called **incentive conflict.**
- Incentive conflict and asymmetric information leads to *moral hazard* and *adverse selection.*
- The costs of controlling incentive conflict go down if the principal can gather information about the agent's productivity (adverse selection) and about his actions (moral hazard).
- Three approaches to controlling incentive conflicts are
  1. fixed payment and monitoring (shirking, adverse selection, and monitoring costs),
  2. incentive pay and no monitoring (must compensate agents for bearing risk), or

3. sharing contract and some monitoring (some agency costs and some risk compensation).

- In a well-run organization, decision makers have (1) the information necessary to make good decisions and (2) the incentive to do so.
  - If you decentralize decision-making authority, you should strengthen incentive compensation schemes.
  - If you centralize decision-making authority, you should make sure to transfer needed information to the decision makers.
- To analyze principal-agent conflicts, focus on three questions:
  1. Who is making the (bad) decisions?
  2. Does the decision maker have enough information to make good decisions?
  3. Does the decision maker have the incentive to make good decisions?
- Alternatives for controlling principal-agent conflicts center on one of the following:
  - Reassigning decision rights
  - Transferring information
  - Changing incentives

Multiple-Choice Questions

1. Your notebook computer's hard drive recently crashed, and you decide to take it to a local repair technician to have it fixed. In this relationship,
   a. you are the agent.
   b. the technician is the principal.
   c. the technician is the agent.
   d. no principal-agent relationship exists.
2. Employee compensation can come in the form of
   a. paid time off.
   b. stock options.
   c. monetary bonuses.
   d. All of the above
3. Principal-agent relationships
   a. reduce monitoring costs.
   b. occur because managers have good information about employees.
   c. are not related to asymmetric information.
   d. are subject to moral hazard problems.
4. Agency costs include costs associated with
   a. adverse selection.
   b. moral hazard.
   c. compensation for bearing risk.
   d. all of the above.
5. Principal-agent problems
   a. occur when firm managers have more incentive to maximize profit than shareholders do.
   b. help explain why equity investments are an important financing source for firms.
   c. would not arise if firm owners had complete information about the actions of the firm's managers.
   d. are increased as more information is shared between the parties.
6. In order to create an effective incentive compensation scheme, you must have
   a. adequate performance measures.
   b. unlimited funds.
   c. a flat management structure.
   d. None of the above
7. Decentralization of decision-making authority is supported by which of the following?
   a. A trend of stronger, more active CEOs
   b. Shrinking costs of computing bandwidth, which allows information to be inexpensively aggregated from geographically diverse business units
   c. Development of microcomputing resources at the corporate, division, and employee level
   d. Reduction in the use of incentive compensation
8. A firm faces two kinds of employees, those able to sell 10 units/year, and those able to sell 5 units/year. High productivity employees are willing to work for $100/year while low productivity employees are willing to work for only $50/year. To screen out the low productivity employees, the firm should
   a. offer a salary of $100.
   b. offer a salary of $75 plus $5/unit commission.

c. offer sales commission of $10/unit.
d. offer a sales commission of $20/unit, on sales above 5 units.

9. You own a retail establishment run by a store manager who receives a flat salary of $80,000. If you set up another store as a franchise with incentive compensation to the franchisee, what would be a reasonable total compensation range that the franchisee could earn?
   a. $80,000
   b. $40,000–$80,000
   c. $60,000–$100,000
   d. $80,000–$100,000
10. In the magazine *Budget Travel*, a hotel maid admits, "I cut corners everywhere I could. Instead of vacuuming, I found that just picking up the larger crumbs from the carpet would do. Rather than scrub the tub with hot water, sometimes it was just a spray-and-wipe kind of day.... After several weeks on the job, I discovered that the staff leader who inspected the rooms couldn't tell the difference between a clean sink and one that was simply dry, so I would often just run a rag over the wet spots.... I apologize to you now if you ever stayed in one of my rooms." Which of the following organizational forms is more likely to have caused this kind of shirking?
   a. Franchising: where the hotel managers are the owners of the hotel (franchisee) and pay a fixed franchise fee
   b. Company-owned hotels
   c. Franchising with a sharing contract, where the hotel managers are the owners of the hotel (franchisee), but they pay a smaller fixed fee to the franchisor, but share revenue with the franchisor
   d. None of the above

Individual Problems

21-1 Real Estate Agents

When real estate agents sell their own, rather than clients', houses, they leave the houses on the market for a longer time (10 days longer on average) and wind up with better prices (2% higher on average). Why?

21-2 Friendly Contractors

Often building supply retail store employees become friendly with their customers (building contractors) and will do them favors. For example, they might charge customers for 90% of the flooring material being purchased, or they might hide the last of a unique flooring material for the contractor while passing on sales to others. Would the retailer treat these two favors differently?

21-3 Incentive Conflicts

Which of the following are characteristic of *principal-agent conflicts* that often exist in a firm? (*Note:* The entire statement must be true in order to be a correct answer.)

a. Managers do not always operate in the best interest of owners because owners are generally more risk averse than managers.
b. Managers generally have a shorter time horizon than owners; thus, managers do not fully take into account the future long-run profitability of the firm.
c. Managers do not always operate in the best interest of owners because managers care about the non-cash benefits of their jobs.
d. Firms can usually find solutions that reduce agency costs without increasing monitoring or incentive costs.

21-4 Public School Principals

Each year, public schools are rewarded with bigger budgets for achieving a rating of "excellent" or "recommended" and are punished for rating "needs improvement." These ratings are based on meeting thresholds on a broad set of measures such as attendance rates, graduation rates, standardized test scores, SAT scores, etc. Discuss the incentives for principals under this scheme and how you might improve them.

21-5 Venture Capital

Venture capital (VC) firms are pools of private capital that typically invest in small, fast-growing companies, which usually can't raise funds through other means. In exchange for this financing, the VCs receive a share of the company's equity, and the founders of the firm typically stay on and continue to manage the company.

a. Describe the nature of the incentive conflict between VCs and the managers, identifying the principal and the agent.
b. VC investments have two typical components: (1) Managers maintain some ownership in the company and often earn additional equity if the company performs well; (2) VCs demand seats on the company's board. Discuss how these two components help address the incentive conflict.

21-6 Meeting Milestones

A convenience store manager earns a base salary plus small bonuses for each of ten different possible monthly milestones he meets. Typical managers can meet half of these milestones. Do they miss the others by a little or a lot?

Group Problems

G21-1 Incentive Conflict

Describe an incentive conflict in your company. What is the source of the conflict, and how is it being controlled? Could you control it in a less costly way? Compute the profit consequences of the change.

G21-2 Incentive Pay

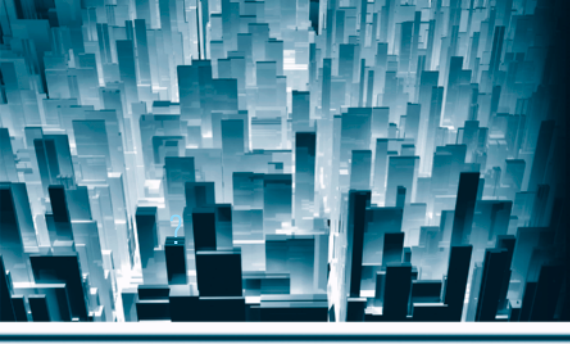
Describe a job compensated with incentive pay in your company. What performance evaluation metric is used, and how is it tied to compensation? Does this compensation scheme align the incentives of the employee with the goals of the company? Estimate the profit consequences of the scheme relative to the next best alternative.

G21-3 Centralization versus Decentralization

Describe a decision that is centralized (or decentralized) in your company. How could you decentralize (or centralize) the decision? What would happen if it were decentralized (or centralized)? Compute the profit consequences of the change.

END NOTES

1. For more on the incentive compensation challenges and solutions in fruit farming, see Tim Harford, "The Fruits of Their Labors," *Slate,* August 23, 2008, http://www.slate.com/id/2197735/.
2. The variability of franchisee profit represents risk, and the franchisee must be compensated for bearing this risk. Note also that the franchisor needs to be aware of the incentive conflict regarding quality. Franchisees have an incentive to free ride on the brand name of the franchisor by reducing quality.



CHAPTER 22

Getting Divisions to Work in the Firm's Best Interests

Black liquor soap is a by-product of the paper manufacturing process at Acme's Paper Division. The Paper Division normally sold the soap to Acme's Resins Division, which converted it into crude tall oil, an input into resin manufacturing. The parent company of the two divisions decided the transfer price for the soap. Since a low transfer price increased the Resins Division's profit, its managers spent a lot of effort lobbying for a low transfer price while the Paper Division pushed for a high transfer price.

The Resins Division "won" this lobbying battle when a relatively low price was set, but it turned out to be a hollow victory. Instead of transferring the soap, the Paper Division decided to burn it for fuel. This raised the Paper Division's profit because the value of soap as a fuel was higher than the transfer price, but it decreased the Resins Division's profit because it was forced to purchase higher-priced soap on the open market. On net, burning the soap decreased overall company profit because black liquor soap was less valuable as fuel than it was as an input into resin manufacturing.

To make matters worse, the Paper Division's burners were not designed to handle black liquor soap, leading to a potentially explosive situation. Fortunately, corporate headquarters recognized the danger before any catastrophes; however, their "solution" to the problem was to spend $5 million for a special furnace to allow the Paper Division to safely burn the soap.

The moral of this story is that incentive conflict between divisions is costly to control. In this case, a low transfer price not only prevented the movement of an asset (black liquor soap) to a higher-valued use (resin manufacturing), but the parent company compounded its mistake by building a new furnace. In addition, lobbying by the two divisions diverted management attention from more pressing concerns. All of these costs could have been reduced, if not avoided, had the managers of Acme read this chapter.

INCENTIVE CONFLICT BETWEEN DIVISIONS

Incentive conflicts arise in the normal course of business; however, these conflicts need not reduce a company's profit. Without much extra work, we can apply the framework set up in Chapter 21 to make sure that the incentives of the various divisions are aligned with the goals of the parent company. Instead of focusing on incentive conflict between employers (principals) and employees (agents), in this chapter we focus on the incentive conflict between a parent company (principal) and its various subdivisions (agents). We "personify" the divisions and think of them as rational, self-interested actors. As in Chapter 21, we begin with the decision that is causing the problem. The problem we are interested here is whether assets are moving to their highest-valued use. If not, we ask the same three questions to identify the cause:

1. Which division is making the bad decision?
2. Does the division have enough information to make a good decision?
3. Does it have the incentive to do so?

To understand division managers' incentives, we have to understand how the parent company evaluates the performance of each division and how each division manager's compensation is tied to its division performance.

It seems likely that the incentive conflict between the Resins Division and Paper Division arose because the transfer price raised the profit of one division while simultaneously reducing the profit of the other. Otherwise, the transfer price would not have been a source of conflict. From this we can infer that the parent company treated each division as a separate profit center.

*A **profit center** is a division that is evaluated based on the profit it earns.*

Treating divisions as profit centers and rewarding managers based on division profit has a number of virtues. First, it often makes sense to assign some decision-making authority to division managers because they have the best information about how to run their divisions. As part of the assignment of decision-making authority, we also want to give these managers incentives to make good decisions for the division. Another virtue of a profit center is that it largely runs by itself and doesn't require a lot of parent company involvement. The parent company looks at division revenue, subtracts division costs, and rewards managers based on the difference. Division managers are given a lot of discretion because the parent company has a good performance evaluation metric, and it's relatively easy to tie management pay to division performance.

However, maximizing division profit can sometimes reduce company-wide profit. Let's see how well our framework does in diagnosing the problem of the black liquor soap not moving to its highest-valued use:

1. *Who is making the bad decision?* The Paper Division decided to burn the soap for fuel instead of transferring it to the Resins Division.[1]
2. *Did they have enough information to make a good decision?* Yes, they knew that the soap's value as fuel was below its value as an input to resin manufacturing.
3. *Did they have the incentive to make a good decision?* No. The Paper Division received a reward for increasing division profit, not the profit of the parent company.

Our problem-solving framework tells us that the Paper Division's incentives were not aligned with the profitability goals of the parent company.

Once you understand the problem, try to solve it by moving information, altering incentives, or changing decision rights. One obvious solution is simply to give information to senior management that would allow them to set a better transfer price. But where does senior management of the parent company get the information necessary to set a good transfer price? If they have to rely on reports from interested parties, like the buying and selling divisions, they are likely to see only information favorable to one side or the other. This solution only shifts the divisions' attention away from lobbying for a favorable price to attempting to produce more favorable information.[2]

Another possible solution is to alter the incentives of the Paper Division so that it is evaluated based on parent company profit. Although this might eliminate the incentive conflict over the transfer price, it might create a free-riding problem. Division managers would exert less effort because they have less control over parent company profit compared to division profit.[3]

Another solution would be to change the decision rights by giving the Paper Division managers the right to sell black liquor soap to the external market if they couldn't negotiate favorable terms with Resins. With this simple organizational change, the Paper Division would burn the soap only if the Resins Division was not willing to pay very much. And this is exactly the decision that maximizes parent company profit. Additionally, this organizational change means that senior management need not spend time resolving disputes between divisions about the transfer price.

Choosing the best solution depends on the magnitude of all the costs and benefits of the various solutions. From what we know, this last solution appears to be the best.

This story has a happy ending (and no explosions). Soon after the company had the burners redesigned to handle black liquor soap, an increase in the price of energy raised the soap's value as a fuel, making it profitable for the Paper Division to burn it. So the company's initial mistake became profitable, thanks to an unforeseen increase in the price of energy. In other words, Acme got lucky. But once the price of energy falls, the problem will reappear, so it is still important to try to address it.

TRANSFER PRICING

Transfer pricing is a contentious issue for almost any company in which buying and selling occurs between divisions. Together with corporate budgeting (a topic we'll cover later in this chapter), transfer pricing causes more conflict between divisions than almost any other issue. To illustrate a more typical transfer pricing conflict, let's return to our paper company and examine the transfer of paper from the upstream Paper Division to the downstream Cardboard Box Division. Paper is the most expensive input into box fabrication.

When two profit centers negotiate a transfer price, sometimes the divisions bargain so hard that they reach an impasse. And sometimes, the downstream Box Division will purchase from an external supplier, even though the parent company would prefer that the Box Division purchase from the Paper Division. And finally, even if the divisions reach agreement, the cost of interdivision haggling may exceed any benefit the parent company derives from the transfer.

In this case, the two divisions agreed on a transfer price that was 25% higher than the marginal costs of the Paper Division. Although this price ensured that the Paper Division found it profitable to transfer paper to the Box Division, it also raised the costs of the downstream Box Division, making the boxes difficult to sell.

To understand the effects of a high transfer price, look at Figure 22-1. The Paper Division produces paper at a marginal cost of $100 and transfers the paper to the Box Division at a price of $125. The downstream Box Division counts the transfer price as part of its costs and then makes all sales where MR > MC + $25. The $25 represents the markup that Paper Division builds into the transfer price, and MC is the marginal cost of producing boxes. This is a higher threshold for making sales than the profit-maximizing threshold, MR > MC. In other words, under this scheme, the Box Division makes fewer sales, and charges higher prices, than would maximize parent company profit. As a result, both the Paper Division and the Box Division sell less paper and fewer boxes than they should.

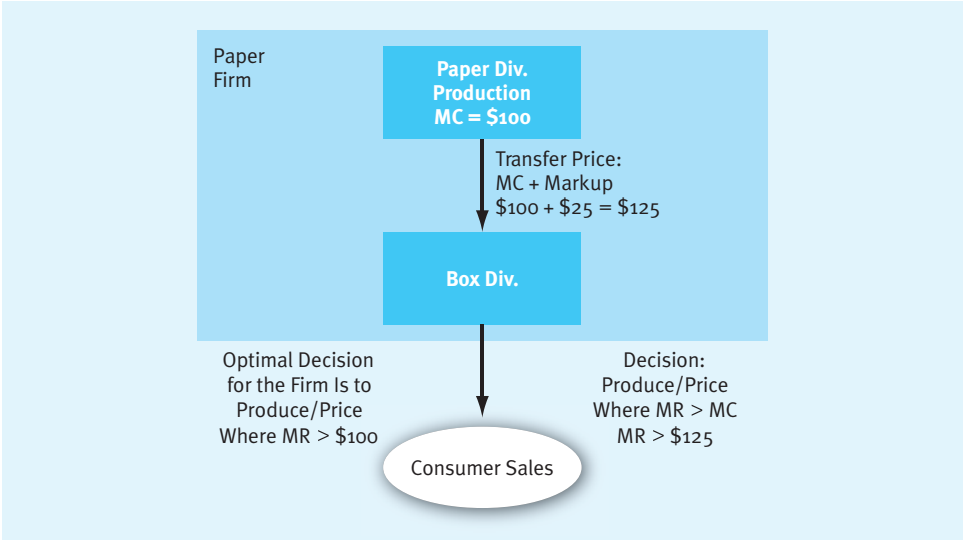


FIGURE **22.1 Transfer Pricing**

Note that this problem is the opposite of the one faced by a marketing division in Chapter 21. There, the sales agents made *more* sales and charged *lower* prices than those that would have maximized company-wide profit.

Let's see how well our framework does in analyzing this problem:

1. *Who is making the bad decision?* The Paper Division is charging too much for paper. This raises the cost of the downstream boxes, reducing downstream sales and profit.
2. *Did the division have enough information to make a good decision?* Yes. Paper Division managers are familiar enough with the parent company's operations to know better.
3. *Did the division have the incentive to do so?* No. The divisions are run as separate profit centers, so they work to increase profit of their own divisions, even if it means reducing parent company profit.

The analysis makes clear that the conflict arises because two profit centers are each trying to extract profit from a single product. For this reason, we call this the "double markup" problem. One way of solving it would be to turn the upstream Paper Division into a cost center.

*A **cost center** is rewarded for reducing the cost of producing a specified output.*

Cost centers are not evaluated based on the profit they earn, so they don't care about the transfer price. If the Paper Division became a cost center, its managers would not object to transferring paper at marginal cost. And this would cause the downstream division to reduce box prices to their profit-maximizing level.

But cost centers have other problems. For example, the cost center may try to reduce cost by reducing quality, so the company may have to add a quality control and testing facility to the factory. As long as this kind of monitoring is not too costly, the cost center may be the best solution. As always, the right answer depends on the magnitude of the benefits and costs of the alternative solutions.

As we might expect, once our Paper Division became a cost center and began transferring paper at marginal cost, the Box Division began winning more jobs from its rivals. Ironically, though, the Box Division's success set off a price war in the industry that lasted for five years. The previous inefficient organizational form had the hidden benefit of softening price competition with rival box producers, the third of our generic strategies from Chapter 10.[4] This underscores another lesson for decision makers—make sure that you can predict all of the consequences of changes before you make them.

FUNCTIONAL SILOS VERSUS PROCESS TEAMS

Many firms are organized into functional divisions. Adam Smith's pin factory and Henry Ford's automobile assembly line are classic examples of production processes that divide tasks into narrow functional steps.

*A **functionally organized firm** is one in which various divisions perform separate tasks, such as production and sales.*

Functional organization offers firms the advantage that workers develop functional expertise and can easily share information within their division. This setup also fosters exploitation of economies of scale inside the function because all of the activities of a particular function are concentrated together. For example, a global consumer products manufacturer might choose to centralize all its R&D activity in order to capture economies of scale and learning curve effects rather than have separate R&D facilities across the globe. Functional divisions also make it easy to tie pay to performance because performance is narrowly defined and thus relatively easy to measure. *Piece-rate pay*—compensation based on the number of units a worker produces—is an example of such a simple performance evaluation metric.

The major difficulty in running a functionally organized firm is ensuring that the functional divisions are working toward a common goal.[5] Consider the problems faced by a functionally organized company when it designed a new turbine jet engine. The Engineering Division designed the engine, the Production Division manufactured it, and the Finance Division decided how much to charge for it. The engineers came up with a radical new design incorporating hollow fan blades. The award-winning design required less fuel than conventional engines, but the hollow fan blades were very difficult to build. When the Finance Division computed the operating costs of the engine, it discovered that the new engines were much more expensive to buy and operate than rival engines, even after accounting for the expected fuel savings. The lack of coordination between the divisions resulted in a product whose total cost was higher than its value.

A similar coordination problem arose at a midsized regional bank divided into a Loan Origination Division (LOD) and a Loan Servicing Division (LSD). The LOD identifies

potential borrowers, lends money to them, and then hands them over to the LSD. The LSD collects interest on the loan and makes sure that borrowers repay the loans as payments come due. However, the bank suffered an unusually high number of defaults.

Again, let's use our framework to diagnose the problem:

1. *Who is making the bad decision?* The LOD was making risky loans that resulted in a high number of defaults.
2. *Did the LOD have enough information to make a good decision?* The LOD could have verified the credit status of the borrowers.
3. *Did the LOD have the incentive to do so?* The parent bank evaluated the LOD managers on the amount of money they were able to lend. They had no incentive to restrict lending to qualified borrowers.

In other words, the LOD made loans regardless of their profitability.

We could change the incentives of the LOD so that its managers are rewarded for making only profitable loans. This would be difficult to implement because it may take many years before a bank knows whether loans are unprofitable, and then only when borrowers don't repay them.

We could adopt a solution similar to the one used by the General Store from Chapter 21 whose development agents were opening unprofitable stores. If we could design a good predictor of whether a loan would be profitable, we could let the LOD make loans only when the model predicts a good chance of repayment.

Another solution, and one that banks commonly use, is to put the origination and servicing personnel in the same division, essentially reorganizing the bank into an M-form or multidivisional company with process teams built around a multifunction task:

> *An* ***M-form firm*** *is one whose divisions perform all the tasks necessary to serve customers of a particular product or in a particular geographic area.*

In a bank, an M-form reorganization might consist of two divisions: one focused on both originating and servicing residential loans and the other focused on commercial loans. In each division, the profit of the loans originated and served would determine the managers' evaluation and subsequent compensation.

In fact, our bank decided to do just that—reorganize as an M-form. Not only did the number of bad loans decrease, but the speed of decision making increased. The M-form organization made it relatively easy for the divisions to respond to the changing conditions in local markets because its managers no longer had to coordinate with a sister division who shared responsibility for the customer. The bank also found it easier to develop long-term customer relationships because customers always dealt with the same person, whose responsibility included both origination and servicing.

The answer of whether it is better to organize as a functional or M-form organization is, of course, "it depends." Each form has particular benefits and drawbacks, and the right choice will depend on the magnitude of these costs and benefits in specific cases.

BUDGET GAMES: PAYING PEOPLE TO LIE[6]

Corporate budgets transfer information between divisions that need to coordinate with one another. Consider a toy company where the Marketing Division submits a budget that includes a forecast of the number and types of toys it expects to sell in the upcoming

holiday season. The Manufacturing Division uses the sales forecast to plan production for the coming year. An accurate sales forecast means that the company will produce the right amount and types of goods in time for the holiday demand. At least, that's how the process is supposed to work.

In reality, something very different usually occurs. It begins with the stock analysts who set profit and sales expectations for the company. If the company doesn't meet their expectations, the stock analysts downgrade the stock (e.g., from a "buy" to a "hold" or, worse, to a "sell" rating). A ratings downgrade reduces demand for the stock and causes its price to fall.

The CEO and top management understand this process and do everything they can to meet the analysts' expectations because their compensation depends on how well the stock performs. But even in cases without explicit incentive compensation, top management operates under an implied threat that the board of directors will fire them if the stock does poorly.

Consequently, senior managers use the analysts' profit forecast to set a company-wide budget for the coming year. They then assign divisional profit goals to each division, typically tied to big bonuses if these managers meet or exceed the profit goals. If the analysts have less information than the division managers, it is easy to see how this process can cause problems.

Put yourself in the place of a division manager who has good information about how much her division can earn. If her divisional budget goal is above what she thinks she can earn, she complains to senior managers that her goal is unreachable. However, regardless of her information, she always has an incentive to try to reduce the goal to make it easier to reach because her bonus is tied to reaching her profitability goal. The CEO understands her incentives and typically treats what she says with skepticism. They eventually hammer out a compromise that has more to do with the bargaining ability of the various divisional managers than about the information that they possess. As a consequence, the budget process often fails in its most basic function—transferring information from one division to another.

This lack of information can cause problems. For example, if the Marketing Division of the toy manufacturer lobbies successfully for a low sales budget, the Manufacturing Division may produce too little of a popular item just as the holiday season begins.

And the problems do not end there. Once the goal is set, a division may accelerate sales or delay costs to make sure that it can meet the goal. For example, a division's managers may ship products near the end of the year and record these shipments as sales. They do this even though they know that it is likely that the items will be returned later. This is sometimes referred to as "channel stuffing."

Alternatively, division managers who have already met their goals—or those who know they have no chance of meeting their goals—will delay sales or accelerate costs to make it easier to meet next year's budget goals. And these practices can generate real losses for the parent company. If, for example, a division tries to persuade a customer to delay purchasing a new piece of equipment, that customer might demand a discount or purchase from a rival instead of waiting to place the order.

The software industry gives us a good example of the effects of compensation schemes that adjust at different target levels. A typical salesperson earns 2% if she sells $100,000 worth of software; 5% if $500,000; 8% if $1,000,000; and up to 25% if $8,000,000. This kind of "high-powered" compensation scheme gives salespeople an incentive to try to "bunch" sales into a single quarter. Proprietary data from one large vendor showed evidence of bunching: 75% of sales occurred on the last day of the quarter 5% of sales occurred on the first day of the quarter, as salespeople gave discounts to customers to accelerate or delay purchases.[7] These discounts cost the firm about 7% of revenue, as much as they paid out in sales commissions.

Figure 22-2 shows a fairly typical compensation scheme that pays division managers a bonus when they reach a minimum profit goal (e.g., a $20,000 bonus for reaching $4 million in profit). Note the kink in the compensation scheme. This kink gives division managers an incentive to lie about the information they have in order to make the goal easier to reach.

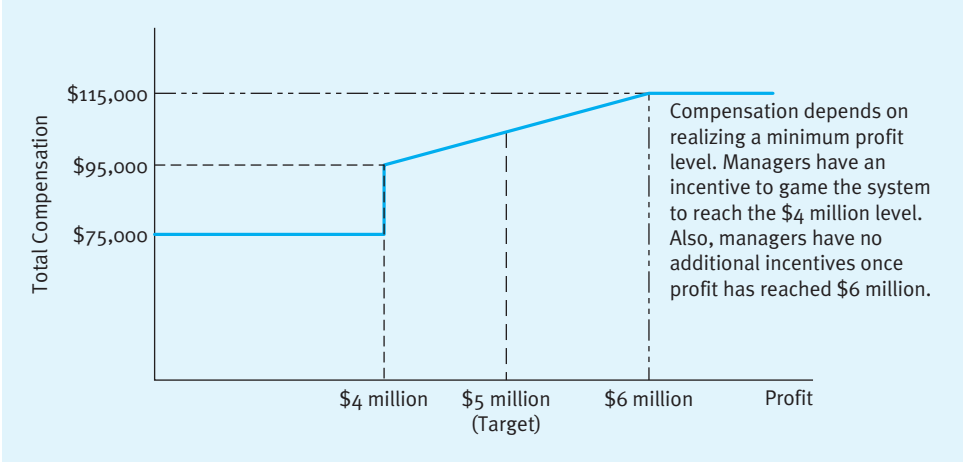


FIGURE **22.2 Typical Incentive Compensation Scheme**

Figure 22-3 shows a simple solution to this budget-gaming problem: Remove all kinks from the compensation schedule. Straight-line pay-for-performance functions eliminate division managers' incentives to lie about the budget because compensation does not depend on meeting a particular budget goal. Managers get rewards for doing more and punished for doing less, no matter where they are relative to the budget target. This compensation scheme provides incentives to increase performance while eliminating the perverse incentive to hide information.

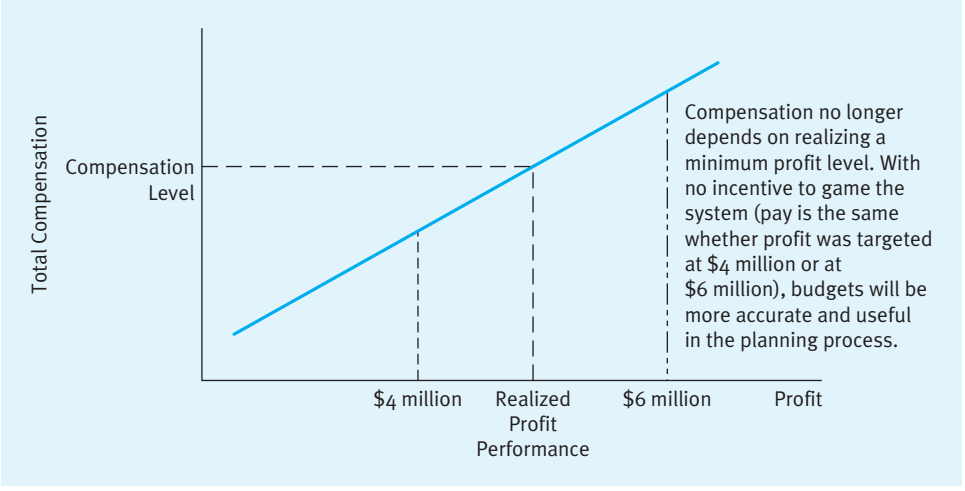


FIGURE **22.3 A Better Compensation Scheme**

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Companies are principals trying to get their divisions (agents) to work profitably in the interests of the parent company.
- Transfer pricing does not merely transfer profit from one division to another; it can stop assets from moving to higher-valued use. Efficient transfer prices are set equal to the opportunity cost of the asset being transferred.
- A **profit center** on top of another profit center can result in too few goods' being sold; one common way of addressing this problem is to change one of the profit centers into a **cost center.** This eliminates the incentive conflict (about price) between the divisions.
- Companies with functional divisions share functional expertise within a division and can more easily evaluate and reward division employees. However, change is costly, and senior management must coordinate the activities of the various divisions.
- Process teams are built around a multifunction task and are evaluated based on the success of the project on which they are working.
- When divisions are rewarded for reaching a budget threshold, they have an incentive to lie to make the threshold as low as possible, thus ensuring they get their bonuses. In addition, they will often pull sales into the present, and push costs into the future, to make sure they reach the threshold level. A simple linear compensation scheme solves this problem.

Multiple-Choice Questions

1. A computer manufacturer has two divisions: one serving residential customers and one serving business customers. If an incentive conflict arises between the two divisions, how will overall company profits be affected?
   a. Profits will definitely fall.
   b. Profits will definitely rise.
   c. Profits may fall, but it depends on the nature of the conflict.
   d. The conflict has no potential to affect overall profit.
2. Which type of organizational form has the benefit of closer coordination to serve a particular product or geographic area?
   a. Profit centers.
   b. Functional organizations.
   c. M-form organizations.
   d. Functional and M-form organizations have the same benefits.
3. Joe runs the Service Division for a car dealership. The overall dealership has profit of $10 million on sales of $100 million and costs of $90 million. Joe's division contributed $9 million in sales and $7 million in costs. If the Service Division is evaluated as a profit center, what dollar amount is most relevant to Joe?
   a. $2 million
   b. $7 million
   c. $9 million
   d. $10 million
4. As the CEO of a large multidivisional company, it falls to you to set a transfer price between your Materials Division and your Production Division. Which cost is most relevant in making your decision?
   a. Average cost
   b. Average avoidable cost
   c. Direct cost
   d. Opportunity cost
5. Why might it be a bad idea to have corporate headquarters set transfer prices?
   a. Corporate managers may not have good information about the best transfer price.
   b. It may lead division managers to provide misinformation about costs related to the transfer price.
   c. It distracts corporate managers from concentrating on larger problems.
   d. All of the above
6. Transfer prices should be set at
   a. marginal cost of the selling division plus a reasonable profit amount.
   b. marginal cost of the selling division unless it is evaluated as a profit center.
   c. the opportunity cost of the asset being transferred.
   d. at whatever price is negotiated between the selling and buying divisions.

7. Which of the following organizational forms requires the strongest management oversight to ensure coordination of functions?
   a. Profit centers.
   b. Functional organizations.
   c. M-form organizations.
   d. Functional and M-form organizations likely require similar oversight.
8. If you were a manager of a cost center, which of the following areas would be of most interest to you?
   a. Capturing potential economies of scale.
   b. Increasing the quality of your product.
   c. Hiring more marketing staff to figure out how to increase prices.
   d. Adding additional features to your product.
9. Which of the following actions is consistent with a manager whose compensation depends on meeting a budget goal and who does not believe he can make that goal?
   a. Asking a vendor to pre-ship and invoice materials for the following year.
   b. Discovering a "problem" in the order-taking process, thereby forcibly pushing sales into the ensuing year.
   c. Increasing accounting reserve estimates, leading to higher recognized expenses.
   d. All of the above
10. One of the basic functions of the budgeting process is
   a. assigning decision rights.
   b. transferring information.
   c. evaluating managerial performance.
   d. implementing structural change.

Individual Problems

22-1 Divisional Profit Measure

Discuss the advantages and disadvantages of using divisional profit as the basis of incentive compensation for division managers compared to using company profit as the basis.

22-2 Furniture Forecasting

Futura Furniture Products manufactures upscale office furniture for the "Office of the Future." The sales division is comprised of regionally based sales offices made up of sales representatives and regional managers. Sales representatives—who report to the regional managers—conduct direct sales efforts with customers in their regions. As part of the sales process, representatives gather information about likely future orders and convey that information back to the regional managers. Regional managers use that information to create sales forecasts, which are then used as the basis for manufacturing schedules.

Sales representatives and regional managers are both compensated on a salary plus commission (percentage of revenue as pricing is centrally controlled). However, a regional manager's commission is adjusted based on regional sales that exceed the forecasted budget.

Corporate managers are concerned with one of Futura's key products, the "DeskPod." They worry that DeskPod forecasts are inaccurate, causing extreme havoc in the manufacturing process. How are the forecasts likely to be inaccurate? What do you think is driving this inaccuracy? How might this problem be solved?

22-3 Chargebacks

Your local fast food chain with two dozen stores uses the company's internal corporate marketing department to produce signage, print ads, in-store displays, and so forth. When placing an order, store managers are assessed a chargeback (transfer price) that reduces store profitability but increases marketing department profitability. Lately, the store managers have been ordering more and more marketing services; the marketing department is swamped, and it cannot afford to hire more staff. What does this indicate about the chargeback rates?

22-4 Jet Turbine Design

This problem is mentioned in the text (see the section on "Functional Silos versus Process Teams"). Your task is to propose an organizational solution. To briefly recap, a manufacturer is trying to design the next generation of turbine engines for jet airplanes. The company is divided along functional lines. Engineering designs the engine, production manufactures it, and finance figures out how

much to charge for it. The engineers invented a radical new design that used hollow fan blades. The award-winning design used less fuel than conventional engines, but the hollow fan blades were very difficult to build. When the Finance Division computed the marginal cost of an engine, it discovered that the new engines were much more expensive than rival engines, even accounting for the expected fuel savings. No one purchased the engine. How would you make sure that this problem does not recur?

22-5 Bank Transfer Pricing

Banks earn money by borrowing from depositors at low interest rates and lending to individuals and businesses at high interest rates. As banks grow, they split into functional divisions that either generate deposits or make loans. To measure the profitability of each division, banks use transfer pricing. For example, if a deposit costs 5%, a loan earns 8%, and the transfer price is 6%, then the deposit division earns 1% times the size of the deposit, and the loan division earns 2% times the size of the loan. Normally, loans and deposits of shorter maturities (less than one year) earn and pay lower interest rates, whereas those of longer maturities (more than one year) pay higher interest rates. This is illustrated in the following table, which shows four types of customers: those who want 1- and 5-year loans, and those who want 1- and 5-year deposits. Assume equal numbers of each consumer type, and each wants to borrow or deposit $100,000.

	1-Year Rates	5-Year Rates
Deposits	2%	5%
Loans	4%	7%

a. If the bank sets a single transfer price between the deposit and the loan divisions, what is the profit-maximizing transfer price or range of prices and what is the bank's maximum profit? (*Hint:* The amount of total deposits must equal the amount of total loans.)

b. Do you see any problem with this kind of performance evaluation scheme? (*Hint:* What happens to bank profit if one-year rates rise?) How can the bank solve the problems by changing its performance evaluation scheme?

22-6 Transfer Pricing

Suppose that a paper mill "feeds" a downstream box mill. For the downstream mill, the *marginal profitability* of producing boxes declines with volume. For example, the first unit of boxes increases earnings by $10, the second $9, the third $8, and so on, until the tenth unit increases profit by just $1. The cost the upstream mill incurs for producing enough paper to make one unit of boxes is $3.50.

a. If the two companies are separate profit centers, and the upstream paper mill sets a single transfer price (the price the box company pays the paper mill), what price will it set, and how much money will the company make?

b. If the paper mill were forced to transfer at marginal cost, how much money would the company make?

Group Problems

G22-1 Transfer Pricing

Does your company use transfer pricing to "charge" divisions for the cost of the products they consume? Are these prices set equal to the opportunity cost of the product? Why or why not? Can you think of a better organizational architecture? Compute the profit consequences of changing the organizational architecture.

G22-2 Divisional Evaluation

Discuss a division or subunit of your organization and how it is evaluated (revenue center, profit center, cost center, etc.). How does the evaluation scheme affect performance? If it is optimal, explain why. Otherwise, explain why you think it is suboptimal, and recommend what you would do if you were free to change it. Compute the profit consequences of the change.

G22-3 Budget Games

Does your company tie compensation to meeting a budget? If so, what kinds of problems does this practice cause? What can you do to fix these problems? Compute the profit consequences of changing the process.

G22-4 Functional Silos versus Process Teams

Is your company organized around functional divisions? If so, what kind of problems does this cause? What can you do to fix these problems? Compute the profit consequences of fixing the problem.

END NOTES

1. The decision is "bad" from the perspective of the parent company because it results in lower overall profit. From the perspective of the Paper Division, the decision to burn the fuel was reasonable.
2. Using this solution would also require that you make sure senior management has the correct incentive to set a good transfer price.
3. This solution would also expose the managers to additional risk, likely requiring additional compensation.
4. See Mikhael Shor and Hui Chen, "Decentralization, Transfer Pricing and Tacit Collusion," *Contemporary Accounting Research* 26, no. 2 (2009): 581–604.
5. For one example of the challenge of organizing economists, see Luke M. Froeb, Paul A. Pautler, and Lars-Hendrik Roller, "The Economics of Organizing Economists," *Antitrust Law Journal* 76 (2009): 569–584.
6. This section was inspired by the ideas of Michael Jensen, "Paying People to Lie: The Truth about the Budgeting Process," HBS Working Paper 01-072, September 2001. An executive summary of this paper entitled "Corporate Budgeting Is Broken, Let's Fix It" was published in the *Harvard Business Review* (November 2001).
7. Ian I. Larkin, "The Cost of High-powered Incentives: Salesperson Gaming in Enterprise Software," Working Paper. Harvard University.

CHAPTER 23

Managing Vertical Relationships

When Jacques Papillon was appointed marketing manager for Argent Tobacco, one of the first things he did was commission a study of retail prices in the drugstores, supermarkets, and convenience stores that sold Argent cigarettes. What he found was disturbing. Whenever Argent reduced the wholesale price in order to promote its brand, fewer than half of the retail outlets responded with price cuts of their own. Instead, most retail outlets "ate" the price reduction, which increased retail profit but did nothing for Argent's sales or profitability.

M. Papillon traced the source of the problem to an incentive conflict between Argent, who is interested in the profit from sales of its own brand, and retailers, who are trying to maximize profit from sales of all the brands they carry. In other words, when a customer comes into a store, Argent wants the customer to purchase Argent's brand, while the retailer is content if the customer purchases any brand. As a consequence, retailers were reluctant to "pass through" Argent's price reductions because doing so would cannibalize sales of other brands they carried.[1]

As you should now be able to recognize, this is a type of a principal-agent conflict (Chapter 21) caused by moral hazard (Chapter 20). The manufacturer is the principal, the retailer is the agent, and the principal finds it difficult to control the pricing behavior of the agent. If the manufacturer could figure out which price the retailer should charge, it would be a simple matter to write a contract, offering the wholesale price reduction in exchange for a reduction in the retail price. The problem for Argent was that there were thousands of different retail outlets, each with different pricing strategies and each facing different demand elasticities. M. Papillon couldn't write and enforce contracts specifying a discount off the regular price because he didn't know what the regular price should be.

M. Papillon came up with a clever solution. In the contract, he specified the "regular" price as the price of Argent's closest rival brand. So, for example, when Argent reduced the wholesale price by two cents, the retailer would have to reduce the retail price of Argent by two cents below the retail price of the rival brand. This contract gave each retail outlet the flexibility to set the overall *level* of prices according to the demand they faced, while finding a way to get wholesale price discounts passed through to Argent's retail price. The contract raised the profit from selling and promoting Argent cigarettes, which was shared between Argent and its retailers.

This kind of incentive conflict, between firms in the same vertical supply chain, is quite common. This chapter is about how vertically related firms use a variety of informal and formal measures, like the contract above, to control the incentive conflict to increase profit. We also discuss tax avoidance, and end the chapter with a discussion of the legal (antitrust) and financial concerns associated with vertical relationships.

INCENTIVE CONFLICTS BETWEEN RETAILERS AND MANUFACTURERS

The relationship between retailers and manufacturers is one of the most studied in business. In this section, we use it to illustrate the various incentive conflicts that occur between firms at adjacent "links" in the vertical supply "chain" and the various measures that firms take to resolve these incentive conflicts. Both the manufacturer and retailer have an incentive to manage these conflicts to increase the size of the profit "pie" that they split.

Quality Control

A manufacturer of perishable food may want her product kept fresh and at a controlled temperature. If not kept fresh, a consumer might mistakenly attribute an unsatisfying experience with the brand (at least partly) to the manufacturer. This would harm the manufacturer's reputation and reduce sales across all retailers that carry the brand. This incentive conflict arises because the retailer does not bear the full cost of the consumer response and may not have sufficient incentive to invest in refrigeration and inventory management. Recognizing this possibility, a manufacturer might "give" a refrigerator to the retailer to guarantee freshness. The gift might come with the stipulation that the retailer keep at least 60% of the refrigerator shelf space stocked with the manufacturer's product.

The same concern with quality control arises between manufacturers of copy machines and the firms that service them. If a machine breaks down, a consumer might mistakenly infer that it is due to faulty design or manufacture when in fact, it is due to faulty service. To better protect its reputation, the manufacturer might "bundle" service with the sales of the machine, or try to "exclude" any but its own qualified technicians from servicing and repairing the machines. It can do this by refusing to provide diagnostic software and spare parts to third party firms that service the machines.[2]

Double Marginalization

When a manufacturer sells to a retailer, both of these parties apply a corresponding markup to achieve a final retail price. Because the retail price includes successive markups, the resulting price is higher than would result if, for example, the manufacturer sold the product directly to consumers or if the manufacturer and retailer were to merge. This is commonly referred to as "double marginalization" because the retailer sets prices based on both the costs of production and the manufacturer's markup. These successive markups result in prices that are too high (where MR < MC). Note that this concern is similar to the incentive conflict that occurs over transfer pricing (covered in Chapter 22), between divisions of the same firm.

If the retailer and manufacturer were to merge, the merged firm would internalize the effect of price on total profit, and set a lower retail price (one where MR = MC). Many vertical contracts aim to achieve the same end, lowering the price charged by the retailer, and compensating

the retailer for its lower margins through payments from the manufacturer. Vertical contracts that aim to decrease retailer prices typically benefit the manufacturer, the retailer, and consumers.

Promotional Activities

Advertising, service, promotion activities, and quality control can increase customer interest, awareness, and sales. However, since the retailer earns only a fraction of the revenue from these sales, the retailer often does not have sufficient incentive to invest in these important demand-enhancing services. While a manufacturer generally wants the retailer to provide the best service and promotion at the lowest cost, retailers have less of an incentive to stimulate sales.[3]

To see this, consider a customer who adopts a new brand of cigarettes, due to the promotional efforts of a retailer. This consumer will subsequently purchase the brand from many different retailers, and each of those sales benefits the manufacturer, but not the original retailer. Since the original retailer fails to realize the full benefits of its promotional activities, it will invest less effort in garnering a sale. Consider, for example, where an investment of $5,000 in a display cabinet returns $8,000 of additional profit. Clearly, it is efficient to make this investment. However, if the profit is divided equally between the retailer and manufacturer, neither would have the incentive to make the investment on its own because each would realize only a benefit of $4,000 but pay a cost of $5,000.[4] Vertical contracts often aim to provide the retailer with incentive to undertake these costly activities.

"Free Riding" among Retailers

Another reason why retailers do not find it profitable to engage in promotional activities is the ability of competing retailers to "free-ride" on these efforts. If a retailer invests in promotional activities, displays, or expensive storage, the consumer is provided with a higher quality product and a better ability to choose. However, since these activities are costly, a retailer that provides these services would need to charge a higher price than a retailer who does not. When the high-service retailer generates a new customer, competing retailers could benefit by not providing these services and offering a lower price to that consumer.[5]

As an example, consider PING golf clubs. PING wants its retailers to spend considerable time and effort custom-fitting clubs to individual customers. But discount retailers can tell consumers to visit a full-service retailer to get a custom-fitting session, and then bring the specifications back to the discounter for a lower price. This kind of "free riding" by the discounters on the custom-fitting efforts of the full-service retailers weakens the incentive of full-service retailers to perform these services.[6]

Vertical contracts can often overcome this problem. For example, awarding retailers exclusive territories reduces the effects of free-riding by discounters on the promotional activities of full-service retailers. Such agreements can lead simultaneously to higher prices (in accordance with service, quality, and promotional activity) *and* higher sales volume, suggesting that consumer awareness and willingness to pay are both increased.[7] Recently the Supreme Court ruled that it may be okay for manufacturers like PING to set minimum retail prices to prevent this kind of free riding. This limits free riding from discounters because they are prohibited from offering lower prices. Beware that in some states, and in foreign jurisdictions, contracts specifying retail prices are still illegal.

New Product Introduction

A similar kind of incentive conflict between retailers and manufacturers surrounds the introduction of new products. It is often quite costly to introduce and promote a new product. Sufficient resources must be invested in promotional pricing, advertising, and customer education. Ability to free-ride on these investments by other retailers reduces retailer incentives to invest in new products. Additionally, retailers often have very little information about a new product's sales prospects, while manufacturers, having invested in market research, are better informed. Various forms of vertical agreements reward the retailer for incurring the risk inherent in introducing a new product and the cost of managing an expanded inventory. Further, large lump-sum payments from the manufacturer to the retailer sometimes serve as a credible "signal" because only a manufacturer who believes in the likely success of her product would be willing to make these payments.[8]

Price Discrimination

Retailers can defeat upstream price discrimination schemes designed by a manufacturer. To see this, suppose that home gardeners and farmers both use the same herbicide. Home gardeners are willing to pay $5 for a one-liter spray bottle ($5 per liter), whereas farmers are willing to pay $600 for a 200-liter barrel ($3 per liter).

If the manufacturer tries to price discriminate (by pricing at $5 per liter to home retailers and $3 per liter to farm retailers), the farm retailers could buy herbicide in 200-liter barrels, put it in small spray bottles, and sell it to home gardeners. By vertically integrating into retail operations, the manufacturer can prevent this kind of arbitrage. Note that the manufacturer has to integrate only into the low-price retailing to accomplish this.

A VARIETY OF CONTRACTUAL AND ORGANIZATIONAL FORMS CAN ADDRESS INCENTIVE CONFLICT

All of the incentive conflicts described in the previous section can reduce the size of the profit "pie" that manufacturers and retailers split. The One Lesson of Business (Chapter 2) tells us that if we can figure out way to control these conflicts, we can make money. We state this as a general principle:

> *If unrealized profit exists at one stage of the vertical supply chain—as often happens as a consequence of incentive conflict—firms can capture some of the unrealized profit by adopting a variety of contractual or organizational forms.*

To illustrate this idea, view the ability of a retailer to thwart a manufacturer's price discrimination scheme as a kind of incentive conflict. In this case, price discrimination represents unrealized profit in the vertical supply chain, so our problem is how to convince the retailer to go along with the price discrimination scheme. Vertical integration is just one way to accomplish this. Designing a contract with a reward to the retailer for supporting the scheme is another.

Regulatory Evasion

To illustrate how a variety of contractual and organizational forms can accomplish the same end, let's return to the simple example of rent control. Suppose a rent-controlled apartment has a price ceiling of $1,000, meaning that city regulations limit the rent to less than $1,000 per month. If a renter is willing to pay $1,500 per month, the landlord has an

incentive to evade the price regulation by "bundling" the apartment, say, with furniture or by "tying" furniture rental to the apartment rental. In the first case (**bundling**), the landlord offers a "furnished apartment" for $1,500; in the latter (**tying**), the landlord requires the renter to rent furniture from the landlord for an additional $500.

In this setting, think of "furnished housing" as our vertical supply chain, which is comprised of two links, apartment rental and furniture. The two solutions (tying and bundling) are contractual links between divisions of the same firm, that generate higher profit. Each can be used to evade rent control.

Exclusion can accomplish the same thing. If a building owner can make it costly or difficult for rival furniture sellers to sell to the tenant (by "excluding" them), the tenant is forced to purchase or rent furniture from the landlord. The landlord can then capture the some of the unrealized profit from the apartment through the sale of overpriced furniture.

Regulators usually anticipate these strategies and often require unbundled pricing, or they make it illegal to tie the sale of a regulated good to the sale of an unregulated one. To thwart exclusionary tactics, regulators mandate access for rival sellers, but this is difficult to enforce. For example, following storm outages, a regulated local phone company that also sells long-distance service restored service to customers of rival long distance carriers only after restoring service to its own customers. This tactic reduced the attractiveness of rival long distance service, which increased demand for its own long distance service.

Use Vertical Integration When Contractual Solutions Aren't Enough

In general, there are many contractual ways to control the incentive conflicts inherent in vertical relationships. But sometimes, you can control the conflict only by buying your upstream supplier or downstream customer. By putting the two firms under the same corporate "roof," you eliminate the incentive conflict, but you also create a bigger firm that is more difficult and costly to manage. And sometimes, the incentive conflicts reappear in different parts of the organization. For example, if a manufacturing firm buys a retail outlet, and operates it as a separate profit center, the incentive conflict between two separate firms becomes a conflict between two separate divisions of the same company. These conflicts were covered in Chapter 22.

TAX AVOIDANCE

Multinational companies can also use vertical integration to evade national corporate profit taxes. A company manufacturing shirts in Mexico, for example, can transfer the shirts at a low price to a sister division located in the Cayman Islands, where they are marked up and shipped to the United States for sale to final consumers. The company reduces its tax burden by choosing to realize most of its profit in the Cayman Islands, which has lower taxes than Mexico or the United States.

Regulators in Mexico anticipate this strategy and force goods to be sold for at least a 5% markup over cost before they are transferred out of the country. This forces the company to realize at least some of its profit in Mexico.

ANTITRUST RISKS

Most countries have antitrust laws governing vertical relationships between firms in the same vertical supply chain. The laws are generally focused on two types of anticompetitive risks. The first is that a dominant firm at one level of the supply chain will use vertical contracts to extend

its market power to other levels of the supply chain. The second is that vertical contracts will reduce the intensity of competition and harm consumers. In the case of Argent Tobacco, for example, a competition agency sued Argent and its retailers because it thought that the contracts reduced the intensity of price competition among cigarette manufacturers. Eventually, Argent was exonerated by a court, but only after a long and costly trial.

It is instructive to compare the effects of horizontal agreements (like those between two retailers or two manufacturers) and the effects of vertical agreements. Horizontal agreements generally run contrary to the goals of consumers because they eliminate competition between firms selling substitute products, and this often results in higher prices. Vertical agreements, on the other hand, as seen above, are typically undertaken to control incentive conflict, which reduce the costs of the firms that use them. In this way, they are much like agreements between firms producing complementary products, which often result in lower prices. What this means is that the antitrust risks from vertical restraints are typically smaller than those from horizontal agreements. But these risks are not negligible, especially for big or dominant firms.

For example, European authorities have prohibited Coke from purchasing refrigerators for retail outlets (a demand-enhancing investment) because the practice may exclude rival soft drink manufacturers from retail outlets that use Coke's refrigerators. In the United States, Dentsply has been convicted of excluding rival tooth manufacturers from its dealer distribution network, which forces rivals to use less efficient and higher cost ways of distributing their (false) teeth. Similarly, 3M has been convicted of unfairly using discounts to encourage retailers to carry only 3M products. Again this makes it more costly for rival manufacturers to get into retail outlets that carry 3M products.

These practices are called *abuse of dominance* in Europe and *monopolization* or *exclusion* in the United States. Even though these practices have cost-reducing justifications, they can also harm competitors, and sometimes consumers. To avoid running afoul of these laws, we repeat the following advice taken from a book on antitrust law:

> *If you have significant market power, you should consider the effect any planned action will have on competitors.*[9]

If your plans are likely to hurt your competitors, be sure that such harm is a by-product of actions that have a sound business justification. These laws are in a state of flux right now, so be sure to seek legal counsel if your firm is dominant in your market and you are considering adopting contracts or practices that would disadvantage your competitors.

DO *NOT* BUY A CUSTOMER OR SUPPLIER SIMPLY BECAUSE IT IS PROFITABLE

We end this chapter with a warning—one that most of you will forget when you have the opportunity to buy a profitable customer or supplier.

> *Purchasing a profitable upstream supplier or downstream customer will not necessarily increase your profit.*

Rather, it depends on what price you pay. The current owners know how much the company is worth, so you'll be paying a price exactly equal to the value of the company's discounted future profits. In addition, adverse selection is a potential problem because

current owners typically have better information about the value of the firm than do potential buyers. They are likely to sell only when a buyer offers too much.

Without some kind of synergy that makes an asset more valuable to the buyer than it is to current owners, the acquisition will not be profitable.

Remember that profitable transactions move assets to higher-valued use. Unless the assets are worth more to the buyer than they are to the seller, there's no reason to buy.[10] Based on the stock price reactions following acquisition announcements, it appears that about half of all corporate acquisitions are unprofitable. The shareholders of the acquired firm gain a little, but the shareholders of the acquiring firm typically lose a lot.

However, even if acquisitions turn out to be unprofitable, this doesn't necessarily mean that acquiring the company was the wrong thing to do at the time of the acquisition. In 1999, for example, AT&T purchased the cable assets of Tele-Communications, Inc. (TCI), for $97 billion, anticipating that the acquisition would allow them to offer local telephone service through TCI's cable lines. Three years later, the technology failed to develop as expected, so AT&T sold the old TCI cable assets to Comcast for $60 billion.

AT&T purchased the company because it anticipated a synergy. After that synergy failed to materialize, it sold the assets and moved on. A lesser firm might have held onto the assets to avoid the embarrassment of publicizing a $37 billion mistake—a version of the sunk-cost fallacy.

SUMMARY & HOMEWORK PROBLEMS

Summary of Main Points

- Manufacturers typically want higher quality, lower retail prices, higher sales effort, and higher levels of promotional activity than retailers want to provide. Manufacturers and retailers use a variety of formal and informal agreements to more closely align the incentives of retailers with the profitability goals of manufacturers
- If unrealized profit exists at one stage of the vertical supply chain—as often happens as a consequence of incentive conflict—a firm can capture some of the unrealized profit by integrating vertically, by **tying,** by **bundling,** or by **excluding** competitors.
- Multinational companies can reduce their tax burden by choosing to realize more of their income in low-tax countries.
- Most countries have laws that regulate vertical relationships. To avoid running afoul of these laws, remember that if you have significant market power, you should consider the effect that any planned action will have on competitors.
- Do not purchase a customer or supplier merely because that customer or supplier is profitable. There must be a synergy that makes it more valuable to you than it is to its current owners. And do *not* overpay.

Multiple-Choice Questions

1. Alpha Industries is considering acquiring Foxtrot Flooring. Foxtrot is worth $20 million to its current owners under its existing operational methods. Due to some opportunities for synergies between the two companies, Alpha believes that Foxtrot is worth $25 million as part of Alpha Industries. What do you predict for a sales price of Foxtrot?
   a. Less than $20 million or Alpha will not buy
   b. More than $25 million or Foxtrot will not sell
   c. Something between $20 and $25 million
   d. The different valuations make a sale very unlikely.

2. All of the following provide a motive for vertical agreements EXCEPT
   a. effective execution of price discrimination.
   b. elimination of free-riding among retailers.
   c. quality control.
   d. diversification.
3. Which of the following is an example of vertical integration?
   a. A custom software company purchasing a competing software firm
   b. A soft drink producer buying one of its bottling plants
   c. A coal manufacturer purchasing a nuclear power plant
   d. A gourmet cheese company purchasing a wine maker
4. Why are contact lens manufacturers reluctant to sell their lenses through the Internet?
   a. The Internet price is too high due to double marginalization.
   b. Search costs are lower, so the Internet sales are too competitive.
   c. Doing so reduces the incentives of retailers to provide point-of-sale services.
   d. It is afraid of antitrust lawsuits.
5. In which of the following instances would an acquisition make the most sense?
   a. The target is a very profitable company.
   b. Synergies exist between the acquirer and the target.
   c. Integration costs are low between the two.
   d. Synergy benefits outweigh the costs of integration.
6. Why do vertical agreements typically pose less antitrust risk than horizontal agreements?
   a. Vertical agreements occur less often than horizontal agreements.
   b. Vertical agreements often result in lower prices, which is beneficial to the consumer.
   c. Vertical agreements are rarely profitable.
   d. Vertical agreements do not pose less antitrust risk than horizontal agreements.
7. Giganto Grocery Chain wishes to sell Boldo detergent. Boldo's manufacturer, CPG Industries, will not supply Giganto unless Giganto agrees to carry all of CPG's other detergents. This is an example of
   a. exclusion.
   b. tying.
   c. territory restriction.
   d. bundling.
8. A multinational firm acquires many of its components pre-assembled from suppliers. One of these suppliers operates in a country with a much lower corporate income tax rate. How does this affect the vertical relationship between this supplier and the multinational?
   a. This will not affect the relationship.
   b. The multinational should stop working with the supplier.
   c. The multinational should consider purchasing this supplier.
   d. The multinational should move all its operations to the supplier's home country.
9. In which of the following cases might you expect to find a manufacturer granting exclusive territories?
   a. A pet supply chain that requires heavy local advertising to drive sales.
   b. Custom computer sales that require a good deal of consultation.
   c. A submarine sandwich chain that relies on its nationwide brand reputation.
   d. All of the above
10. Britain's beer industry is vertically integrated, from production to distribution, and they even own a large number of their own pubs, which serve branded beer to patrons. The United States, by contrast, has a three-tiered distribution system. The idea is that brewers and distillers, the first tier, have to distribute their product through independent wholesalers, the second tier. And wholesalers, in turn, have to sell only to retailers, the third tier, and not directly to the public. Based on this difference, one might expect

a. Lower consumption in the United States.
b. Higher prices in the United States.
c. Less refrigeration of beer in the United States.
d. All of the above

Individual Problems

23-1 Local Phone Companies

State utility commissions typically regulate local phone companies, but local phone companies also offer long-distance service to their customers. Rival long-distance carriers also connect to local phone lines to provide long-distance service to customers. Recently, the rival long-distance carriers have complained that the local phone company repair persons have put peanut butter on rival long-distance carrier's phone lines to encourage rats to eat through the lines. If true, why is this a profitable strategy?

23-2 Integration of Physician Groups and Testing Services

Under a proposed healthcare reform, doctors' fees will be capped at 80% of their current rate, but doctors can order blood tests that will be reimbursed at 90% of the current rate. How does vertical integration of physician groups into testing services increase profits?

23-3 Artificial Tooth Manufacturer

An artificial tooth manufacturer sells teeth to distributors through a dealer network. The dealers sell to dental labs, which construct dentures for consumers. The manufacturer has spent a great deal of money advertising its teeth, and it has become the most popular brand of artificial teeth. It is now a dominant firm in the industry. But recently, it has discovered that its rivals are offering very attractive sales incentives for dealers to steer customers toward rival brands. How should the manufacturer respond to this competitive threat? Suggest at least two alternatives.

23-4 Wedding Dresses

Stores that sell wedding dresses do not typically permit photos, and do not have tags in the dresses that would identify the manufacturer and style type. What is the purpose of these rules? Suggest one other way of accomplishing the same objective.

23-5 Herbicide Integration

Suppose the herbicide manufacturer mentioned in the chapter can vertically integrate only into home gardening retailing. Would this allow the manufacturer to price discriminate?

23-6 Loyalty Payments

Intel made large loyalty payments to HP in exchange for buying most of their chips from Intel instead of rival AMD. AMD sued Intel under the antitrust laws, and Intel settled the case by paying $1.25 billion to AMD. What incentive conflict was being controlled by these loyalty payments? What advice did Intel ignore when they adopted this practice?

Group Problems

G23-1 Managing Vertical Relationships

Identify a vertical relationship in your company and determine whether it could be managed more profitably by tying, bundling, exclusion, or vertical integration. Clearly identify the source of the profitability (e.g., regulatory evasion, elimination of double markup, better goal alignment, or price discrimination), and describe how to exploit it. Estimate the change in profit.

G23-2 Undoing Vertical Relationships

Identify a vertical relationship in your company, and determine whether it could be managed more profitably by outsourcing, untying, unbundling, inclusion of rivals, or vertical disintegration. Clearly identify the source of the profitability and describe how to exploit it. Estimate the gain in profit from the change.

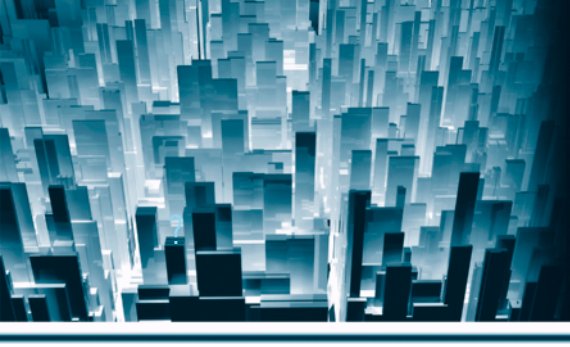
END NOTES

1. We have simplified the theory for this example. In general, pass through depends not only on how many other competing brands a store carries, but also on things like the curvature of demand. See Luke Froeb, Steven Tschantz, and Gregory Werden, "Vertical Restraints and the Effects of Upstream Horizontal Mergers," in *The Political Economy of Antitrust*, edited by Vivek Ghosal and Johann Stennek (Amsterdam: North-Holland Publishing, 2007). Available at SSRN: http://ssrn.com/abstract=917897.
2. There may be some antitrust risk in doing this as we discuss later in the chapter.
3. *See* B. Klein and K.M. Murphy, "Vertical Contracts as Contract Enforcement Mechanisms," *Journal of Law and Economics* 31, no. 2 (1988): 265–296; and P.H. Rubin, "The Theory of the Firm and the Structure of the Franchise Contract," *Journal of Law and Economics* 21, no. 1 (1978): 223–233.
4. See, for example, B. Klein, "The Economics of Franchise Contracts," *Journal of Corporate Finance* 2, nos. 1–2 (1995): 9–37; and J.C. Cooper, L.M. Froeb, D.P. O'Brien, and M. Vita, "A Comparative Study of United States and European Union Approaches to Vertical Policy," *George Mason Law Review* 13, no. 2 (2005): 289–308.
5. Brief of *Amici Curiae* Economists in Support of Petitioner, et al., Leegin. v. PSKS, 75 U.S.L.W. 3207 (U.S. Nov. 3, 2006) (No. 06-480) (On Writ of Certiorari to the United States Court of Appeals for the Fifth Circuit).
6. See brief of PING, Inc. as Amicus Curiae in Support of Petitioner, Leegin Creative Leather Prods., Inc. v. PSKS, Inc., 127 S. Ct. 2705 (2007), at 9–15 (noting PING, Inc.'s significant costs in operating a unilateral RPM policy), available at http://www.abanet.org/antitrust/at-conversation/pdf/Leegin_PING_Amicus.pdf.
7. *See* T.R. Sass and D.S. Saurman, "Mandated Exclusive Territories and Economic Efficiency: An Empirical Analysis of the Malt-Beverage Industry," *Journal of Law and Economics* 36, no. 1 (1993): 153–177.
8. See W. Chu, "Demand Signalling and Screening in Channels of Distribution," *Marketing Science* 11, no. 4 (1992): 327–347.
9. John Shenefield and Irwin Stelzer, *The Antitrust Laws: A Primer,* 4th edition (Washington, D.C.: AEI Press, 2001).
10. For more on this topic, see Luke Froeb, "If Merger Is the Answer, What Is the Question?" *M&A Journal* 41, no. 3 (March 2006), reprinted in *Owen Manager* (2006) and in *Proceedings of the I Lisbon Conference on Competition Law and Economics* (Kluwer Law International, forthcoming).

SECTION 7

Wrapping Up

24 You Be the Consultant



CHAPTER 24

You Be the Consultant

The preceding chapters have given you the analytical tools to solve business problems. In this chapter, we give you an opportunity to use these tools to solve a fresh set of problems faced by real businesses. We'll give you a brief description of a problem, after which you'll see a break in the text. At that point, take a couple of minutes to identify the source of the problem. Then propose a solution.

LOW PROFITS ON RENTAL APARTMENTS

After the housing bust in 2008 and the resulting uncertainty surrounding the future of housing, many would-be home buyers decided to rent instead of buy. By 2012, the rental market was booming. One company that should have been reaping the benefits of the boom was Focus Real Estate. Instead, profits from its residential apartment portfolio decreased by 7% from 2010 to 2011, despite a 3% increase in occupancy rates during the same period. The profit decline was due both to an increase in costs and reduced revenue.

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Our problem-solving methodology requires that we first reduce the problem to a bad decision, isolate the cause of the bad decision, and then figure out how to fix it. Here, we have a couple of clues as to the source of the bad decision. We know that revenue went down while occupancy went up, which tells you that prices must have declined. The second clue is that costs are also going up. In this case, the one person responsible for leasing apartments was the source of both problems. Apartment managers were leasing to higher cost tenants and charging them lower prices. This answers our first question:

1. *Who is making the bad decision?* Apartment managers were leasing to high cost tenants and charging them lower prices. The fact that this was happening at all four of the company's apartment buildings suggests a system-wide problem.
2. *Does the decision maker have enough information to make a good decision?* Yes. These managers were the only ones with enough information to make good decisions.

3. *And the incentive to do so?* No. In this case, the managers were rewarded for increasing occupancy rates. This caused them to lower prices and lease to higher cost tenants in order to fill the building.

The source of the problem should now be clear. The property managers made bad pricing decisions by (i) renting units to tenants for less than market value, and/or (ii) giving tenants special deals (e.g., waiver of security deposits) to encourage them to rent. The managers also rented to high-risk tenants. These tenants caused expenses to rise by moving out before the lease expired and damaging the units, both of which increased costs.

Fixing the problem is relatively easy. First, get rid of the bonuses based on occupancy rates. This will give managers an incentive to rent units at market value to lower-risk tenants, while removing the incentive to simply rent as many units as possible. Second, replace them with bonuses based on profitability of the property. This will get rid of the problem of renting to high cost tenants.

Implementing the scheme is not as straightforward as it seems because some properties are naturally more profitable than others. To address this shortcoming, a regional manager can set guidelines regarding what profit margins are expected from each property. The data in Table 24-1 compares the current compensation structure to a proposed alternative for one 200-unit property. Although the occupancy rate is expected to slightly decrease with the proposed structure (based on increasing rent to market value), the combination of increased monthly rent and reduced expenses would allow Focus to significantly increase profits.

TABLE **24.1**

Comparing Compensation Structures

	Current Structure	Proposed Structure
Avg. Monthly Rent	$700	$800
% Occupancy	93.0%	90.0%
Annual Rental Income	$1,562,400	$1,728,000
Uncollected Rent	(46,872)	(17,280)
Net Rental Income	$1,515,528	$1,710,720
Total Expenses	$772,919	$821,146
Net Operating Income	$742,609	$889,574
	Annual Increase	**$146,966**

If the proposed structure were used for all 16,000 units in the Focus portfolio, annual net operating income would increase over $10 million.

EXCESS INVENTORY OF PROSTHETIC HEART VALVES

Heart valve size is as varied as body size. So when a surgeon operates to replace a diseased valve, no one knows exactly what size replacement valve the patient will need. To ensure that the right size is available, medical device companies must keep an entire set of different-sized heart valves at a hospital.

The Heart Plus medical device company employs salespeople to place and maintain valve inventories at hospitals in each region. After a valve is used, Heart Plus bills the patient's insurance company and credits the salesperson with a sale. Each salesperson earns a commission based on revenue from her territory.

Because Heart Plus doesn't get paid until it sells a valve, it must bear the cost of holding inventory, calculated as the cost of capital (12%) multiplied by the wholesale cost of the valves placed at hospitals. The problem: total inventory holding costs for Heart Plus are much higher than those of its competitors. Heart Plus calls you in to figure out what's wrong and how to fix it.

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Start by asking and answering our three questions:

1. *Who is making the bad decision?* The salesperson decides whether to put valves on inventory at a hospital.
2. *Does she have enough information to make a good decision?* Yes. Through her continuing interactions with the hospitals and surgeons who use the valves, she knows whether it is profitable to keep valves on inventory at the hospital.
3. *And the incentive to do so?* No. The salesperson doesn't care about inventory costs because her evaluation and compensation depend only on revenue.

The problem should now be clear. The only way a salesperson can make a sale is to place valves at a hospital and wait for one to be used. She has an incentive to place as much inventory in hospitals as she can (an extent decision) regardless of whether the expected revenue covers the inventory holding costs. As a consequence, the salesperson places inventory at hospitals even when the probability that the valve will be used is very small. Note that this problem is similar to the problems created by incentive conflict between marketing and sales discussed in Chapter 21. There, the salesperson priced too low and sold too many; in this case, the salesperson puts too much inventory in the field, which results in too many sales. In both cases, salespeople ignored costs when making sales. To maximize profit, the Heart Plus salesperson should place inventory at hospitals only if the company expects to earn enough to cover the inventory holding costs—that is, only in cases where *expected* MR > MC.

To fix the problem, change the sales incentives so that the salesperson faces both the costs and the benefits of making a sale. Reward her for increasing net revenue—revenue above the costs of carrying inventory. Under this performance evaluation metric, the salesperson maximizes her compensation by placing heart valves only at hospitals where the expected revenue is above the costs of carrying inventory.

You can expect the salesperson to make fewer sales after the change, but this is exactly what you want because she stops making unprofitable sales. Also remember that fewer sales will translate into lower income for the salesperson. If you don't want to reduce her compensation, pay the salesperson a larger commission on net revenue. Otherwise, sales compensation will fall, and the salesperson may quit. And due to adverse selection, the best salespeople are the ones most likely to quit.

HIGH TRANSPORTATION COSTS AT A COAL-BURNING UTILITY

A large coal-burning electric power plant is located on a river, and each week, a dozen barges arrive loaded with coal to feed the power plant. The Transportation Division of the parent company is responsible for transporting coal to the Power Plant Division, and it pays a barge company to make the deliveries.

Once the barges arrive at the docks, the Power Plant Division is very slow to unload the coal. The Power Plant Division has just one crew of dockworkers, who rarely work overtime or on weekends. The barge company charges the Transportation Division $500 per day for every barge that is not unloaded within three days. Because very few barges are unloaded within three days, the Transportation Division faces unusually high transportation costs. You are brought in to fix the problem.

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Start by asking and answering our three questions:

1. *Who is making the bad decision?* The Power Plant Division is unloading the barges too slowly, raising costs for the Transportation Division and reducing company-wide profit.
2. *Does the Power Plant Division have enough information to make a good decision?* Yes. The Power Plant Division knows that leaving barges at the dock beyond three days results in extra charges to the Transportation Division.
3. *And the incentive to do so?* No. Promptly unloading the barges would require overtime pay to the dockworkers. Since dockworkers' overtime wages are twice the normal wages, the Power Plant Division saves money by waiting until the barges can be unloaded during normal work hours.

The problem should now be obvious. The Power Plant Division decides when to unload the barges but doesn't face the profit consequences of its decision—the Transportation Division bears the costs of unloading delays. Unloading more quickly requires overtime pay, so the Power Plant Division increases its own *division* profit by keeping the barges at the dock until they can be unloaded during regular work hours, requiring no overtime pay. How would you solve the problem?

One way to solve the problem is to force the Power Plant Division to pay the barge company for late unloading. If the costs of paying overtime are less than late fees, the Power Plant will unload the barges within three days. If not, it won't. Either way, this solution aligns the incentives of the Power Plant Division with the profitability goals of the parent company.

The other obvious solution is to move the decision rights about when to unload the coal to the division paying the late fees (the Transportation Division). Although this may reduce the late fees, it would likely create coordination problems because the dockworkers have other responsibilities within the Power Plant Division.

OVERPAYING FOR ACQUIRED HOSPITALS

HCO, a healthcare management company, purchases orthopedic surgical hospitals and makes money by running them more efficiently. But of the 12 acquisitions that HCO made in 2002, 4 were unprofitable.

The acquisitions were priced at a multiple of operating cash flow, typically five times EBITDA.[1] When the development team (those in charge of making acquisitions) paid too much, HCO found that the team typically overestimated EBITDA by a significant amount. One particularly egregious error involved the purchase of a Jackson, Wyoming, orthopedic hospital. Development team managers estimated EBITDA based on six months of winter data—and they simply multiplied the winter earnings by two to compute annual EBITDA. Because the hospital earned the bulk of its profit during the ski season, EBITDA estimates turned out to be 40% too high, translating into a purchase price that was $8 million too high.

The problem was uncovered by the managers of the Operations Division because their performance was measured relative to estimated EBITDA. For two years running, their performance came in under their goal, which was based on the development team's EBITDA estimate.

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Start by asking and answering our three questions:

1. *Who made the bad decision?* The development team overestimated EBITDA, leading to overpayment for the acquired hospitals.
2. *Did the development team have enough information to make a good decision?* Probably not. The Operations team would have been able to forecast EBITDA more accurately.
3. *Did the development team have the incentive to make a good decision?* No. Development team members earn compensation based on how much they pay for the hospitals, which is, in turn, based on budgeted EBITDA. So they actually have an incentive to overestimate EBITDA, and thus to overpay for the acquired hospitals.

Asking and answering the three questions should make the problem obvious. The development team has neither the information nor the incentive to forecast earnings accurately. The necessary expertise resides in Operations, not Development. Propose two potential solutions to the problem.

There are two obvious solutions: (1) Move the decision rights to acquire hospitals (now with Development) to those who have the necessary information (Operations), or (2) move the necessary information to those who have the decision rights.

The first option is probably not feasible. The skills necessary to purchase a company at a good price include much more than simply being able to forecast earnings accurately. Moreover, these skills are significantly different from those necessary to run the company.

The second option would mean that Operations would be given a *ratification* role in estimating the target hospital's EBITDA. Operations must okay or ratify the purchase price of each acquired hospital. Operations has an obvious incentive to make sure the earnings are not overestimated.

Recall that we encountered a similar problem in Chapter 21, with the low profitability of newly opened general stores. In that case, the development executives deliberately overestimated profitability just to earn bonuses based on the number of stores they opened. Our solution was to allow development executives to open only profitable stores, where profit was forecast using a statistical model based on area demographics. Here we propose a similar solution—ask Operations to estimate the EBITDA on which the purchase price is based, but leave the negotiations with the development team.

LOSING MONEY ON HOMEOWNER'S INSURANCE

A large, well-established home insurance company writes insurance policies to cover losses from fire, theft, liability, and vandalism. In a recent financial review, managers discovered that company performance was lagging behind projections. They examined pricing and claims history in more detail and identified a group of about 10,000 customers whose claims far exceeded the collected premiums. Members of the actuarial group, whose compensation was partially tied to profitability of the policies they priced, were particularly frustrated. How would you recommend the insurer address this problem?

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Start by asking and answering our three questions:

1. *Who is making the bad decision?* Members of the actuarial group are pricing policies too low.
2. *Do the actuaries have enough information to make a good decision?* Probably not. For some reason, this group of policyholders is more costly than other groups.
3. *Do the actuaries have the incentive to make a good decision?* Yes. Their compensation is partially dependent on the profitability of the decisions they make, so they do have an incentive to make a good decision.

Given the lessons from Chapters 19 and 20, the first two phrases that should occur to you are "adverse selection" and "moral hazard." The actuaries lack some sort of critical information about this group of policyholders. Losses are likely associated with either the fact that the company cannot observe behavior after policy purchase (moral hazard) or the company does not observe the inherent risks being faced by potential customers (adverse selection). How would you suggest the problem be solved?

The solution of gathering more information is fairly obvious. The problem is what type of information the company should gather. A good place to start would be to examine the 10,000 clients with large claims histories to try to identify any commonalities among them.

When they did this, the company actuaries discovered that of the 10,000 clients with big claims, a significant percentage had large claims with prior insurance companies. The actuaries had been pricing based on the *number* of prior claims but had not been taking into account the *size* of the claims. Overall, the company had about 2,000 clients who had prior large claims, and it turned out that these customers were about twice as likely as the average customer to experience another loss. The company had collected around $5 million in premiums from this group but had paid out around $10 million in claims. After this discovery, the company changed its pricing policy to take into account the size of any prior losses.

QUANTITY DISCOUNTS ON HIP REPLACEMENTS

Surgeons at Mercy Memorial Hospital perform about 600 hip replacements per year. The implants are available from a variety of vendors, and individual surgeons decide which implants they will use. The surgeons have strong preferences for specific vendors; however, there is no evidence that higher-priced implants perform better. Over the last year, four different vendors supplied implants to Mercy with the average price ranging from $5,500 to $12,000. The price differences were almost solely driven by quantity discounts. The least

expensive price came from the vendor that supplied about 50% of all of the hospital's implants; the most expensive price came from the vendor whose share was under 5%. Had the hospital purchased all of the implants at the $5,500 price, their costs would have been reduced by $1 million.

Before Continuing, Try to Diagnose and Solve the Problem

Answer: Start by asking and answering our three questions:

1. *Who is making the bad decision?* The doctors are ordering from a variety of vendors, resulting in higher average prices.
2. *Do the surgeons have enough information to make a good decision?* Yes. The doctors are aware of the pricing policies of the vendors.
3. *Do the surgeons have the incentive to make a good decision?* No. Their compensation is not dependent on the cost of the implant.

The problem here is fairly obvious. Those making the decisions lack the incentive to reduce costs. To fix the problem, you can either change decision rights or change incentives. What would you suggest?

In this case, either solution has potential problems. Let's consider changing incentives first. Giving the surgeons an incentive to reduce costs is challenging because federal laws are designed to prevent financial considerations from influencing clinical decisions. Because of these laws, directly sharing the cost savings with the surgeons is probably not a viable solution.

Mercy could require that all surgeons use a specific vendor. That would allow the hospital to reap the benefits of quantity discounts. But this solution might alienate surgeons, some of whom might have to spend additional time to become familiar with a new product. This is a concern because the surgeons can easily take their patients to rival hospitals. So, if Mercy wants to move to a standardized solution, hospital managers need to figure out a way to keep the surgeons happy (in a manner that complies with the applicable federal laws). To do this the hospital adopted a tiered system that allowed surgeons a choice between two approved vendors. This allowed the hospital to take advantage of some quantity discounts, while preserving some degree of surgeon choice.

WHAT YOU SHOULD HAVE LEARNED

If you've read and understood this book, you should know how to:

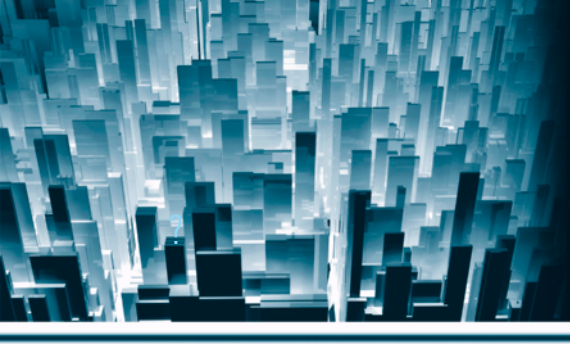
1. Use the rational-actor paradigm, identify problems, and then fix them
2. Use benefit-cost analysis to evaluate decisions
3. Use marginal analysis to make extent (how much) decisions
4. Make profitable investment and shut-down decisions
5. Set optimal prices and price discriminate
6. Predict industry-level changes using demand-supply analysis
7. Understand the long-run forces that erode profitability
8. Develop long-run strategies to increase firm value
9. Predict how your own actions will influence others' actions
10. Bargain effectively
11. Make decisions in uncertain environments
12. Solve the problems caused by moral hazard and adverse selection

13. Motivate employees to work in the firm's best interests
14. Motivate divisions to work in the best interests of the parent company
15. Manage vertical relationships with upstream suppliers or downstream customers

Now go forth and move assets to higher-valued uses.

END NOTE

1. EBITDA—earnings before interest, taxes, depreciation, and amortization.



EPILOGUE

Can Those Who Teach, Do?

by Luke Froeb

I finished the first edition of this book while managing 110 employees in the Bureau of Economics at the Federal Trade Commission. The experience taught me much about management that isn't in this book.

The government has no well-defined goals, few metrics to measure performance, and only small rewards to align employees' incentives with organizational goals. In addition, most federal employees are lifetime civil servants, with better information and strong ideas about what the agency should be doing. They can easily outlast the political appointees who come for just a few years.

The rational-actor paradigm predicts that government employees would shirk, or follow objectives of their own choosing. And although this is true of some, a substantial number work hard and take considerable pride in their work. If you want to accomplish anything during a short government stint, you have to identify these employees and motivate them to work toward a common goal.

Before you can work toward a common goal, you must have one. Set realistic goals during annual or semi-annual meetings that review past accomplishments, and outline what you hope to accomplish in the future. Be as specific as possible with time tables and measurable benchmarks.

Constantly monitor progress toward those goals. Otherwise, subordinates will infer that your priorities have changed, and, as a consequence, they will stop working toward your goals. To guard against this, require weekly reports from your subordinates; ask questions during weekly meetings to assure them that you still care about what they're doing and to motivate them to keep making progress. Refine and re-adjust your goals as new information becomes available. If you discover that a goal has become too costly to reach, drop it and replace it with another.

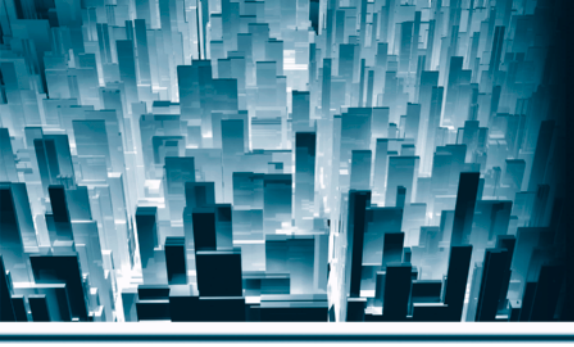
If the organizational structure is broken, fix it. Otherwise, respect the organizational structure you have. This means letting your subordinates manage their own people. If you jump over them to become directly involved in specific matters, you're implicitly telling them that you don't think they're capable of doing their assigned jobs. Every time I did this, I ended up creating more work for subordinates with no better outcome.

If you work in a functional organization, make sure that the functional areas are coordinating with each other and working towards a common goal. If you manage a divisional organization, make sure that you recognize and reward functional expertise. Also, try to recognize and reward those who act "irrationally," by putting the interests of the organization ahead of their own.

Most importantly, manage yourself. Here are some things that worked for me.

- At the beginning of each day, write down on a card what you want to accomplish. Keep the card in your pocket and try to get at least half way through the list.
- Figure out what you can do that no one else in the organization is capable of doing, and then do it. If you find yourself doing something that your subordinates can do, stop.
- Do not let your "In" box run your life. Answer e-mail *only* once each day—otherwise, you'll soon find yourself glued to your computer, putting out fires instead of making progress toward your goals.
- When you find yourself becoming frustrated or angry with subordinates, recognize that the problem is likely with you, not with them.

This book contains what we think are the best, and most important management lessons for people who actually have to manage. As we learn more, we will update the text in future editions. Many of the updates come from our blog, managerialecon.com. We welcome your participation, ideas and stories for future editions.



GLOSSARY

A

Accounting costs costs that appear on the financial statements of a company.

Accounting profit profits as shown on a company's financial statements. Accounting profit does not necessarily correspond to real or economic profit.

Adverse selection refers to the fact that "bad types" are likely to be selected in transactions where one party is better informed than the other. Examples include higher-risk individuals being more likely to purchase insurance, more low-quality cars (lemons) being offered for sale, or lazy workers being more likely to accept job offers. Adverse selection is a pre-contractual problem that arises from hidden information about risks, quality, or character.

Agency costs costs associated with moral hazard and adverse selection problems.

Agent a person who acts on behalf of another individual (a principal). Principal–agent problems are created by the incentive conflict between principals and agents.

Aggregate demand curve describes the buying behavior of a group of consumers. We add up all the individual demand curves to get an aggregate demand curve (the relationship between the price and the number of purchases made by a group of consumers).

Arbitrage a means to defeat a price discrimination scheme; it occurs when low-value individuals are able to resell their lower-priced goods to the higher-value group.

Average cost the total cost of production divided by the number of units produced.

Avoidable costs costs that you get back if you shut down operations.

B

Breakeven price the price that you must charge to at least break even (make zero profit). It is equal to average avoidable cost per unit.

Breakeven quantity the amount you need to sell to at least break even (make zero profit). The formula (assuming that you can sell all you want at price and with constant marginal cost) is $Q = F/(P - MC)$, where F is fixed costs, P is price, and MC is marginal cost.

Bundling the practice of offering multiple goods for sale as one combined product.

Buyer surplus the difference between the buyer's value (what he is willing to pay) and the price (what he has to pay).

C

Common-value auction in a common-value auction, the value is the same for each bidder, but no one knows what it is. Each bidder has only an estimate of the unknown value, and the value is the same for everyone. In common-value auctions, bidders have to bid below their values in order to avoid the winner's curse.

Compensating wage differentials in equilibrium, differences in wages that reflect differences in the *inherent* attractiveness of various professions or jobs.

Competitive industry competitive industries are characterized by three factors: (1) firms produce a product or service with very close substitutes so they have very elastic demand, (2) firms have many rivals and no cost advantage over those rivals, and (3) the industry has no barriers to entry or exit.

Complement a good whose demand increases when the price of another good decreases. Examples include a parking lot and shopping mall or a hamburger and a hamburger bun.

Constant returns to scale when average costs are constant with respect to output level.

Consumer surplus see **Buyer surplus**.

Contribution margin the amount that one unit contributes to profit. It is defined as Price–Marginal Cost.

Controllable factor something that affects demand that a company can change. Examples include price, advertising, warranties, and product quality.

Cost center a division whose parent company rewards it for reducing the cost of producing a specified output.

Cross-price elasticity of demand the cross-price elasticity of demand for Good A with respect to the price of

Good B measures the percentage change in demand of Good A caused by a percentage change in the price of Good B.

D

Decreasing returns to scale see **Diseconomies of scale.**

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

Direct price discrimination scheme a price discrimination scheme in which we can identify members of the low-value group, charge them a lower price, and prevent them from reselling their lower-priced goods to the higher-value group.

Diseconomies of scale diseconomies of scale exist when average costs rise with output.

Diseconomies of scope diseconomies of scope exist when the cost of producing two products jointly is more than the cost of producing those two products separately.

E

Economic profit a measure of profit that includes recognition of implicit costs (like the cost of equity capital). Economic profit measures the true profitability of decisions.

Economies of scale economies of scale exist when average costs fall as output increases.

Economies of scope economies of scope exist when the cost of producing two products jointly is less than the cost of producing those two products separately.

Efficient an economy is efficient if all assets are employed in their highest-valued uses.

Elastic a demand curve on which percentage quantity changes more than percentage price is said to be elastic, or sensitive to price. If $|e| > 1$, demand is elastic, where e is the price elasticity of demand.

English auction see **Oral auction.**

Exclusion the practice of blocking competitors from participating in a market.

Extent decision a decision regarding how much or how many of a product to produce.

F

First Law of Demand consumers demand (purchase) more as price falls (i.e., demand curves slope downward), assuming other factors are held constant.

Fixed cost costs that do not vary with output.

Fixed-cost fallacy consideration of costs that do not vary with the consequences of your decision (also known as the sunk-cost fallacy).

Functionally organized firm a firm in which various divisions perform separate tasks, such as production and sales.

H

Hidden-cost fallacy occurs when you ignore relevant costs, those costs that do vary with the consequences of your decision.

I

Implicit costs additional costs that do not appear on the financial statements of a company. These costs include items like the opportunity cost of capital.

Incentive conflict the fact that principals and agents often have different goals.

Income elasticity of demand income elasticity of demand measures the percentage change in demand arising from a percentage change in income.

Increasing returns to scale see **Economies of scale.**

Indifference principle if an asset is mobile, then in long-run equilibrium, the asset will be indifferent about where it is used; that is, it will make the same profit no matter where it goes.

Indirect price discrimination scheme a price discrimination scheme in which a seller cannot directly identify low- and high-value consumers or cannot prevent arbitrage between two groups. The seller can still practice indirect price discrimination by designing products or services that appeal to groups with different price elasticities of demand.

Inelastic a demand curve on which percentage change in quantity is smaller than percentage change in price is said to be inelastic, or insensitive to price. If $|e| < 1$, demand is price-inelastic.

Inferior goods for inferior goods, demand decreases as income increases.

L

Law of diminishing marginal returns as you try to expand output, your marginal productivity (the extra output associated with extra inputs) eventually declines.

Learning curves when current production lowers future costs.

Long-run equilibrium when firms are in long-run equilibrium, economic profit is zero (including the opportunity cost of capital), firms break even, and price equals average cost (i.e., no one wants to enter or leave the industry).

M

Marginal cost the additional cost incurred by producing and selling one more unit.

Marginal profit the extra profit from producing and selling one more unit (MR – MC).

Marginal revenue the additional revenue gained from selling one more unit.

Market equilibrium the price at which quantity supplied equals quantity demanded.

Mean reversion suggests that performance eventually moves back toward the mean or average.

M-form firm a company whose divisions perform all the tasks necessary to serve customers of a particular product or in a particular geographic area (also known as a multidivisional company).

Monopoly a firm that is the single seller in its market. Monopolies have market power because they produce a product or service without close substitutes, they have no rivals, and barriers to entry prevent other firms from entering the industry.

Moral hazard post-contractual increases in risky or negative behavior. Examples include reduced incentive to exercise care once you purchase insurance and reduced incentives to work hard once you have been hired. Moral hazard is similar to adverse selection in that it is caused by information asymmetry; it differs in that it is caused by hidden actions rather than hidden types.

Movement along the demand curve change in quantity demanded in response to change in price.

N

Nash equilibrium a pair of strategies, one for each player, in which each strategy is a best response against the other.

Non-strategic view of bargaining a view that does not focus on the explicit rules of the game to understand the likely outcome of the bargaining. This view says that the likely outcome of bargaining is determined by each player's gains to agreement relative to alternatives to agreement.

Normal goods for normal goods, demand increases as income increases.

NPV rule if the present value of the net cash flows is larger than zero, the project is profitable (i.e., earns more than the opportunity cost of capital).

O

Opportunity cost the opportunity cost of an alternative is the profit you give up to pursue it.

Oral auction in this auction type, bidders submit increasing bids until only one bidder remains. The item is awarded to the last remaining bidder.

P

Post-investment hold-up an attempt by a trading partner to renegotiate the terms of trade after one party has made a sunk cost investment or investment specific to the relationship.

Price ceilings a type of price control that outlaws trade at prices above the ceiling.

Price control a regulation that allows trade only at certain prices.

Price discrimination the practice of charging different people or groups of people different prices that are not cost-justified.

Price elasticity of demand (*e*) a measure of how responsive quantity demanded is to changes in price. Formula: (% change in quantity demanded) ÷ (% change in price).

Price floors a type of price control that outlaws trade at prices below the floor.

Principal an individual who hires another (an agent) to act on his or her behalf.

Prisoners' dilemma a game in which conflict and cooperation are in tension; self-interest leads the players to outcomes that no one likes. It is in each player's individual interest to not cooperate regardless of what the other does. Thus, both players end up not cooperating. Their joint interest would be better served, however, if they could find a way to cooperate.

Profit center a division whose parent company evaluates it on the basis of the profit it earns.

R

Random variables a variable whose values (outcomes) are random and therefore unknown. The distribution of possible outcomes, however, is known or estimated. Random variables are used to explicitly take account of uncertainty.

Rational–actor paradigm this paradigm says that people act rationally, optimally, and in their self interests.

Relationship-specific investments see **Specific investments**.

Relevant benefits all benefits that vary with the consequence of a decision.

Relevant costs all costs that vary with the consequence of a decision.

Risk premium higher expected rates of return that compensate investors in risky assets. In equilibrium, differences in the rate of return reflect differences in the riskiness of an investment.

Risk-averse a risk-averse individual values a lottery at *less* than its expected value.

Risk-neutral a risk-neutral individual values a lottery *at* its expected value.

Robinson-Patman Act part of a group of laws collectively called the *antitrust laws* governing competition in the United States. Under the Robinson–Patman Act, it's illegal to give or receive a price discount on a good sold to another business. This law does not cover services and sales to final consumers.

S

Screening a solution to the problem of adverse selection that describes the efforts of a less informed party to gather information about the more informed party. Information may be gathered indirectly by offering consumers a menu of choices, and consumers reveal information about their type by the choices they make. A successful screen means that it is unprofitable for bad types to mimic the behavior of good types. Any successful screen can also be used as a signal.

Sealed-bid first-price auction a sealed-bid auction in which the highest bidder gets the item at a price equal to his bid.

Second-price auction see **Vickrey auction**

Seller surplus the difference between price (what the seller is able to sell for) and the seller's value (what she is willing to sell for).

Sequential-move games in these games, players take turns, and each player observes what his or her rival did before having to move.

Sharing contracts a type of franchising agreement under which the franchisee pays the franchisor a percentage of revenue rather than a fixed fee.

Shift of the demand curve a change in demand caused by any variable except price. If demand increases (shifts up and to the right), consumers demand larger quantities of the good at the same price. If demand decreases (shifts down and to the left), consumers demand lower quantities of the good at the same price. Shifts are caused by factors like advertising, changes in consumer tastes, and product quality changes.

Signaling a solution to the problem of adverse selection that describes an informed party's effort to communicate her type, risk, or value to less informed parties by her actions. A successful signal is one that bad types won't mimic. Any successful signal can also be used as a screen.

Simultaneous-move games in these games, players move at the same time. Neither player knows prior to moving what the other has done.

Specific investment investments that are less valuable outside of a particular relationship. They are similar to sunk costs in that the costs are "sunk" in the relationship.

Stay-even analysis analysis that allows you to determine the volume required to offset a change in cost, price, or other revenue factor.

Strategic view of bargaining a view that focuses on how the outcome of bargaining games depends on the specific rules of the game, such as who moves first, who can commit to a bargaining position, or whether the other player can make a counteroffer.

Substitute a good whose demand increases when price of another good increases. Two brands of cola soft drinks are substitutes.

Sunk cost costs that cannot be recovered. They are unavoidable even in the long run.

Sunk-cost fallacy see **Fixed-cost fallacy**.

Supply curves describe the behavior of sellers and tell you how much will be offered for sale at a given price.

T

Tying the practice of making the sale of one good conditional on the purchase of an additional, separate good.

U

Uncontrollable factor something that affects demand that a company cannot control. Examples include

consumer income, weather, and interest rates.

V

Value an individual's value for a good or service is the amount of money he or she is willing to pay for it.

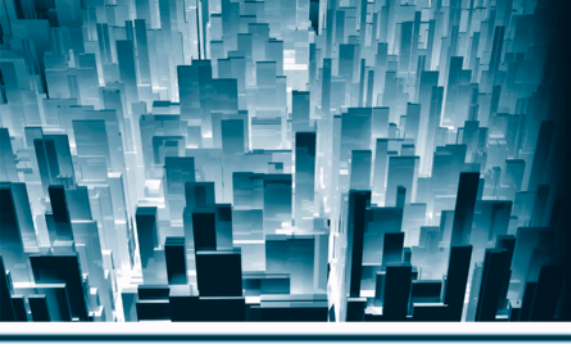
Variable cost costs that change as output levels change.

Vertical integration refers to the common ownership of two firms in separate stages of the vertical supply chain that connects raw materials to finished goods.

Vickrey auction a sealed-bid auction in which the item is awarded to the highest bidder, but the winner pays only the second-highest bid.

W

Winner's curse the winner's curse arises in common value auctions and refers to the fact that the "winner" of the auction is usually the bidder with the highest estimate of the item's value. To avoid bidding too aggressively, bidders should bid as if their estimate is the most optimistic and reduce their estimate accordingly.



INDEX

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